

Machine Automation Controller CJ-series Analog I/O Units

Operation Manual for NJ-series CPU Unit

CJ1W-AD0□□-□□

CJ1W-DA0□□□

CJ1W-MAD42

Analog I/O Units



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Introduction

Thank you for purchasing an CJ-series Analog I/O Unit.

This manual contains information that is necessary to use with the NJ-series CPU Unit. Please read this manual and make sure you understand the functionality and performance of the NJ-series CPU Unit before you attempt to use it in a control system.

Keep this manual in a safe place where it will be available for reference during operation.

Intended Audience

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

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

For programming, this manual is intended for personnel who understand the programming language specifications in international standard IEC 61131-3 or Japanese standard JIS B3503.

Applicable Products

This manual covers the following products.

- CJ-series Analog I/O Units
 - CJ1W-AD041-V1/081-V1/042
 - CJ1W-DA021/041/08V/08C/042V
 - CJ1W-MAD42

Relevant Manuals

There are three manuals that provide basic information on the NJ-series CPU Units: the *NJ-series CPU Unit Hardware User's Manual*, the *NJ-series CPU Unit Software User's Manual*, and the *NJ-series Instructions Reference Manual*.

Most operations are performed from the Sysmac Studio Automation Software. Refer to the *Sysmac Studio Version 1 Operation Manual* (Cat. No. W504) for information on the Sysmac Studio.

Other manuals are necessary for specific system configurations and applications.

Read all of the manuals that are relevant to your system configuration and application to make the most of the NJ-series CPU Unit.

	NJ-series User's Manuals								CJ-series Special Unit Operation Manuals for NJ-series CPU Unit
	Basic information								
	NJ-series CPU Unit Hardware User's Manual	NJ-series CPU Unit Software User's Manual	NJ-series Instructions Reference Manual	NJ-series CPU Unit Motion Control User's Manual	NJ-series CPU Unit Built-in EtherCAT Port User's Manual	NJ-series Motion Control Instructions Reference Manual	NJ-series CPU Unit Built-in EtherNet/IP Port User's Manual	NJ-series Troubleshooting Manual	
Introduction to NJ-series Controllers	●								
Setting devices and hardware									
Using motion control				●					
Using EtherCAT	●				●				
Using EtherNet/IP							●		
Using CJ-series Units									●
Software settings									
Using motion control		●		●					
Using EtherCAT					●				
Using EtherNet/IP							●		
Programming		●	●						
Using motion control				●		●			
Using EtherCAT					●				
Using CJ-series Units									●
Programming error processing								●	
Testing operation and debugging									
Using motion control		●		●					
Using EtherCAT					●				
Using EtherNet/IP							●		
Troubleshooting and managing errors in an NJ-series Controller	△	△		△			△	●	
Use the relevant manuals for references according to any error that occurs.									
Maintenance									
Using EtherCAT	●				●				
Using EtherNet/IP							●		
Using CJ-series Units									●

Manual Configuration

NJ-series CPU Unit Hardware User's Manual (Cat. No. W500)

Section	Description
Section 1 Introduction	This section provides an introduction to the NJ-series Controllers and their features, and gives the NJ-series Controller specifications.
Section 2 System Configuration	This section describes the system configuration used for NJ-series Controllers.
Section 3 Configuration Units	This section describes the parts and functions of the configuration devices in the NJ-series Controller configuration, including the CPU Unit and Configuration Units.
Section 4 Installation and Wiring	This section describes where and how to install the CPU Unit and Configuration Units and how to wire them.
Section 5 Troubleshooting	This section describes the event codes, error confirmation methods, and corrections for errors that can occur.
Section 6 Inspection and Maintenance	This section describes the contents of periodic inspections, the service life of the Battery and Power Supply Units, and replacement methods for the Battery and Power Supply Units.
Appendices	The appendices provide the specifications of the Basic I/O Units, Unit dimensions, load short-circuit protection detection, line disconnection detection, and measures for EMC Directives.

NJ-series CPU Unit Software User's Manual (Cat. No. W501)

Section	Description
Section 1 Introduction	This section provides an introduction to the NJ-series Controllers and their features, and gives the NJ-series Controller specifications.
Section 2 CPU Unit Operation	This section provides information that is necessary to use the CPU Unit, including how the CPU Unit works and the operations that it performs depending on the status of the CPU Unit.
Section 3 I/O Ports, Slave Configuration, and Unit Configuration	This section describes how to use I/O ports, how to create the slave configuration and unit configuration and how to assign functions.
Section 4 Controller Setup	This section describes the initial settings of the function modules.
Section 5 Designing Tasks	This section describes the task system and types of tasks.
Section 6 Programming	This section describes programming, including the programming languages and the variables and instructions that are used in programming.
Section 7 Checking Operation and Actual Operation	This section describes the items and procedures for checking the operation of an NJ-series Controller, including offline debugging procedures.
Section 8 CPU Unit Functions	This section describes the functionality provided by the CPU Unit.
Section 9 Communications Setup	This section describes how to go online with the CPU Unit and how to connect to other devices.
Section 10 Example of Actual Application Procedures	This section describes the procedures that are used to actually operate an NJ-series Controller.
Section 11 Troubleshooting	This section describes the event codes, error confirmation methods, and corrections for errors that can occur.
Appendices	The appendices provide the CPU Unit specifications, task execution times, specifications of individual system-defined variables, data attribute lists, CJ-series Unit memory information, CJ-series Unit memory allocation methods, and version information.

Sysmac Studio Version 1 Operation Manual (Cat. No. W504)

Section	Description
Section 1 Introduction	This section provides an overview and lists the specifications of the Sysmac Studio and describes its features and components.
Section 2 Installation and Uninstallation	This section describes how to install and uninstall the Sysmac Studio.
Section 3 System Design	This section describes the basic concepts for designing an NJ-series System with the Sysmac Studio and the basic operating procedures.
Section 4 Programming	This section describes how to create programs with the Sysmac Studio.
Section 5 Online Connections to a Controller	This section describes how to go online with a Controller.
Section 6 Debugging	This section describes how to debug the programs online on the Controller or debug it offline with the Simulator.
Section 7 Other Functions	This section describes other functions that are supported by the Sysmac Studio, including security functions and troubleshooting functions.
Section 8 Reusing Programming	This section describes how to reuse the programs that you create with the Sysmac Studio.
Section 9 Support Software Provided with the Sysmac Studio	This section describes the Support Software that is provided with the Sysmac Studio.
Section 10 Troubleshooting	This section describes the error messages that are displayed when you check a program on the Sysmac Studio and how to correct those errors.
Appendices	The appendices describe the following: Driver Installation for Direct USB Cable Connection Specifying One of Multiple Ethernet Interface Cards Online Help Simulation Instructions

CJ-series Analog I/O Units Operation Manual for NJ-series CPU Unit (Cat. No. W490) (This Manual)

Section	Description
Section 1 System Design	This section provides a brief description of the features and the functionality of the Analog I/O Units and describes where and how to install the Units.
Section 2 CJ-series Analog Input Units (CJ1W-AD041-V1/081-V1)	This section provides the specifications of the CJ1W-AD041-V1/081-V1 Analog Input Units, and describes how to wire and use the Units.
Section 3 CJ-series Analog Input Units (CJ1W-AD042)	This section provides the specifications of the CJ1W-AD042 Analog Input Units, and describes how to wire and use the Units.
Section 4 CJ-series Analog Output Unit (CJ1W-DA021/041/08V/08C)	This section provides the specifications of the CJ1W-DA021/041/08V/08C Analog Output Units, and describes how to wire and use the Units.
Section 5 CJ-series Analog Output Unit (CJ1W-DA042V)	This section provides the specifications of the CJ1W-DA042V Analog Output Units, and describes how to wire and use the Units.
Section 6 CJ-series Analog I/O Unit (CJ1W-MAD42)	This section provides the specifications of the CJ1W-MAD42 Analog I/O Units, and describes how to wire and use the Units.
Section 7 Common Items	This chapter explains the operating procedure common among Analog Input Units, Output Units and I/O Units.
Appendices	---

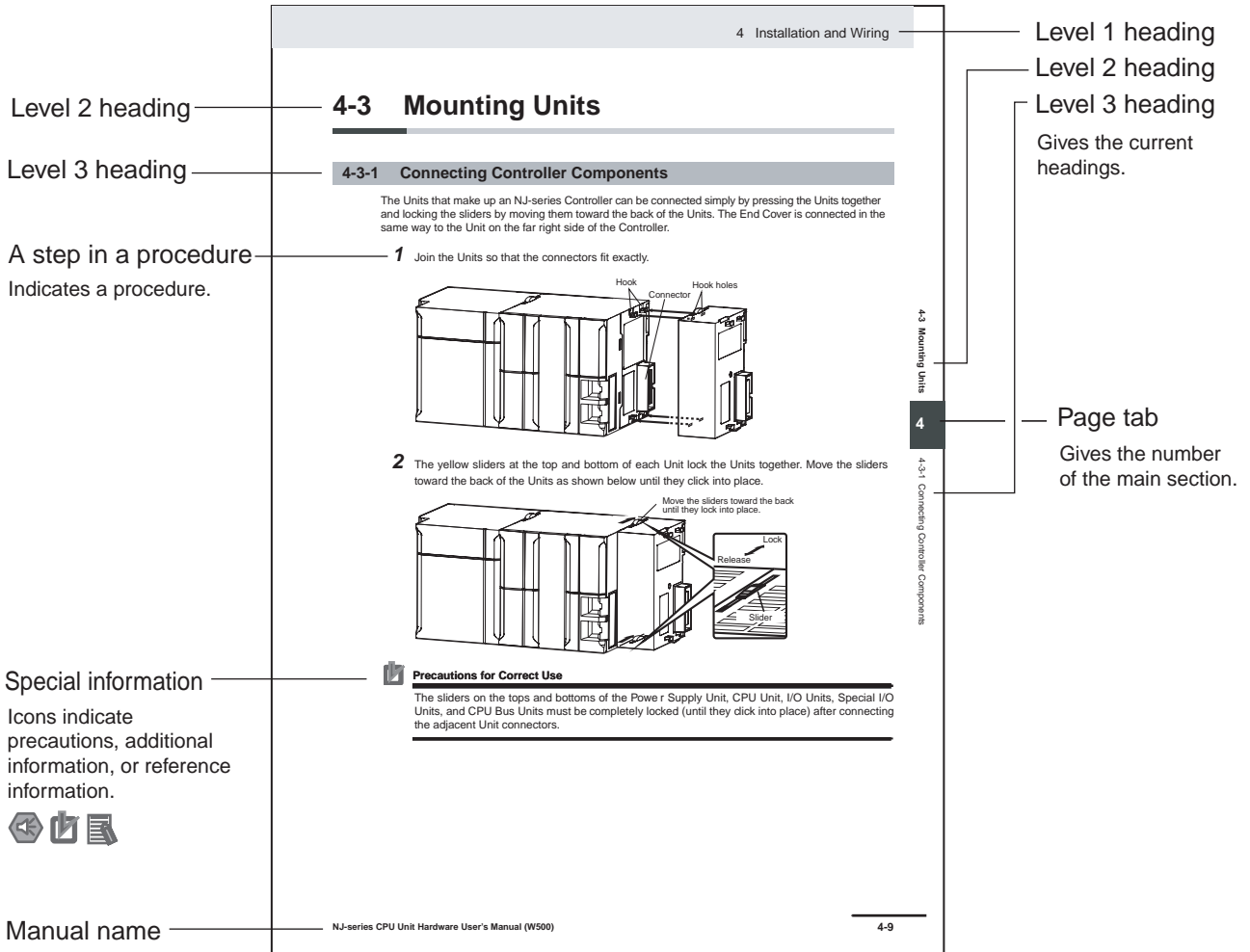
CS/CJ-series Analog I/O Units Operation Manual (Cat. No. W345)

Section	Description
Section 1 System Design	This section provides a brief description of the features and the functionality of the Analog I/O Units and describes where and how to install the Units.
Section 2 CS-series Analog Input Units (CS1W-AD041-V1/081-V1/161)	This section provides the specifications of the CS1W-AD041-V1/081-V1/161 Analog Input Units, and describes how to wire and use the Units.
Section 3 CJ-series Analog Input Units (CJ1W-AD041-V1/081-V1)	This section provides the specifications of the CJ1W-AD041-V1/081-V1 Analog Input Units, and describes how to wire and use the Units.
Section 4 CJ-series Analog Input Units (CJ1W-AD042)	This section provides the specifications of the CJ1W-AD042 Analog Input Units, and describes how to wire and use the Units.
Section 5 CS-series Analog Output Units (CS1W-DA041/08V/08C)	This section provides the specifications of the CS1W-DA041/08V/08C Analog Output Units, and describes how to wire and use the Units.
Section 6 CJ-series Analog Output Unit (CJ1W-DA051/041/08V/08C)	This section provides the specifications of the CJ1W-DA051/041/08V/08C Analog Output Units, and describes how to wire and use the Units.
Section 7 CJ-series Analog Output Unit (CJ1W-DA042V)	This section provides the specifications of the CJ1W-DA042V Analog Output Units, and describes how to wire and use the Units.
Section 8 CS-series Analog I/O Unit (CS1W-MAD44)	This section provides the specifications of the CS1W-MAD44 Analog I/O Units, and describes how to wire and use the Units.
Section 9 CJ-series Analog I/O Unit (CJ1W-MAD42)	This section provides the specifications of the CJ1W-MAD42 Analog I/O Units, and describes how to wire and use the Units.
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Manual Structure

Page Structure

The following page structure is used in this manual.



This illustration is provided only as a sample. It may not literally appear in this manual.

Special Information

Special information in this manual is classified as follows:



Precautions for Safe Use

Precautions on what to do and what not to do to ensure safe usage of the product.



Precautions for Correct Use

Precautions on what to do and what not to do to ensure proper operation and performance.



Additional Information

Additional information to read as required.

This information is provided to increase understanding or make operation easier.

Note References are provided to more detailed or related information.

Precaution on Terminology

In this manual, “download” refers to transferring data from the Sysmac Studio to the physical Controller and “upload” refers to transferring data from the physical Controller to the Sysmac Studio.

For the Sysmac Studio, synchronization is used to both upload and download data. Here, “synchronize” means to automatically compare the data for the Sysmac Studio on the computer with the data in the physical Controller and transfer the data in the direction that is specified by the user.

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Read and Understand this Manual

Please read and understand this manual before using the products. 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.

Safety Precautions

Definition of Precautionary Information

The following notation is used in this manual to provide precautions required to ensure safe usage of a CJ-series Analog I/O Unit. The safety precautions that are provided are extremely important to safety. Always read and heed the information provided in all safety precautions. The following notation is used.



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.



Precautions for Safe Use

Indicates precautions on what to do and what not to do to ensure safe usage of the product.



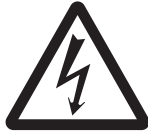
Precautions for Correct Use

Indicates precautions on what to do and what not to do to ensure proper operation and performance.

Symbols



The circle and slash symbol indicates operations that you must not do. The specific operation is shown in the circle and explained in text. This example indicates prohibiting disassembly.



The triangle symbol indicates precautions (including warnings). The specific operation is shown in the triangle and explained in text. This example indicates a precaution for electric shock.



The triangle symbol indicates precautions (including warnings). The specific operation is shown in the triangle and explained in text. This example indicates a general precaution.

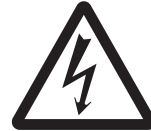


The filled circle symbol indicates operations that you must do. The specific operation is shown in the circle and explained in text. This example shows a general precaution for something that you must do.

 **WARNING**

During Power Supply

Do not touch any of the terminals or terminal blocks while the power is being supplied. Doing so may result in electric shock.



Do not attempt to take any Unit apart. In particular, high-voltage parts are present in the Power Supply Unit while power is supplied or immediately after power is turned OFF. Touching any of these parts may result in electric shock. There are sharp parts inside the Unit that may cause injury.



Fail-safe Measures

Provide safety measures in external circuits to ensure safety in the system if an abnormality occurs due to malfunction of the CPU Unit, other Units, or slaves or due to other external factors affecting operation. Not doing so may result in serious accidents due to incorrect operation.



Emergency stop circuits, interlock circuits, limit circuits, and similar safety measures must be provided in external control circuits.



The Controller outputs may remain ON or OFF due to deposition 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 safe operation of the system.



The CPU Unit will turn OFF all outputs from Basic Output Units in the following cases. The remote I/O slaves will operate according to the settings in the slaves.

- If an error occurs in the power supply
- If the power supply connection becomes faulty
- If a CPU watchdog timer error or CPU reset occurs
- If a major fault level Controller error occurs
- While the CPU Unit is on standby until RUN mode is entered after the power is turned ON



External safety measures must be provided to ensure safe operation of the system in such cases.

If external power supplies for slaves or other devices are overloaded or short-circuited, the voltage will drop, outputs will turn OFF, and the system may be unable to read inputs. Provide external safety measures in controls with monitoring of external power supply voltage as required so that the system operates safely in such a case.



WARNING

Fail-safe Measures

Unintended outputs may occur when an error occurs in variable memory or in memory used for CJ-series Units. As a countermeasure for such problems, external safety measures must be provided to ensure safe operation of the system.



Provide measures in the communications system and user program to ensure safety in the overall system even if errors or malfunctions occur in data link communications or remote I/O communications.



If there is interference in remote I/O communications or if a major fault level error occurs, output status will depend on the products that are used. Confirm the operation that will occur when there is interference in communications or a major fault level error, and implement safety measures. Correctly set all of the EtherCAT slaves.



The NJ-series Controller continues normal operation for a certain period of time when a momentary power interruption occurs. This means that the NJ-series Controller may receive incorrect signals from external devices that are also affected by the power interruption. Accordingly, take suitable actions, such as external fail-safe measures and interlock conditions, to monitor the power supply voltage of the external device as required.



You must take fail-safe measures 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 due to incorrect operation.



Voltage and Current Inputs

Make sure that the voltages and currents that are input to the Units and slaves are within the specified ranges. Inputting voltages or currents that are outside of the specified ranges may cause accidents or fire.



Downloading

Always confirm safety at the destination before you transfer a user program, configuration data, setup data, device variables, or values in memory used for CJ-series Units from the Sysmac Studio. The devices or machines may perform unexpected operation regardless of the operating mode of the CPU Unit.



Caution

Application

Do not touch any Unit when power is being supplied or immediately after the power supply is turned OFF. Doing so may result in burn injury.



Wiring

Be sure that all terminal screws and cable connector screws are tightened to the torque specified in the relevant manuals. The loose screws may result in fire or malfunction.



Online Editing

Execute online editing only after confirming that no adverse effects will be caused by deviations in the timing of I/O. If you perform online editing, the task execution time may exceed the task period, I/O may not be refreshed with external devices, input signals may not be read, and output timing may change.



Using Analog I/O Units

With the CJ1W-AD042/-DA042V, always connect surge suppressors to inductive loads in the system (e.g., magnetic contactors, relays, and solenoids). Always separate devices that generate surge from the Analog I/O Units.

Faulty Unit operation may cause unexpected system operation.



Precautions for Safe Use

Disassembly and Dropping

- Do not attempt to disassemble, repair, or modify any Units. Doing so may result in malfunction or fire.
- Do not drop any Unit or subject it to abnormal vibration or shock. Doing so may result in Unit malfunction or burning.

Mounting

- The sliders on the tops and bottoms of the Power Supply Unit, CPU Unit, I/O Units, and other Units must be completely locked (until they click into place) after connecting the adjacent Unit connectors.

Installation

- Always connect to a ground of 100 Ω or less when installing the Units. A ground of 100 Ω or less must be installed when shorting the GR and LG terminals on the Power Supply Unit.

Wiring

- Follow the instructions in this manual to correctly perform wiring.
Double-check all wiring and switch settings before turning ON the power supply.
- Use crimp terminals for wiring.
Do not connect bare stranded wires directly to terminals.
- Do not pull on the cables or bend the cables beyond their natural limit.
Do not place heavy objects on top of the cables or other wiring lines. Doing so may break the cables.
- Mount terminal blocks and connectors only after checking the mounting location carefully.
- Be sure that the terminal blocks, expansion cables, and other items with locking devices are properly locked into place.
- Always remove any dustproof labels that are on the top of the Units when they are shipped before you turn ON the power supply. If the labels are not removed, heat will accumulate and malfunctions may occur.
- Before you connect a computer to the CPU Unit, disconnect the power supply plug of the computer from the AC outlet. Also, if the computer has an FG terminal, make the connections so that the FG terminal has the same electrical potential as the GR terminal on the Power Supply Unit. A difference in electric potential between the computer and Controller may cause failure or malfunction.
- If the external power supply to an Output Unit or slave has polarity, connect it with the correct polarity. If the polarity is reversed, current may flow in the reverse direction and damage the connected devices regardless of the operation of the Controller.

Power Supply Design

- Do not exceed the rated supply capacity of the Power Supply Units in the NJ-series Controller. The rated supply capacities are given in the *NJ-series CPU Unit Hardware User's Manual* (Cat. No. W500).
If the capacity is exceeded, operation may stop, malfunctions may occur, or data may not be backed up normally for power interruptions.
Use NJ-series Power Supply Units for both the NJ-series CPU Rack and Expansion Racks.
Operation is not possible if a CJ-series Power Supply Unit is used with an NJ-series CPU Unit or an NJ-series Power Supply Unit is used with a CJ-series CPU Unit.

- Do not apply voltages or connect loads to the Output Units or slaves in excess of the maximum ratings.
- Surge current occurs when the power supply is turned ON. When selecting fuses or breakers for external circuits, consider the above precaution and allow sufficient margin in shut-off performance. Refer to the relevant manuals for surge current specifications. Refer to the *NJ-series CPU Unit Hardware User's Manual* (Cat. No. W500) for surge current specifications.
- If the full dielectric strength voltage is applied or turned OFF using the switch on the tester, the generated impulse voltage may damage the Power Supply Unit. Use the adjustment on the tester to gradually increase and decrease the voltage.
- Apply the voltage between the Power Supply Unit's L1 or L2 terminal and the GR terminal when testing insulation and dielectric strength.
- Do not supply AC power from an inverter or other device with a square-wave output. Internal temperature rise may result in smoking or burning. Always input a sinusoidal wave with the frequency that is given in the *NJ-series CPU Unit Hardware User's Manual* (Cat. No. W500).
- Install external breakers and take other safety measures against short-circuiting in external wiring.

Turning ON the Power Supply

- It takes up to approximately 10 to 20 s to enter RUN mode after the power is turned ON. During that time, outputs will be OFF or will be the values specified in the Unit or slave settings, and external communications cannot be performed. Use the RUN output on the Power Supply Unit, for example, to implement fail-safe circuits so that external devices do not operate incorrectly.
- Configure the external circuits so that the power supply to the control system turns ON only after the power supply to the Controller has turned ON. If the power supply to the Controller is turned ON after the control power supply, temporary errors may result in incorrect control system signals because the output terminals on Output Units may momentarily turn ON when power supply is turned ON to the Controller.
- If you transfer data from a backup file on an SD Memory Card to the Controller when the power supply is turned ON, properly select the data groups to transfer. If the data for an unintended data group is transferred to the Controller, it may cause the equipment to operate unpredictably.

Actual Operation

- Check the user program, data, and parameter settings for proper execution before you use them for actual operation.

Turning OFF the Power Supply

- Never turn OFF the power supply to the Controller when the BUSY indicator is flashing. While the BUSY indicator is lit, the user program and settings in the CPU Unit are being backed up in the built-in non-volatile memory. This data will not be backed up correctly if the power supply is turned OFF. Also, a major fault level Controller error will occur the next time you start operation, and operation will stop.
- Do not turn OFF the power supply or remove the SD Memory Card while SD Memory Card access is in progress (i.e., while the SD BUSY indicator flashes). Data may become corrupted, and the Controller will not operate correctly if it uses corrupted data. To remove the SD Memory Card from the CPU Unit while the power supply is ON, press the SD Memory Card power supply switch and wait for the SD BUSY indicator to turn OFF before you remove the SD Memory Card.
- Do not disconnect the cable or turn OFF the power supply to the Controller when downloading data or the user program from Support Software.
- Always turn OFF the power supply to the Controller before you attempt any of the following.
 - Mounting or removing I/O Units or the CPU Unit
 - Assembling the Units
 - Setting DIP switches or rotary switches

- Connecting cables or wiring the system
- Connecting or disconnecting the connectors

The Power Supply Unit may continue to supply power to the rest of the Controller for a few seconds after the power supply turns OFF. The PWR indicator is lit during this time. Confirm that the PWR indicator is not lit before you perform any of the above.

Operation

- Confirm that no adverse effect will occur in the system before you attempt any of the following.
 - Changing the operating mode of the CPU Unit (including changing the setting of the Operating Mode at Startup)
 - Changing the user program or settings
 - Changing set values or present values
 - Forced refreshing
- Always sufficiently check the safety at the connected devices before you change the settings of an EtherCAT slave or Special Unit.
- If two different function modules are used together, such as when you use CJ-series Basic Output Units and EtherCAT slave outputs, take suitable measures in the user program and external controls to ensure that safety is maintained in the controlled system if one of the function modules stops. The relevant outputs will stop if a partial fault level error occurs in one of the function modules.
- Always confirm safety at the connected equipment before you reset Controller errors with an event level of partial fault or higher for the EtherCAT Master Function Module.

When the error is reset, all slaves that were in any state other than Operational state due to a Controller error with an event level of partial fault or higher (in which outputs are disabled) will go to Operational state and the outputs will be enabled.

Before you reset all errors, confirm that no Controller errors with an event level of partial fault have occurred for the EtherCAT Master Function Module.
- Always confirm safety at the connected equipment before you reset Controller errors for a CJ-series Special Unit. When a Controller error is reset, the Unit where the Controller error with an event level of observation or higher will be restarted.

Before you reset all errors, confirm that no Controller errors with an event level of observation or higher have occurred for the CJ-series Special Unit. Observation level events do not appear on the Controller Error Tab Page, so it is possible that you may restart the CJ-series Special Unit without intending to do so.

You can check the status of the `_CJB_UnitErrSta[0,0]` to `_CJB_UnitErrSta[3,9]` error status variables on a Watch Tab Page to see if an observation level Controller error has occurred.

Battery Backup

- The user program and initial values for the variables are stored in non-volatile memory in the CPU Unit. The present values of variables with the Retain attribute and the values of the Holding, DM, and EM Areas in the memory used for CJ-series Units are backed up by a Battery. If the Battery is not connected or the Battery is exhausted, the CPU Unit detects a Battery-backup Memory Check Error. If that error is detected, variables with a Retain attribute are set to their initial values and the Holding, DM, and EM Areas in memory used for CJ-series Units are cleared to all zeros. Perform thorough verifications and provide sufficient measures to ensure that the devices perform safe operation for the initial values of the variables with Retain attributes and the resulting operation.

Debugging

- Forced refreshing ignores the results of user program execution and refreshes I/O with the specified values. If forced refreshing is used for inputs for which I/O refreshing is not supported, the inputs will first take the specified values, but they will then be overwritten by the user program. This operation differs from the force-set/reset functionality of the CJ-series PLCs.

- You cannot upload or download information for forced refreshing with the Sysmac Studio. After downloading data that contains forced refreshing, change to RUN mode and then use the Sysmac Studio to perform the operation for forced refreshing. Depending on the difference in the forced status, the control system may operate unexpectedly.
- Do not specify the same address for the AT specification for more than one variable. Doing so would allow the same entity to be accessed with different variable names, which would make the user program more difficult to understand and possibly cause programming mistakes.

General Communications

- When you use data link communications, check the error information that is given in *ErrSta* (Controller Error Status) to make sure that no error has occurred in the source device. Write the user program to use the received data only if there is no error. If there is an error in the source device, the data for the data link may contain incorrect values.
- Unexpected operation may result if inappropriate data link tables are set. Even if appropriate data link tables have been set, confirm that the controlled system will not be adversely affected before you transfer the data link tables. The data links start automatically after the data link tables are transferred.
- All CPU Bus Units are restarted when routing tables are transferred from Support Software to the CPU Unit. Confirm that the system will not be adversely affected by restarting before you transfer the routing tables.
- Tag data links will stop between related nodes while tag data link parameters are transferred during Controller operation. Confirm that the system will not be adversely affected before you transfer the tag data link parameters.

EtherNet/IP Communications

- All related EtherNet/IP nodes are reset when you transfer settings for the built-in EtherNet/IP port (including IP addresses and tag data links settings). Confirm that the system will not be adversely affected by resetting nodes before you transfer the settings.
- If EtherNet/IP tag data links (cyclic communications) are used with a repeating hub, the communications load on the network will increase. This will increase collisions and may prevent stable communications. Do not use repeating hubs on networks where tag data links are used. Use an Ethernet switch instead.

EtherCAT Communications

- Make sure that the communications distance, number of nodes connected, and method of connection for EtherCAT are within specifications. Do not connect EtherCAT communications to EtherNet/IP, a standard in-house LAN, or other networks. An overload may cause the network to fail or malfunction.
- Malfunctions or unexpected operation may occur for some combinations of EtherCAT revisions of the master and slaves. If you disable the revision check in the network settings, use the Sysmac Studio to check the slave revision settings in the master and the actual slave revisions, and then make sure that functionality is compatible in the slave manuals or other references. You can check the actual slave revisions from the Sysmac Studio or on slave nameplates.
- After you transfer the user program, the CPU Unit is restarted and communications with the EtherCAT slaves are cut off. During that period, the slave outputs behave according to the slave settings. The time that communications are cut off depends on the EtherCAT network configuration. If the EtherCAT network configuration contains only OMRON EtherCAT slaves, communications are cut off for a maximum of 45 seconds. Before you transfer the user program, confirm that the system will not be adversely affected.

- If the Fail-soft Operation parameter is set to stop operation, process data communications will stop for all slaves when an EtherCAT communications error is detected in a slave. For this reason, if Servo Drives are connected, the Servos for all axes will be turned OFF. Make sure that the Fail-soft Operation parameter setting results in safe operation when a device error occurs.
- EtherCAT communications are not always established immediately after the power supply is turned ON. Use the system-defined variables in the user program to confirm that communications are established before attempting control operations.
- If frames sent to EtherCAT slaves are lost due to noise or other causes, slave I/O data is not communicated, and the intended operation is sometimes not achieved. If noise countermeasures are required, use the `_EC_InDataInvalid` (Input Data Disable) system-defined variable as an interlock condition in the user program.
Refer to the *NJ-series CPU Unit Built-in EtherCAT Port User's Manual* (Cat. No. W505) for details.
The slave outputs behave according to the slave settings. Refer to the manuals for the slaves for details.
- When an EtherCAT slave is disconnected, communications will stop and control of the outputs will be lost not only for the disconnected slave, but for all slaves connected after it. Confirm that the system will not be adversely affected before you disconnect a slave.
- If you disconnect the cable from an EtherCAT slave to disconnect it from the network, any current communications frames may be lost. If frames are lost, slave I/O data is not communicated, and the intended operation is sometimes not achieved. Perform the following processing for a slave that needs to be replaced.
 - Program the `_EC_InDataInvalid` (Input Data Disable) system-defined variable as an interlock condition.
 - Set the Impermissible Number of Continuous Timeouts setting in the EtherCAT master to at least 2.
 Refer to the *NJ-series CPU Unit Built-in EtherCAT Port User's Manual* (Cat. No. W505) for details.

Motion Control

- Confirm the axis number carefully before you perform an MC Test Run.
- The motor is stopped if communications are interrupted between the Sysmac Studio and the CPU Unit during an MC Test Run. Connect the communications cable between the computer and CPU Unit securely and confirm that the system will not be adversely affected before you perform an MC Test Run.
- Always execute the Save Cam Table instruction if you change any of the cam data from the user program in the CPU Unit or from the Sysmac Studio. If the cam data is not saved, the previous condition will be restored when the power is turned ON again, possibly causing unexpected machine operation.
- The positive drive prohibit input (POT), negative drive prohibit input (NOT), and home proximity input (DEC) of the Servo Drive are used by the MC Function Module as the positive limit input, negative limit input, and home proximity input. Make sure that the signal widths for all of these input signals are longer than the control period of the MC Function Module. If the input signal widths are shorter than the control period, the MC Function Module may not be able to detect the input signals, resulting in incorrect operation.

Battery Replacement

- The Battery may leak, rupture, heat, or ignite. Never short-circuit, charge, disassemble, heat, or incinerate the Battery or subject it to strong shock.
- 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.
- UL standards require that only an experienced engineer replace the Battery. Make sure that an experienced engineer is in charge of Battery replacement.

- Apply power for at least five minutes before changing the Battery. Install a new Battery within five minutes (at 25°C) of turning OFF the power supply. If power is not supplied for at least 5 minutes, the saved data may be lost.

Unit Replacement

- We recommend replacing the Battery with the power turned OFF to prevent the CPU Unit's sensitive internal components from being damaged by static electricity and to prevent malfunctions. 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 you start the procedure. After you replace the Battery, connect the Sysmac Studio and clear the Low Battery Voltage error.
- Make sure that the required data, including the user program, configurations, settings, variables, and memory used for CJ-series Units, is transferred to a CPU Unit that was replaced and to externally connected devices before restarting operation. Be sure to include the routing tables, network parameters, and other CPU Bus Unit data, which are stored in the CPU Unit.

Disposal

- Dispose of the product and Batteries according to local ordinances as they apply.



廢電池請回收

- The following information must be displayed for all products that contain primary lithium batteries with a perchlorate content of 6 ppb or higher when shipped to or transported through the State of California, USA.
Perchlorate Material - special handling may apply.
See www.dtsc.ca.gov/hazardouswaste/perchlorate.
- The CPU Unit contains a primary lithium battery with a perchlorate content of 6 ppb or higher. Place the above information on the individual boxes and shipping boxes when shipping finished products that contain a CPU Unit to the State of California, USA.

Precautions for Correct Use

Storage, Mounting, and Wiring

- Do not operate or store the Controller in the following locations. Operation may stop or malfunctions may occur.
 - 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
- Take appropriate and sufficient countermeasures when installing the Controller in the following locations.
 - Locations subject to strong, high-frequency noise
 - 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
- Before touching a Unit, be sure to first touch a grounded metallic object in order to discharge any static build-up.
- Install the Controller away from sources of heat and ensure proper ventilation. Not doing so may result in malfunction, in operation stopping, or in burning.
- An I/O bus check error will occur and the Controller will stop if an I/O Connecting Cable's connector is disconnected from the Rack. Be sure that the connectors are secure.
- Do not allow foreign matter to enter the openings in the Unit. Doing so may result in Unit burning, electric shock, or failure.
- Do not allow wire clippings, shavings, or other foreign material to enter any Unit. Otherwise, Unit burning, failure, or malfunction may occur. Cover the Units or take other suitable countermeasures, especially during wiring work.
- For EtherCAT and EtherNet/IP, use the connection methods and cables that are specified in the *NJ-series CPU Unit Built-in EtherCAT Port User's Manual* (Cat. No. W505) and the *NJ-series CPU Unit Built-in EtherNet/IP Port User's Manual* (Cat. No. W506). Otherwise, communications may be faulty.
- Use the rated power supply voltage for the Power Supply Units. Take appropriate measures to ensure that the specified power with the rated voltage and frequency is supplied in places where the power supply is unstable.
- Make sure that the current capacity of the wire is sufficient. Otherwise, excessive heat may be generated. When cross-wiring terminals, the total current for all the terminals will flow in the wire. When wiring cross-overs, make sure that the current capacity of each of the wires is not exceeded.
- Do not touch the terminals on the Power Supply Unit immediately after turning OFF the power supply. Residual voltage may cause electrical shock.
- If you use reed switches for the input contacts for AC Input Units, use switches with a current capacity of 1 A or greater.
If the capacity of the reed switches is too low, surge current may fuse the contacts.

Error Processing

- In applications that use the results of instructions that read the error status, consider the affect on the system when errors are detected and program error processing accordingly. For example, even the detection of a minor error, such as Battery replacement during operation, can affect the system depending on how the user program is written.
- If you change the event level of a Controller error, the output status when the error occurs may also change. Confirm safety before you change an event level.

Restoring and Automatically Transferring Data

- When you edit the restore command file or the automatic transfer command file, do not change anything in the file except for the “yes” and “no” specifications for the selectable data groups. If you change anything else in the file, the Controller may perform unexpected operation when you restore or automatically transfer the data.

Unit Replacement

- If you replace a CPU Bus Unit or Special I/O Unit, refer to operation manual for the Unit for information on the data required for individual Units and redo the necessary settings.
- The absolute encoder home offset is backed up with a Battery in the CPU Unit.
When you change the combination of the CPU Unit and Servomotor, e.g., when you add or replace a Servomotor, define home again.
To restore the information without changing the CPU Unit-Servomotor combination, remove the absolute encoder home offset from the data to restore.

Task Settings

- If a Task Period Exceeded error occurs, shorten the programs to fit in the task period or increase the setting of the task period.

Motion Control

- Use the system-defined variable in the user program to confirm that EtherCAT communications are established before you attempt to execute motion control instructions. Motion control instructions are not executed normally if EtherCAT communications are not established.
- Use the system-defined variables to monitor for errors in communications with the slaves that are controlled by the motion control function module. Motion control instructions are not executed normally if an error occur in slave communications.
- Before you start an MC Test Run, make sure that the operation parameters are set correctly.
- Do not download motion control settings during an MC Test Run.

EtherCAT Communications

- Do not disconnect the EtherCAT slave cables during operation. The outputs will become unstable.
- Set the Servo Drives to stop operation if an error occurs in EtherCAT communications between the Controller and a Servo Drive.
- Make sure that all of the slaves to be restored are participating in the network before you reset a Network Configuration Verification Error, Process Data Communications Error, or Link OFF Error in the EtherCAT Master Function Module. If any slave is not participating when any of these errors is reset, the EtherCAT Master Function Module may access slave with a different node address than the specified node address or the error may not be reset correctly.

Battery Replacement

- Be sure to install a replacement Battery within two years of the production date shown on the Battery label.
- 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.
- When you replace the Battery, use the CJ1W-BAT01 Battery Set.

SD Memory Cards

- Insert the SD Memory Card all the way.
- Do not turn OFF the power supply to the Controller during SD Memory Card access. The files may be corrupted.
If there is a corrupted file in the SD Memory Card, the file is automatically deleted by the restoration function when the power supply is turned ON.

Regulations and Standards

Conformance to EC Directives

Applicable Directives

- EMC Directives
- Low Voltage Directive

Concepts

● EMC Directive

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.*

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

* Applicable EMC (Electromagnetic Compatibility) standards are as follows:

EMS (Electromagnetic Susceptibility): EN 61131-2 and EN 61000-6-2

EMI (Electromagnetic Interference): EN 61131-2 and EN 61000-6-4 (Radiated emission: 10-m regulations)

● Low Voltage Directive

Always ensure that devices operating at voltages of 50 to 1,000 VAC and 75 to 1,500 VDC meet the required safety standards. The applicable directive is EN 61131-2.

● Conformance to EC Directives

The NJ-series Controllers comply with EC Directives. To ensure that the machine or device in which the NJ-series Controller is used complies with EC Directives, the Controller must be installed as follows:

- The NJ-series Controller must be installed within a control panel.
- You must use reinforced insulation or double insulation for the DC power supplies connected to DC Power Supply Units and I/O Units.
- NJ-series Controllers that comply with EC Directives also conform to the Common Emission Standard (EN 61000-6-4). 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.

Conditions for Conforming to EMC Directives

The following immunity test conditions apply to CS/CJ-series Analog I/O Units.

Overall Accuracy

Analog Input Unit	CS1W-AD161	+4%/–6%
	CJ1W-AD041-V1/AD081-V1	+3%/–6%
	CJ1W-AD042	+6%/–6%
Analog Output Units	CJ1W-DA021/DA041	+4%/–1%
	CJ1W-DA08V/DA08C	+4%/–4%
	CJ1W-DA042V	+4.5%/–4.5%
Analog I/O Unit	CS1W-MAD44	+2%/–1%
	CJ1W-MAD42	+4%/–4%

Use shielded twisted-pair cable to connect analog inputs and connect the shield on the input line to the AG terminal.

Conformance to Shipbuilding Standards

The NJ-series Controllers comply with the following shipbuilding standards. Applicability to the shipbuilding standards is based on certain usage conditions. It may not be possible to use the product in some locations. Contact your OMRON representative before attempting to use a Controller on a ship.


Usage Conditions for NK and LR Shipbuilding Standards

- The NJ-series Controller must be installed within a control panel.
- Gaps in the door to the control panel must be completely filled or covered with gaskets or other material.
- The following noise filter must be connected to the power supply line.

Noise Filter

Manufacturer	Model
Cosel Co., Ltd.	TAH-06-683

Trademarks

- Sysmac and SYSMAC are trademarks or registered trademarks of OMRON Corporation in Japan and other countries for OMRON factory automation products.
- Windows, Windows 98, Windows XP, Windows Vista, and Windows 7 are registered trademarks of Microsoft Corporation in the USA and other countries.
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- The SD logo is a trademark of SD-3C, LLC. 

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Unit Versions

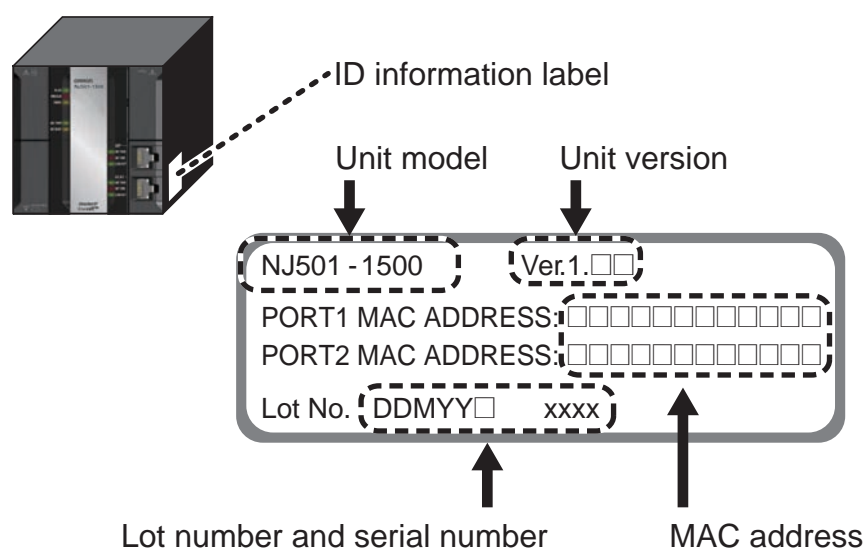
Unit Versions

A “unit version” has been introduced to manage CPU Units in the NJ Series according to differences in functionality accompanying Unit upgrades.

Notation of Unit Versions on Products

The unit version is given on the ID information label of the products for which unit versions are managed, as shown below.

Example for NJ-series NJ501-□□□□ CPU Unit:



The following information is provided on the ID information label.

Item	Description
Unit model	Gives the model of the Unit.
Unit version	Gives the unit version of the Unit.
Lot number and serial number	Gives the lot number and serial number of the Unit. DDMY: Lot number, □: For use by OMRON, xxxx: Serial number “M” gives the month (1 to 9: January to September, X: October, Y: November, Z: December)
MAC address	Gives the MAC address of the built-in port on the Unit.

Confirming Unit Versions with Sysmac Studio

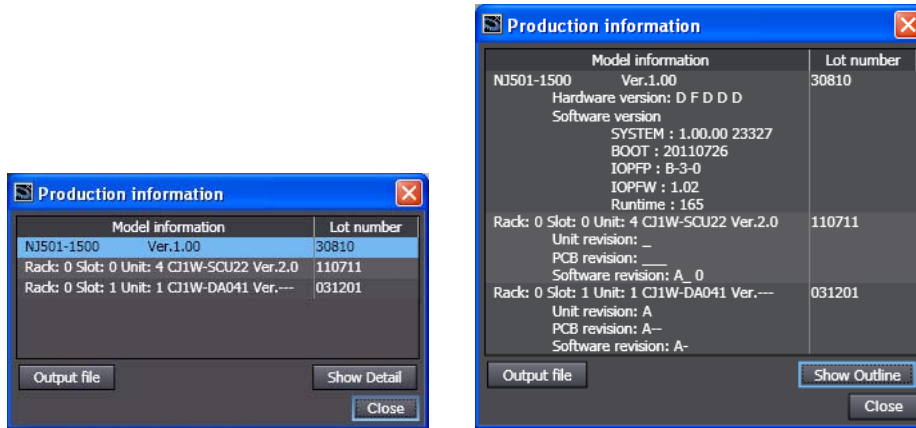
You can use the Unit Production Information on the Sysmac Studio to check the unit version of the CPU Unit, CJ-series Special I/O Units, CJ-series CPU Bus Units, and EtherCAT slaves. The unit versions of CJ-series Basic I/O Units cannot be checked from the Sysmac Studio.

● CPU Unit and CJ-series Units

- 1 Double-click **CPU/Expansion Racks** under **Configurations and Setup** in the Multiview Explorer. Or, right-click **CPU/Expansion Racks** under **Configurations and Setup** and select **Edit** from the menu.

The Unit Editor is displayed for the Controller Configurations and Setup layer.

- Right-click any open space in the Unit Editor and select **Production Information**.
The Production Information Dialog Box is displayed.



Simple Display

Detailed Display

In this example, "Ver.1.00" is displayed next to the unit model.

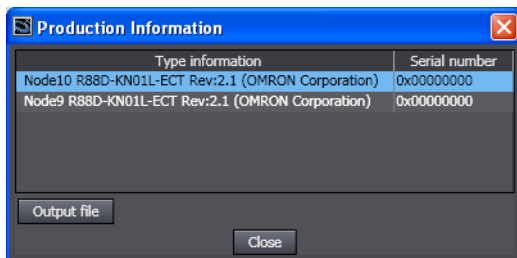
The following items are displayed.

CPU Unit	CJ-series Units
Unit model	Unit model
Unit version	Unit version
Lot number	Lot number
	Rack number, slot number, and unit number

● **EtherCAT Slaves**

- Double-click **EtherCAT** under **Configurations and Setup** in the Multiview Explorer. Or, right-click **EtherCAT** under **Configurations and Setup** and select **Edit** from the menu.
The EtherCAT Configuration Tab Page is displayed for the Controller Configurations and Setup layer.
- Right-click the master in the EtherCAT Configurations Editing Pane and select **Display Production Information**.

The Production Information Dialog Box is displayed.



The following items are displayed.

- Node address
- Type information*
- Serial number

* If the model number cannot be determined (such as when there is no ESI file), the vendor ID, product code, and revision number are displayed.

Related Manuals

The following manuals are related to the NJ-series Controllers. Use these manuals for reference.

Manual name	Cat. No.	Model numbers	Application	Description
NJ-series CPU Unit Hardware User's Manual	W500	NJ501-□□□□ NJ301-□□□□	Learning the basic specifications of the NJ-series CPU Units, including introductory information, designing, installation, and maintenance. Mainly hardware information is provided.	An introduction to the entire NJ-series system is provided along with the following information on the CPU Unit. <ul style="list-style-type: none"> • Features and system configuration • Introduction • Part names and functions • General specifications • Installation and wiring • Maintenance and inspection Use this manual together with the <i>NJ-series CPU Unit Software User's Manual</i> (Cat. No. W501).
NJ-series CPU Unit Software User's Manual	W501	NJ501-□□□□ NJ301-□□□□	Learning how to program and set up an NJ-series CPU Unit. Mainly software information is provided.	The following information is provided on a Controller built with an NJ501 CPU Unit. <ul style="list-style-type: none"> • CPU Unit operation • CPU Unit features • Initial settings • Programming based on IEC 61131-3 language specifications Use this manual together with the <i>NJ-series CPU Unit Hardware User's Manual</i> (Cat. No. W500).
Sysmac Studio Version 1 Operation Manual	W504	SYSMAC-SE2□□□	Learning about the operating procedures and functions of the Sysmac Studio.	Describes the operating procedures of the Sysmac Studio.
CJ-series Analog I/O Units Operation Manual for NJ-series CPU Unit (This Manual)	W490	CJ1W-AD0□□-□□ CJ1W-DA0□□□ CJ1W-MAD42	Learning about the functions and usage of CJ-series Analog Input Units, Analog Output Units, and Analog I/O Units for using them in an NJ-series configuration.	The functions and usage of the CJ-series Analog Input Units, Analog Output Units, and Analog I/O Units for using them in an NJ-series configuration are described.
CS/CJ Series Analog I/O Units Operation Manual	W345	CS1W-AD041-V1/081-V1/161 CS1W-DA041/08V/08C CS1W-MAD44 CJ1W-AD041-V1/081-V1/042 CJ1W-DA021/041/08V/08C/042V CJ1W-MAD42	Learning about the functions and usage of CJ-series Analog Input Units, Analog Output Units, and Analog I/O Units.	The functions and usage of the CJ-series Analog Input Units, Analog Output Units, and Analog I/O Units for using them in a CJ-series configuration are described.

Revision History

A manual revision code appears as a suffix to the catalog number on the front and back covers of the manual.

Cat. No. W490-E1-03

↑
Revision code

Revision code	Date	Revised content
01	July 2011	Original production
02	March 2012	Corrected errors.
03	August 2012	Made changes accompanying release of unit version 1.03 of the CPU Unit.

1

System Design

This section describes the features and system configurations of the CJ-series Analog I/O Units which you can connect to the NJ-series CPU Unit.

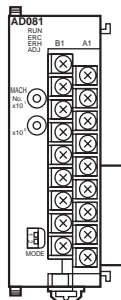
1-1	Features and Functions	1-2
1-2	Mouting the Unit	1-7
1-2-1	Basic System Configuration	1-7
1-2-2	Mounting Procedure	1-8
1-2-3	Precautions	1-9
1-3	Function Applications	1-10

1-1 Features and Functions

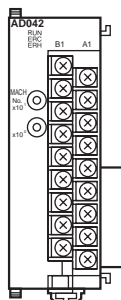
CJ-series Analog I/O Units

Analog Input Unit

CJ1W-AD041-V1
CJ1W-AD081-V1

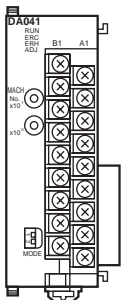


CJ1W-AD042

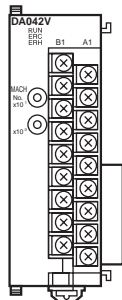


Analog Output Unit

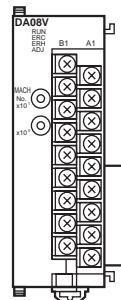
CJ1W-DA021
CJ1W-DA041



CJ1W-DA042V

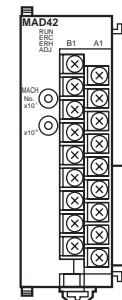


CJ1W-DA08V
CJ1W-DA08C



Analog I/O Unit

CJ1W-MAD42



The CJ Series includes CJ1W-AD041-V1, CS1W-AD081-V1, and CJ1W-AD042 Analog Input Units that convert analog signals to digital signals and transfer them to CJ-series CPU Units. It also includes CJ1W-DA041, CS1W-DA021, CJ1W-DA042V, CJ1W-DA08V, and CJ1W-DA08C Analog Output Units that convert digital data from CJ-series CPU Units into analog signals for output, and CJ1W-MAD42 Analog I/O Units that have both analog input and output function.

The main specifications are listed in the following table.

Unit	Analog input		Analog output		Conversion cycle
	Maximum input points	Input signal range *	Maximum output points	Output signal range *	
Analog Input Units	CJ1W-AD041-V1	4	---	---	1 ms/point (Can be set to 250 μs/point.)
	CJ1W-AD081-V1	8			
	CJ1W-AD042	4			-10 to 10 V 0 to 10 V -5 to 5 V 1 to 5 V 4 to 20 mA

Unit		Analog input		Analog output		Conversion cycle		
		Maximum input points	Input signal range *	Maximum output points	Output signal range *			
Analog Output Units	CJ1W-DA021	---	---	2	-10 to 10 V 0 to 10 V 0 to 5 V 1 to 5 V 4 to 20 mA	1 ms/point		
	CJ1W-DA041			4				
	CJ1W-DA08V			8			-10 to 10 V 0 to 10 V 0 to 5 V 1 to 5 V	1 ms/point (Can be set to 250 μ s/point.)
	CJ1W-DA08C			8			4 to 20 mA	
	CJ1W-DA042V			4			-10 to 10 V 0 to 10 V 0 to 5 V 1 to 5 V	20 μ s for 1 point 25 μ s for 2 points 30 μ s for 3 points 35 μ s for 4 points
Analog I/O Units	CJ1W-MAD42	4	-10 to 10 V 0 to 10 V 0 to 5 V 1 to 5 V 4 to 20 mA	2	-10 to 10 V 0 to 10 V 0 to 5 V 1 to 5 V 4 to 20 mA	1 ms/point (Can be set to 500 μ s/point.)		

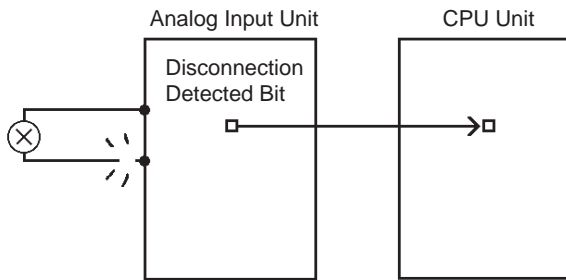
* You can separately set the input signal range or output signal range for each input or output.

Unit support for functions is shown in the following table.

Unit		Input disconnection detection	Peak value hold	Output hold	Mean value processing	Proportional conversion	Offset and gain adjustment	Scaling
Analog Input Units	CJ1W-AD041-V1	Supported.	Supported.	Not supported.	Supported.	Not supported.	Supported.	Not supported.
	CJ1W-AD081-V1	Supported.	Supported.	Not supported.	Supported.	Not supported.	Supported.	Not supported.
	CJ1W-AD042	Supported.	Supported.	Not supported.	Supported.	Not supported.	Not supported.	Supported.
Analog Output Units	CJ1W-DA041	Not supported.	Not supported.	Supported.	Not supported.	Not supported.	Supported.	Not supported.
	CJ1W-DA021	Not supported.	Not supported.	Supported.	Not supported.	Not supported.	Supported.	Not supported.
	CJ1W-DA08V	Not supported.	Not supported.	Supported.	Not supported.	Not supported.	Supported.	Supported.
	CJ1W-DA08C	Not supported.	Not supported.	Supported.	Not supported.	Not supported.	Supported.	Supported.
	CJ1W-DA042V	Not supported.	Not supported.	Supported.	Not supported.	Not supported.	Not supported.	Supported.
Analog I/O Units	CJ1W-MAD42	Supported.	Supported.	Supported.	Supported.	Supported.	Supported.	Supported.

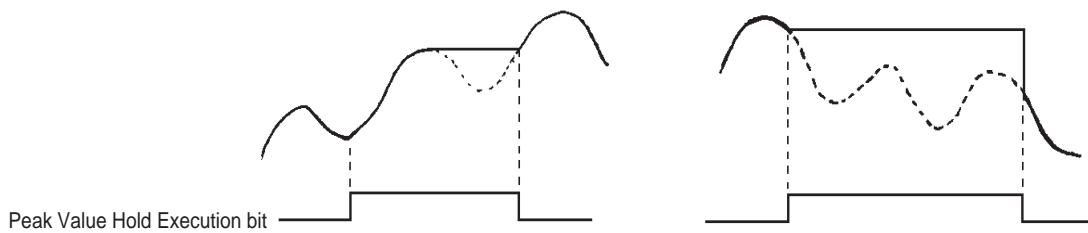
● **Input Disconnection Detection Function**

You can use the input disconnection detection function for analog inputs within an input signal range of 1 to 5 V (4 to 20 mA). Any input under 0.3 V (1.2 mA) will be regarded as a disconnection. For details, refer to 2-6-4, 3-6-5 or 6-6-5.



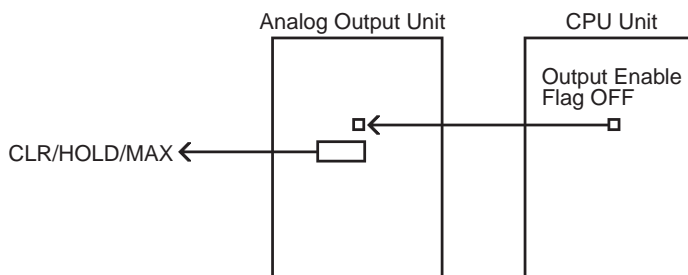
● **Peak Value Hold Function**

The peak value hold function holds the maximum digital conversion value for every input (this includes mean value processing). You can use this function with analog input. The following diagram shows how digital conversion values are affected when the peak value hold function is used. For details, refer to 2-6-3, 3-6-4 or 6-6-3.



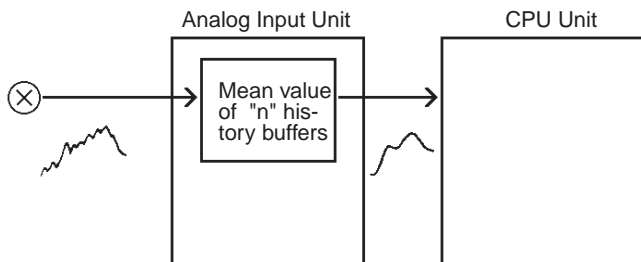
● **Output Hold Function**

You can use the output hold function to hold the analog output value at any preset value during a major fault level Controller error at the CPU Unit or when specified by the CPU Unit. When output stops, you can select CLR, HOLD, or MAX for output. For details, refer to 4-6-2, 5-6-2 or 6-7-2.



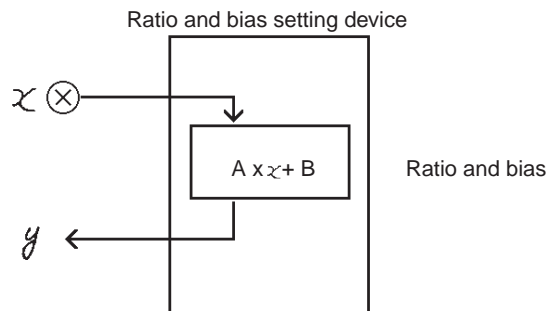
● Mean Value Function

You can use the mean value function to remove erroneous values that occur due to factors such as noise that is included in analog inputs. The operating mean is taken without affecting the data refresh cycle. For details, refer to 2-6-2, 3-6-2 or 6-6-2.



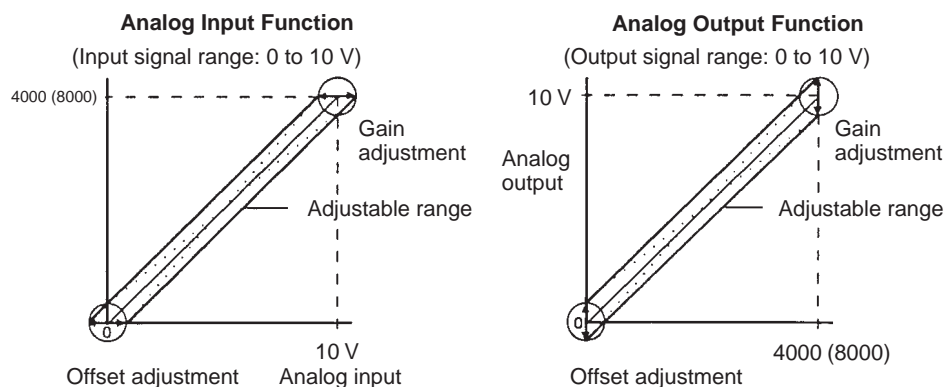
● Ratio Conversion Function

The CJ1W-MAD42 Analog I/O Unit can output in analog format the results of analog inputs calculated for ratio and bias. For details, refer to 6-8.



● Offset and Gain Adjustment Function

You can adjust the A/D and D/A converter offset deviation and gain deviation for each input and output. The offset and gain adjustments are made with the Unit set for the Adjustment Mode, and the adjustment values are stored in the Unit's built-in non-volatile memory. For details, refer to 7-1 *Adjusting Offset and Gain*.



● **Scaling Function**

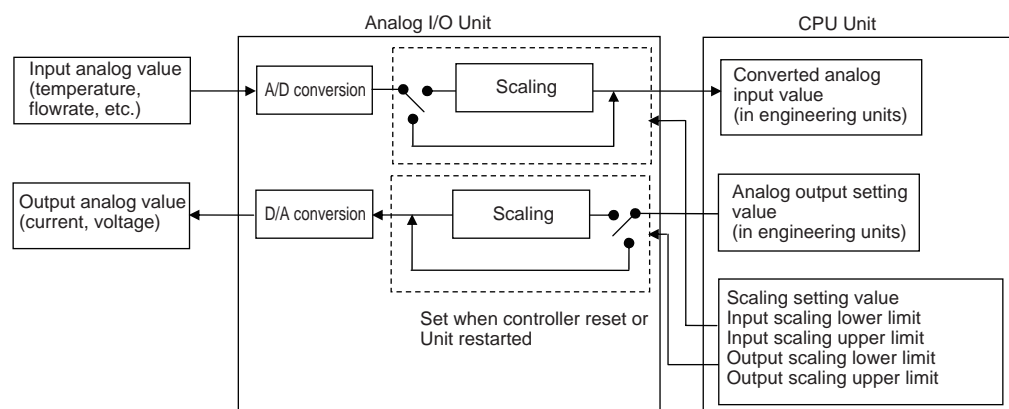
With CJ1W-AD042 Analog Input Units (*1), CJ1W-DA08V/08C/042V Analog Output Units (*1), and CJ1W-MAD42 Analog I/O Units, you can automatically convert input analog values and output analog set values into user-specified units.

When upper and lower limit parameters are preset in the CPU Unit's initial setting parameters, within a decimal range of -32,000 to +32,000, you can automatically convert input analog values and output analog set values into user-specified industrial units. (*2)

- *1 Only input scaling is supported by CJ1W-AD042 Analog Input Units.
Only output scaling is supported by CJ1W-DA08V/08C/042V Analog Output Units.
- *2 With the CJ1W-DA08V/08C Analog Output Unit and CJ1W-MAD42 Analog I/O Unit, you can scale only for a conversion cycle of 1 ms and a resolution of 4,000. The scaling function is not enabled for a conversion cycle of 250 μs (500 μs for the CJ1W-MAD42) and a resolution of 8,000.

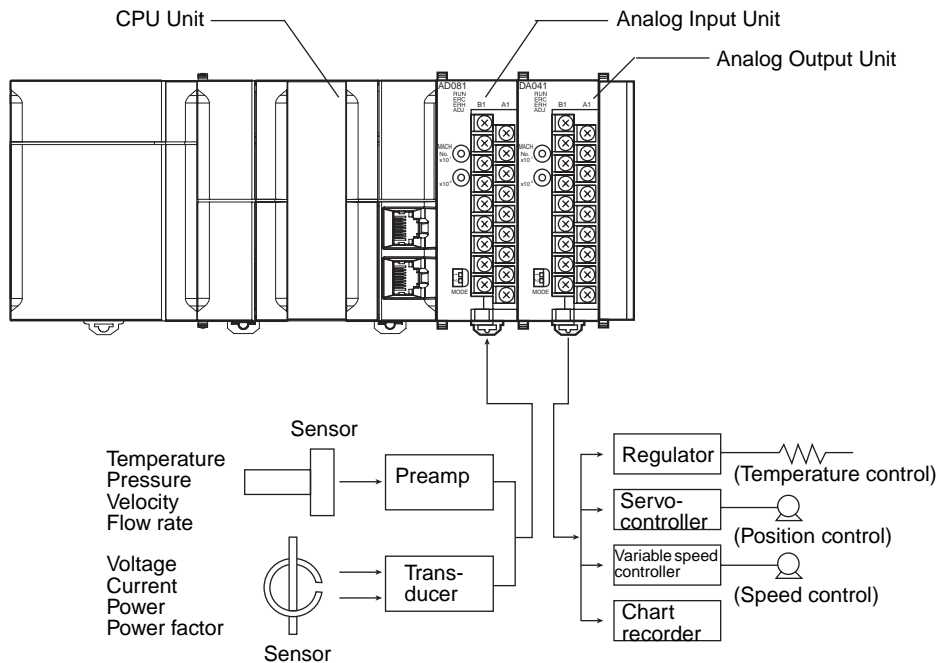
Refer to 3-6-3, 4-6-3, 5-6-3, 6-6-4 or 6-7-3.

Conceptual Diagram of Scaling (CJ1W-MAD42 Only)



1-2 Mounting the Unit

1-2-1 Basic System Configuration



Note The above diagram is an installation example for the CJ1W-AD081-V1 Analog Input Unit and CJ1W-DA041 Analog Output Unit.

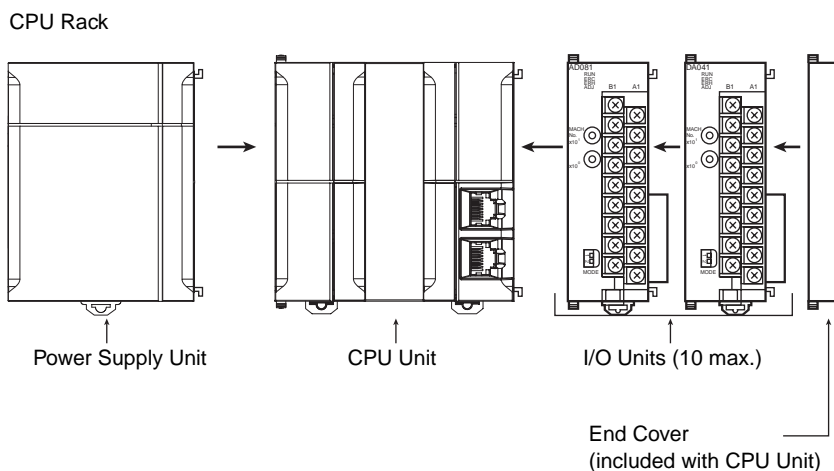
Mounting Restrictions

CJ-series Analog I/O Units are Special I/O Units of the NJ-series Controllers.

You can mount these Analog I/O Units to the CJ-series CPU Rack or Expansion Racks. The number of Analog I/O Units that you can mount to each Rack will depend on the current consumption of the other Units in the Rack. The number of Analog I/O Units that you can mount to one Rack (i.e., a CPU Rack or Expansion Rack) depends on the current consumption of other Units.

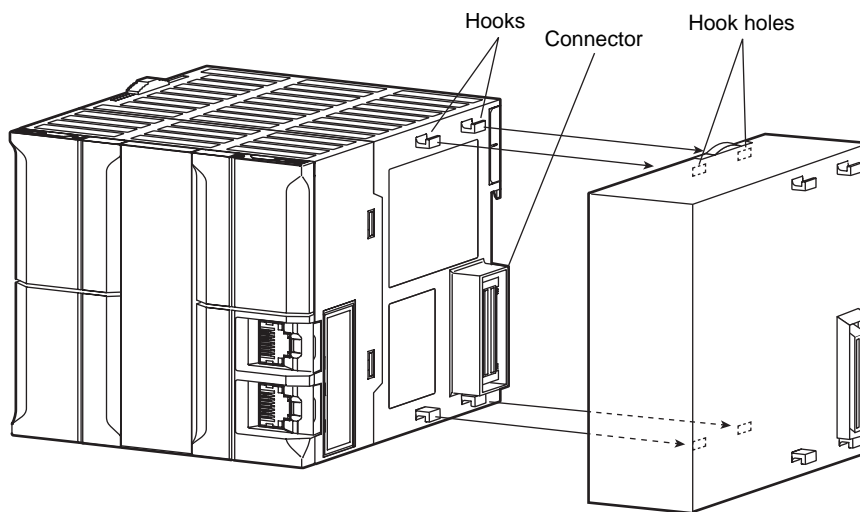
1-2-2 Mounting Procedure

Analog I/O Units are connected as I/O Units at the location of the Configuration Unit, as shown below.

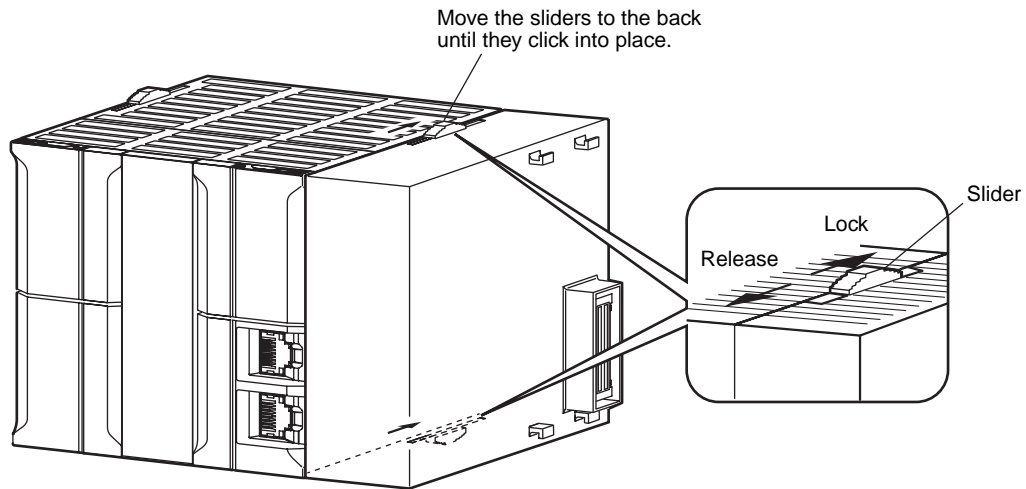


Use the following procedure to connect Analog I/O Units to a CJ-series Rack.

- 1** Align the connectors and press in firmly on the Units to connect them completely.



- 2** Move the sliders on the top and bottom of the Unit to the lock position to secure the Units. The sliders should click into place.



- 3** Attach an End Cover to the Unit on the right end of the Rack.

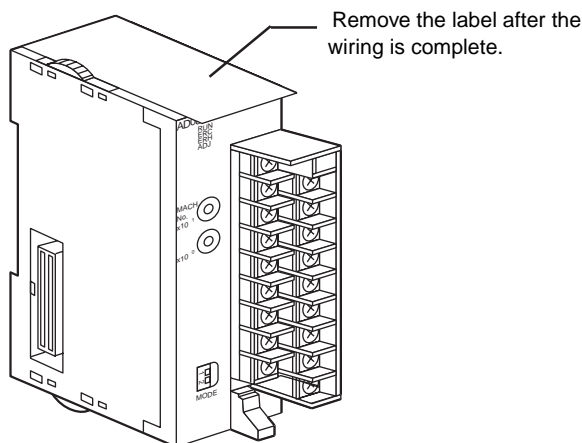


Precautions for Safe Use

The NJ-series function may not operate properly if the sliders are not locked firmly into place.

1-2-3 Precautions

- Be sure to turn OFF the power supply to the Controller before you install or disconnect Units or connect lines.
- To reduce the risk of malfunction due to electrical noise, wire input and output lines in separate ducts from high-voltage and power lines.
- Prevent wire clippings, cutting chips or other materials from getting inside the Unit. They could cause scorching, failure, and malfunction. Pay particular attention to this during installation and take measures such as covering with a cover.
- If the Unit was shipped from the factory with the dust protection label on top of the unit, be sure to remove that label before switching ON the power. The label prevents heat dissipation and could cause a malfunction.



1-3 Function Applications

Function	Application	Section
Mean value processing	Performs a smooth conversion when the input fluctuation is too extreme. Example: Removes noise interference from data such as flow/pressure.	2-6-2, 3-6-2, 6-6-2
Peak value hold	Holds the maximum value that was read. Holds the data that is less than the maximum value.	2-6-3, 3-6-4, 6-6-3
Disconnection detection	Detects disconnection of input signals.	2-6-4, 3-6-5, 6-6-5
Output hold function	Holds the output signal at the previous value for certain conditions, such as errors.	4-6-2, 5-6-2, 6-7-2
	Holds the output signal in the lower-limit value or 0 V for certain conditions, such as errors.	
	Holds the output signal in the upper-limit value for certain conditions, such as errors.	
Ratio conversion	Uses the Analog I/O Unit as a gradient setting device for setting ratio and bias.	6-8
Offset and gain adjustment	Adjusts the offset and gain, and uses the I/O functions.	7-1

2

CJ-series Analog Input Units (CJ1W-AD041-V1/081-V1)

This section explains how to use the CJ1W-AD041-V1/081-V1 Analog Input Units.

2-1	Specifications	2-2
2-1-1	Specifications	2-2
2-1-2	Input Function Block Diagram	2-4
2-1-3	Input Specifications	2-4
2-2	Operating Procedure	2-7
2-3	Components and Switch Settings	2-9
2-3-1	Component Names	2-9
2-3-2	Indicators	2-10
2-3-3	Unit Number Switches	2-11
2-3-4	Operating Mode Switch	2-11
2-3-5	Voltage/Current Switch	2-12
2-4	Wiring	2-13
2-4-1	Terminal Arrangement	2-13
2-4-2	Internal Circuit	2-14
2-4-3	Voltage Input Disconnection	2-15
2-4-4	Input Wiring Example	2-16
2-4-5	Input Wiring Considerations	2-17
2-5	Exchanging Data with the CPU Unit	2-18
2-5-1	Outline of Data Exchange	2-18
2-5-2	Accessing from the User Program	2-19
2-5-3	Allocating Device Variable for CJ-series Unit	2-20
2-6	Analog Input Functions and Operating Procedures	2-25
2-6-1	Input Settings and Conversion Values	2-25
2-6-2	Mean Value Processing	2-27
2-6-3	Peak Value Hold Function	2-31
2-6-4	Input Disconnection Detection Function	2-32

2-1 Specifications

2-1-1 Specifications

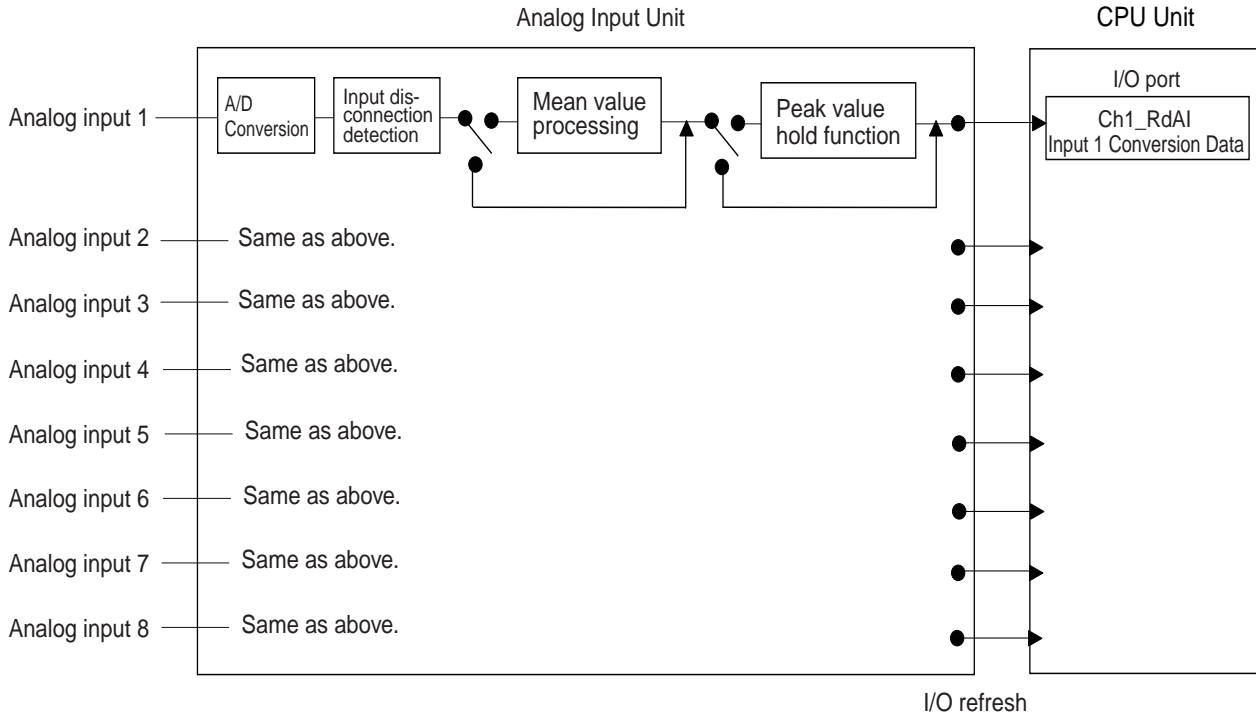
Item		CJ1W-AD041-V1	CJ1W-AD081-V1	
Unit type		CJ-series Special I/O Unit		
Isolation *1		Between inputs and internal signals: Photocoupler (No isolation between input signals.)		
External connection terminal		18-point detachable terminal block (M3 screws)		
Current consumption		420 mA at 5 VDC		
Dimensions (mm) *2		31 × 90 × 65 (W × H × D)		
Weight		140 g max.		
General specifications		Conforms to general specifications for NJ Series.		
Mounting position		NJ-Series CPU Rack or NJ-Series Expansion Rack		
Maximum number of Units		Per CPU Rack or Expansion Rack *3	Power Supply Unit	No. of mountable Units
			NJ-PA3001	Max. 10 units on CPU Rack Max. 10 units per Expansion Rack
			NJ-PD3001	Max. 3 units on CPU Rack Max. 4 units per Expansion Rack
Data exchange with the CPU Unit		Data exchange with I/O ports Refer to 2-5 <i>Exchanging Data with the CPU Unit</i> .		
Inputs specifications	Number of analog inputs	4	8	
	Input signal range *4	1 to 5 V 0 to 5 V 0 to 10 V −10 to 10 V 4 to 20 mA *5		
	Maximum rated input *6	Voltage Input: ±15 V Current Input: ±30 mA		
	Input impedance	Voltage Input: 1 MΩ min. Current Input: 250 Ω (rated value)		
	Resolution *7	4,000/8,000	4,000/8,000	
	Converted output data	16-bit integer (INT)		
	Accuracy *8	23±2°C	Voltage Input: ±0.2% of full scale Current Input: ±0.4% of full scale	
		0°C to 55°C	Voltage Input: ±0.4% of full scale Current Input: ±0.6% of full scale	
A/D conversion cycle *9	1 ms/250 μs *7	1 ms/250 μs *7		
Inputs functions	Mean value processing	Stores the last "n" sampling data in the buffer, and stores the mean value of the conversion values. (Number of samplings: n = 2, 4, 8, 16, 32, 64)		
	Peak value hold	Stores the maximum conversion value while the specified Peak Value Hold Execution bit is ON.		
	Input disconnection detection	Detects the disconnection and turns ON the Disconnection Detected Bit. *10		

*1 Do not apply a voltage higher than 600 V to the terminal block when you perform a withstand voltage test on this Unit. Otherwise, internal elements may deteriorate.

*2 Refer to A-1 *Dimensions* for details on the Unit's dimensions.

- *3 The maximum number of Analog Input Units that you can mount to one Rack depends on the current consumption of other units that are mounted.
- *4 You can set input signal ranges for each input.
- *5 Use the voltage/current switch at the back of the terminal block to choose voltage input or current input.
- *6 Use within the specified input range. Exceeding the specified range may result in failure.
- *7 With Analog Input Units, the resolution can be set to 8,000 and the conversion cycle to 250 μ s in the initial setting parameter. Note that the settings for resolution and conversion cycle are changed simultaneously.
- *8 The accuracy is given for full scale. For example, when resolution is 4,000, an accuracy of $\pm 0.2\%$ means a maximum error of ± 8 (BCD).
The default setting is adjusted for voltage input. To use current input, perform the offset and gain adjustments as required.
- *9 The A/D conversion cycle is the time it takes for an analog signal to be stored in the Analog Input Unit memory as conversion data after it has been input. It takes at least one task period before the conversion data is read by the CPU Unit.
- *10 Line disconnection detection is supported only when the range is set to 1 to 5 V or 4 to 20 mA. If there is no input signal when the 1 to 5-V or 4 to 20-mA range is set, the Line Disconnection Flag will turn ON.

2-1-2 Input Function Block Diagram

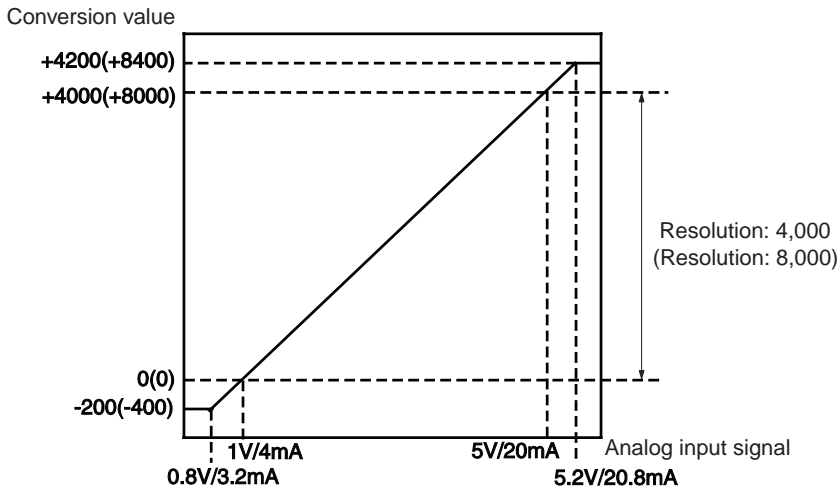


Note There are only four analog inputs for the CJ1W-AD041-V1.

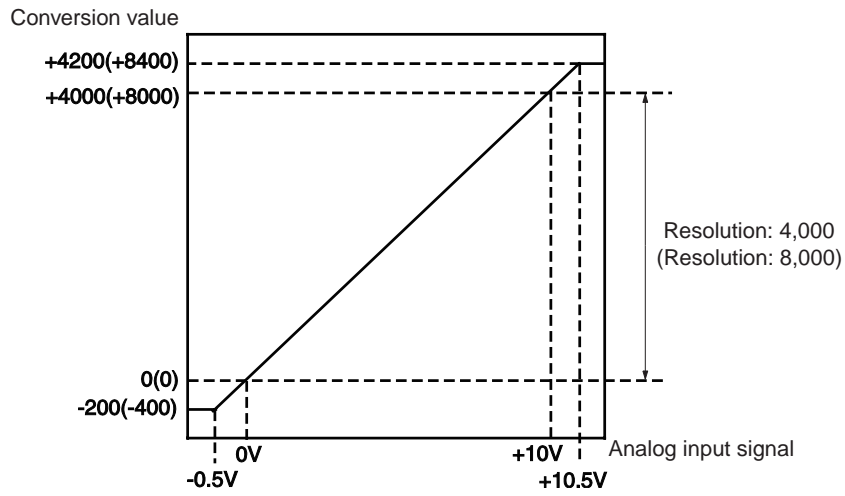
2-1-3 Input Specifications

If signals that are outside the specified range provided below are input, the conversion values (16-bit integer) used will be either the maximum or minimum value.

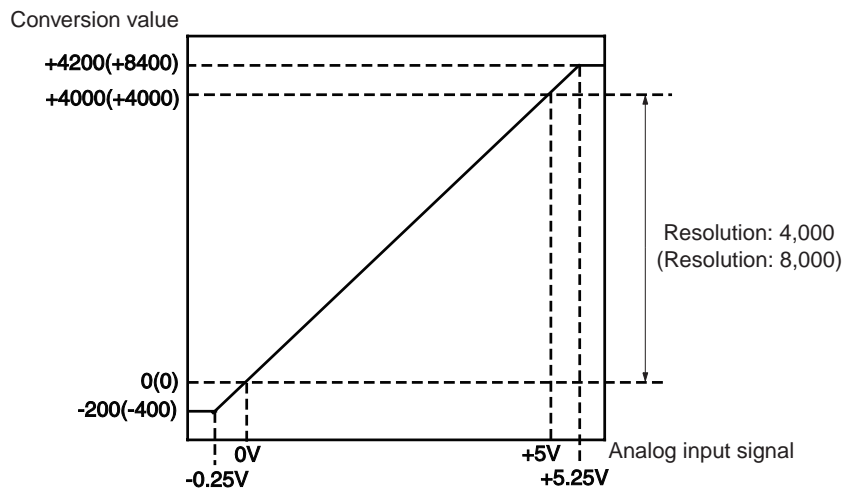
Range: 1 to 5 V (4 to 20 mA)



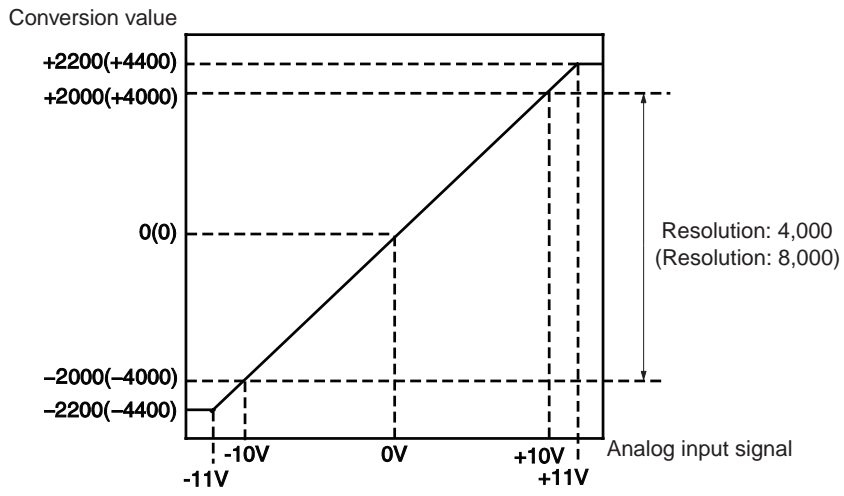
Range: 0 to 10 V



Range: 0 to 5 V



Range: -10 to 10 V



2-2 Operating Procedure

Follow the procedures outlined below when using the Analog Input Unit.

There is no restriction regarding the sequence of "Programs and software settings" and "Hardware setting and Rack assembly." These tasks may be carried out concurrently or in the reverse order.

Use Sysmac Studio to create and set programs.

For operations of Sysmac Studio, refer to the *Sysmac Studio Version 1 Operation Manual* (Cat. No. W504).

● Programs and software settings

- 1** Create POU and global variables
Create Unit Configuration
 - Create and register global variables and each POU.
 - Create algorithms for each POU and register local variables of each POU.
 - Register the Unit in the Unit Configuration on the CPU/Expansion Racks screen in Configuration and Setup.
At this time, set both the device name and the unit number of the unit to be registered.
 - Create device variable for CJ-series Unit by using I/O Map.
- 2** Create Unit initial setting parameters
Create the Unit settings by using Special Unit Setup Editing.
 - Set the input numbers to be used.
 - Set the input signal ranges.
 - Set the number of mean value processing samplings.
 - Set the conversion cycle and resolution.
(When the program is transferred, the items set here will be reflected in the initial setting parameters.)

● Hardware setting and Rack assembly

- 1** Set the operating mode to Normal Mode.
Set DIP switch on the front panel to Normal Mode.
- 2** Set the voltage/current switch at the back of the terminal block.
- 3** Use the unit number switches on the front panel of the Unit to set the unit number.
Set the same unit number as in the Unit Configuration settings.
- 4** Mount and wire the Unit to either a CPU Rack or Expansion Rack.
- 5** Turn ON the power to the Controller.
At this time, an I/O Setting Check Error occurs when there is a Unit Configuration in the CPU Unit which does not match the actual Unit Configuration. In this case, with the step *Turn OFF the power to the Controller*, turn off the power to the Controller or reset the Controller to cancel the error.

● **Program transfer and adjustment**

- 1** Transfer programs, Unit Configuration and Setup and variable information.
- 2** Turn OFF the power to the Controller.
 - Reset the Controller if adjusting offset and gain is not required.
The power need not be cycled.
- 3** Set the operating mode switch to Adjustment Mode.
Set DIP switch on the front panel to Adjustment Mode.
- 4** Turn the power to the Controller OFF and ON.
 - The Special Unit is restarted and operates in the Adjustment Mode. In the Adjustment Mode, the ADJ indicator flashes.
 - Set the CPU Unit to PROGRAM mode.
- 5** Adjust the offset and gain.
Adjusting Offset and Gain is performed if the input must be calibrated for the connected device.
- 6** Turn OFF the power to the Controller.
- 7** Set the operating mode switch to Normal Mode.
Set DIP switch on the front panel to Normal Mode.
- 8** Turn the power to the Controller OFF and ON.
 - The Special Unit is restarted and operates in the Normal Mode.
 - In the Normal Mode, the ADJ indicator remains unlit.

● **Main operation**

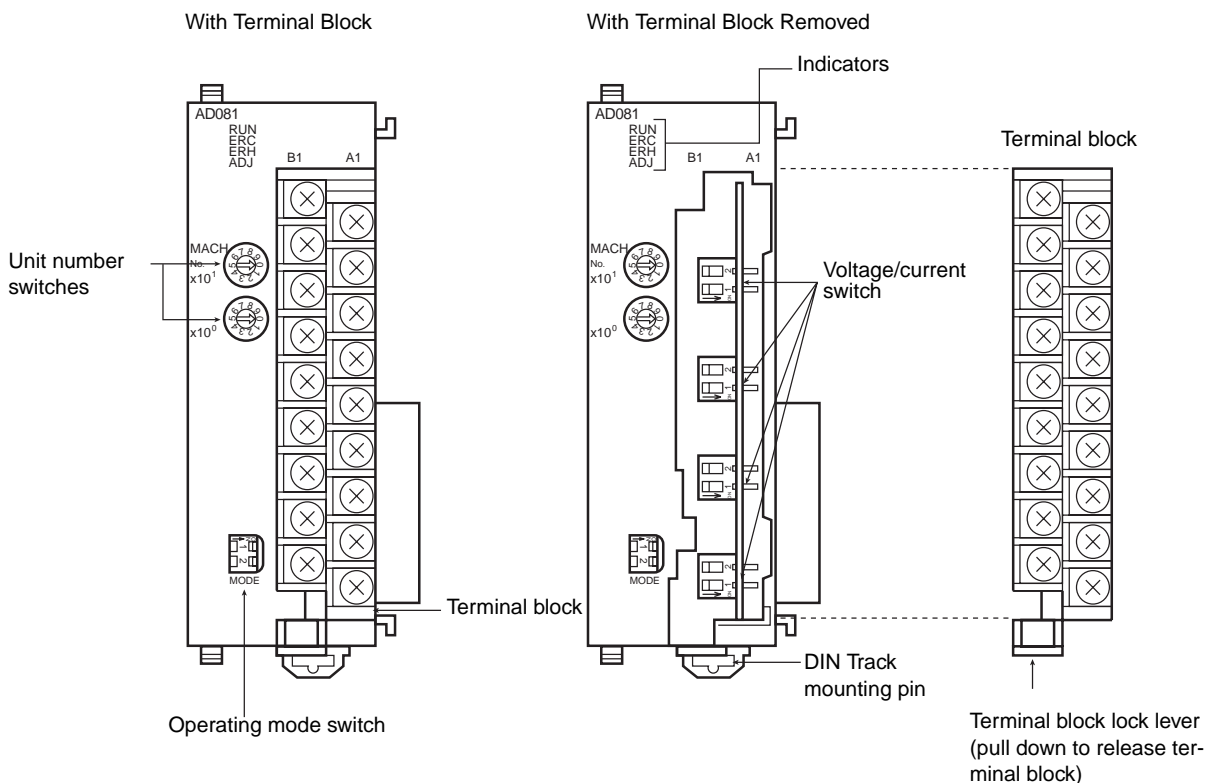
- 1** Main operation
Read or write set values from the user program.
Acquire conversion value and status (disconnection detection and error flag)
Specify the peak value hold function.

2-3 Components and Switch Settings

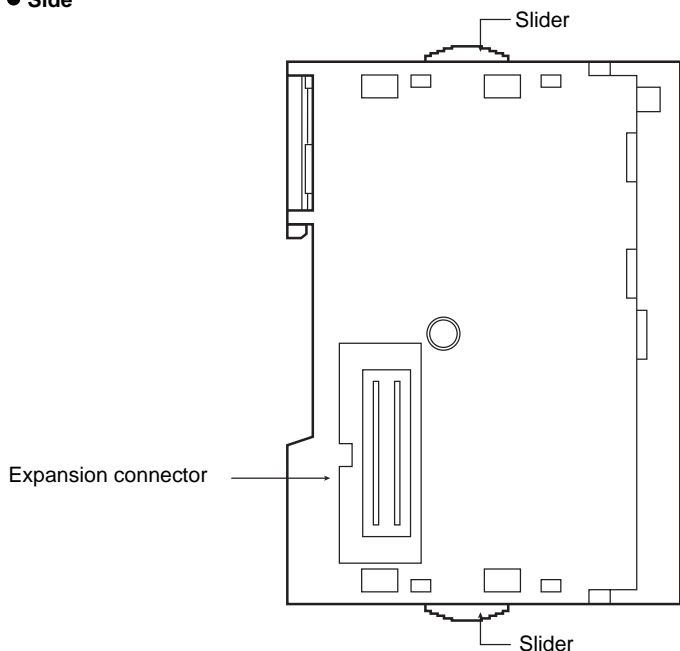
2-3-1 Component Names

CJ1W-AD041-V1/CJ1W-AD081-V1

● Front



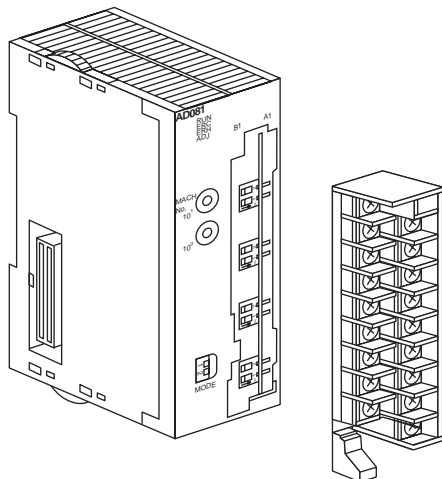
● Side





Additional Information

- Use a connector to attach the terminal block. Lower the lever at the bottom of the terminal block to remove the connector.
- Normally keep the lever in the raised position. Confirm this before operation.



2-3-2 Indicators

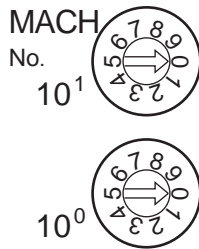
The indicators show the operating status of the Unit. The following table shows the meanings of the indicators.

Indicator	Meaning	Indicator status	Operating status
RUN (green)	Operating	Lit	Operating in Normal Mode.
		Not lit	Unit has stopped exchanging data with the CPU Unit.
ERC (red)	Error detected by Unit	Lit	Alarm has occurred (such as disconnection detection) or initial settings are incorrect.
		Not lit	Operating normally.
ERH (red)	Error in the CPU Unit	Lit	Error has occurred during data exchange with the CPU Unit.
		Not lit	Operating normally.
ADJ (yellow)	Adjusting	Flashing	Operating in offset/gain Adjustment Mode.
		Not lit	Other than the above.

2-3-3 Unit Number Switches

Use the unit number switches to set the specific unit number for each Special I/O Unit mounted in a CPU Rack or Expansion Rack. The unit number must be the one registered in Unit Configurations.

Turn OFF the Controller before changing the unit number setting.



Switch setting	Unit number
0	Unit #0
1	Unit #1
2	Unit #2
3	Unit #3
4	Unit #4
5	Unit #5
6	Unit #6
7	Unit #7
8	Unit #8
9	Unit #9
10	Unit #10
to	to
n	Unit #n
to	to
95	Unit #95



Additional Information

- If two or more Special I/O Units are assigned the same unit number, a "Duplicate Unit Number" major fault level Controller error is generated and the Controller will not operate.
- After correcting the unit number setting, cycle the power to the Controller.

2-3-4 Operating Mode Switch

The operating mode switch on the front panel of the Unit is used to set the operating mode to either Normal Mode or Adjustment Mode (to adjust offset and gain).

Even if the Normal Mode is set, you can set Operating Mode Settings (*_MdCfg) to the Adjustment Mode (16#C1) and transfer the data setup file to switch to the Adjustment Mode.



MODE

Pin number		Mode
1	2	
OFF	OFF	Normal Mode
ON	OFF	Adjustment Mode

Note The default settings for SW1 and SW2 are both OFF.



Precautions for Safe Use

Be sure to turn OFF the power of the Controller before operating the operating mode switch.

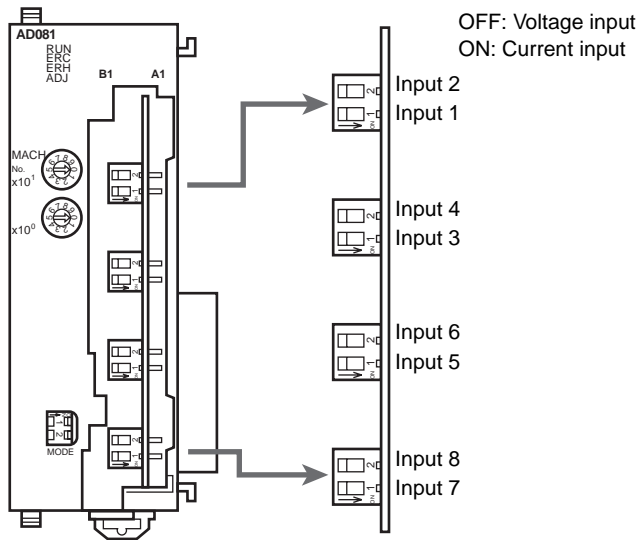


Precautions for Correct Use

- Do not set the pins to any combination other than those shown in the above table.
- Be sure to set pin 2 to OFF.

2-3-5 Voltage/Current Switch

Change the pin settings on the voltage/current switch located on the back of the terminal block to switch the analog conversion input from voltage input to current input.



Note There are only four inputs for the CJ1W-AD041-V1.



Precautions for Safe Use

Be sure to turn OFF the power to the Controller before you mount or remove the terminal block.

2-4 Wiring

2-4-1 Terminal Arrangement

The signal names that correspond to the connecting terminals are as shown in the following diagram.

● CJ1W-AD041-V1

Input 2 (+)	B1	A1	Input 1 (+)
Input 2 (-)	B2	A2	Input 1 (-)
Input 4 (+)	B3	A3	Input 3 (+)
Input 4 (-)	B4	A4	Input 3 (-)
AG	B5	A5	AG
N.C.	B6	A6	N.C.
N.C.	B7	A7	N.C.
N.C.	B8	A8	N.C.
N.C.	B9	A9	N.C.

● CJ1W-AD081-V1

Input 2 (+)	B1	A1	Input 1 (+)
Input 2 (-)	B2	A2	Input 1 (-)
Input 4 (+)	B3	A3	Input 3 (+)
Input 4 (-)	B4	A4	Input 3 (-)
AG	B5	A5	AG
Input 6 (+)	B6	A6	Input 5 (+)
Input 6 (-)	B7	A7	Input 5 (-)
Input 8 (+)	B8	A8	Input 7 (+)
Input 8 (-)	B9	A9	Input 7 (-)



Additional Information

- Use the device variable for CJ-series Unit Input Use Settings (*Ch#_InChUseCfg*) to set the analog input number that you can use.
- Use the device variable for CJ-series Unit Input Signal Range Settings (**_InRngCfg*) to set the input signal range for each analog input. The input signal range can be set separately for each input number.
- The AG terminals are connected to the 0-V analog circuit in the Unit. Connect the input line shield to improve noise resistance.



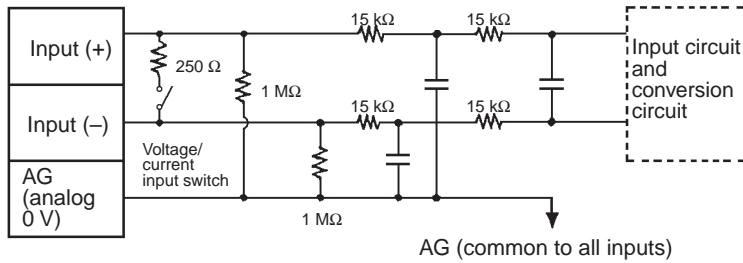
Precautions for Correct Use

Do not make any connections to the N.C. terminals.

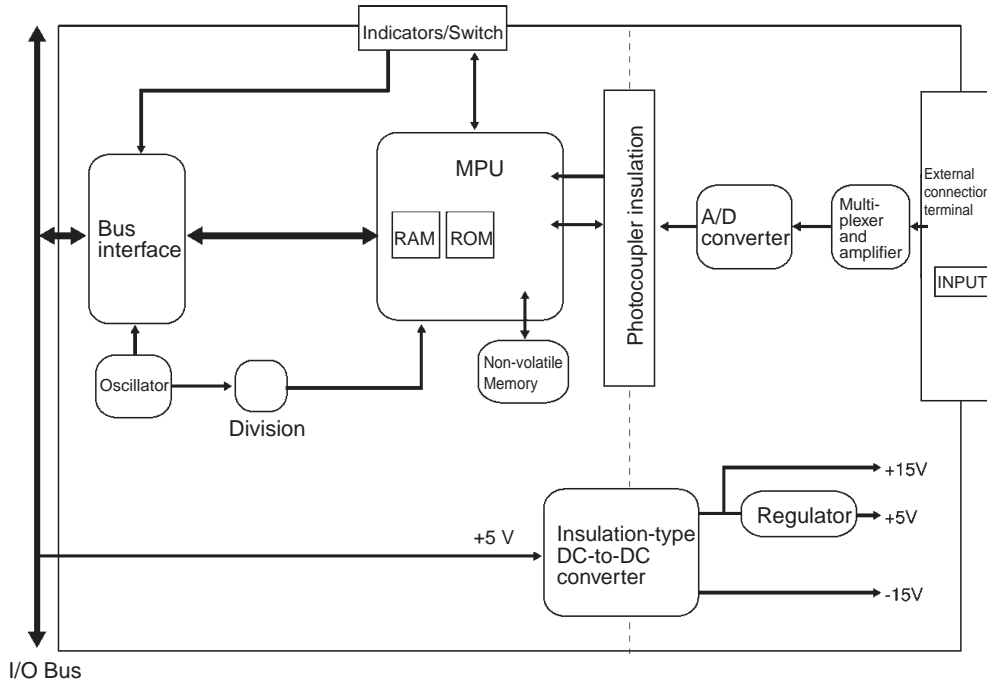
2-4-2 Internal Circuit

The following diagrams show the internal circuit of the analog input section.

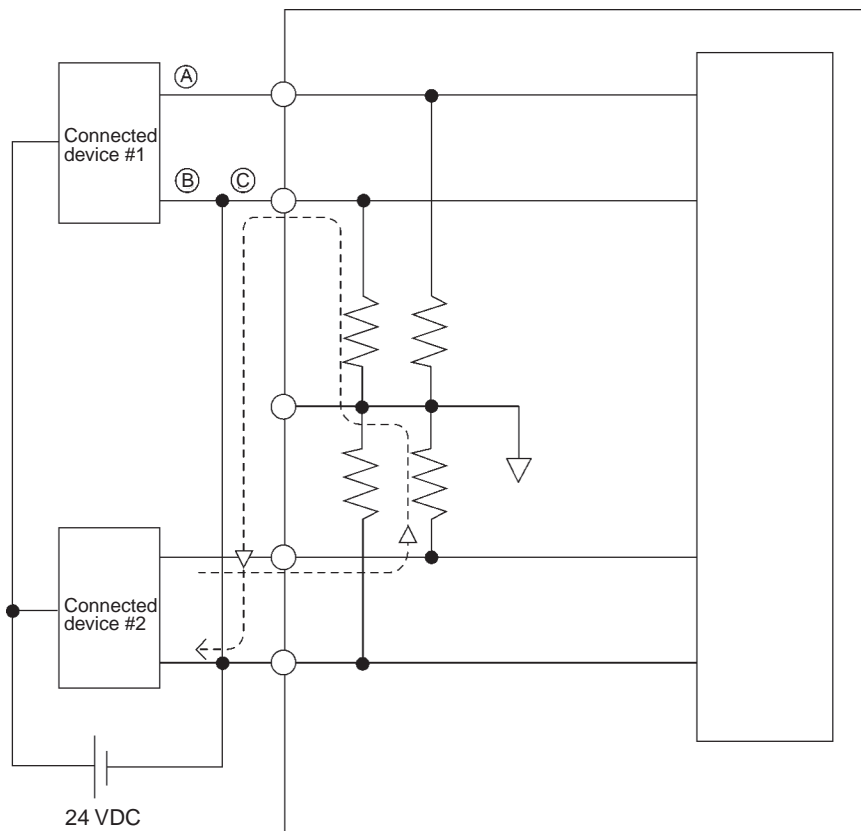
● Input Circuit



● Internal Configuration



2-4-3 Voltage Input Disconnection



(Example)

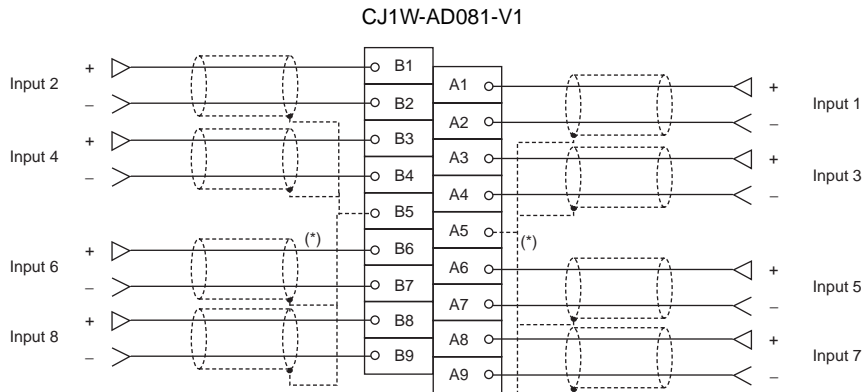
If the connected device #2 in the above example outputs 5 V and the power supply is shared by 2 channels as shown in the above diagram, approximately one-third of the voltage, or 1.6 V, will be input at input 1.

When voltage inputs are used and a disconnection occurs, separate the power supply at the side of the connected devices or use an insulating device (isolator) for each input to avoid the following problems.

When the power supply at the connected devices is shared and section A or B is disconnected, power will flow in the direction of the broken line and the output voltage of the other connected devices will be reduced to between a third to a half of the voltage. If 1 to 5 V is used and the reduced voltage output, disconnection may not be detectable. If section C is disconnected, the power at the (-) input terminal will be shared and disconnection will not be detectable.

For current inputs, you can share the power supply between the connected devices without causing any problems.

2-4-4 Input Wiring Example



* There are only four inputs for the CJ1W-AD041-V1. Inputs 5 to 8 are not used.

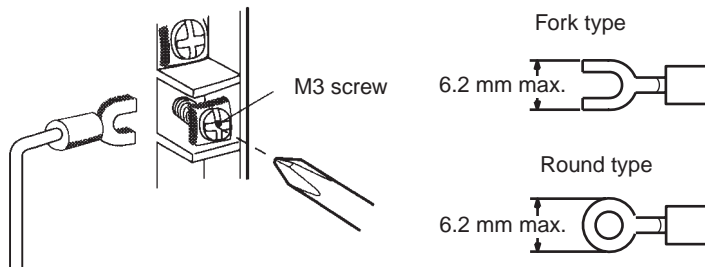
The AG terminal need not be connected in normal conditions, but if noise is of concern, connect the shielded wire for each input by one of the following methods:

- Connect the end of the shielded wire* on AD Unit side, to the AG terminals, as shown in the above diagram. Use a wire that is 30 cm or shorter if possible. In this case, do not connect the end of the shielded wire on output device side to any other device or FG.
- Ground the end of the shielded wire on AD Unit side to the FG on the control panel. In this case, keep the AG terminal open and do not connect the end of the shielded wire on output device side to any other device or FG.



Precautions for Safe Use

Crimp-type terminals must be used for terminal connections, and the screws must be tightened securely. Use M3 screws and tighten them to a torque of 0.5 N·m.



Precautions for Correct Use

- When you use current inputs, turn ON the voltage/current switches. Refer to 2-3-5 *Voltage/Current Switch* for further details.
- For inputs you do not use, set them to Not Used in the input number settings (refer to *Setting Use Settings and Input Signal Ranges* in 2-6-1 *Input Settings and Conversion Values*). If they are set to Used and actually not used, unintended conversion data may be input. To prevent this, short-circuit the voltage input terminals (V+) and (V-). Take note that, in the case of a range from 1 to 5-V or 4 to 20-mA, short-circuiting (V+) and (V-) causes the Disconnection Detected bit to turn ON.
- Do not connect anything to N.C. terminals shown in the wiring diagram on 2-4-1 *Terminal Arrangement*.

2-4-5 Input Wiring Considerations

When you wire inputs, apply the following points to avoid noise interference and optimize Analog Input Unit performance.

- Use two-core shielded twisted-pair cables for input connecting lines.
- Route input cables separately from the AC cable, and do not run the Unit's cables near a main circuit cable, high voltage cable, or a non-PLC load cable.
- If there is noise interference from power lines (for example, the power supply is shared with electrical welding devices or electrical discharge machines, or there is a high-frequency generation source nearby) install a noise filter at the power supply input area.

2-5 Exchanging Data with the CPU Unit

2-5-1 Outline of Data Exchange

The CPU Unit and Analog Input Unit CJ1W-AD041-V1/AD081-V1 exchange operation data and initial setting parameters via the I/O port generated for this Analog Input Unit.

The table and figure below show the data exchange method for each data type.

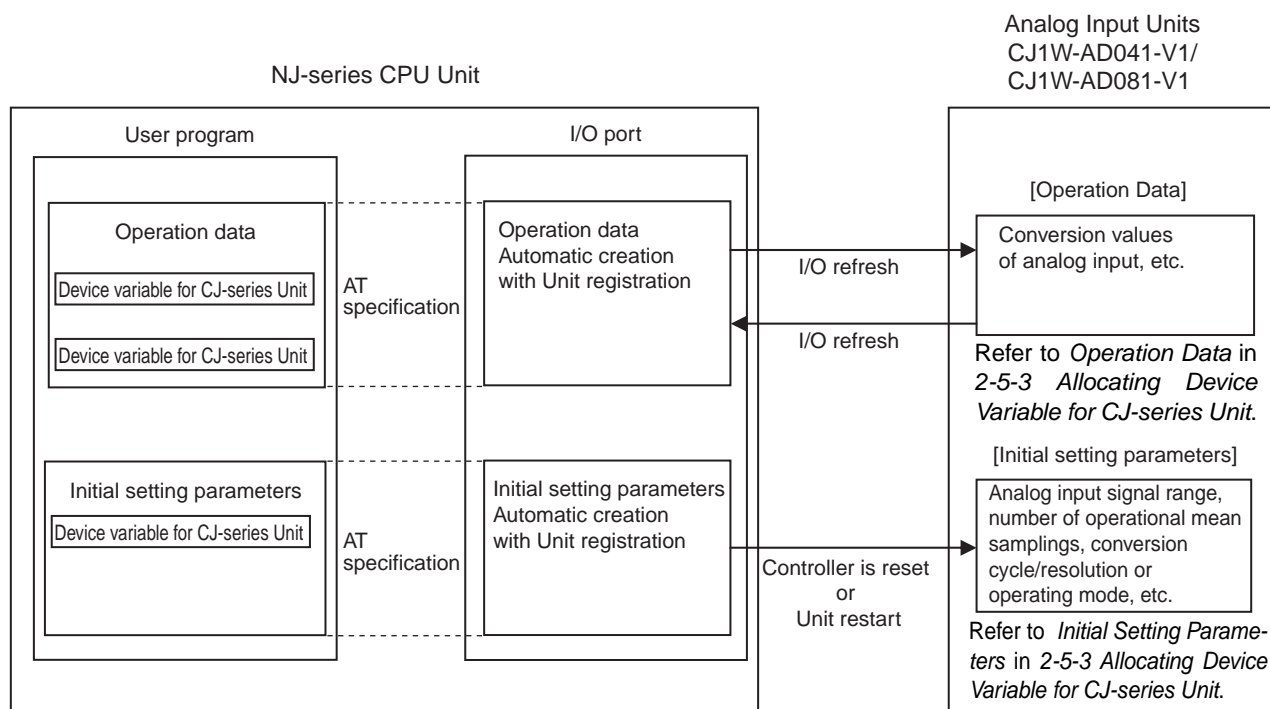
Data exchange type

Unit data type	Data contents	AT specification destination	How to access from user program	Timing of data exchange
Operation data	Analog input conversion value, etc.	I/O port (operation data)	Device variable for CJ-series Unit	At I/O refreshing
Initial setting parameters	Analog input signal range, number of operational mean samplings, etc.	I/O port (initial setting parameters) *	Device variable for CJ-series Unit	When the Controller is reset or the Unit restarts
Unit Restart Bit, etc.	Unit Restart Bit, etc.	None	System-defined variable	At I/O refreshing

* The initial setting parameters are retained in the CPU Unit by the battery even during power interruptions.

● Device Variable for CJ-series Unit

Device variables for CJ-series Unit are variables used for data exchange between a user program and Special I/O Units. The user program uses device variables for CJ-series Unit to control the Analog I/O Unit.



2-5-2 Accessing from the User Program

The user program uses device variables for CJ-series Unit to control the Analog Input Unit.

● I/O port

An "I/O port" is a logical interface for data exchange by a CPU Unit with an Analog I/O Unit or other configuration unit.

An I/O port has a unique predefined name for each unit model and function.

An I/O port is automatically created by preparing the Unit Configuration with Sysmac Studio.

● How to specify device variables for CJ-series Unit

Specify the AT specifications to I/O ports for device variables for CJ-series Unit with the I/O Map from Sysmac Studio.

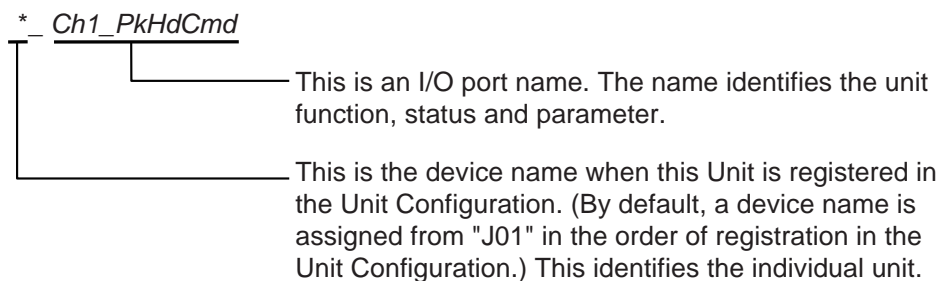
Specify the variable name for the AT specification with one of the following methods.

1. Select a variable already registered in the variable table
2. Input a new variable name
3. Automatically create a variable name with "Device variable creation"

When a device variable name for CJ-series Unit is assigned with method 2 or 3, the variable input by Sysmac Studio is automatically registered in the variable table.

The following is the configuration of variable names created with automatic creation in method 3.

Name of device variable for CJ-series Unit



For details on creation of device variables for CJ-series Unit, refer to *Sysmac Studio Version 1 Operation Manual* (Cat. No. W504).

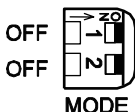
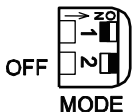
There are two types of device variables for CJ-series Unit: "Operation Data" and "Initial Setting Parameters".

In the explanations from here on, the device name automatically created is used as the device variable for CJ-series Unit, for example *_ Ch1_PkHdCmd.

Switching Operating Mode

You can switch between the Normal Mode and Adjustment Mode (during offset and gain adjustments, etc.) with the operating mode switch on the front panel of the Unit or Operating Mode Settings (*_MdCfg).

You can also use Operating Mode Settings (*_MdCfg) to switch to the Adjustment Mode even when in the Normal Mode.

Setting method	Normal Mode	Adjustment Mode
Set the front DIP switch		
Set device variables for CJ-series Unit	AND	OR
	"*_MdCfg"=16#00	"*_MdCfg"=16#C1

2-5-3 Allocating Device Variable for CJ-series Unit

Initial Setting Parameters

Perform Unit settings such as the analog input signal range, number of operational mean samplings, etc.

Initial setting parameters settings are set from Special Unit Setup Editing of Sysmac Studio.

Unit settings can also be performed by setting the values in the device variables for CJ-series Unit.

Unit settings are reflected only when the Controller is reset, or when the Unit restarts. The initial setting parameters are retained in the CPU Unit by the battery even during power interruptions.



Precautions for Safe Use

- When initial setting parameters are set and transferred from Sysmac Studio, Sysmac Studio checks whether or not the Unit must be restarted. Restart the Unit after confirming the safety of the connected destination.
- The contents of initial setting parameters will be transferred to the Unit when the Controller reset or when the Unit restarts.

List of Initial Setting Parameters (common to both Normal Mode and Adjustment Mode)

Name of device variable for CJ-series Unit	Type	R/W	Name	Feature/reference page	Bit Number
*_InChUseCfg	WORD	RW	Input Use Settings	Refer to 2-6-1 <i>Input Settings and Conversion Values</i> . WORD-type variable that combines the following BOOL-type variables:	
*_Ch1_InChUseCfg	BOOL	RW	Input 1 Use Setting	BOOL-type variable that specifies each input for use setting. 0: Not used. 1: Used Ch5 to Ch8 are used only for AD081-V1.	00
*_Ch2_InChUseCfg	BOOL	RW	Input 2 Use Setting		01
*_Ch3_InChUseCfg	BOOL	RW	Input 3 Use Setting		02
*_Ch4_InChUseCfg	BOOL	RW	Input 4 Use Setting		03
*_Ch5_InChUseCfg	BOOL	RW	Input 5 Use Setting		04
*_Ch6_InChUseCfg	BOOL	RW	Input 6 Use Setting		05
*_Ch7_InChUseCfg	BOOL	RW	Input 7 Use Setting		06
*_Ch8_InChUseCfg	BOOL	RW	Input 8 Use Setting		07
*_InRngCfg	WORD	RW	Input Signal Range Settings	Refer to 2-6-1 <i>Input Settings and Conversion Values</i> .	
*_Ch1_AveCfg	UINT	RW	Input 1 Number of Samplings for Mean Value Processing	Refer to 2-6-2 <i>Mean Value Processing</i> . 0: Number of samplings 2 1: No mean value processing 2: Number of samplings 4 3: Number of samplings 8 4: Number of samplings 16 5: Number of samplings 32 6: Number of samplings 64 Ch5 to Ch8 are used only for AD081-V1.	
*_Ch2_AveCfg	UINT	RW	Input 2 Number of Samplings for Mean Value Processing		
*_Ch3_AveCfg	UINT	RW	Input 3 Number of Samplings for Mean Value Processing		
*_Ch4_AveCfg	UINT	RW	Input 4 Number of Samplings for Mean Value Processing		
*_Ch5_AveCfg	UINT	RW	Input 5 Number of Samplings for Mean Value Processing		
*_Ch6_AveCfg	UINT	RW	Input 6 Number of Samplings for Mean Value Processing		
*_Ch7_AveCfg	UINT	RW	Input 7 Number of Samplings for Mean Value Processing		
*_Ch8_AveCfg	UINT	RW	Input 8 Number of Samplings for Mean Value Processing		
*_MdCfg	BYTE	RW	Operating Mode Settings	Refer to 2-3-4 <i>Operating Mode Switch</i> . 16#00: Normal Mode 16#C1: Adjustment Mode	
*_ResolutionCfg	BYTE	RW	Resolution/Conversion Time Settings	Refer to <i>Conversion Cycle/Resolution Setting</i> in 2-6-1 <i>Input Settings and Conversion Values</i> . 16#00: 4,000 resolutions/1 ms cycle 16#C1: 8,000 resolutions/250 μs cycle	

Operation Data

Operation data includes data such as analog input conversion value, etc. Operation data is exchanged constantly during I/O refreshing.

List of operation data (during Normal Mode)

Name of device variable for CJ-series Unit	Type	RW	Name	Feature/reference page	
*_Ch1_RdAI	INT	R	Input 1 Conversion Data	Refer to 2-6-1 <i>Input Settings and Conversion Values</i> . Input 5 to 8 are used only for AD081-V1	
*_Ch2_RdAI	INT	R	Input 2 Conversion Data		
*_Ch3_RdAI	INT	R	Input 3 Conversion Data		
*_Ch4_RdAI	INT	R	Input 4 Conversion Data		
*_Ch5_RdAI	INT	R	Input 5 Conversion Data		
*_Ch6_RdAI	INT	R	Input 6 Conversion Data		
*_Ch7_RdAI	INT	R	Input 7 Conversion Data		
*_Ch8_RdAI	INT	R	Input 8 Conversion Data		
*_PkHdCmd	WORD	RW	Peak Value Hold Execution Settings	Refer to 2-6-3 <i>Peak Value Hold Function</i> . WORD-type variable that combines the following BOOL-type variables:	Bit Number
*_Ch1_PkHdCmd	BOOL	RW	Input 1 Peak Value Hold Execution	BOOL-type variable that instructs each input for execution of peak value hold. 0: Do not perform peak value hold 1: Perform peak value hold Ch5 to Ch8 are used only for AD081-V1.	00
*_Ch2_PkHdCmd	BOOL	RW	Input 2 Peak Value Hold Execution		01
*_Ch3_PkHdCmd	BOOL	RW	Input 3 Peak Value Hold Execution		02
*_Ch4_PkHdCmd	BOOL	RW	Input 4 Peak Value Hold Execution		03
*_Ch5_PkHdCmd	BOOL	RW	Input 5 Peak Value Hold Execution		04
*_Ch6_PkHdCmd	BOOL	RW	Input 6 Peak Value Hold Execution		05
*_Ch7_PkHdCmd	BOOL	RW	Input 7 Peak Value Hold Execution		06
*_Ch8_PkHdCmd	BOOL	RW	Input 8 Peak Value Hold Execution		07
*_SensErr	BYTE	R	Disconnection Detected	Refer to 2-6-4 <i>Input Disconnection Detection Function</i> . BYTE-type variable that combines the following BOOL-type variables:	Bit Number

Name of device variable for CJ-series Unit	Type	R/W	Name	Feature/reference page
*_Ch1_SensErr	BOOL	R	Input 1 Disconnection Detected	BOOL-type variable that checks each input for disconnection. 0: No disconnection 1: Disconnection Ch5 to Ch8 are used only for AD081-V1.
*_Ch2_SensErr	BOOL	R	Input 2 Disconnection Detected	
*_Ch3_SensErr	BOOL	R	Input 3 Disconnection Detected	
*_Ch4_SensErr	BOOL	R	Input 4 Disconnection Detected	
*_Ch5_SensErr	BOOL	R	Input 5 Disconnection Detected	
*_Ch6_SensErr	BOOL	R	Input 6 Disconnection Detected	
*_Ch7_SensErr	BOOL	R	Input 7 Disconnection Detected	
*_Ch8_SensErr	BOOL	R	Input 8 Disconnection Detected	
*_UnitErr	BYTE	R	Error Flags	Refer to <i>7-2-2 Alarms Occurring at the Unit</i> . BYTE-type variable that combines the following BOOL-type variables:
*_AveErr	BOOL	R	Mean Value Processing Setting Error	0: No error 1: Error in initial setting parameters

List of Operation Data (during Adjustment Mode)

Name of device variable for CJ-series Unit	Type	R/W	Name	Feature/reference page	
*_AdjCh	BYTE	RW	Inputs to Be Adjusted	Refer to 7-1 <i>Adjusting Offset and Gain</i> . Setting and instruction flag for input adjustments.	
*_AdjOfs	BOOL	RW	Offset Flag		
*_AdjGain	BOOL	RW	Gain Flag		
*_AdjDwn	BOOL	RW	Adjustment Value Down Flag		
*_AdjUp	BOOL	RW	Adjustment Value Up Flag		
*_AdjSet	BOOL	RW	Adjustment Value Set Flag		
*_AdjClr	BOOL	RW	Adjustment Value Clear Flag		
*_AdjPV	INT	R	Conversion value for adjustment		
*_AdjUnitErr	BYTE	R	Error Flags	Refer to 7-2-2 <i>Alarms Occurring at the Unit</i> . BYTE-type variable that combines the following BOOL-type variables:	Bit Number
*_AdjAveErr	BOOL	R	Mean Value Processing Setting Error	0: No error 1: Error in initial setting parameters	03
*_AdjInErr	BOOL	R	Input Value Adjustment Range Exceeded	0: No error 1: Input outside adjustable range	04
*_AdjInNoErr	BOOL	R	Input Value Adjustment Number Setting Error	0: No error 1: Setting "**_AdjCh" is out of range	05
*_AdjMemErr	BOOL	R	Non-volatile Memory Error	0: No error 1: Adjustment data could not be written properly	06
*_AdjMd	BOOL	R	Starting Adjustment Mode	0: Running in the Normal Mode 1: Running in the Adjustment Mode	07

2-6 Analog Input Functions and Operating Procedures

2-6-1 Input Settings and Conversion Values

Setting Use Settings and Input Signal Ranges

● Input Use Settings

Analog Input Unit converts only the analog inputs specified among input numbers 1 to 8 (1 to 4 for AD041-V1). The Unit skips samplings with unused input.

Accordingly, the conversion cycle per unit is calculated by conversion cycle × used input points.

For the conversion cycle setting, refer to 2-6-2 *Mean Value Processing* on page 2-27.

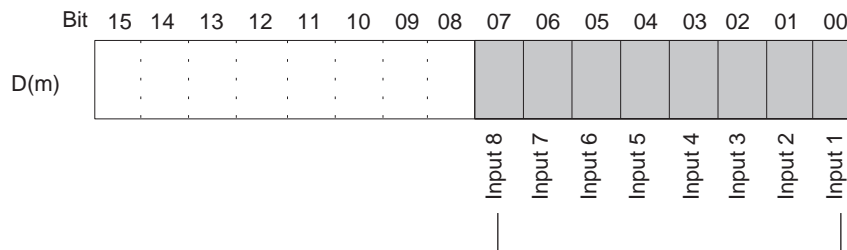
Use the Input # Use Setting (*_Ch#_InChUseCfg) to set the analog inputs to be used.

Variable name	Type
*_Ch#_InChUseCfg	BOOL
	0: Not used
	1: Used

An input number from 1 to 8 is included in place of # in the variable name.

You can also perform batch settings with Input Use Setting (*_InChUseCfg).

Variable name	Type	Setting
*_InChUseCfg	WORD	16#0000 to 16#00FF (To 16#000F for AD041-V1)



0: Not used
1: Used



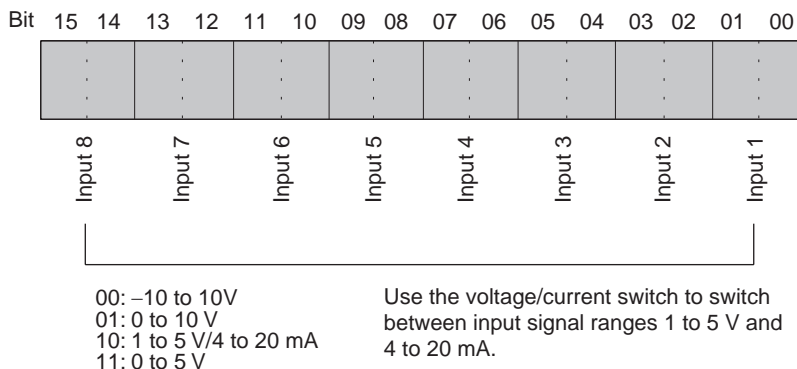
Additional Information

The input conversion value set to "Not used" will be "0" at all times.

● Input Signal Ranges

For input numbers 1 to 8 (1 to 4 for AD041-V1), select from four types of input signal ranges: -10 to +10 V, 0 to 10 V, 1 to 5 V/4 to 20 mA, and 0 to 5 V. Use the Input Signal Range Settings (*_InRngCfg) to set the used input signal ranges.

Variable name	Type	Setting
*_InRngCfg	WORD	16#0000 to 16#FFFF (To 16#00FF for AD041-V1)



Precautions for Safe Use

- When initial setting parameters are set and transferred from Sysmac Studio, Sysmac Studio checks whether or not the Unit must be restarted. Restart the Unit after confirming the safety of the connected destination.
- The contents of initial setting parameters will be transferred to the Unit when the Controller reset or when the Unit restarts.

Reading Conversion Values

Analog input conversion values are output to the device variable for CJ-series Unit Input # Conversion Data (*_Ch#_RdAI) shown below.

Variable name	Type
*_Ch#1_RdAI	INT

An input number from 1 to 8 is included in place of # in the variable name (1 to 4 for AD041-V1).

Conversion Cycle/Resolution Setting

You can switch the conversion cycle and resolution with Resolution/Conversion Time Settings (*_ResolutionCfg).

This setting is common to analog inputs 1 to 8 (1 to 4 for AD041-V1).

Variable name	Type	Setting
*_ResolutionCfg	BYTE	16#00: 4,000 resolutions/1 ms cycle 16#C1: 8,000 resolutions/250 μs cycle

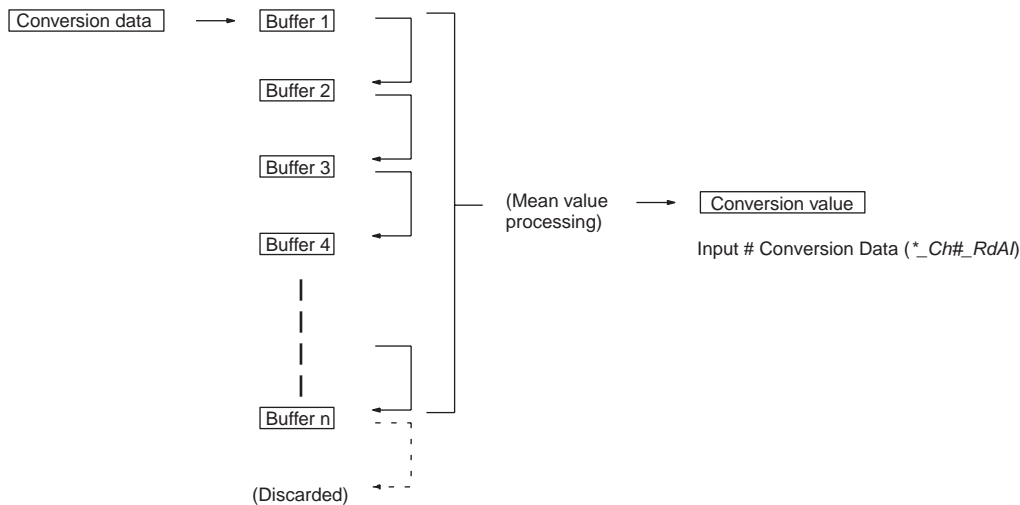


Precautions for Safe Use

- When initial setting parameters are set and transferred from Sysmac Studio, Sysmac Studio checks whether or not the Unit must be restarted. Restart the Unit after confirming the safety of the connected destination.
- The contents of initial setting parameters will be transferred to the Unit when the Controller is reset or when the Unit restarts.

2-6-2 Mean Value Processing

The Analog Input Unit can compute the mean value of the conversion values of analog inputs that were previously sampled several times. Mean value processing involves an operational mean value in the history buffers, so it has no effect on the data refresh cycle. (The number of history buffers that you can set to use mean value processing is 2, 4, 8, 16, 32, or 64.)



Additional Information

- The first conversion data is stored for all buffers for the set number of mean value processing immediately after data conversion has begun and after a disconnection is restored.
- When mean value processing is used together with the peak value hold function, the mean value will be held.

Use Input # Number of Samplings for Mean Value Processing (*_Ch#_AveCfg) to set whether to perform the mean value processing and the number of samplings in the case the process is performed.

Variable name	Type	Setting
*_Ch#_AveCfg	UINT	0: Mean value processing with 2 samplings 1: No mean value processing 2: Mean value processing with 4 samplings 3: Mean value processing with 8 samplings 4: Mean value processing with 16 samplings 5: Mean value processing with 32 samplings 6: Mean value processing with 64 samplings

Variable (name) # is input number 1 to 8 (1 to 4 for AD041-V1).



Precautions for Safe Use

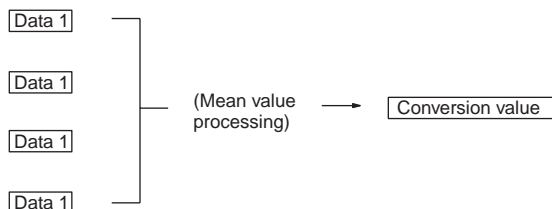
- When initial setting parameters are set and transferred from Sysmac Studio, Sysmac Studio checks whether or not the Unit must be restarted. Restart the Unit after confirming the safety of the connected destination.
- The contents of initial setting parameters will be transferred to the Unit when the Controller is reset or when the Unit restarts.



Additional Information

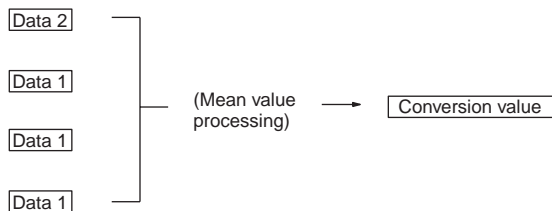
- The history buffer moving average is calculated as shown below. (In this example, there are four buffers.)

1 With the first cycle, data 1 is stored in all the history buffers.



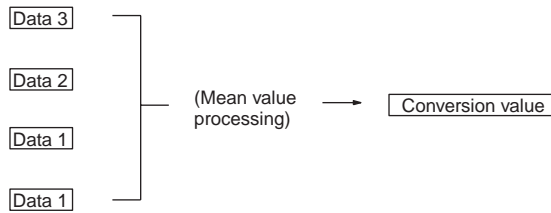
$$\text{Mean value} = (\text{Data 1} + \text{Data 1} + \text{Data 1} + \text{Data 1}) \div 4$$

2 With the second cycle, data 2 is stored in the first history buffer.



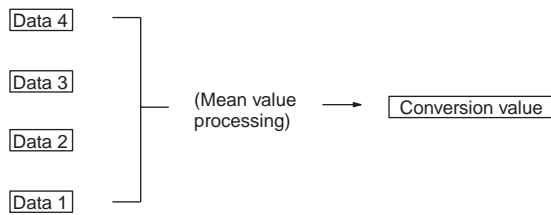
$$\text{Mean value} = (\text{Data 2} + \text{Data 1} + \text{Data 1} + \text{Data 1}) \div 4$$

3 With the third cycle, data 3 is stored in the first history buffer.



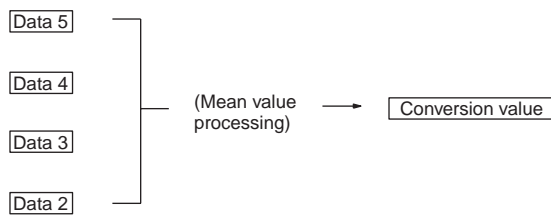
$$\text{Mean value} = (\text{Data 3} + \text{Data 2} + \text{Data 1} + \text{Data 1}) \div 4$$

4 With the fourth cycle, data 4 is stored in the first history buffer.



$$\text{Mean value} = (\text{Data 4} + \text{Data 3} + \text{Data 2} + \text{Data 1}) \div 4$$

5 With the fifth cycle, data 5 is stored in the first history buffer.



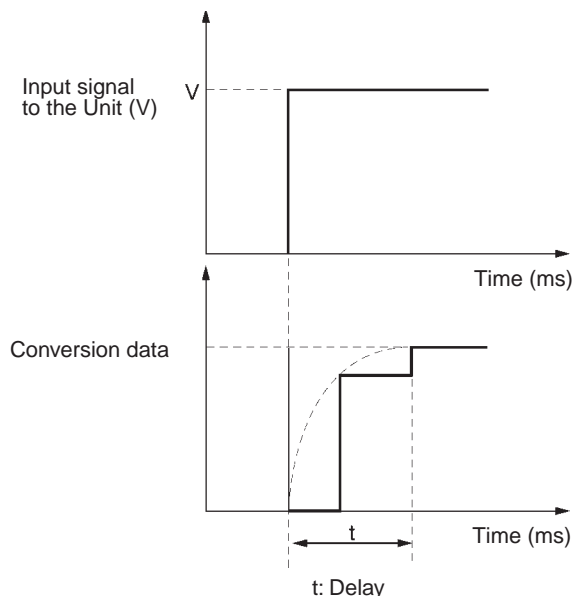
$$\text{Mean value} = (\text{Data 5} + \text{Data 4} + \text{Data 3} + \text{Data 2}) \div 4$$

- When a disconnection is restored, the mean value processing function begins again from step 1.



Additional Information

- If the mean value processing function is used, the delay in the conversion data in comparison to changes in the input signals will be as shown below.
- Specify "no mean value processing" to follow conversion of a rapid change in input signals.



For V = 20 V (-10 to 10 V)

1-ms Conversion cycle/4,000 Resolution

Using One Word

$$t = n + (2 \text{ to } 3)$$

Using m Words (1 ≤ m ≤ 8)

No mean value processing (n = 1) or 2 samplings (n = 2):
 $t = n \times (m + 2)$

Number of samplings = (4 ≤ n ≤ 64):
 $t = (n - 2) \times m + 10.5$

250-μs Conversion cycle/8,000 Resolution

Using One Word

$$t = n + (2 \text{ to } 3) \times 1/4$$

Using m Words (1 ≤ m ≤ 8)

No mean value processing (n = 1) or 2 samplings (n = 2):
 $t = n \times (m + 2) \times 1/4$

Number of samplings = (4 ≤ n ≤ 64):
 $t = \{(n - 2) \times m + 10.5\} \times 1/4$

● **Response Time at 1-ms Conversion cycle/4,000 Resolution**

Unit: ms

m	n						
	64	32	16	8	4	2	1
8	506.5	250.5	122.5	58.5	26.5	20	10
7	444.5	220.5	108.5	52.5	24.5	18	9
6	382.5	190.5	94.5	46.5	22.5	16	8
5	320.5	160.5	80.5	40.5	20.5	14	7
4	258.5	130.5	66.5	34.5	18.5	12	6
3	196.5	100.5	52.5	28.5	16.5	10	5
2	134.5	70.5	38.5	22.5	14.5	8	4
1	67	35	19	11	7	5	3

● **Response Time at 250-μs Conversion cycle/8,000 Resolution**

Unit: ms

m	n						
	64	32	16	8	4	2	1
8	126.625	62.625	30.625	14.625	6.625	5	2.5
7	111.125	55.125	27.125	13.125	6.125	4.5	2.25
6	95.625	47.625	23.625	11.625	5.625	4	2
5	80.125	40.125	20.125	10.125	5.125	3.5	1.75
4	64.625	32.625	16.625	8.625	4.625	3	1.5
3	49.125	25.125	13.125	7.125	4.125	2.5	1.25
2	33.625	17.625	9.625	5.625	3.625	2	1
1	16.75	8.75	4.75	2.75	1.75	1.25	0.75

● **Symbols**

m: Number of input words used in initial setting parameters
 n: Average number of samplings set for the input number for which to find the response time

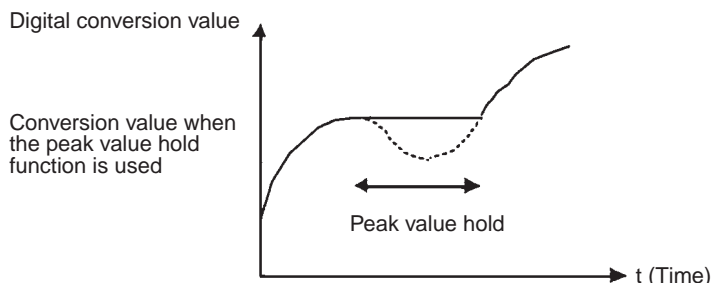
● **Calculation Example**

The following example calculations are for a resolution of 8,000 with an application of inputs 1 and 8, 64 samplings set for input 1, and no mean value processing set for input 8.

- Response time for input 1: $t = \{(64 - 2) \times 2 + 10.5\} \times 1/4 = 34$ (ms)
- Response time for input 8: $t = 1 \times (2 + 2) \times 1/4 = 1$ (ms)

2-6-3 Peak Value Hold Function

The peak value hold function holds the maximum digital conversion value for every input (this includes mean value processing). You can use this function with analog input. The following diagram shows how digital conversion values are affected when the peak value hold function is used.



The peak value hold function is executed with the device variable for CJ-series Unit Input # Peak Value Hold Execution (*_Ch#_PkHdCmd) shown below.

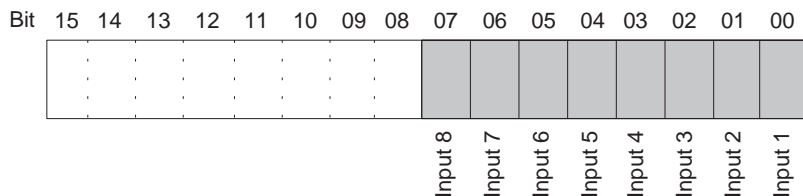
Peak value hold of the conversion value is performed while this variable is "1".

Variable name	Type	Setting
*_Ch#_PkHdCmd	BOOL	0: Do not perform peak value hold 1: Perform peak value hold

An input number from 1 to 8 is included in place of # in the variable name (1 to 4 for AD041-V1).

You can also perform batch settings with the device variable for CJ-series Unit Peak Value Hold Execution Settings (*_PkHdCmd) shown below.

Variable name	Type	Setting
*_PkHdCmd	WORD	16#0000 to 16#00FF (To 16#000F for AD041-V1)



Additional Information

- When mean value processing is used together with the peak value hold function, the mean value will be held.
- As long as the peak value hold function is executing, the peak value hold will be held even in the event of a disconnection.

2-6-4 Input Disconnection Detection Function

When an input signal range of 1 to 5 V (4 to 20 mA) is used, you can detect input circuit disconnections. The detection conditions for each of the input signal ranges are shown in the following table. The current/voltage level will fluctuate according to the offset/gain adjustment.

Input signal range	Voltage/current for disconnection detection
1 to 5 V	Less than 0.3 V
4 to 20 mA	Less than 1.2 mA

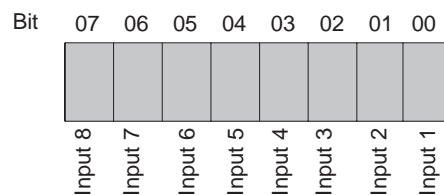
The disconnection detection status of each input is output to the device variable for CJ-series Unit Input # Disconnection Detected (**_Ch#_SensErr*) shown below.

Variable name	Type	Setting
<i>*_Ch#_SensErr</i>	BOOL	0: No disconnection 1: Disconnection

An input number from 1 to 8 is included in place of # in the variable name (1 to 4 for AD041-V1).

You can also perform batch readout with the device variable for CJ-series Unit Disconnection Detected (**_SensErr*) shown below.

Variable name	Type
<i>*_SensErr</i>	BYTE



The respective bit turns ON when a disconnection is detected for a given input. When the disconnection is restored, the bit turns OFF.



Additional Information

The conversion value during disconnection is 0.

3

CJ-series Analog Input Units (CJ1W-AD042)

This section explains how to use the CJ1W-AD042 Analog Input Units.

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3-1-3	Inputs Specifications	3-3
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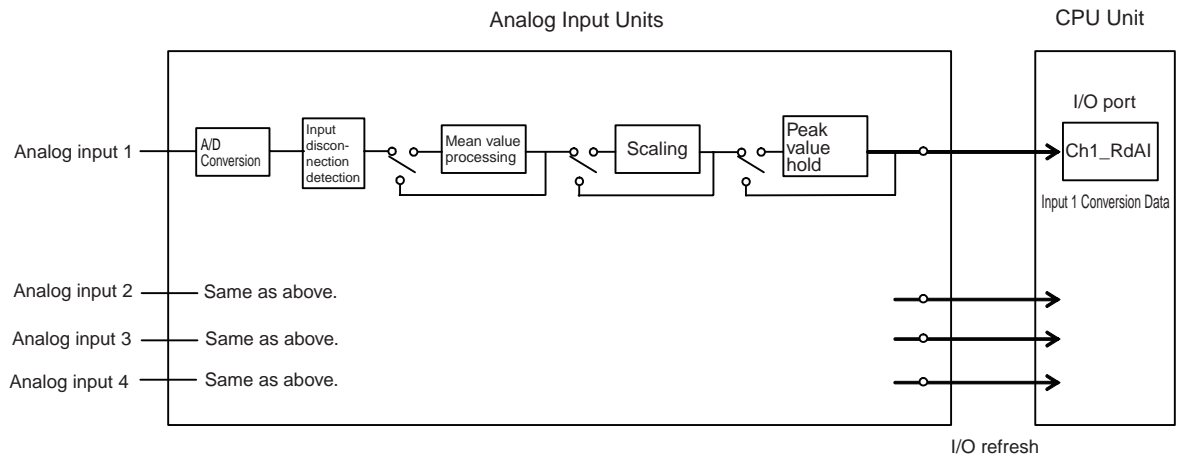
3-1 Specifications

3-1-1 Specifications

Unit model		CJ1W-AD042		
Unit type		CJ-series Special I/O Unit		
Isolation *1		Between inputs and internal signals: Digital isolator (No isolation between input signals.)		
External connection terminal		18-point detachable terminal block (M3 screws)		
Current consumption		520 mA at 5 VDC		
Dimensions (mm) *2		31 × 90 × 65 (W × H × D)		
Weight		150 g max.		
General specifications		Conforms to general specifications for NJ Series.		
Mounting position		NJ-series CPU Rack or NJ-series Expansion Rack		
Maximum number of Units		Per CPU Rack or Expansion Rack *3	No. of mountable Units	
		Power Supply Unit NJ-PA3001	Max. 7 units on CPU Rack Max. 9 units per Expansion Rack	
		NJ-PD3001	Max. 7 units on CPU Rack Max. 9 units per Expansion Rack	
Data exchange with CPU Unit		Data exchange with I/O ports For details, see 3-5 <i>Exchanging Data with the CPU Unit</i>		
Inputs specifications	Number of analog inputs	4		
	Input signal range *4	1 to 5 V/0 to 10 V/-5 to 5 V/-10 to 10 V/4 to 20 mA *5		
	Maximum rated input *6	Voltage Input: ±15 V Current Input: ±30 mA		
	Input impedance	Voltage Input: 1 MΩ min. Current Input: 250 Ω (typical)		
	Resolution	1 to 5 V	1/10,000 (full scale)	
		0 to 10 V	1/20,000 (full scale)	
		-5 to 5 V	1/20,000 (full scale)	
		-10 to 10 V	1/40,000(full scale)	
		4 to 20 mA	1/10,000(full scale)	
	A/D conversion data		16-bit integer (INT)	
Accuracy	25°C	Voltage Input: ±0.2% of full scale Current Input: ±0.4% of full scale		
	0 to 55°C	Voltage Input: ±0.4% of full scale Current Input: ±0.6% of full scale		
Conversion cycle *7		20 μs for 1 point, 25 μs for 2 points, 30 μs for 3 points, 35 μs for 4 points		
Input functions	Mean value processing	Stores the last "n" sampling data in the buffer, and stores the mean value of the conversion values. (Number of samplings: n = 2, 4, 8, 16, 32, 64, 128, 256, 512)		
	Peak value hold	Stores the maximum conversion value (includes value after mean value processing) while the specified Peak Value Hold Execution bit is ON.		
	Scaling	Set values in any specified Unit within a range of ±32,000 as the upper and lower limits to allow A/D conversion to be executed and analog signals to be output using the set values as full scale.		
	Input disconnection detection	Detects a disconnection and turns ON the Disconnection Detected Bit. *8		

- *1 Do not apply a voltage higher than 600 VAC to the terminal block when you perform a withstand voltage test on this Unit. Otherwise, internal elements may deteriorate.
- *2 For the dimensions, refer to *A-1 Dimensions*.
- *3 The maximum number of Analog Input Units that you can mount to one Rack depends on the current consumption of other units that are mounted.
- *4 You can set input signal ranges for each input.
- *5 To use a current input, connect the positive current input terminal and positive voltage input terminal with the enclosed short bar.
- *6 Use within the specified input range. Operation of the Unit outside these specifications may result in failure.
- *7 The A/D conversion cycle is the time it takes for an analog signal to be stored in the Analog Input Unit memory as conversion data after it has been input. It takes at least one task period before the conversion data is read by the CPU Unit.
- *8 Line disconnection detection is supported only when the range is set to 1 to 5 V or 4 to 20 mA. If there is no input signal when the 1 to 5-V or 4 to 20-mA range is set, the Line Disconnection Flag will turn ON.

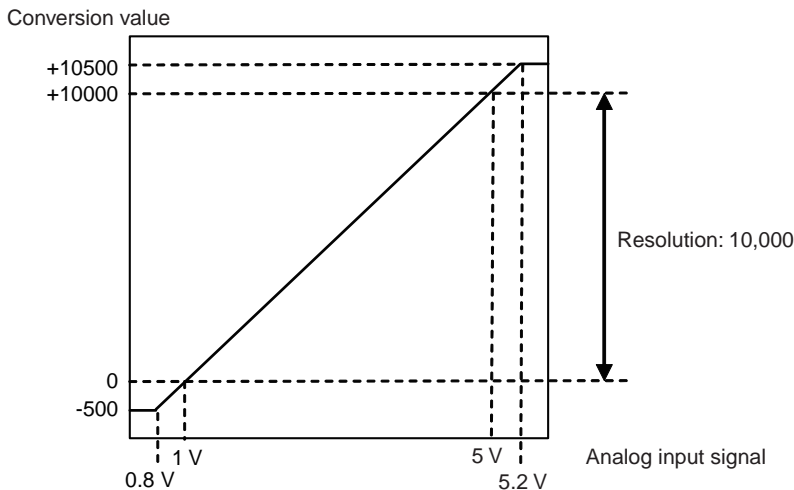
3-1-2 Input Function Block Diagram



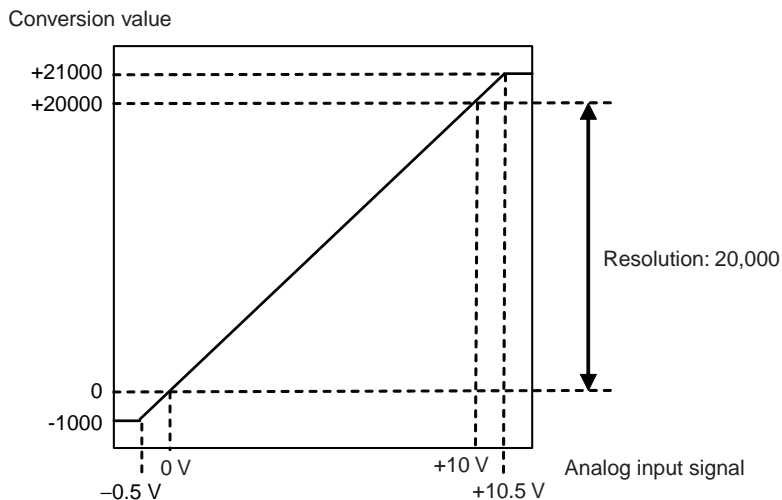
3-1-3 Inputs Specifications

If signals that are outside the specified range provided below are input, the conversion values (16-bit integer) used will be either the maximum or minimum value.

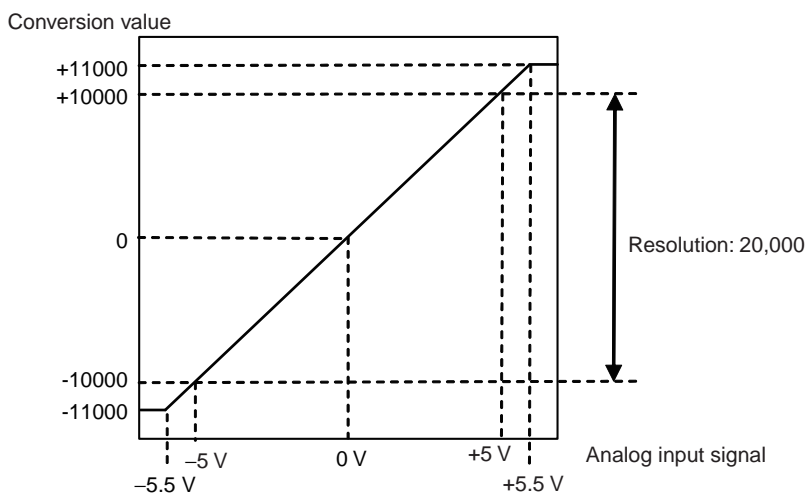
Range: 1 to 5 V



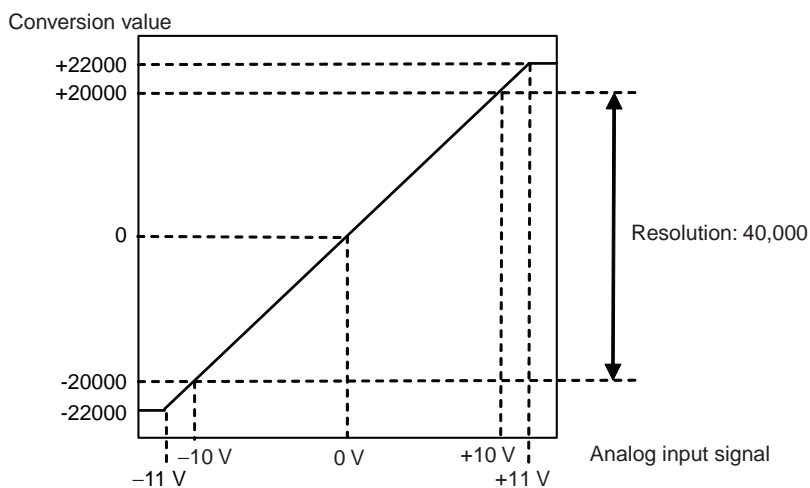
Range: 0 to 10 V



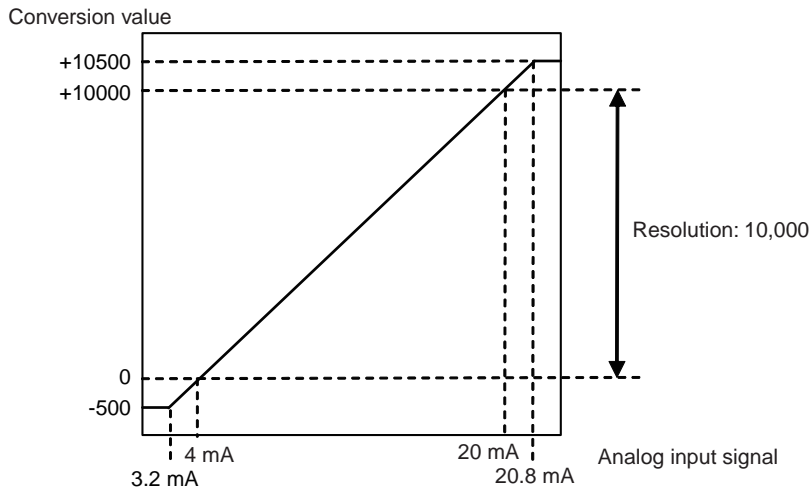
Range: -5 to 5 V



Range: -10 to 10 V



Range: 4 to 20 mA



3-2 Operating Procedure

Follow the procedures outlined below when using the Analog Input Unit.

There is no restriction regarding the sequence of "Programs and software settings" and "Hardware setting and Rack assembly." These tasks may be carried out concurrently or in the reverse order.

Use Sysmac Studio to create and set programs.

For operations of Sysmac Studio, refer to the *Sysmac Studio Version 1 Operation Manual* (Cat. No. W504).

● Programs and software settings

- 1** Create POU and global variables
Create Unit Configuration
 - Create and register global variables and each POU.
 - Create algorithms for each POU and register local variables of each POU.
 - Register the Unit in the Unit Configuration on the CPU/Expansion Racks screen in Configuration and Setup.
At this time, set both the device name and the unit number of the unit to be registered.
 - Create device variable for CJ-series Unit by using I/O Map.

- 2** Create Unit initial setting parameters
Create the Unit settings by using Special Unit Setup Editing.
 - Set the number of analog inputs to be used.
 - Set the input signal ranges.
 - Set the number of mean value processing samplings.
 - Set upper and lower limits for scaling.

(When the program is transferred, the items set here will be reflected in the initial setting parameters.)

● Hardware setting and Rack assembly

- 1** Use the unit number switches on the front panel of the Unit to set the unit number.
Set the same unit number as in the Unit Configuration settings.

- 2** Mount and wire the Unit to either a CPU Rack or Expansion Rack.

- 3** Turn ON the power to the Controller.
At this time, an I/O Setting Check Error occurs when there is a Unit Configuration in the CPU Unit which does not match the actual Unit Configuration. In this case, reset the Controller in step 2 *Reset the Controller or restart the Unit* of the following process to cancel the error.

● Program transfer

- 1** Transfer programs, Unit Configuration and Setup and variable information.

- 2** Reset the Controller or restart the Unit.

- **Main operation**

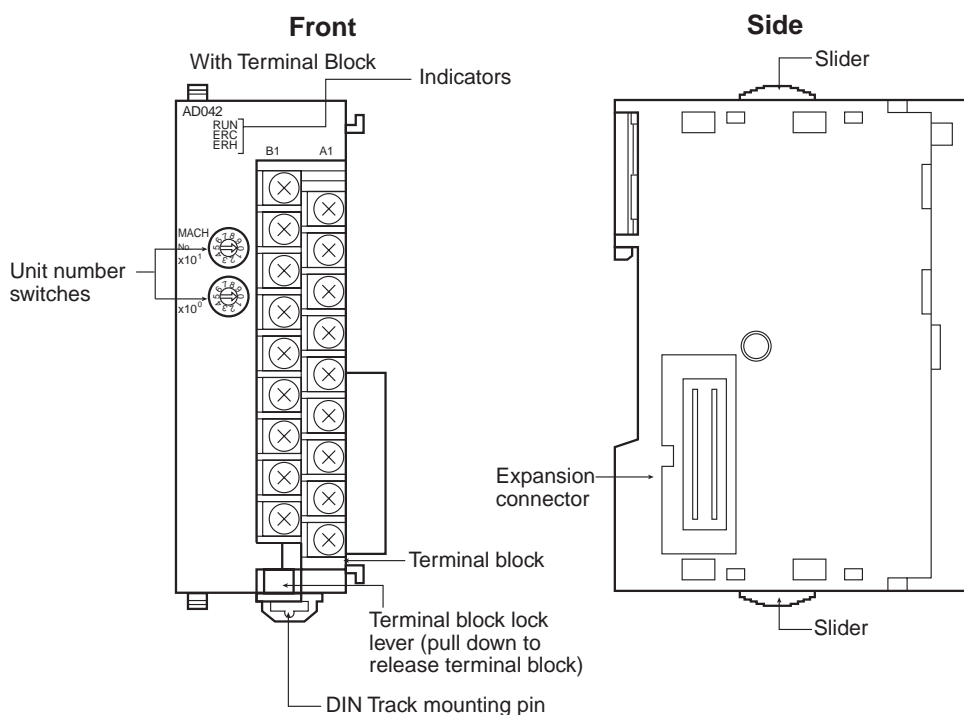
- 1** Main operation

- Read or write set values from the user program.
Acquire conversion value and status (disconnection detection and error flag)
- Specify the peak value hold function.

3-3 Components and Switch Settings

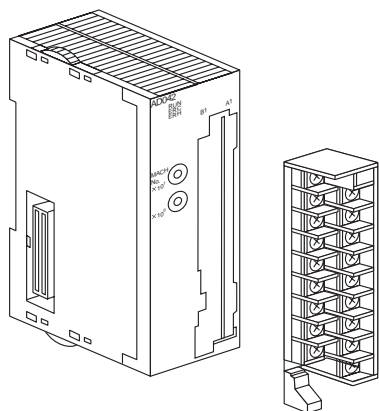
Procedure Examples

3-3-1 Component Names



Additional Information

- Use a connector to attach the terminal block. Lower the lever at the bottom of the terminal block to remove the connector.
- Normally, the lever should be in the raised position.



3-3-2 Indicators

The indicators show the operating status of the Unit. The following table shows the meanings of the indicators.

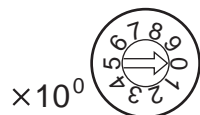
Indicator	Meaning	Indicator status	Operating status
RUN (green)	Operating	Lit	Operation normal.
		Not lit	Unit has stopped exchanging data with the CPU Unit.
ERC (red)	Error detected by Unit	Lit	Alarm has occurred (such as disconnection detection) or initial settings are incorrect.
		Not lit	Operating normally.
ERH (red)	Error in the CPU Unit	Lit	Error has occurred during data exchange with the CPU Unit.
		Not lit	Operating normally.

3-3-3 Unit Number Switches

Use the unit number switches to set the specific unit number for each Special I/O Unit mounted in a CPU Rack or Expansion Rack. The unit number must be the one registered in Unit Configurations.

Turn OFF the Controller before changing the unit number setting.

Unit number switches



Switch setting	Unit number
0	0
1	1
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9
10	10
to	to
n	n
to	to
95	95



Additional Information

- If two or more Special I/O Units are assigned the same unit number, a "Duplicate Unit Number" major fault level Controller error is generated and the Controller will not operate.
- After correcting the unit number setting, cycle the power to the Controller.

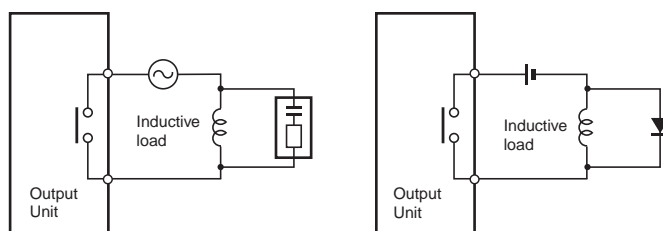
3-4 Wiring



Precautions for Safe Use

Always connect surge suppressors to inductive loads in the system (e.g., magnetic contactors, relays, and solenoids). Always separate devices that generate surge from the Analog Input Unit. Faulty Unit operation may cause unexpected system operation.

If inductive loads are connected to output signals from Relay Contact Output Units, connect a surge suppressor in an AC circuit and a diode in a DC circuit close to the inductive load to absorb the counter-electromotive force.



Connect a surge suppressor in an AC circuit and a diode in a DC circuit.

3-4-1 Terminal Arrangement

The signal names that correspond to the connecting terminals are as shown in the following diagram.

Current input 2 (+) *	B1	A1	Current input 1 (+) *
Voltage input 2 (+)	B2	A2	Voltage input 1 (+)
Input 2 (-)	B3	A3	Input 1 (-)
AG	B4	A4	AG
Current input 4 (+) *	B5	A5	Current input 3 (+) *
Voltage input 4 (+)	B6	A6	Voltage input 3 (+)
Input 4 (-)	B7	A7	Input 3 (-)
AG	B8	A8	AG
N.C.	B9	A9	N.C.

* To use a current input, connect the positive current input terminal and positive voltage input terminal with the enclosed short bar.



Additional Information

- The number of analog inputs that can be used is set in the device variable for CJ-series Unit Input Use Setting "**_InChUseCfg*".
- Set the input signal range for each analog input with the device variable for CJ-series Unit Input Signal Range Settings "**_Ch#_InRngCfg*".
- The AG terminals are connected to the 0-V analog circuit in the Unit. Connect the input line shield to improve noise resistance.



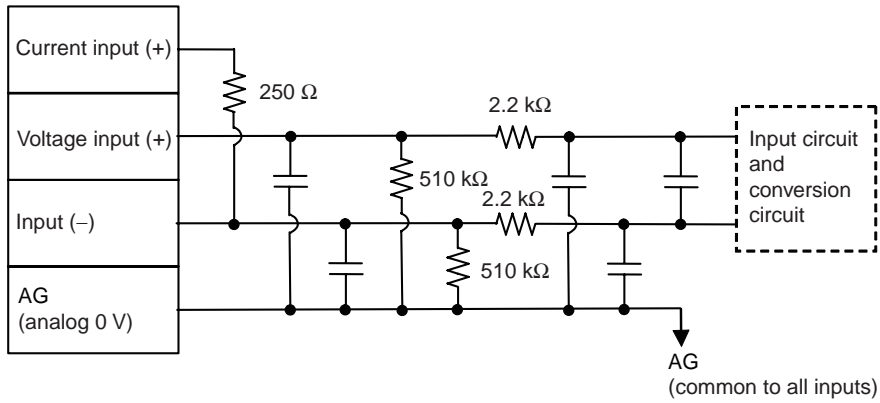
Precautions for Correct Use

Do not make any connections to the NC terminals.

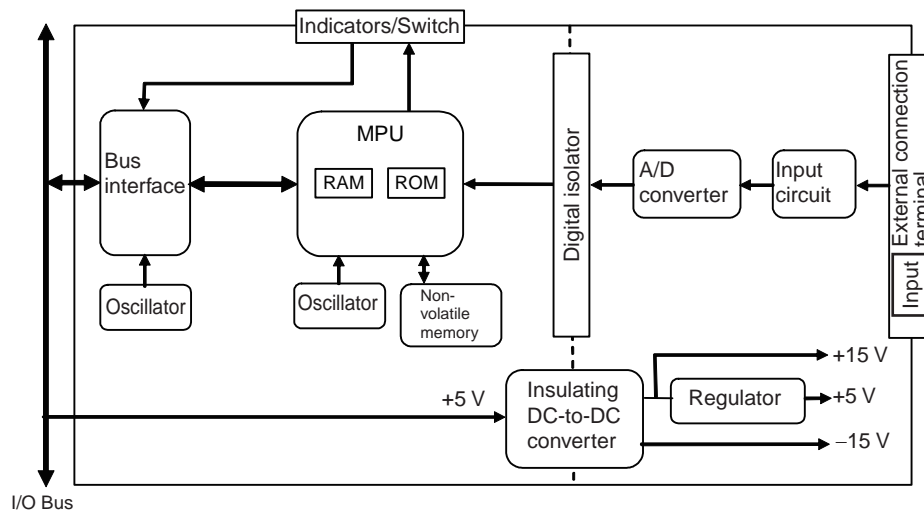
3-4-2 Internal Circuit

The following diagrams show the internal circuit of the analog input section.

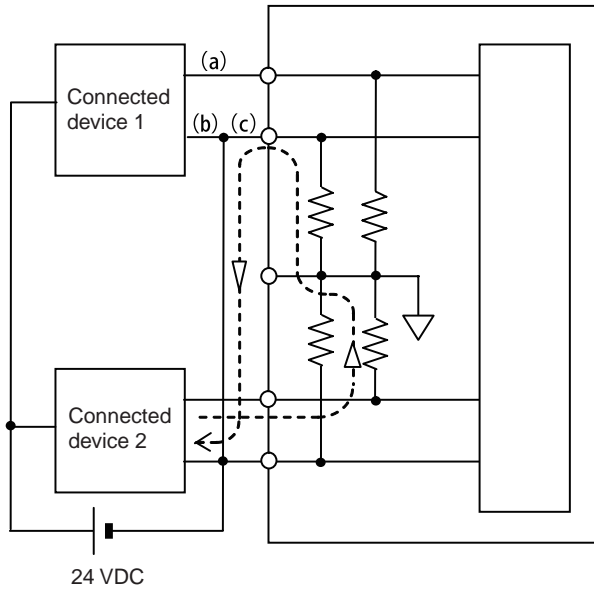
● Input Circuit



● Internal Configuration



3-4-3 Voltage Input Disconnection



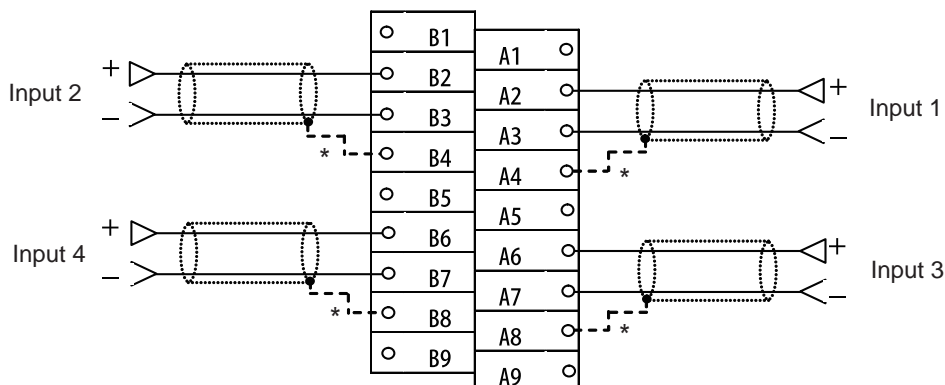
When voltage inputs are used and a disconnection occurs, separate the power supply at the side of the connected devices or use an insulating device (isolator) for each input to avoid the following problems.

When the power supply at the connected devices is shared and section a or b is disconnected, power will flow in the direction of the dotted line and the output voltage of the other connected devices will be reduced to between a third to a half of the voltage. If 1 to 5 V is used and reduced voltage occurs, disconnection may not be detectable. If section c is disconnected, the power at the negative input terminal will be shared and disconnection will not be detectable.

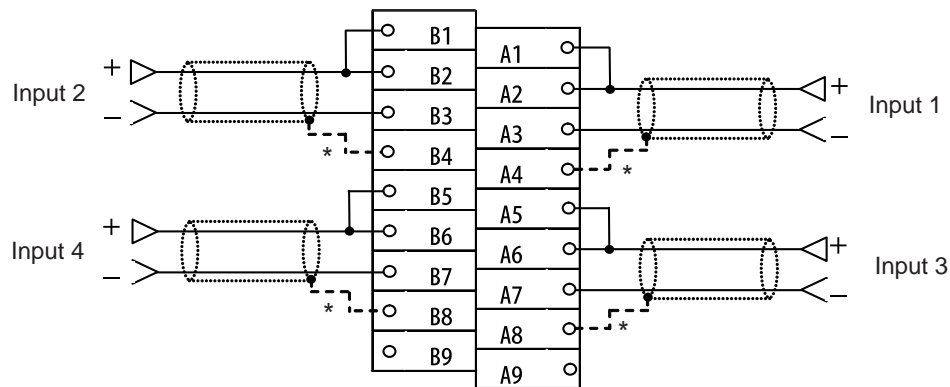
For current inputs, you can share the power supply between the connected devices without causing any problems.

3-4-4 Input Wiring Example

Wiring Example for a Voltage Input



Wiring Example for a Current Input



* Connect the positive current input terminal and positive voltage input terminal with the enclosed short bar.

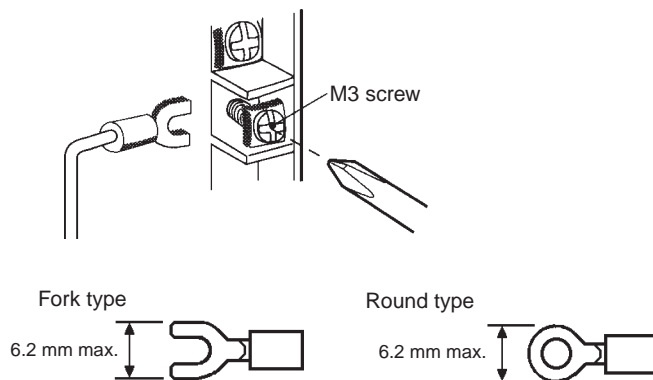
The AG terminal need not be connected in normal conditions, but if noise is of concern, connect the shielded wire for each input by one of the following methods:

- Connect the end of the shielded wire* on AD Unit side, to the AG terminals, as shown in the above diagram. Use a wire that is 30 cm or shorter if possible. In this case, do not connect the end of the shielded wire on output device side to any other device or FG.
- Ground the end of the shielded wire on AD Unit side to the FG on the control panel. In this case, keep the AG terminal open and do not connect the end of the shielded wire on output device side to any other device or FG.



Precautions for Safe Use

Crimp terminals must be used for terminal connections, and the screws must be tightened securely. Use M3 screws and tighten them to a torque of 0.5 N·m.



Precautions for Correct Use

- For inputs you do not use, set them to Not Used in the input number settings (refer to *Setting Inputs and Signal Ranges* in 3-6-1 *Input Settings and Conversion Values*). If they are set to Used and actually not used, unintended conversion data may be input. To prevent this, short-circuit the voltage input terminals (V+) and (V-). Take note that, in the case of a range from 1 to 5-V or 4 to 20-mA, short-circuiting (V+) and (V-) causes the Disconnection Detected bit to turn ON.
- Do not connect anything to N.C. terminals shown in the wiring diagram on page 3-4-1 *Terminal Arrangement*.

3-4-5 Input Wiring Considerations

When you wire inputs, apply the following points to avoid noise interference and optimize Analog Input Unit performance.

- Use two-core shielded twisted-pair cables for input connecting lines.
- Route input cables separately from the power cables (e. g., AC and three-phase lines) and do not run the Unit's cables near a main circuit cable, high voltage cable. Do not insert these cables into the same duct.
- If there is noise interference from power lines (for example, the power supply is shared with electrical welding devices or electrical discharge machines, or there is a high-frequency generation source nearby) install a noise filter at the power supply input area.

3-5 Exchanging Data with the CPU Unit

3-5-1 Outline of Data Exchange

The CPU Unit and Analog Input Unit CJ1W-AD042 exchange operation data and initial setting parameters via the I/O port generated for this Analog Input Unit.

The table and figure below show the data exchange method for each data type.

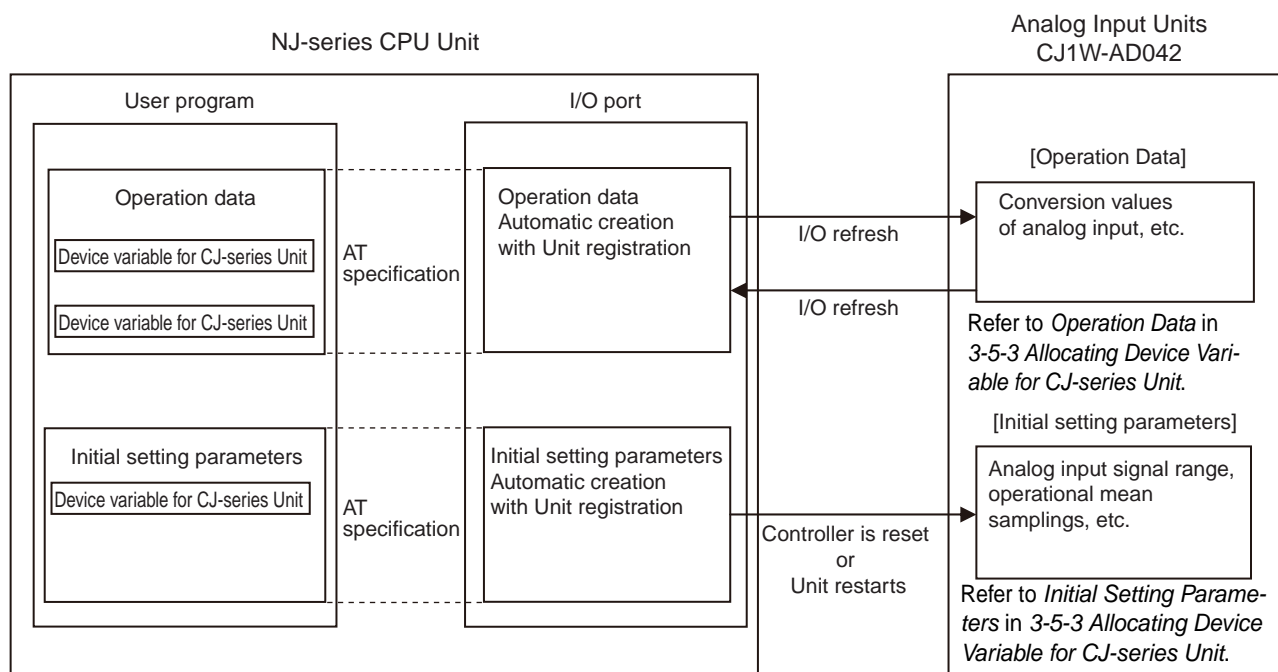
Data exchange type

Unit data type	Data contents	AT specification destination	How to access from user program	Timing of data exchange
Operation data	Analog input conversion value, etc.	I/O port (operation data)	Device variable for CJ-series Unit	At I/O refreshing
Initial setting parameters	Analog input signal range, operational mean samplings, etc.	I/O port (initial setting parameters) *	Device variable for CJ-series Unit	When the Controller is reset or the Unit restarts
Unit Restart Bit, etc.	Unit Restart Bit, etc.	None	System-defined variable	At I/O refreshing

* The initial setting parameters are retained in the CPU Unit by the battery even during power interruptions.

● Device Variable for CJ-series Unit

Device variables for CJ-series Unit are variables used for data exchange between a user program and Special I/O Units. The user program uses device variables for CJ-series Unit to control the Analog I/O Unit.



3-5-2 Accessing from the User Program

The user program uses device variables for CJ-series Unit to control the Analog Input Unit. Use device variables for CJ-series Unit with AT specification for the I/O port, which is explained below.

● I/O port

An "I/O port" is a logical interface for data exchange by a CPU Unit with an Analog I/O Unit or other configuration unit.

An I/O port has a unique predefined name for each unit model and function.

An I/O port is automatically created by preparing the Unit Configuration with Sysmac Studio.

● How to specify device variables for CJ-series Unit

Specify the AT specifications to I/O ports for device variables for CJ-series Unit with the I/O Map from Sysmac Studio.

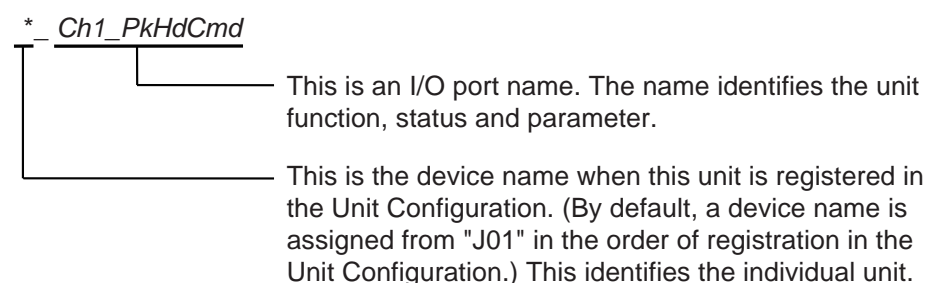
Specify the variable name for the AT specification with one of the following methods.

1. Select a variable already registered in the variable table
2. Input a new variable name
3. Automatically create a variable name with "Device variable creation"

When a device variable name for CJ-series Unit is assigned with method 2 or 3, the variable input by Sysmac Studio is automatically registered in the variable table.

The following is the configuration of variable names created with automatic creation in method 3.

Name of device variable for CJ-series Unit



For details on creation of device variables for CJ-series Unit, refer to *Sysmac Studio Version 1 Operation Manual* (Cat. No. W504).

There are two types of device variables for CJ-series Unit: "Operation Data" and "Initial Setting Parameters".

In the explanations from here on, the device name automatically created is used as the device variable for CJ-series Unit, for example *_ Ch1_PkHdCmd.

3-5-3 Allocating Device Variable for CJ-series Unit

Initial Setting Parameters

Perform Unit settings such as the analog input signal range, number of operational mean samplings, etc.

Initial setting parameters settings are set from Special Unit Setup Editing of Sysmac Studio.

Unit settings can also be performed by setting the values in the device variables for CJ-series Unit.

Unit settings are reflected only when the Controller is reset, or when the Unit restarts. The initial setting parameters are retained in the CPU Unit by the battery even during power interruptions.



Precautions for Safe Use

- When initial setting parameters are set and transferred from Sysmac Studio, Sysmac Studio checks whether or not the Unit must be restarted. Restart the Unit after confirming the safety of the connected destination.
- The contents of initial setting parameters will be transferred to the Unit when the Controller reset or when the Unit restarts.

List of Initial Setting Parameters

Name of device variable for CJ-series Unit	Type	R/W	Name	Feature/reference page
*_InChUseCfg	USINT	RW	Input Use Settings	Refer to <i>Setting Inputs and Signal Ranges</i> in 3-6-1 <i>Input Settings and Conversion Values</i> . 0: No inputs used. 1: 1 input used. 2: 2 inputs used. 3: 3 inputs used. 4: 4 inputs used.
*_Ch1_InRngCfg	USINT	RW	Input 1 Input Signal Range Setting	Refer to <i>Input Signal Ranges</i> in 3-6-1 <i>Input Settings and Conversion Values</i> . 0: -10 to +10 V 2: 0 to 10 V 3: 4 to 20 mA 6: -5 to +5 V 7: 1 to 5 V
*_Ch2_InRngCfg	USINT	RW	Input 2 Input Signal Range Setting	
*_Ch3_InRngCfg	USINT	RW	Input 3 Input Signal Range Setting	
*_Ch4_InRngCfg	USINT	RW	Input 4 Input Signal Range Setting	

Name of device variable for CJ-series Unit	Type	R/W	Name	Feature/reference page
*_Ch1_AveCfg	UINT	RW	Input 1 Number of Samplings for Mean Value Processing	Refer to 3-6-2 <i>Mean Value Processing</i> . 0: No mean value processing 1: Number of samplings 2 2: Number of samplings 4 3: Number of samplings 8 4: Number of samplings 16 5: Number of samplings 32 6: Number of samplings 64 7: Number of samplings 128 8: Number of samplings 256 9: Number of samplings 512
*_Ch2_AveCfg	UINT	RW	Input 2 Number of Samplings for Mean Value Processing	
*_Ch3_AveCfg	UINT	RW	Input 3 Number of Samplings for Mean Value Processing	
*_Ch4_AveCfg	UINT	RW	Input 4 Number of Samplings for Mean Value Processing	
*_Ch1_Scl_L_Cfg	INT	RW	Input 1 Scaling Lower Limit	Refer to 3-6-3 <i>Input Scaling Function</i> . –32000 to +32000 Set lower limit ≠ upper limit. (Can also set lower limit > upper limit.)
*_Ch1_Scl_H_Cfg	INT	RW	Input 1 Scaling Upper Limit	
*_Ch2_Scl_L_Cfg	INT	RW	Input 2 Scaling Lower Limit	
*_Ch2_Scl_H_Cfg	INT	RW	Input 2 Scaling Upper Limit	
*_Ch3_Scl_L_Cfg	INT	RW	Input 3 Scaling Lower Limit	
*_Ch3_Scl_H_Cfg	INT	RW	Input 3 Scaling Upper Limit	
*_Ch4_Scl_L_Cfg	INT	RW	Input 4 Scaling Lower Limit	
*_Ch4_Scl_H_Cfg	INT	RW	Input 4 Scaling Upper Limit	

Operation Data

Operation data includes data such as analog input conversion value, etc. Operation data is exchanged constantly during I/O refreshing.

List of Operation Data

Name of device variable for CJ-series Unit	Type	R/W	Name	Feature/reference page	
*_Ch1_RdAI	INT	R	Input 1 Conversion Data	Refer to 3-6-1 <i>Input Settings and Conversion Values</i> .	
*_Ch2_RdAI	INT	R	Input 2 Conversion Data		
*_Ch3_RdAI	INT	R	Input 3 Conversion Data		
*_Ch4_RdAI	INT	R	Input 4 Conversion Data		
*_PkHdCmd	WORD	RW	Peak Value Hold Execution Settings	Refer to 3-6-4 <i>Peak Value Hold Function</i> . WORD-type variable that combines the following BOOL-type variables:	Bit Number
*_Ch1_PkHdCmd	BOOL	RW	Input 1 Peak Value Hold Execution	BOOL-type variable that instructs each input for execution of peak value hold. 0: Do not perform peak value hold 1: Perform peak value hold	00
*_Ch2_PkHdCmd	BOOL	RW	Input 2 Peak Value Hold Execution		01
*_Ch3_PkHdCmd	BOOL	RW	Input 3 Peak Value Hold Execution		02
*_Ch4_PkHdCmd	BOOL	RW	Input 4 Peak Value Hold Execution		03

Name of device variable for CJ-series Unit	Type	R/W	Name	Feature/reference page	Bit Number
*_SensErr	BYTE	R	Disconnection Detected	Refer to 3-6-5 <i>Input Disconnection Detection Function</i> . BYTE-type variable that combines the following BOOL-type variables:	
*_Ch1_SensErr	BOOL	R	Input 1 Disconnection Detected	BOOL-type variable that checks each input for disconnection. 0: No disconnection 1: Disconnection	00
*_Ch2_SensErr	BOOL	R	Input 2 Disconnection Detected		01
*_Ch3_SensErr	BOOL	R	Input 3 Disconnection Detected		02
*_Ch4_SensErr	BOOL	R	Input 4 Disconnection Detected		03
*_UnitErr	BYTE	R	Error Flags	Refer to 7-2-2 <i>Alarms Occurring at the Unit</i> . BYTE-type variable that combines the following BOOL-type variables:	Bit Number
*_SclErr	BOOL	R	Scaling Data Setting Error	0: No error 1: Error in initial setting parameters	00
*_CfgErr	BOOL	R	Input Signal Range Setting Error or Error in Number of Inputs Setting		01
*_AveErr	BOOL	R	Mean Value Processing Setting Error		03
*_MdErr	BOOL	R	Error in Setting of Conversion Mode		04
*_ConvMd	BOOL	R	Direct Conversion Mode *	0: Cyclic Conversion Mode 1: (Direct Conversion Mode)	05
*_ConvErr	BOOL	R	A/D Conversion Error	0: No error 1: A/D conversion error	06

* The Direct Conversion Mode cannot be used with the NJ-series CPU Unit. On the Special Unit Setup Editing of Sysmac Studio, set "Conversion Mode Setting" to "Cyclic Conversion Mode".

3-6 Analog Input Functions and Operating Procedures

3-6-1 Input Settings and Conversion Values

Setting Inputs and Signal Ranges

● Number of Inputs

The Analog Input Unit performs conversion processing only for the specified number of analog inputs. Use Number of Analog Inputs Used (**_InChUseCfg*) to set the analog inputs to be used.

Variable name	Type	Setting
<i>*_InChUseCfg</i>	USINT	0: No inputs used. 1: One input used (input 1 used). 2: Two inputs used (inputs 1 and 2 used). 3: Three inputs used (inputs 1, 2, and 3 used). 4: Four inputs used (inputs 1, 2, 3, and 4 used).

The sampling interval per Unit changes according to this setting.

To use 1 point: 20 μ s, to use 2 points: 25 μ s, to use 3 points: 30 μ s, to use 4 points: 35 μ s



Additional Information

The conversion value for unused analog input number will be 0 at all times.

● Input Signal Ranges

You can set each of inputs 1 to 4 to one of the following input signal ranges:

–10 to 10 V, 0 to 10 V, 4 to 20 mA, –5 to 5 V, 1 to 5 V. Use Input # Input Signal Range Settings (*Ch#_InRngCfg) to set the used input signal ranges.

Variable name	Type	Setting
*_Ch#_InRngCfg	USINT	0: –10 to +10 V 2: 0 to 10 V 3: 4 to 20 mA 6: –5 to +5 V 7: 1 to 5 V

An input number from 1 to 4 is included in place of # in the variable name.



Precautions for Safe Use

- When initial setting parameters are set and transferred from Sysmac Studio, Sysmac Studio checks whether or not the Unit must be restarted. Restart the Unit after confirming the safety of the connected destination.
- The contents of initial setting parameters will be transferred to the Unit when the Controller is reset or when the Unit restarts.

Reading Conversion Values

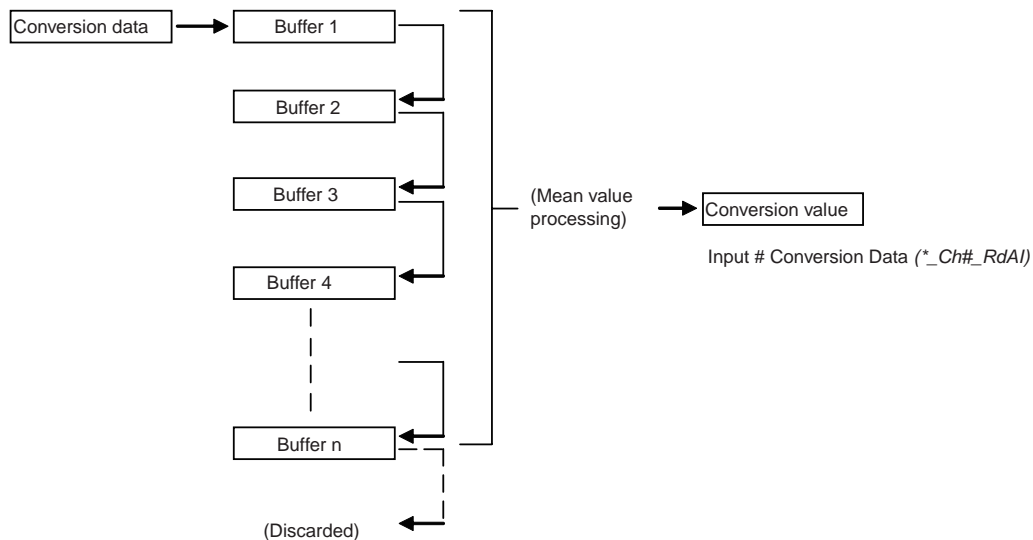
Analog input conversion values are output to the device variable for CJ-series Unit Input # Conversion Data (*_Ch#_RdAI) shown below.

Variable name	Type
*_Ch#_RdAI	INT

An input number from 1 to 4 is included in place of # in the variable name.

3-6-2 Mean Value Processing

In Cyclic Conversion Mode, the Analog Input Unit can compute the mean value of the conversion values of previously sampled analog inputs. Mean value processing involves an operational mean value in the history buffers, so it has no effect on the data refresh cycle. (The number of history buffers that you can set for mean value processing is 2, 4, 8, 16, 32, 64, 128, 256, or 512.)



Additional Information

- The first conversion data is stored for all buffers for the set number of samplings for mean value processing immediately after data conversion has begun and after a disconnection is restored.
- When mean value processing is used together with the peak value hold function, the peak mean value will be held.

Use Input # Number of Samplings for Mean Value Processing (*_Ch#_AveCfg) to set whether to perform the mean value processing and the number of samplings in the case the process is performed.

Variable name	Type	Setting
*_Ch#_AveCfg	UINT	0: No mean value processing 1: Mean value processing with 2 buffers 2: Mean value processing with 4 buffers 3: Mean value processing with 8 buffers 4: Mean value processing with 16 buffers 5: Mean value processing with 32 buffers 6: Mean value processing with 64 buffers 7: Mean value processing with 128 buffers 8: Mean value processing with 256 buffers 9: Mean value processing with 512 buffers

An input number from 1 to 4 is included in place of # in the variable name.



Precautions for Safe Use

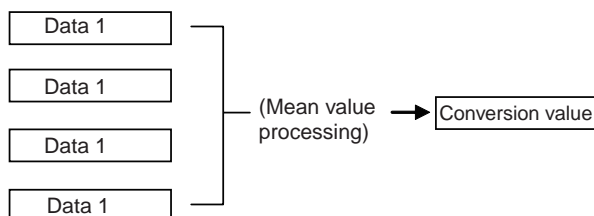
- When initial setting parameters are set and transferred from Sysmac Studio, Sysmac Studio checks whether or not the Unit must be restarted. Restart the Unit after confirming the safety of the connected destination.
- The contents of initial setting parameters will be transferred to the Unit when the Controller is reset or when the Unit restarts.



Additional Information

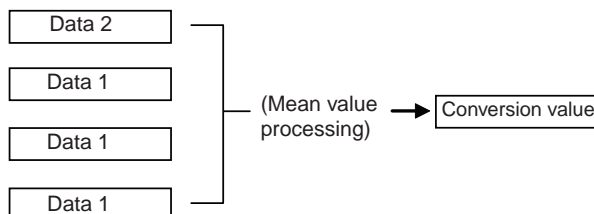
- The mean value is calculated as shown in the following diagram. (In this example, there are four buffers.)

- 1** With the first cycle, data 1 is stored in all the history buffers.



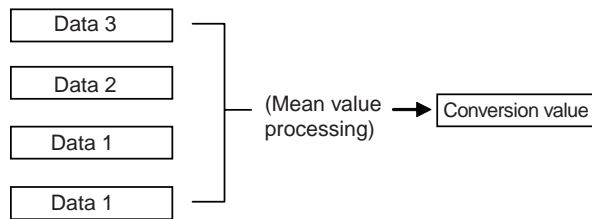
$$\text{Mean value} = (\text{Data 1} + \text{Data 1} + \text{Data 1} + \text{Data 1}) \div 4$$

- 2** With the second cycle, data 2 is stored in the first history buffer.



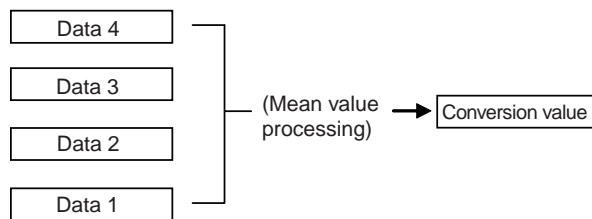
$$\text{Mean value} = (\text{Data 2} + \text{Data 1} + \text{Data 1} + \text{Data 1}) \div 4$$

- 3** With the third cycle, data 3 is stored in the first history buffer.



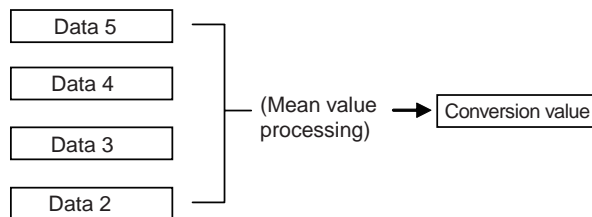
$$\text{Mean value} = (\text{Data 3} + \text{Data 2} + \text{Data 1} + \text{Data 1}) \div 4$$

- 4** With the fourth cycle, data 4 is stored in the first history buffer.



$$\text{Mean value} = (\text{Data 4} + \text{Data 3} + \text{Data 2} + \text{Data 1}) \div 4$$

- 5** With the fifth cycle, data 5 is stored in the first history buffer.



$$\text{Mean value} = (\text{Data 5} + \text{Data 4} + \text{Data 3} + \text{Data 2}) \div 4$$

- When a disconnection is restored, the mean value processing function begins again from step 1.

3-6-3 Input Scaling Function

When upper and lower limits (within a range of $-32,000$ to $+32,000$) are preset, analog input values can then be automatically converted into a user-specified industrial unit, with the upper and lower limits taken as full scale based on that resolution value.



Additional Information

- The upper limit is normally set to be greater than the lower limit, but it is also possible to set the lower limit to be greater than the upper limit for reverse scaling.
- Actual A/D conversion is executed at up to -5% to $+105\%$ of full scale.



Precautions for Correct Use

If the scaling upper limit equals the scaling lower limit, or if the scaling upper limit or scaling lower limit is outside the range of $\pm 32,000$, a scaling data setting error will occur and scaling will not be executed. Normal operation is performed without scaling if both the upper and lower limits are set to 0.

● Setting Upper and Lower Limits for Scaling

The input scaling upper and lower limit values are set with the following initial setting parameters.

Variable name	Type	Setting
*_Ch#_ScL_L_Cfg	INT	Scaling lower limit (-32,000 to +32,000)
*_Ch#_ScL_H_Cfg	INT	Scaling upper limit (-32,000 to +32,000)

Variable (name) # is input number 1 to 4.



Precautions for Safe Use

- When initial setting parameters are set and transferred from Sysmac Studio, Sysmac Studio checks whether or not the Unit must be restarted. Restart the Unit after confirming the safety of the connected destination.
- The contents of initial setting parameters will be transferred to the Unit when the Controller is reset or when the Unit restarts.

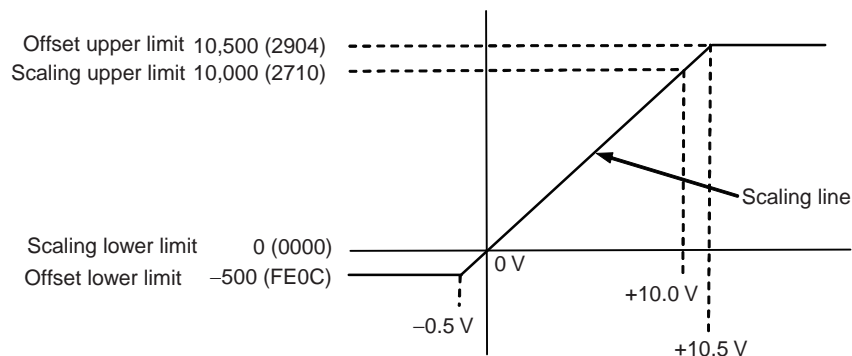
Example Setting 1

Set the following conditions for scaling 0 to 10 V signal of input 1 in set value of 0 to 10,000:

Set Input 1 Scaling Lower Limit (*_Ch1_ScL_L_Cfg) to 0.

Set Input 1 Scaling Upper Limit (*_Ch1_ScL_H_Cfg) to +10,000.

The following diagram shows the correspondence between input signals and converted scaling values.



Input signal range	The conversion results shown in parentheses are 16-bit binary data.
0 V	0
10 V	10,000
-0.5 V	-500
10.5 V	10,500

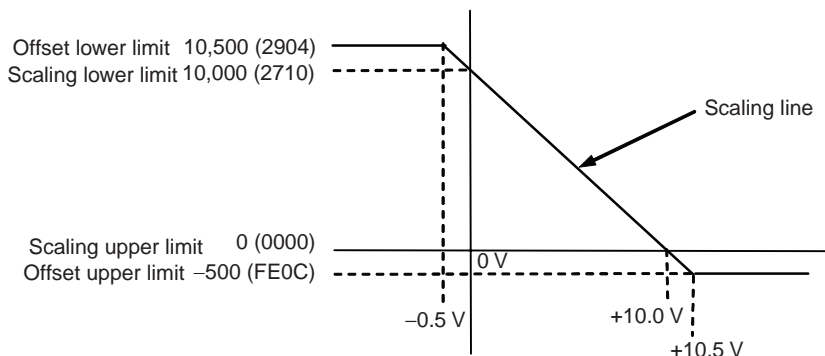
Example Setting 2 (Reverse Scaling)

Set the following conditions for scaling 0 to 10 V signal of input 2 in set value of 10,000 to 0:

Set Input 2 Scaling Lower Limit (*_Ch2_Scl_L_Cfg) to +10,000.

Set Input 2 Scaling Upper Limit (*_Ch2_Scl_H_Cfg) to 0.

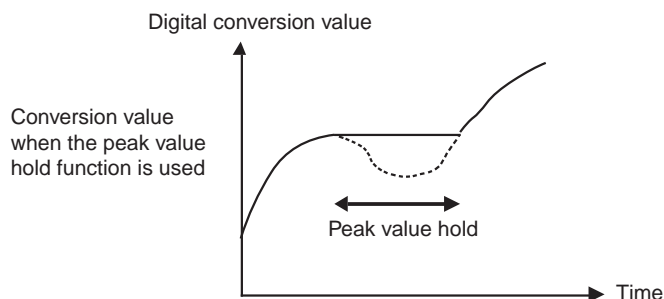
The following diagram shows the correspondence between input signals and converted scaling values.



Input signal range	The conversion results shown in parentheses are 16-bit binary data.
0 V	10,000
10 V	0
-0.5 V	10,500
10.5 V	-500

3-6-4 Peak Value Hold Function

The peak value hold function holds the maximum digital conversion value for every input (this includes mean value processing).



The peak value hold function is executed with the device variable for CJ-series Unit Input # Peak Value Hold Execution (*_Ch#_PkHdCmd) shown below.

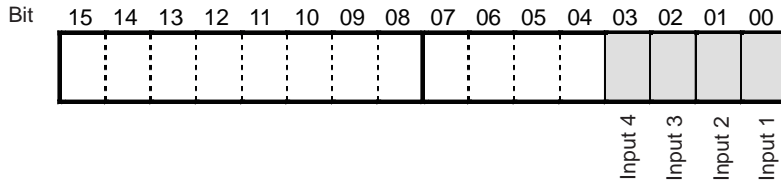
Peak value hold of the conversion value is performed while this variable is "1".

Variable name	Type	Setting
*_Ch#_PkHdCmd	BOOL	0: Do not perform peak value hold 1: Perform peak value hold

An input number from 1 to 4 is included in place of # in the variable name.

You can also perform batch settings with the device variable for CJ-series Unit Peak Value Hold Execution Settings (**_PkHdCmd*) shown below.

Variable name	Type	Setting
<i>*_PkHdCmd</i>	WORD	16#0000 to 16#000F



Additional Information

- When mean value processing is used together with the peak value hold function, the peak mean value will be held.
- If an input signal range is 1 to 5 V or 4 to 20 mA and a disconnection occurs when the peak value hold function is enabled, the conversion value will be +32767. When the disconnection is restored, the peak value hold function will be executed by using the previous peak value.

3-6-5 Input Disconnection Detection Function

When an input signal range of 1 to 5 V or 4 to 20 mA is used, you can detect input wiring disconnections. The detection conditions for each of the input signal ranges are shown in the following table.

Input signal range	Voltage/current for disconnection detection
1 to 5 V	Less than 0.3 V
4 to 20 mA	Less than 1.2 mA

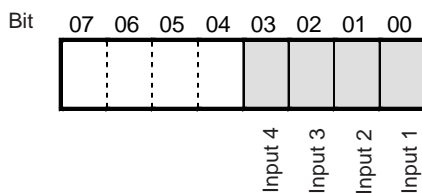
The disconnection detection status of each input is output to the device variable for CJ-series Unit Input # Disconnection Detected (**_Ch#_SensErr*) shown below.

Variable name	Type	Setting
<i>*_Ch#_SensErr</i>	BOOL	0: No disconnection 1: Disconnection

An input number from 1 to 4 is included in place of # in the variable name.

You can also perform batch readout with the device variable for CJ-series Unit Disconnection Detected (**_SensErr*) shown below.

Variable name	Type
<i>*_SensErr</i>	BYTE



The corresponding bit turns ON when a disconnection is detected for a given input. When the disconnection is restored, the bit turns OFF.



Additional Information

The conversion value during disconnection is +32767.

4

CJ-series Analog Output Unit (CJ1W-DA021/041/08V/08C)

This section explains how to use the CJ1W-DA021/041/08V/08C Analog Output Units.

4

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4-1 Specifications

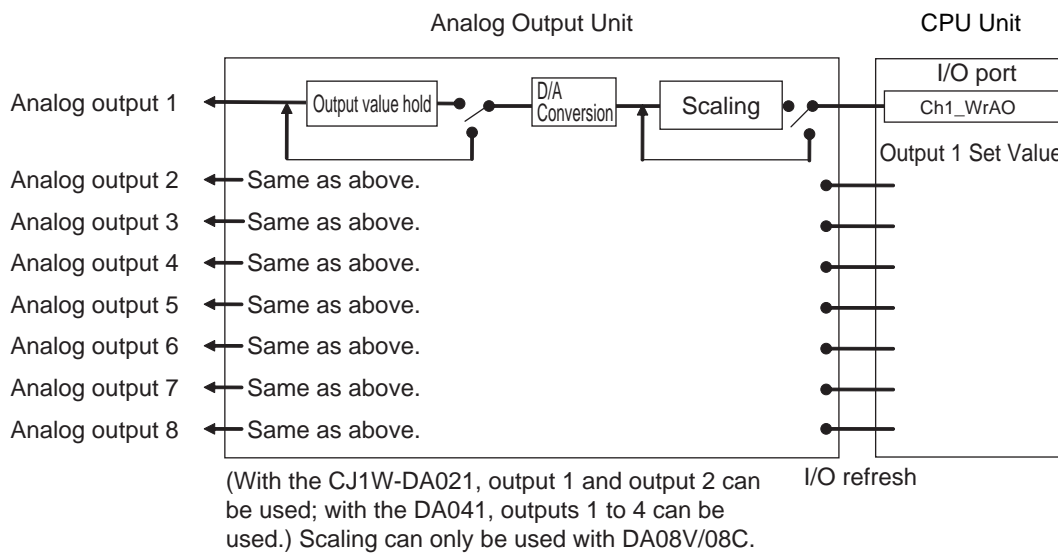
4-1-1 Specifications

Item	CJ1W-DA021	CJ1W-DA041	CJ1W-DA08V	CJ1W-DA08C	
Unit type	CJ-series Special I/O Unit				
Isolation	Between outputs and internal signals: Photocoupler *1 (No isolation between output signals.)				
External connection terminal	18-point detachable terminal block (M3 screws)				
Current consumption	5 VDC, 120 mA max.		5 VDC, 140 mA max.		
External power supply *2	24 VDC +10%, -15% (inrush current: 20 A max., pulse width: 1 ms min.)				
	140 mA max.	200 mA max.	140 mA max.	170 mA max.	
Dimensions (mm) *3	31 × 90 × 65 (W × H × D)				
Weight	150 g max.				
General specifications	Conforms to general specifications for NJ Series.				
Mounting position	NJ Series CPU Rack or Expansion Rack				
Maximum number of Units	Per CPU Rack or Expansion Rack *4	Power Supply Unit	No. of mountable Units		
		NJ-PA3001	Max. 10 units on CPU Rack Max. 10 units per Expansion Rack		
		NJ-PD3001	Max. 10 units on CPU Rack Max. 10 units per Expansion Rack		
Data exchange with CPU Unit	Data exchange with I/O ports For details, see 4-5 <i>Exchanging Data with the CPU Unit.</i>				
Output Specifications	Number of analog outputs	2	4	8	
	Output signal range *5	1 to 5 V/4 to 20 mA 0 to 5 V 0 to 10 V -10 to +10 V		1 to 5 V 0 to 5 V 0 to 10 V -10 to +10 V	
	Output impedance	0.5 Ω max. (for voltage output)			
	Max. output current (for 1 point)	12 mA (for voltage output)		2.4 mA (for voltage output)	---
	Maximum permissible load resistance	600 Ω (current output)		---	350 Ω
	Resolution	4,000 (full scale)		4,000/8,000 *9	
	Data setup file	16-bit integer (INT)			
	Accuracy *6	25°C	Voltage output: ±0.3% of full scale Current output: ±0.5% of full scale		±0.3% of full scale
		0°C to 55°C	Voltage output: ±0.5% of full scale Current output: ±0.8% of full scale		±0.5% of full scale
D/A conversion cycle *7	1.0 ms/point max.		1.0 ms or 250 μs max. per point		
Output functions	Output hold function	Outputs the specified output status (CLR, HOLD, or MAX) under any of the following circumstances. <ul style="list-style-type: none"> When the Conversion Enable Bit is OFF *8 In Adjustment Mode, when a value other than the output number is output during adjustment When an output set value error occurs and CPU Unit operations stop 			
	Scaling function	Set values in any specified Unit within a range of ±32,000 as the upper and lower limits to allow A/D conversion to be executed and analog signals to be output using the set values as full scale. (With the CJ1W-DA08V/DA08C, this function is enabled only for a conversion cycle of 1.0 s and a resolution of 4,000.)		Available only when using conversion cycle of 1ms and resolution of 4,000. Set value in any specified Unit within a range of ±32,000 as the upper and lower limits to allow D/A conversion to be executed and analog signals to be output using the set values as full scale.	

*1 Do not apply a voltage higher than 600 V to the terminal block when you perform a withstand voltage test on this Unit.

- *2 Select a 24-VDC power supply based on the surge current. The following OMRON power supplies are recommended.
S82K-05024: 100 VAC, 50 W
S82K-10024: 100 VAC, 100 W
- *3 Refer to A-1 Dimensions for details on the Unit's dimensions.
- *4 The maximum number of Analog Output Units that you can mount to one Rack depends on the current consumption of other units that are mounted.
- *5 You can set output signal ranges for each output.
- *6 The accuracy is given for full scale. For example, an accuracy of $\pm 0.3\%$ means a maximum error of ± 12 at a resolution of 4,000. For the CJ1W-DA021/041, the accuracy is at the default setting for a current output. When you use a voltage output, adjust the offset and gain as required.
- *7 The A/D conversion cycle is the time it takes for an analog signal to be stored in the Analog Output Unit memory as conversion data. It takes at least one task period before the conversion data is read by the CPU Unit.
- *8 The Output Conversion Enable Flag turns OFF when the CPU Unit shifts from RUN Mode to PROGRAM Mode, as well as when the Controller is reset including when the power turns ON.
- *9 The resolution can be set to 8,000 and the conversion cycle to 250 μ s initial setting parameter for CJ1W-DA08V/08C.

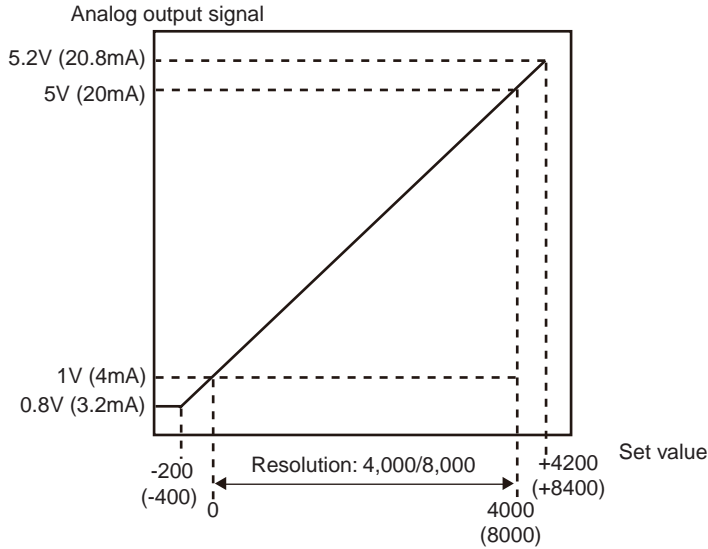
4-1-2 Output Function Block Diagram



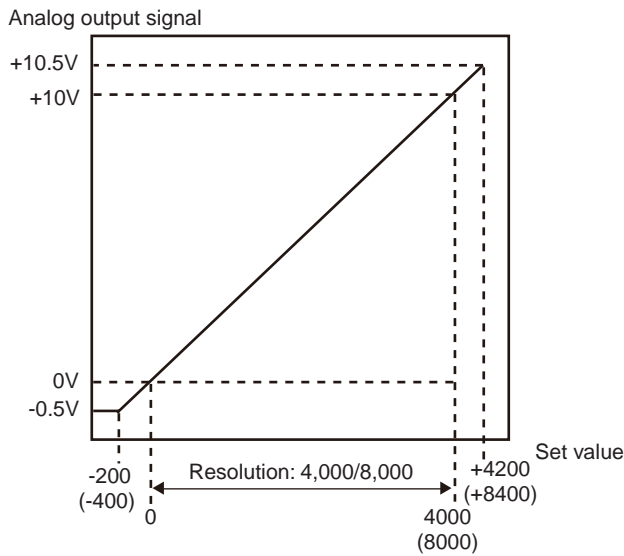
4-1-3 Output Specifications

If the set value is outside the specified range provided below, an output setting error will occur, and the output specified by the output hold function will be output.

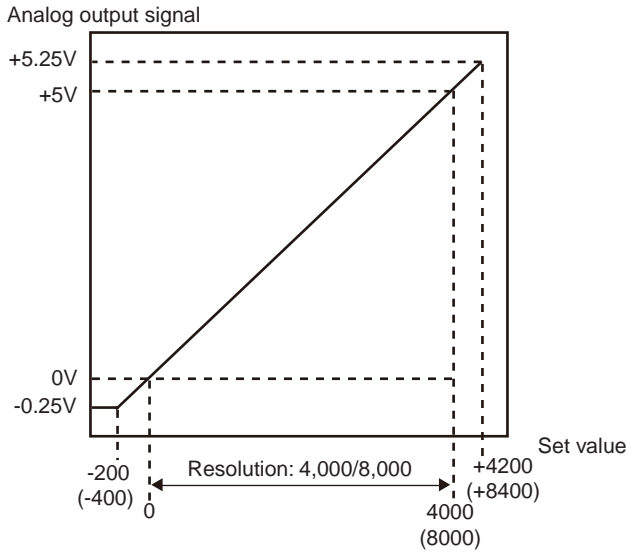
Range: 1 to 5 V (4 to 20 mA)



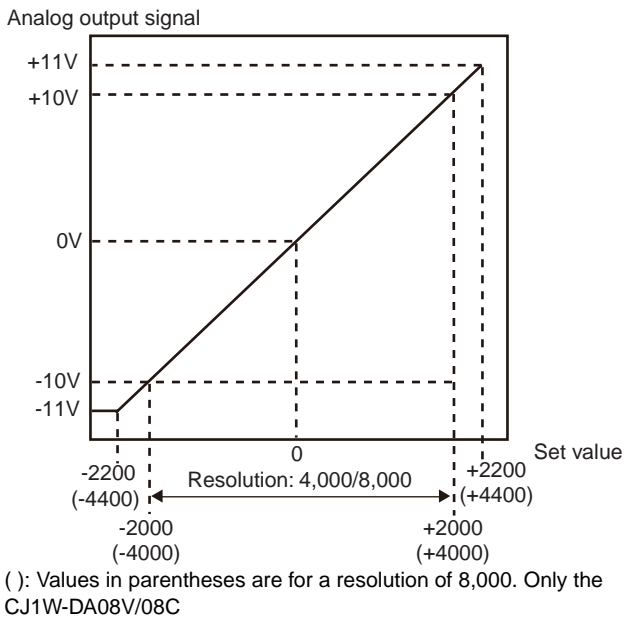
Range: 0 to 10 V



Range: 0 to 5 V



Range: -10 to 10 V



4-2 Operating Procedure

Follow the procedures outlined below when using the Analog Output Unit.

There is no restriction regarding the sequence of "Programs and software settings" and "Hardware setting and Rack assembly." These tasks may be carried out concurrently or in the reverse order.

Use Sysmac Studio to create and set programs.

For operations of Sysmac Studio, refer to the *Sysmac Studio Version 1 Operation Manual* (Cat. No. W504).

The setting procedure and setting order differ between CJ1W-DA021/041 and CJ1W-DA08V/08C.

4-2-1 CJ1W-DA021/041

● Programs and software settings

- 1** Create POU and global variables
Create Unit Configuration
 - Create and register global variables and each POU.
 - Create algorithms for each POU and register local variables of each POU.
 - Register the Unit in the Unit Configuration on the CPU/Expansion Racks screen in Configuration and Setup.
At this time, set both the device name and the unit number of the unit to be registered.
 - Create device variable for CJ-series Unit by using I/O Map.
- 2** Create Unit initial setting parameters
Create the Unit settings by using Special Unit Setup Editing.
 - Set the output numbers to be used.
 - Set the output signal ranges.
 - Set the output hold function.
(When the program is transferred, the items set here will be reflected in the initial setting parameters.)

● Hardware setting and Rack assembly

- 1** Set the operating mode switch on the front panel of the Unit to Normal Mode.
- 2** Use the unit number switches on the front panel of the Unit to set the unit number.
Set the same unit number as in the Unit Configuration settings.
- 3** Mount and wire the Unit to either a CPU Rack or Expansion Rack.
- 4** Turn ON the power to the Controller.
At this time, an I/O Setting Check Error occurs when there is a Unit Configuration in the CPU Unit which does not match the actual Unit Configuration. In this case, in steps 2 and 6 *Turn the external power OFF/Turn OFF the power to the Controller* of the following process, turn off the power to the Controller or reset the Controller to cancel the error.
- 5** Turn ON the power to the external devices.

● Program transfer and adjustment

- 1** Transfer programs, Unit Configuration and Setup and variable information.
- 2** Turn the external power OFF.

Turn OFF the power to the Controller. (Reset the Controller from Sysmac Studio if adjusting offset and gain is not required. The power need not be cycled.)

- 3** Set the operating mode switch to Adjustment Mode.
Set DIP switch on the front panel to Adjustment Mode.

- 4** Turn the power to the Controller OFF and ON.
Turn the external power back ON.
- The Special Unit is restarted and operates in the Adjustment Mode. In the Adjustment Mode, the ADJ indicator flashes.
 - Set the CPU Unit to PROGRAM Mode.

- 5** Adjust the offset and gain.
Adjusting Offset and Gain is performed if the output must be calibrated for the connected device.

- 6** Turn the external power OFF.
Turn OFF the power to the Controller.

- 7** Set the operating mode switch to Normal Mode.
Set DIP switch on the front panel to Normal Mode.

- 8** Turn the power to the Controller OFF and ON.
Turn the external power back ON.
The Special Unit is restarted and operates in the Normal Mode.
In the Normal Mode, the ADJ indicator remains unlit.

● Main operation

- 1** Main operation
- Read or write set values from the user program.
 - Write set values.
 - Start and stop the conversion output.
 - Obtain an error flag.

Note Turn external power ON or OFF while the Controller power is ON, or turn both power supplies ON or OFF at the same time. Do not turn the external power ON or OFF while the Controller is OFF.

4-2-2 CJ1W-DA08V/08C

● Programs and software settings

- 1** Create POU and global variables
Create Unit Configuration
 - Create and register global variables and each POU.
 - Create algorithms for each POU and register local variables of each POU.
 - Register the Unit in the Unit Configuration on the CPU/Expansion Racks screen in Configuration and Setup.
At this time, set both the device name and the unit number of the unit to be registered.
 - Create device variable for CJ-series Unit by using I/O Map.
- 2** Create Unit initial setting parameters
Create the Unit settings by using Special Unit Setup Editing.
 - Set the output numbers to be used.
 - Set the output signal ranges (Not required for the CJ1W-DA08C).
 - Set the output hold function.
 - Set the conversion cycle and resolution.
 - Set the scaling function.

(When the program is transferred, the items set here will be reflected in the initial setting parameters.)

● Hardware setting and Rack assembly

- 1** Use the unit number switches on the front panel of the Unit to set the unit number.
Set the same unit number as in the Unit Configuration settings.
- 2** Mount and wire the Unit to either a CPU Rack or Expansion Rack.
- 3** Turn ON the power to the Controller.
At this time, an I/O Setting Check Error occurs when there is a Unit Configuration in the CPU Unit which does not match the actual Unit Configuration. In this case, reset the Controller in steps 2, 4, and 7 *Reset the Controller or restart the Unit* to cancel the error.
- 4** Turn ON the power to the external devices.

● Program transfer and adjustment

- 1** Transfer programs, Unit Configuration and Setup and variable information.
- 2** Reset the Controller or restart the Unit.
- 3** Set Operating Mode Settings (*_MdCfg) to the Adjustment Mode (16#C1) and transfer the data setup file.
Set the operating mode switch to Adjustment Mode.
- 4** Reset the Controller or restart the Unit.
 - The Special Unit is restarted and operates in the Adjustment Mode. In the Adjustment Mode, the ADJ indicator flashes.
 - Set the CPU Unit to PROGRAM Mode.

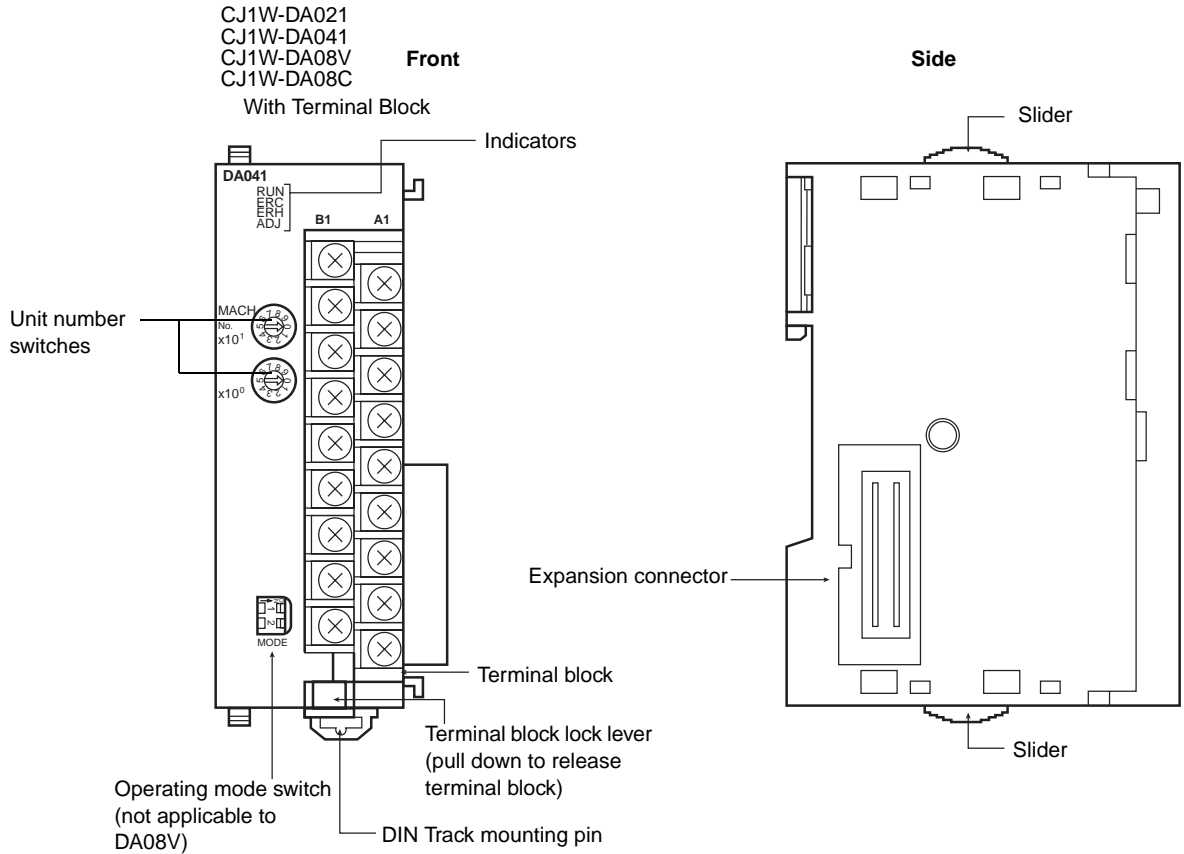
- 5** Adjust the offset and gain.
Adjusting Offset and Gain is performed if the input must be calibrated for the connected device.
- 6** Set Operating Mode Settings (**_MdCfg*) to the Normal Mode (16#00) and transfer the data setup file.
Set the operating mode switch to Normal Mode.
- 7** Reset the Controller or restart the Unit.
The Special Unit is restarted and operates in the Normal Mode.
In the Normal Mode, the ADJ indicator remains unlit.

● Main operation

- 1** Main operation
 - Read or write set values from the user program.
 - Write set values.
 - Start and stop the conversion output.
 - Obtain an error flag.
- Note** Turn external power ON or OFF while the Controller power is ON, or turn both power supplies ON or OFF at the same time. Do not turn the external power ON or OFF while the Controller is OFF.

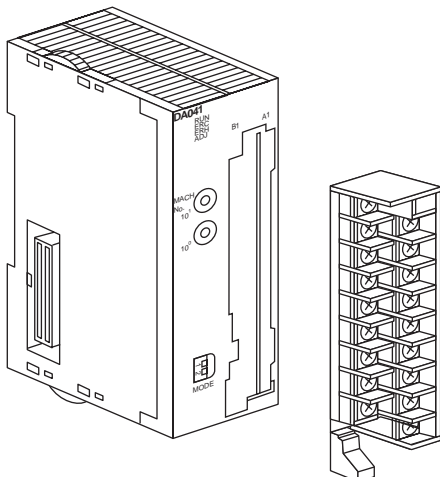
4-3 Components and Switch Settings

4-3-1 Component Names



Additional Information

- Use a connector to attach the terminal block. Press down on the lever at the bottom of the terminal block to remove the connector.
- Normally, the lever should be in the raised position.



4-3-2 Indicators

The indicators show the operating status of the Unit. The following table shows the meanings of the indicators.

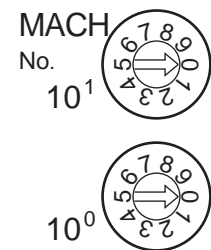
Indicator	Meaning	Indicator status	Operating status
RUN (green)	Operating	Lit	Operating in Normal Mode.
		Not lit	Unit has stopped exchanging data with the CPU Unit.
ERC (red)	Error detected by Unit	Lit	Alarm has occurred (such as disconnection detection) or initial settings are incorrect.
		Not lit	Operating normally.
ERH (red)	Error in the CPU Unit	Lit	Error has occurred during data exchange with the CPU Unit.
		Not lit	Operating normally.
ADJ (yellow)	Adjusting	Flashing	Operating in offset/gain Adjustment Mode.
		Not lit	Other than the above.

4-3-3 Unit Number Switches

Use the unit number switches to set the specific unit number for each Special I/O Unit mounted in a CPU Rack or Expansion Rack. The unit number must be the one registered in Unit Configurations.

Turn OFF the Controller before changing the unit number setting.

Switch setting	Unit number
0	Unit #0
1	Unit #1
2	Unit #2
3	Unit #3
4	Unit #4
5	Unit #5
6	Unit #6
7	Unit #7
8	Unit #8
9	Unit #9
10	Unit #10
to	to
n	Unit #n
to	to
95	Unit #95



Additional Information

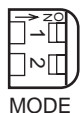
- If two or more Special I/O Units are assigned the same unit number, a "Duplicate Unit Number" major fault level Controller error is generated and the Controller will not operate.
- After correcting the unit number setting, cycle the power to the Controller.

4-3-4 Operating Mode Switch

The operating mode switch on the front panel of the Unit is used to set the operating mode to either Normal Mode or Adjustment Mode (to adjust offset and gain).

In the case of CJ1W-DA08V/08C, you can set Operating Mode Settings (*_MdCfg) to the *Adjustment Mode* (16#C1) and transfer the data setup file to switch to the Adjustment Mode. Refer to *Switching Operating Mode* in 4-5-2 *Accessing from the User Program*.

● CJ1W-DA021/041



Pin number		Mode
1	2	
OFF	OFF	Normal Mode
ON	OFF	Adjustment Mode

Note The default settings for SW1 and SW2 are both OFF.



Precautions for Safe Use

Be sure to turn OFF the power of the Controller before operating the operating mode switch.



Precautions for Correct Use

- Do not set the pins to any combination other than those shown in the above table.
- Be sure to set pin 2 to OFF.

4-4 Wiring

4-4-1 Terminal Arrangement

The signal names that correspond to the connecting terminals are as shown in the following diagram.

● CJ1W-DA021

Voltage output 2 (+)	B1	A1	Voltage output 1 (+)
Output 2 (-)	B2	A2	Output 1 (-)
Current output 2 (+)	B3	A3	Current output 1 (+)
N.C.	B4	A4	N.C.
N.C.	B5	A5	N.C.
N.C.	B6	A6	N.C.
N.C.	B7	A7	N.C.
N.C.	B8	A8	N.C.
0 V	B9	A9	24 V

● CJ1W-DA041

Voltage output 2 (+)	B1	A1	Voltage output 1 (+)
Output 2 (-)	B2	A2	Output 1 (-)
Current output 2 (+)	B3	A3	Current output 1 (+)
Voltage output 4 (+)	B4	A4	Voltage output 3 (+)
Output 4 (-)	B5	A5	Output 3 (-)
Current output 4 (+)	B6	A6	Current output 3 (+)
N.C.	B7	A7	N.C.
N.C.	B8	A8	N.C.
0 V	B9	A9	24 V

● CJ1W-DA08V (Voltage Output) and CJ1W-DA08C (Current Output)

Output 2 (+)	B1	A1	Output 1 (+)
Output 2 (-)	B2	A2	Output 1 (-)
Output 4 (+)	B3	A3	Output 3 (+)
Output 4 (-)	B4	A4	Output 3 (-)
Output 6 (+)	B5	A5	Output 5 (+)
Output 6 (-)	B6	A6	Output 5 (-)
Output 8 (+)	B7	A7	Output 7 (+)
Output 8 (-)	B8	A8	Output 7 (-)
0 V	B9	A9	24 V



Additional Information

- Use the device variable for CJ-series Unit Output Use Setting (*_Ch#_OutChUseCfg) to set the analog output number that you can use.
- Set the output signal range for each analog output with the device variable for CJ-series Unit Output Signal Range Setting (*_OutRngCfg). The output signal range can be set separately for each output number.
- The N.C. terminals are not connected to internal circuit.
- We recommend the following external power supplies.

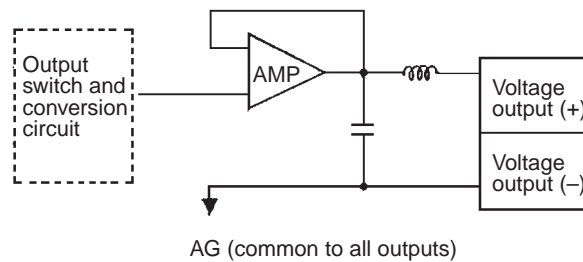
Maker	Model number	Specifications
OMRON	S82K-05024	100 VAC, 50 W
	S82K-10024	100 VAC, 100 W

4-4-2 Internal Circuit

The following diagrams show the internal circuit of the analog output section.

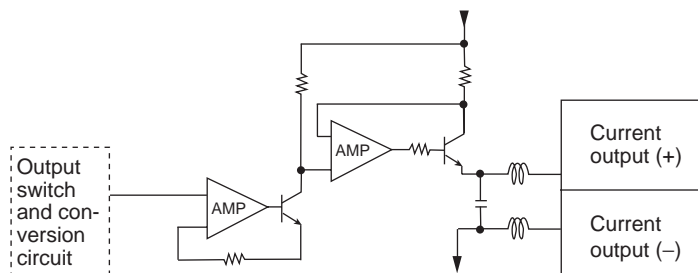
● Voltage Output Circuit

Voltage output section

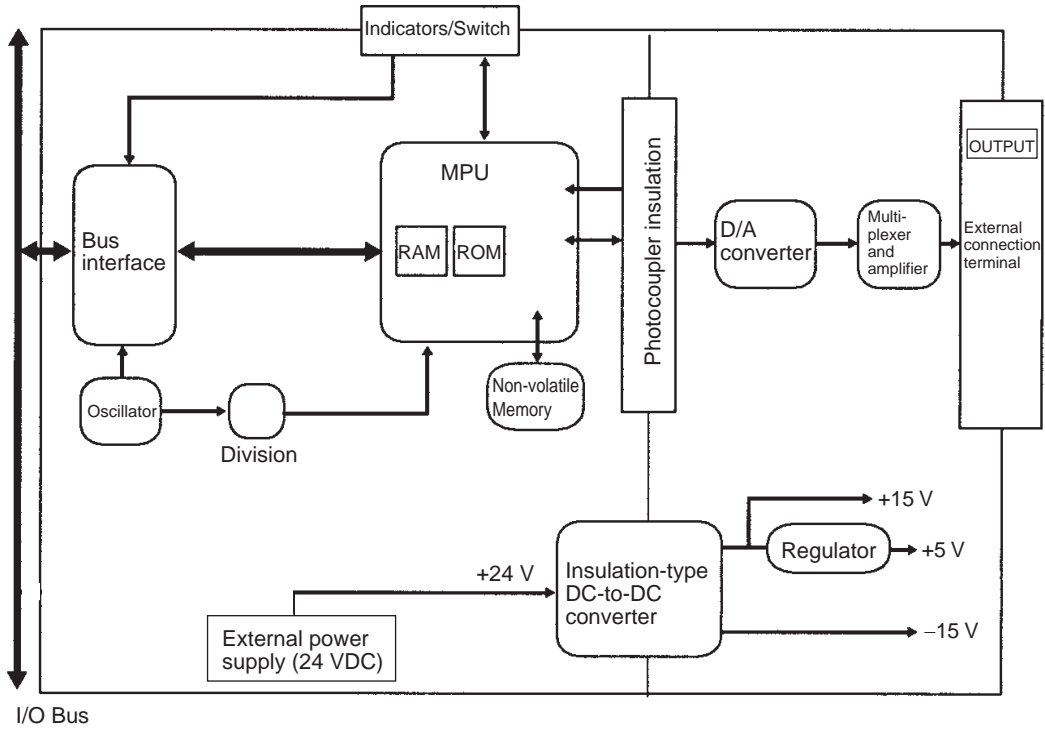


● Current Output Circuit

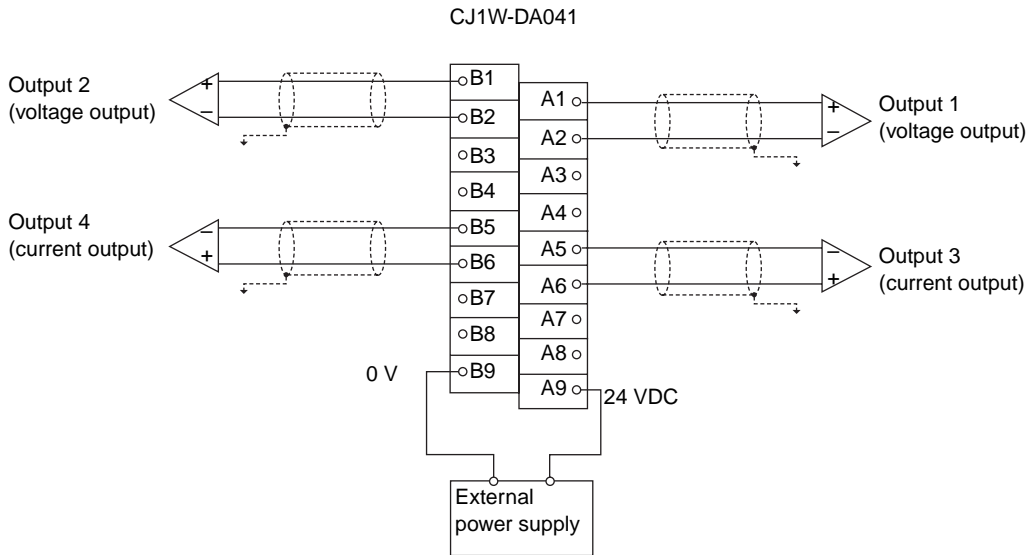
Current output section



● Internal Configuration



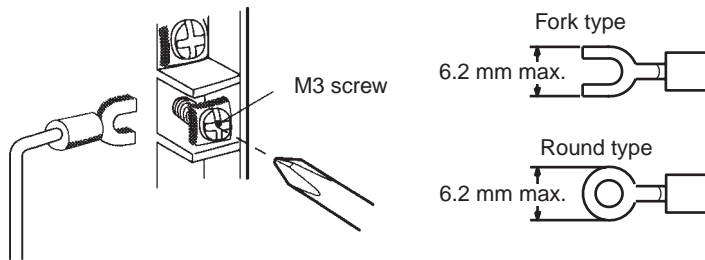
4-4-3 Output Wiring Example





Precautions for Safe Use

Crimp terminals must be used for terminal connections, and the screws must be tightened securely. M3 terminal screws are used. The applicable tightening torque is 0.5 N·m.



Additional Information

To minimize output wiring noise, ground the output signal line to the input device.

4-4-4 Output Wiring Considerations

When you wire outputs, apply the following points to avoid noise interference and optimize Analog Output Unit performance.

- Use two-core shielded twisted-pair cables for output connecting lines.
- Route output cables separately from the power cables (e. g., AC and three-phase lines) and do not run the Unit's cables near a main circuit cable or a high voltage cable. Do not insert these cables into the same duct.
- If there is noise interference from power lines (for example, the power supply is shared with electrical welding devices or electrical discharge machines, or there is a high-frequency generation source nearby) install a noise filter at the power supply input area.
- Use a separate power supply for the external power supply from the one used for Basic I/O Units. If the same power supply is used, noise may cause Units to malfunction.

4-5 Exchanging Data with the CPU Unit

4-5-1 Outline of Data Exchange

The CPU Unit and Analog Output Unit CJ1W-DA021/041/08V/08C exchange operation data and initial setting parameters via the I/O port generated for this Analog Output Unit.

The table and figure below show the data exchange method for each data type.

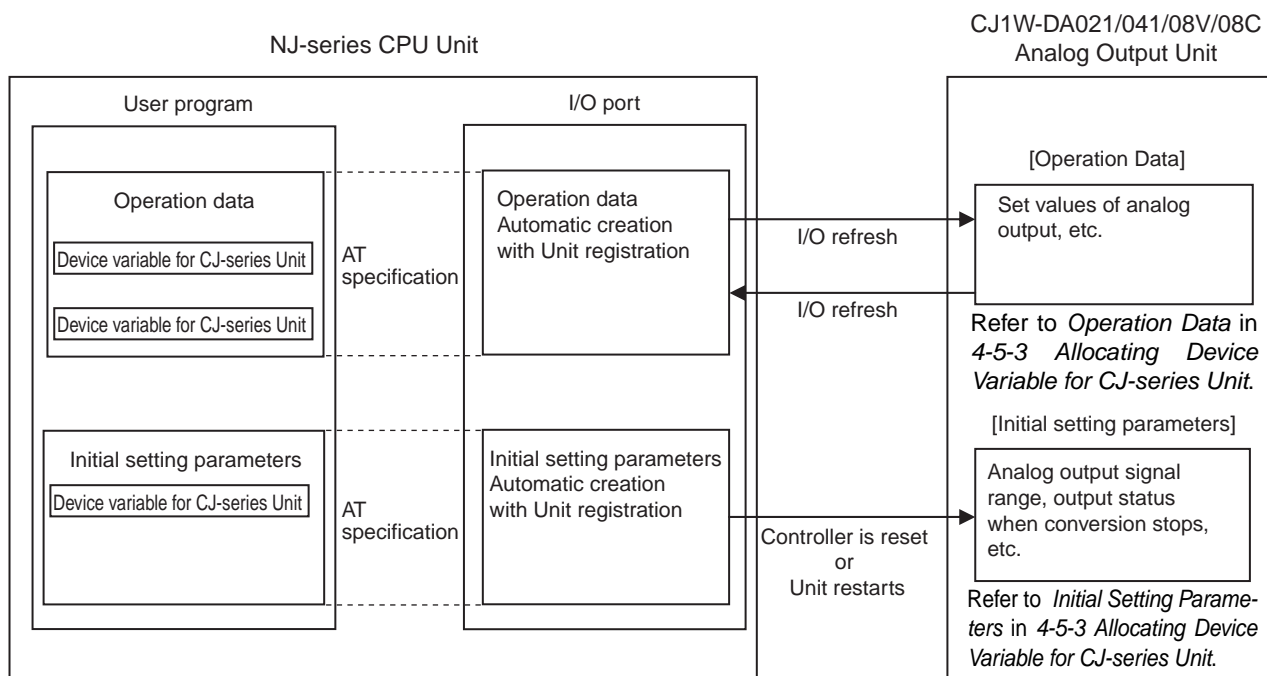
Data exchange type

Unit data type	Data contents	AT specification destination	How to access from user program	Timing of data exchange
Operation data	Analog output setting values, etc.	I/O port (operation data)	Device variable for CJ-series Unit	At I/O refreshing
Initial setting parameters	Analog output signal range, output status when conversion stops, etc.	I/O port (initial setting parameters) *	Device variable for CJ-series Unit	When the Controller is reset or the Unit restarts
Unit Restart Bit, etc.	Unit Restart Bit, etc.	None	System-defined variable	At I/O refreshing

* The initial setting parameters are retained in the CPU Unit by the battery even during power interruptions.

● Device Variable for CJ-series Unit

Device variables for CJ-series Unit are variables used for data exchange between a user program and Special I/O Units. The user program uses device variables for CJ-series Unit to control the Analog I/O Unit.



4-5-2 Accessing from the User Program

The user program uses device variables for CJ-series Unit to control the Analog Output Unit. Use device variables for CJ-series Unit with AT specification for the I/O port, which is explained below.

● I/O port

An "I/O port" is a logical interface for data exchange by a CPU Unit with an Analog I/O Unit or other configuration unit.

An I/O port has a unique predefined name for each unit model and function.

An I/O port is automatically created by preparing the Unit Configuration with Sysmac Studio.

● How to specify device variables for CJ-series Unit

Specify the AT specifications to I/O ports for device variables for CJ-series Unit with the I/O Map from Sysmac Studio.

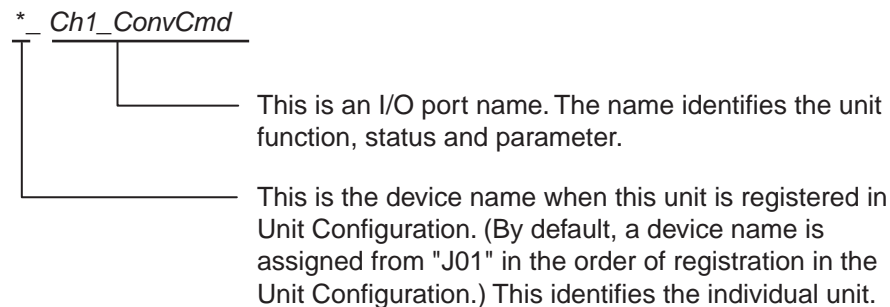
Specify the variable name for the AT specification with one of the following methods.

1. Select a variable already registered in the variable table
2. Input a new variable name
3. Automatically create a variable name with "Device variable creation"

When a device variable name for CJ-series Unit is assigned with method 2 or 3, the variable input by Sysmac Studio is automatically registered in the variable table.

The following is the configuration of variable names created with automatic creation in method 3.

Name of device variable for CJ-series Unit



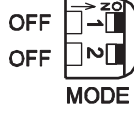
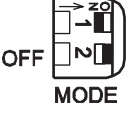
For details on creation of device variables for CJ-series Unit, refer to *Sysmac Studio Version 1 Operation Manual* (Cat. No. W504).

There are two types of device variables for CJ-series Unit: "Operation Data" and "Initial Setting Parameters"

In the explanations from here on, the device name automatically created is used as the device variable for CJ-series Unit, for example *_ Ch1_ConvCmd".

Switching Operating Mode

You can switch between the Normal Mode and Adjustment Mode (during offset and gain adjustments, etc.) depending on the model as follows.

Model	Setting method	Normal Mode	Adjustment Mode
CJ1W-DA021/041	Set the front DIP switch		
CJ1W-DA08V/08C	Set device variable for CJ-series Unit	*_MdCfg=16#00	*_MdCfg=16#C1

4-5-3 Allocating Device Variable for CJ-series Unit

Initial Setting Parameters

Perform unit setting such as output use setting, analog output signal range, etc.

Initial setting parameters settings are set from Special Unit Setup Editing of Sysmac Studio.

Unit settings can also be performed by setting the values in the device variables for CJ-series Unit.

Unit settings are reflected only when the Controller is reset, or when the Unit restarts. The initial setting parameters are retained in the CPU Unit by the battery even during power interruptions.



Precautions for Safe Use

- When initial setting parameters are set and transferred from Sysmac Studio, Sysmac Studio checks whether or not the Unit must be restarted. Restart the Unit after confirming the safety of the connected destination.
- The contents of initial setting parameters will be transferred to the Unit when the Controller reset or when the Unit restarts.

List of Initial Setting Parameters (common among models, for both Normal Mode and Adjustment Mode)

Name of device variable for CJ-series Unit	Type	R/W	Name	Feature/reference page	Bit Number
*_OutChUseCfg	WORD	RW	Output Use Settings	Refer to <i>Setting Outputs and Signal Ranges</i> in 4-6-1 <i>Output Settings and Conversion Values</i> . WORD-type variable that combines the following BOOL-type variables:	
*_Ch1_OutChUseCfg	BOOL	RW	Output 1 Use Setting	Variable to specify usage in Unit of bits per output. 0: Not used 1: Used Ch3 and Ch4 are used only for DA041/08V/08C. Ch5 to Ch8 are used only for DA08V/08C.	00
*_Ch2_OutChUseCfg	BOOL	RW	Output 2 Use Setting		01
*_Ch3_OutChUseCfg	BOOL	RW	Output 3 Use Setting		02
*_Ch4_OutChUseCfg	BOOL	RW	Output 4 Use Setting		03
*_Ch5_OutChUseCfg	BOOL	RW	Output 5 Use Setting		04
*_Ch6_OutChUseCfg	BOOL	RW	Output 6 Use Setting		05
*_Ch7_OutChUseCfg	BOOL	RW	Output 7 Use Setting		06
*_Ch8_OutChUseCfg	BOOL	RW	Output 8 Use Setting		07
*_OutRngCfg	WORD	RW	Output Signal Range Setting	Refer to <i>Output Signal Ranges</i> in 4-6-1 <i>Output Settings and Conversion Values</i> .	
*_Ch1_HdMdCfg	USINT	RW	Output 1 Output Status When Conversion Stops	Refer to 4-6-2 <i>Output Hold Function</i> . 0: CLR 1: HOLD 2: MAX Ch3 and Ch4 are used only for DA041/08V/08C. Ch5 to Ch8 are used only for DA08V/08C.	
*_Ch2_HdMdCfg	USINT	RW	Output 2 Output Status When Conversion Stops		
*_Ch3_HdMdCfg	USINT	RW	Output 3 Output Status When Conversion Stops		
*_Ch4_HdMdCfg	USINT	RW	Output 4 Output Status When Conversion Stops		
*_Ch5_HdMdCfg	USINT	RW	Output 5 Output Status When Conversion Stops		
*_Ch6_HdMdCfg	USINT	RW	Output 6 Output Status When Conversion Stops		
*_Ch7_HdMdCfg	USINT	RW	Output 7 Output Status When Conversion Stops		
*_Ch8_HdMdCfg	USINT	RW	Output 8 Output Status When Conversion Stops		

List of Initial Setting Parameters (DA08V/DA08C unique parameters)

Name of device variable for CJ-series Unit	Type	R/W	Name	Feature/reference page
*_Ch1_Scl_L_Cfg	INT	RW	Output 1 Scaling Lower Limit	Refer to 4-6-3 <i>Output Scaling Function (CJ1W-DA08V/08C Only)</i> on page 4-29. –32000 to +32000 Set lower limit ≠ upper limit. (Can also set lower limit > upper limit.)
*_Ch1_Scl_H_Cfg	INT	RW	Output 1 Scaling Upper Limit	
*_Ch2_Scl_L_Cfg	INT	RW	Output 2 Scaling Lower Limit	
*_Ch2_Scl_H_Cfg	INT	RW	Output 2 Scaling Upper Limit	
*_Ch3_Scl_L_Cfg	INT	RW	Output 3 Scaling Lower Limit	
*_Ch3_Scl_H_Cfg	INT	RW	Output 3 Scaling Upper Limit	
*_Ch4_Scl_L_Cfg	INT	RW	Output 4 Scaling Lower Limit	
*_Ch4_Scl_H_Cfg	INT	RW	Output 4 Scaling Upper Limit	
*_Ch5_Scl_L_Cfg	INT	RW	Output 5 Scaling Lower Limit	
*_Ch5_Scl_H_Cfg	INT	RW	Output 5 Scaling Upper Limit	
*_Ch6_Scl_L_Cfg	INT	RW	Output 6 Scaling Lower Limit	
*_Ch6_Scl_H_Cfg	INT	RW	Output 6 Scaling Upper Limit	
*_Ch7_Scl_L_Cfg	INT	RW	Output 7 Scaling Lower Limit	
*_Ch7_Scl_H_Cfg	INT	RW	Output 7 Scaling Upper Limit	
*_Ch8_Scl_L_Cfg	INT	RW	Output 8 Scaling Lower Limit	
*_Ch8_Scl_H_Cfg	INT	RW	Output 8 Scaling Upper Limit	
*_MdCfg	BYTE	RW	Operating Mode Settings	Refer to <i>Switching Operating Mode</i> in 4-5-2 <i>Accessing from the User Program</i> . 16#00: Normal Mode 16#C1: Adjustment Mode
*_ResolutionCfg	BYTE	RW	Resolution/Conversion Time Settings	Refer to <i>Conversion Cycle/Resolution Setting (CJ1W-DA08V/08C Only)</i> in 4-6-1 <i>Output Settings and Conversion Values</i> . 16#00: 4,000 resolutions/1 ms cycle 16#C1: 8,000 resolutions/250 μs cycle

Operation Data

Operation data includes data such as analog output conversion values, etc. Operation data is exchanged constantly during I/O refreshing.

List of Operation Data (during Normal Mode)

Name of device variable for CJ-series Unit	Type	R/W	Name	Feature/reference page	
*_Ch1_WrAO	INT	RW	Output 1 Set Value	Refer to <i>Writing Set Values</i> in 4-6-1 <i>Output Settings and Conversion Values</i> . Ch3 and Ch4 are used only for DA041/08V/08C. Ch5 to Ch8 are used only for DA08V/08C.	
*_Ch2_WrAO	INT	RW	Output 2 Set Value		
*_Ch3_WrAO	INT	RW	Output 3 Set Value		
*_Ch4_WrAO	INT	RW	Output 4 Set Value		
*_Ch5_WrAO	INT	RW	Output 5 Set Value		
*_Ch6_WrAO	INT	RW	Output 6 Set Value		
*_Ch7_WrAO	INT	RW	Output 7 Set Value		
*_Ch8_WrAO	INT	RW	Output 8 Set Value		
*_ConvCmd	WORD	RW	Conversion Enable Settings	Refer to <i>Starting and Stopping Conversion</i> in 4-6-1 <i>Output Settings and Conversion Values</i> . WORD-type variable that combines the following BOOL-type variables:	Bit Number
*_Ch1_ConvCmd	BOOL	RW	Output 1 Conversion Enable	BOOL-type variable that specifies each output for conversion enable. 0: Stop conversion output 1: Start conversion output Ch3 and Ch4 are used only for DA041/08V/08C. Ch5 to Ch8 are used only for DA08V/08C.	00
*_Ch2_ConvCmd	BOOL	RW	Output 2 Conversion Enable		01
*_Ch3_ConvCmd	BOOL	RW	Output 3 Conversion Enable		02
*_Ch4_ConvCmd	BOOL	RW	Output 4 Conversion Enable		03
*_Ch5_ConvCmd	BOOL	RW	Output 5 Conversion Enable		04
*_Ch6_ConvCmd	BOOL	RW	Output 6 Conversion Enable		05
*_Ch7_ConvCmd	BOOL	RW	Output 7 Conversion Enable		06
*_Ch8_ConvCmd	BOOL	RW	Output 8 Conversion Enable		07
*_MVErr	BYTE	R	Output Set Value Error	Refer to 4-6-4 <i>Output Set Value Error</i> . BYTE-type variable that combines the following BOOL-type variables:	Bit Number
*_Ch1_MVErr	BOOL	R	Output 1 Output Set Value Error	BOOL-type variable that checks each output for error condition. 0: No error 1: Setting error Ch3 and Ch4 are used only for DA041/08V/08C. Ch5 to Ch8 are used only for DA08V/08C.	00
*_Ch2_MVErr	BOOL	R	Output 2 Output Set Value Error		01
*_Ch3_MVErr	BOOL	R	Output 3 Output Set Value Error		02
*_Ch4_MVErr	BOOL	R	Output 4 Output Set Value Error		03
*_Ch5_MVErr	BOOL	R	Output 5 Output Set Value Error		04
*_Ch6_MVErr	BOOL	R	Output 6 Output Set Value Error		05
*_Ch7_MVErr	BOOL	R	Output 7 Output Set Value Error		06
*_Ch8_MVErr	BOOL	R	Output 8 Output Set Value Error		07

Name of device variable for CJ-series Unit	Type	R/W	Name	Feature/reference page	
*_UnitErr	BYTE	R	Error Flags	Refer to 7-2-2 <i>Alarms Occurring at the Unit</i> . BYTE-type variable that combines the following BOOL-type variables:	Bit Number
*_SclErr	BOOL	R	Scaling Data Setting Error	Used only for DA08V/08C. 0: No error 1: Error in initial setting parameters	00
*_HdErr	BOOL	R	Output Hold Setting Error	0: No error 1: Error in initial setting parameters	02
*_MdErr	BOOL	R	Conversion Time/Resolution or Operation Mode Setting Error	Used only for DA08V/08C. 0: No error 1: Error in initial setting parameters	04

List of Operation Data (during Adjustment Mode)

Name of device variable for CJ-series Unit	Type	R/W	Name	Feature/reference page	
*_AdjCh	BYTE	RW	Outputs to Be Adjusted	Refer to 7-1 <i>Adjusting Offset and Gain</i> . Instruction setting and flag for output adjustments.	
*_AdjOfs	BOOL	RW	Offset Flag		
*_AdjGain	BOOL	RW	Gain Flag		
*_AdjDwn	BOOL	RW	Adjustment Value Down Flag		
*_Adjup	BOOL	RW	Adjustment Value Up Flag		
*_AdjSet	BOOL	RW	Adjustment Value Set Flag		
*_AdjClr	BOOL	RW	Adjustment Value Clear Flag		
*_AdjPV	INT	R	Conversion value for adjustment		
*_AdjUnitErr	BYTE	R	Error Flags	Refer to 7-2-2 <i>Alarms Occurring at the Unit</i> . BYTE-type variable that combines the following BOOL-type variables:	Bit Number
*_AdjSclErr	BOOL	R	Scaling Data Setting Error	Used only for DA08V/08C. 0: No error 1: Error in initial setting parameters	00
*_AdjHdErr	BOOL	R	Output Hold Setting Error	0: No error 1: Error in initial setting parameters	02
*_AdjMdErr	BOOL	R	Conversion Time/Resolution or Operation Mode Setting Error	Used only for DA08V/08C. 0: No error 1: Error in initial setting parameters	04

Name of device variable for CJ-series Unit	Type	R/W	Name	Feature/reference page
*_AdjOutNoErr	BOOL	R	Output Value Adjustment Number Setting Error	0: No error 1: "_AdjCh" is outside setting range 05
*_AdjMemErr	BOOL	R	Non-volatile Memory Error	0: No error 1: Adjustment data could not be written properly 06
*_AdjMd	BOOL	R	Starting Adjustment Mode	0: Running in the Normal Mode 1: Running in the Adjustment Mode 07

4-6 Analog Output Functions and Operating Procedures

4-6-1 Output Settings and Conversion Values

Setting Outputs and Signal Ranges

● Output Numbers

The Analog Output Unit converts only the analog outputs specified among output numbers 1 to 8 (1 to 4 for CJ1W-DA041, or 1 and 2 for CJ1W-DA021), and skips unused outputs.

Accordingly, the conversion cycle per unit is calculated by conversion cycle × used output points.

For the conversion cycle setting, refer to *Conversion Cycle/Resolution Setting (CJ1W-DA08V/08C Only)* on page 4-27.

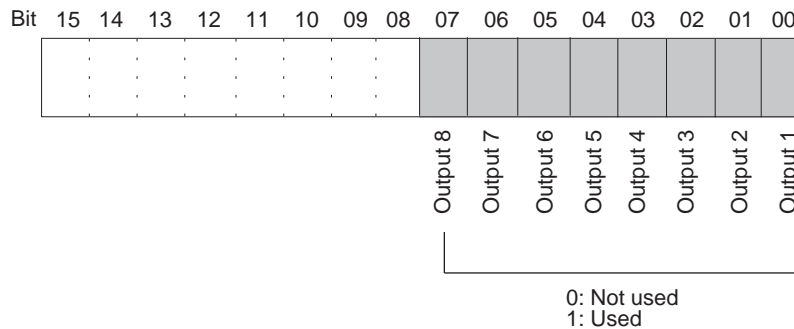
Use the Output # Use Setting (*_Ch#_OutChUseCfg) to set the analog outputs to be used.

Variable name	Type	Setting
*_Ch#_OutChUseCfg	BOOL	0: Not used 1: Used

An output number from 1 to 8 is included in place of # in the variable name.
(1 to 4 for DA041 and 1 to 2 for DA021)

You can also perform batch settings with Output Use Setting (*_OutChUseCfg).

Variable name	Type	Setting
*_OutChUseCfg	WORD	16#0000 to 16#00FF (To 16#000F for DA041 and 16#0003 for DA021)

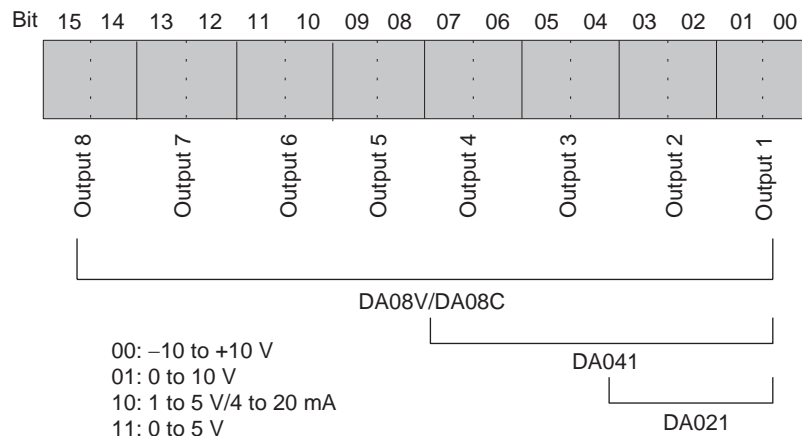


The output value of the output number set to "Not used" will be 0 V.

● Output Signal Ranges

You can select any of four types of output signal range (–10 to 10 V, 0 to 10 V, 1 to 5 V, 4 to 20 mA, and 0 to 5 V) for each of the outputs (only voltage output for the CJ1W-DA08V). (The output signal range for the CJ1W-DA08C is 4 to 20 mA only.) To specify the output signal range for each output, use Output Signal Range Setting (*_OutRngCfg).

Variable name	Type	Setting
*_OutRngCfg	WORD	16#0000 to 16#FFFF



- For CJ1W-DA021/041, change the terminal connections to switch the output signal range 1 to 5 V and the output signal range 4 to 20 mA.
- For CJ1W-DA08V, only the voltage output is valid. The output signal range 4 to 20 mA is invalid.
- For CJ1W-DA08C, only the output signal range 4 to 20 mA is valid. The voltage output is invalid.



Precautions for Safe Use

- When initial setting parameters are set and transferred from Sysmac Studio, Sysmac Studio checks whether or not the Unit must be restarted. Restart the Unit after confirming the safety of the connected destination.
- The contents of initial setting parameters will be transferred to the Unit when the Controller is reset or when the Unit restarts.

Writing Set Values

Use the device variable for CJ-series Unit Output # Set Value (*_Ch#_WrAO) shown below to set analog output setting.

Variable name	Type	Setting
*_Ch#_WrAO	INT	Refer to 4-1-3 Output Specifications.

An output number from 1 to 8 is included in place of # in the variable name (1 to 4 for DA041 and 1 to 2 for DA021).



Additional Information

If the set value has been written outside the setting range, an output setting error will occur, and the value set by the output hold function will be output.

Conversion Cycle/Resolution Setting (CJ1W-DA08V/08C Only)

You can switch the conversion cycle and resolution with Resolution/Conversion Time Settings (*_ResolutionCfg).

This setting is common to analog output 1 to 8.

Variable name	Type	Setting
*_ResolutionCfg	BYTE	16#00: 4,000 resolutions/1 ms cycle 16#C1: 8,000 resolutions/250 μ s cycle



Precautions for Safe Use

- When initial setting parameters are set and transferred from Sysmac Studio, Sysmac Studio checks whether or not the Unit must be restarted. Restart the Unit after confirming the safety of the connected destination.
- The contents of initial setting parameters will be transferred to the Unit when the Controller is reset or when the Unit restarts.

Starting and Stopping Conversion

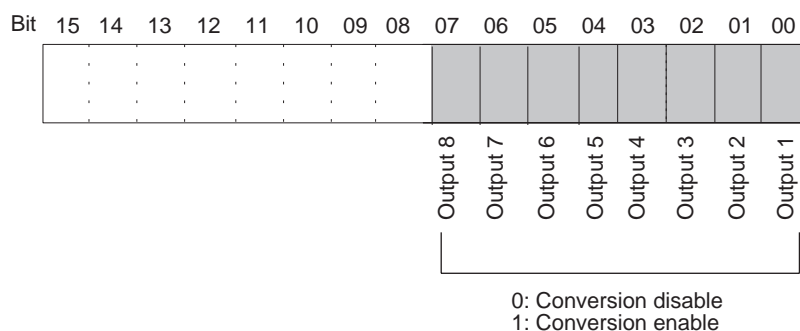
To start conversion of analog output, there is the need to set used output to conversion enable with the device variables for CJ-series Unit Output # Conversion Enable (*_Ch#_ConvCmd) shown below.

Variable name	Type	Setting
*_Ch#_ConvCmd	BOOL	0: Conversion disable 1: Conversion enable

An output number from 1 to 8 is included in place of # in the variable name (1 to 4 for DA041 and 1 to 2 for DA021).

You can also perform batch settings with the device variable for CJ-series Unit Conversion Enable Settings (*_ConvCmd) shown below.

Variable name	Type	Setting
*_ConvCmd	WORD	16#0000 to 16#00FF (To 16#000F for DA041 and 16#0003 for DA021)



Additional Information

- The analog output when conversion is stopped will depend on the output signal range setting and output hold setting. Refer to *Output Signal Ranges* on page 4-25 and *4-6-2 Output Hold Function*.
- Conversion will not begin under the following conditions even if the Conversion Enable is turned ON. Refer to *4-6-2 Output Hold Function*.
 - In Adjustment Mode, when something other than the output number is output during adjustment
 - When there is an output setting error

- When a major fault level Controller error occurs at the CPU Unit
- When the CPU Unit changes from the RUN Mode to PROGRAM Mode, all output for the device variable for CJ-series Unit *_ConvCmd will change to the status of conversion disabled. This also happens when the Controller is reset including when the power is turned ON. This output status is set by the output hold function.

4-6-2 Output Hold Function

The Analog Output Unit stops conversion under the following conditions and outputs the value set for the output hold function.

- 1** When the Conversion Enable Bit is OFF
Refer to *Starting and Stopping Conversion* in 4-6-1 *Output Settings and Conversion Values*.
- 2** In Adjustment Mode, when something other than the output number is output during adjustment
Refer to 4-3-4 *Operating Mode Switch*.
- 3** When there is an output setting error
Refer to 4-6-4 *Output Set Value Error*.
- 4** When a major fault level Controller error occurs.

You can select CLR, HOLD, or MAX for the output status when conversion stops.

Output signal range	CLR	HOLD	MAX
0 to 10 V	-0.5 V (Min. -5% of full scale)	Voltage that was output just prior to stopping.	10.5 V (Max. +5% of full scale)
-10 to 10 V	0.0 V	Voltage that was output just prior to stopping.	11.0 V (Max. +5% of full scale)
1 to 5 V	0.8 V (Min. -5% of full scale)	Voltage that was output just prior to stopping.	5.2 V (Max. +5% of full scale)
0 to 5 V	-0.25 V (Min. -5% of full scale)	Voltage that was output just prior to stopping.	5.25 V (Max. +5% of full scale)
4 to 20 mA	3.2 mA (Min. -5% of full scale)	Current that was output just prior to stopping.	20.8 mA (Max. +5% of full scale)

The above values may fluctuate if offset/gain adjustment is applied.

Set the output hold function with Output # Output Status When Conversion Stops (*_Ch#_HdMdCfg).

Variable name	Type	Setting
*_Ch#_HdMdCfg	USINT	0: CLR 1: HOLD 2: MAX

An output number from 1 to 8 is included in place of # in the variable name. (1 to 4 for DA041 and 1 to 2 for DA021)



Precautions for Safe Use

- When initial setting parameters are set and transferred from Sysmac Studio, Sysmac Studio checks whether or not the Unit must be restarted. Restart the Unit after confirming the safety of the connected destination.
- The contents of initial setting parameters will be transferred to the Unit when the Controller is reset or when the Unit restarts.

4-6-3 Output Scaling Function (CJ1W-DA08V/08C Only)

When upper and lower limits are preset within a decimal range of $-32,000$ to $32,000$, D/A conversion of analog output setting values is performed with the upper and lower limits taken as full scale.

This scaling eliminates the previous need to provide a numeric conversion program. It is only enabled, however, for a conversion cycle of 1 ms and a resolution of $4,000$. It is not enabled for a conversion cycle of $250\text{ }\mu\text{s}$ and a resolution of $8,000$.



Additional Information

- The upper limit is normally set to be greater than the lower limit, but it is also possible to set the lower limit to be greater than the upper limit for reverse scaling.
- Actual D/A conversion is executed at up to -5% to $+105\%$ of full scale. If values that exceed this range are set, an output setting value error will occur and the output hold function will operate.



Precautions for Correct Use

- If the scaling upper limit equals the lower limit, or if the scaling upper limit or lower limit is outside the range of $\pm 32,000$, a scaling data setting error is generated and the Controller will not operate.
- If both the upper limit and lower limit are 0 , scaling is not performed.

● Setting Upper and Lower Limits for Output Scaling

Use the initial setting parameters shown below to set the output scaling upper and lower limit values.

Variable name	Type	Setting
*_Ch#_Scl_L_Cfg	INT	Scaling lower limit ($-32,000$ to $+32,000$)
*_Ch#_Scl_H_Cfg	INT	Scaling upper limit ($-32,000$ to $+32,000$)

Variable (name) # is output number 1 to 8 (1 to 4 for DA041 and 1 to 2 for DA021)



Precautions for Safe Use

- When initial setting parameters are set and transferred from Sysmac Studio, Sysmac Studio checks whether or not the Unit must be restarted. Restart the Unit after confirming the safety of the connected destination.
- The contents of initial setting parameters will be transferred to the Unit when the Controller is reset or when the Unit restarts.

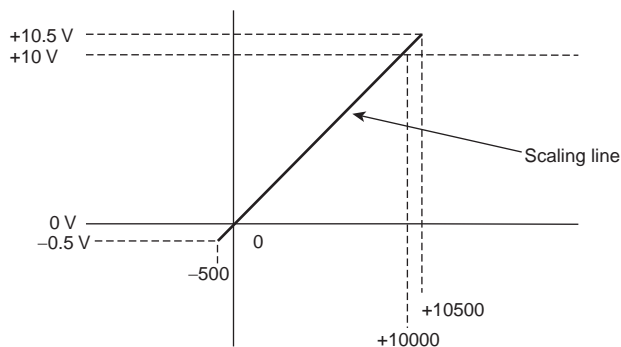
● **Example Setting 1**

If the output 1 signal of 0 to 10 V is to be scaled to a set value of 0 to 10000, set as follows:

Set Output 1 Scaling Lower Limit (*_Ch1_Scl_L_Cfg) to 0.

Set Output 1 Scaling Upper Limit (*_Ch1_Scl_H_Cfg) to +10,000.

The following diagram shows the correspondence between output signals and converted scaling values.



Output set value	Output signal
0	0 V
+10,000	10 V
-500	-0.5 V
+10,500	10.5 V

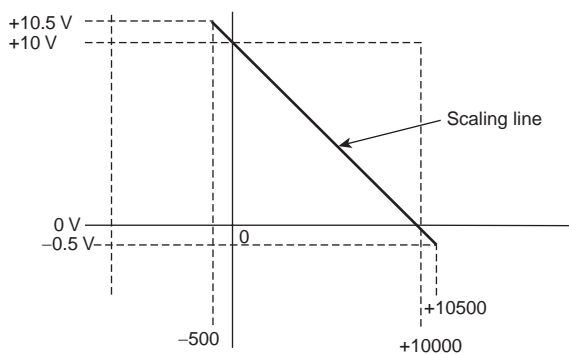
● **Example Setting 2 (Reverse Scaling)**

If the output 2 signal of 0 to 10 V is to be scaled to a set value of 10000 to 0, set as follows:

Set Output 2 Scaling Lower Limit (*_Ch2_Scl_L_Cfg) to +10,000.

Set Output 2 Scaling Upper Limit (*_Ch2_Scl_H_Cfg) to 0.

The following diagram shows the correspondence between output signals and converted scaling values.



Conversion result	Output signal
+10,000	0 V
0	10 V
+10,500	-0.5 V
-500	10.5 V

4-6-4 Output Set Value Error

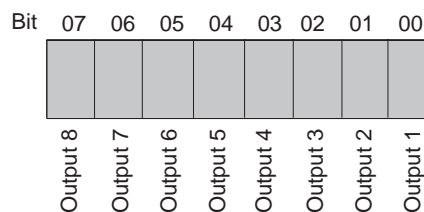
Acquire the error status of the analog output setting value with the device variable for CJ-series Unit Output # Output Set Value Error (*_Ch#_MVErr) shown below.

Variable name	Type	Setting
*_Ch#_MVErr	BOOL	0: No error 1: Setting error

An output number from 1 to 8 is included in place of # in the variable name. (1 to 4 for DA041 and 1 to 2 for DA021)

You can also perform batch readout with the device variable for CJ-series Unit Output Set Value Error (*_MVErr) shown below.

Variable name	Type
*_MVErr	BYTE



Additional Information

The output for an output number at which a setting error occurred will be output according to the output hold function.

5

CJ-series Analog Output Unit (CJ1W-DA042V)

This section explains how to use the CJ1W-DA042V Analog Output Units.

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5-1 Specifications

5-1-1 Specifications

Unit model		CJ1W-DA042V		
Unit type		CJ-series Special I/O Unit		
Isolation		Between outputs and internal signals: Digital isolator (No isolation between output signals.) *1		
External connection terminal		18-point detachable terminal block (M3 screws)		
Current consumption		400 mA max. at 5 VDC		
Dimensions (mm) * 2		31 × 90 × 65 (W × H × D)		
Weight		150 g max.		
General specifications		Conforms to general specifications for NJ Series.		
Mounting position		NJ Series CPU Rack or Expansion Rack		
Maximum number of Units		Per CPU Rack or Expansion Rack *3	Power Supply Unit	No. of mountable Units
			NJ-PA3001	Max. 10 units on CPU Rack Max. 10 units per Expansion Rack
			NJ-PD3001	Max. 10 units on CPU Rack Max. 10 units per Expansion Rack
Data exchange with the CPU Unit		Data exchange with I/O ports For details, refer to 5-5 <i>Exchanging Data with the CPU Unit</i> .		
Output specifications	Number of analog outputs		4	
	Output signal range *4		1 to 5 V 0 to 10 V -10 to 10 V	
	Output impedance		0.5 Ω max.	
	Maximum permissible load resistance		5 kΩ min. (per output)	
	Resolution		1 to 5 V	1/10,000 (full scale)
			0 to 10 V	1/20,000 (full scale)
			-10 to 10 V	1/40,000 (full scale)
	Set data		16-bit integer (INT)	
	Accuracy	25°C	±0.3% (full scale)	
0 to 55°C		±0.5% (full scale)		
Conversion period *5		20 μs for 1 point, 25 μs for 2 points, 30 μs for 3 points, 35 μs for 4 points		
Output functions	Output hold function		Outputs the specified output status (CLR, HOLD, or MAX) under any of the following circumstances. <ul style="list-style-type: none"> When the Conversion Enable Bit is OFF. *6 Output Set Value Error, major fault level Controller error of the CPU Unit 	
	Scaling		Setting values in any specified unit within a range of ±32,000 as the upper and lower limits allows D/A conversion to be executed and analog signals to be output with these values as full scale.	

*1 Do not apply a voltage higher than 600 V to the terminal block when you perform a withstand voltage test on this Unit. Otherwise, internal elements may deteriorate.

*2 Refer to A-1 *Dimensions* for Unit dimensions.

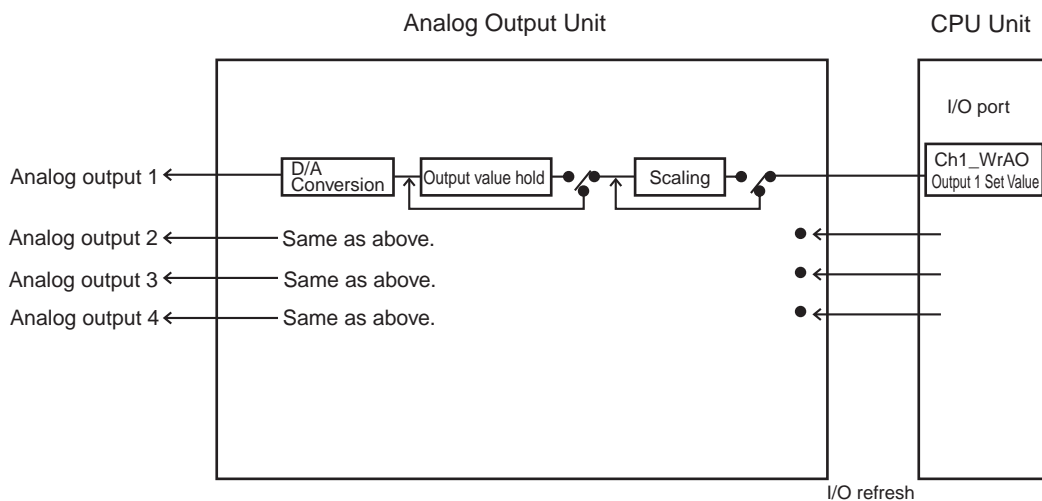
*3 The maximum number of Analog Input Units that you can mount to one Rack depends on the Power Supply Unit mounted.

*4 You can set output signal ranges for each output.

*5 Conversion time is the time required for converting and outputting the CPU Unit data. At least one task period is required for CPU Unit data to be read into an Analog Output Unit.

*6 The Output Conversion Enable Flag turns OFF when the CPU Unit shifts from RUN Mode to PROGRAM Mode, as well as when the Controller is reset including when the power turns ON. The output status specified according to the output hold function will be output.

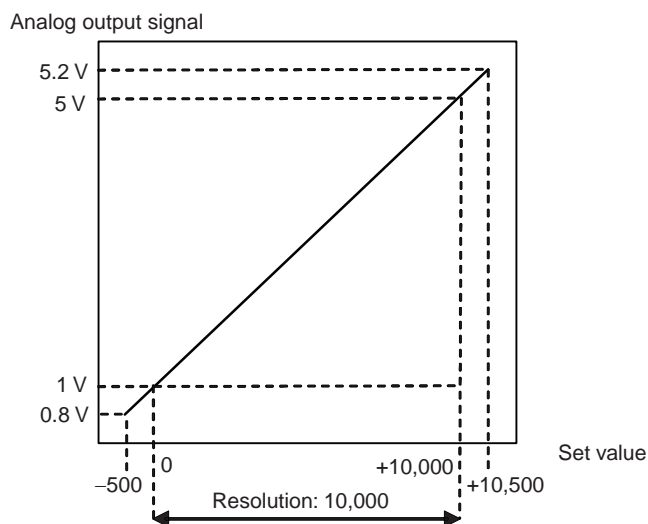
5-1-2 Output Function Block Diagram



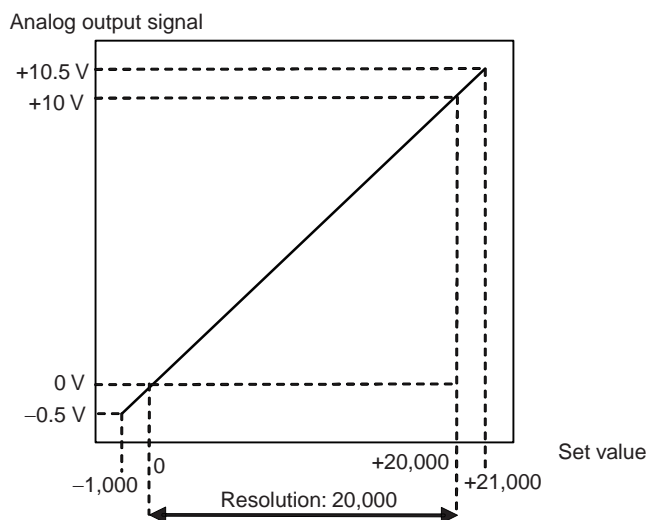
5-1-3 Output Specifications

If the set value is outside the specified range given below, an output setting error will occur, and the output specified by the output hold function will be output.

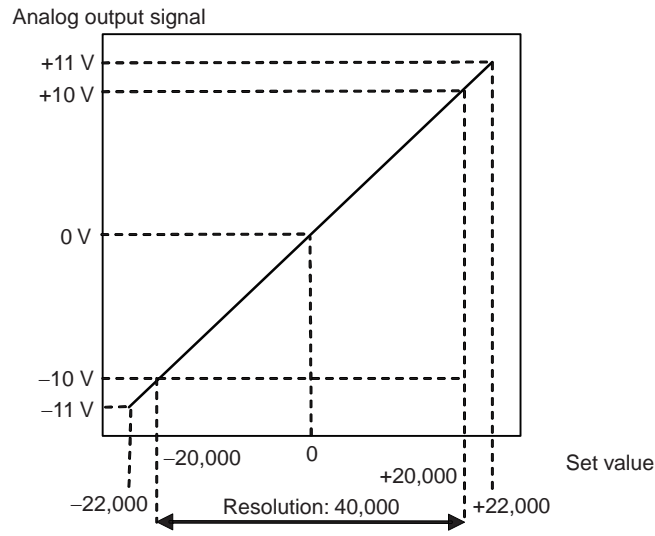
Range: 1 to 5 V



Range: 0 to 10 V



Range: -10 to 10 V



5-2 Operating Procedure

Follow the procedures outlined below when using the Analog Output Unit.

There is no restriction regarding the sequence of "Programs and software settings" and "Hardware setting and Rack assembly." These tasks may be carried out concurrently or in the reverse order.

Use Sysmac Studio to create and set programs.

For operations of Sysmac Studio, refer to the *Sysmac Studio Version 1 Operation Manual* (Cat. No. W504).

● Programs and software settings

- 1** Create POU and global variables
Create Unit Configuration
 - Create and register global variables and each POU.
 - Create algorithms for each POU and register local variables of each POU.
 - Register the Unit in the Unit Configuration on the CPU/Expansion Racks screen in Configuration and Setup.
At this time, set both the device name and the unit number of the unit to be registered.
 - Create device variable for CJ-series Unit by using I/O Map.
- 2** Create Unit initial setting parameters
Create the Unit settings by using Special Unit Setup Editing.
 - Set the number of analog outputs to be used.
 - Set the output signal ranges.
 - Set the output hold function.
 - Set upper and lower limits for scaling.
(When the program is transferred, the items set here will be reflected in the initial setting parameters.)

● Hardware setting and Rack assembly

- 1** Use the unit number switches on the front panel of the Unit to set the unit number.
Set the same unit number as in the Unit Configuration settings.
- 2** Mount and wire the Unit to either a CPU Rack or Expansion Rack.
- 3** Turn ON the power to the Controller.
At this time, an I/O Setting Check Error occurs when there is a Unit Configuration in the CPU Unit which does not match the actual Unit Configuration. In this case, reset the Controller in step 2 *Reset the Controller or restart the Unit* of the following process to cancel the error.

● Program transfer

- 1** Transfer programs, Unit Configuration and Setup and variable information.
- 2** Reset the Controller or restart the Unit.

- **Main operation**

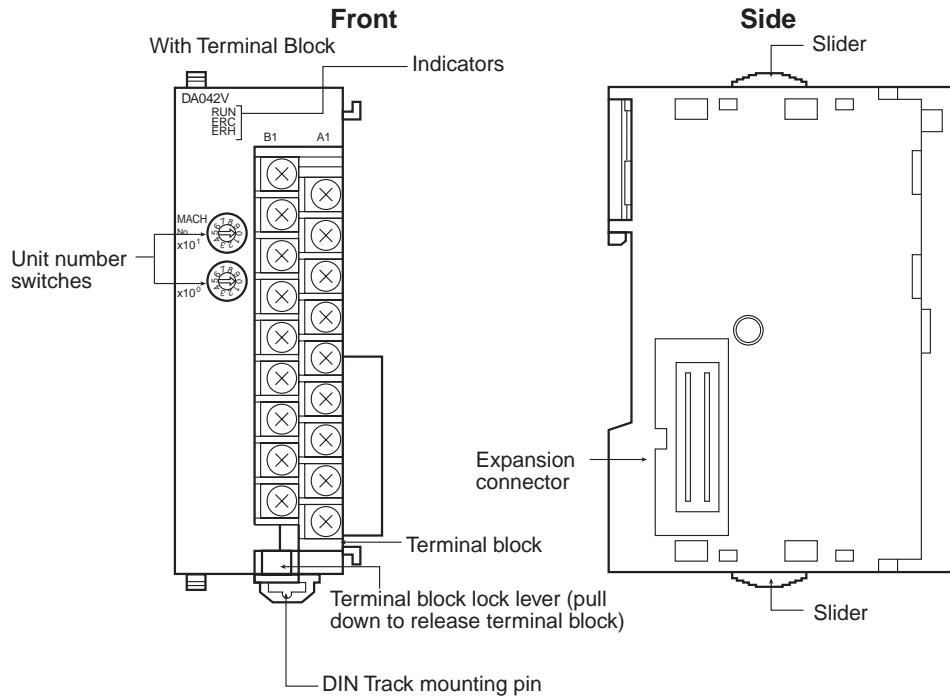
- 1** Main operation

Read or write set values from the user program.

- Write set values.
- Start and stop the conversion output.
- Obtain an error flag.

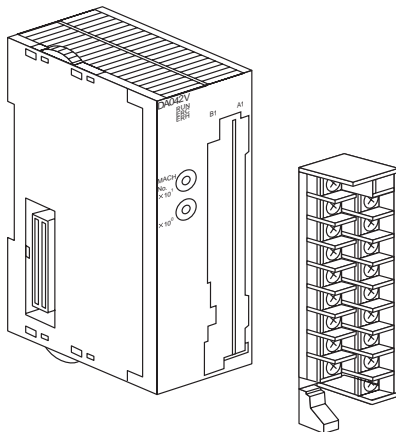
5-3 Components and Switch Settings

5-3-1 Component Names



Additional Information

- Use a connector to attach the terminal block. Press down on the lever at the bottom of the terminal block to remove the connector.
- Normally put the lever in the raised position. Confirm this before operation.



5-3-2 Indicators

The indicators show the operating status of the Unit. The following table shows the meanings of the indicators.

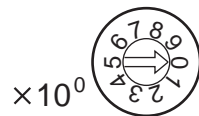
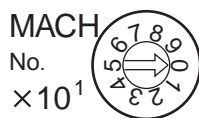
Indicator	Meaning	Indicator status	Operating status
RUN (green)	Operating	Lit	Operation normal.
		Not lit	Unit has stopped exchanging data with the CPU Unit.
ERC (red)	Error detected by Unit	Lit	Initial settings are incorrect.
		Not lit	Operating normally.
ERH (red)	Error in the CPU Unit	Lit	Error has occurred during data exchange with the CPU Unit.
		Not lit	Operating normally.

5-3-3 Unit Number Switches

Use the unit number switches to set the specific unit number for each Special I/O Unit mounted in a CPU Rack or Expansion Rack. The unit number must be the one registered in Unit Configurations.

Turn OFF the Controller before changing the unit number setting.

Unit number switches



Switch setting	Unit number
0	Unit #0
1	Unit #1
2	Unit #2
3	Unit #3
4	Unit #4
5	Unit #5
6	Unit #6
7	Unit #7
8	Unit #8
9	Unit #9
10	Unit #10
to	to
n	Unit #n
to	to
95	Unit #95



Additional Information

- If two or more Special I/O Units are assigned the same unit number, a "Duplicate Unit Number" major fault level Controller error is generated and the Controller will not operate.
- After correcting the unit number setting, cycle the power to the Controller.

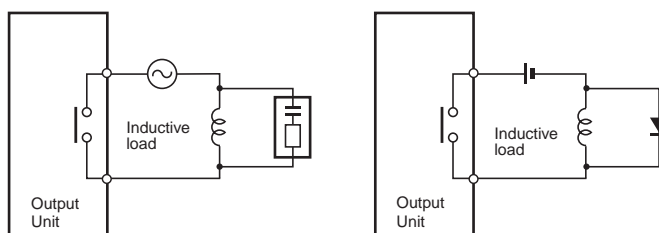
5-4 Wiring

Caution

Always connect surge suppressors to inductive loads in the system (e.g., magnetic contactors, relays, and solenoids). Always separate devices that generate surge from the Analog I/O Units. Faulty Unit operation may cause unexpected system operation.



If inductive loads are connected to output signals from Relay Contact Output Units, connect a surge suppressor in an AC circuit and a diode in a DC circuit close to the inductive load to absorb the counter-electromotive force.



Connect a surge suppressor in an AC circuit and a diode in a DC circuit.

5-4-1 Terminal Arrangement

The signal names that correspond to the connecting terminals are as shown in the following diagram.

Output 2 (+)	B1	A1	Output 1 (+)
Output 2 (-)	B2	A2	Output 1 (-)
N.C.	B3	A3	N.C.
Output 4 (+)	B4	A4	Output 3 (+)
Output 4 (-)	B5	A5	Output 3 (-)
N.C.	B6	A6	N.C.
N.C.	B7	A7	N.C.
N.C.	B8	A8	N.C.
N.C.	B9	A9	N.C.



Additional Information

- Use the device variable for CJ-series Unit Output Use Settings (**_OutChUseCfg*) to set the number of analog outputs that you can use.
- Set the output signal range for each analog output with the device variable for CJ-series Unit Output Signal Range Setting (**_Ch#_OutRngCfg*). The output signal range can be set separately for each output number.



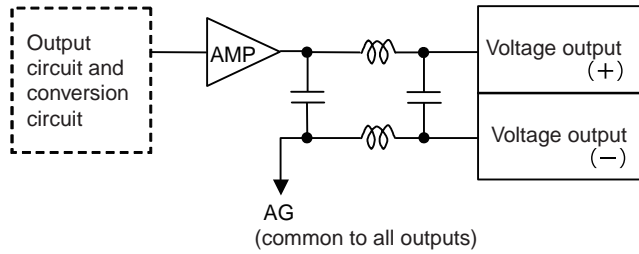
Precautions for Correct Use

Do not make any connections to the N.C. terminals.

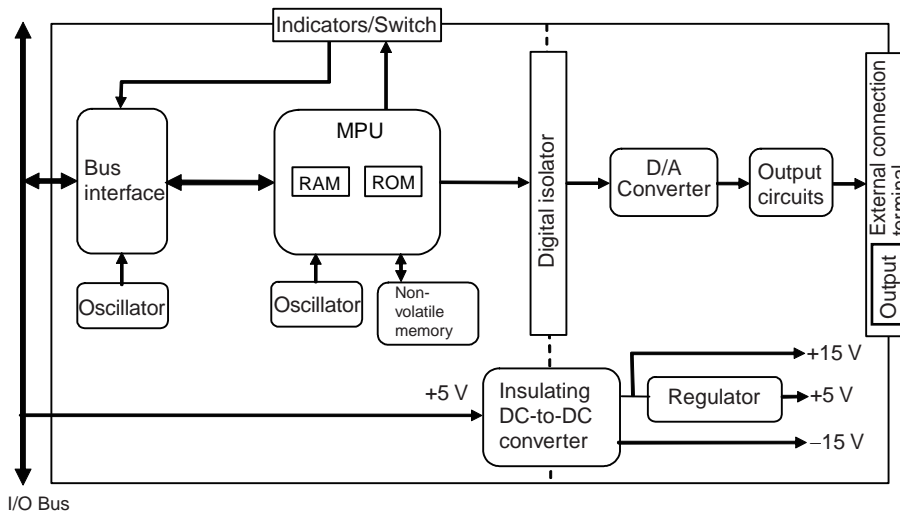
5-4-2 Internal Circuit

The following diagrams show the internal circuit of the analog output section.

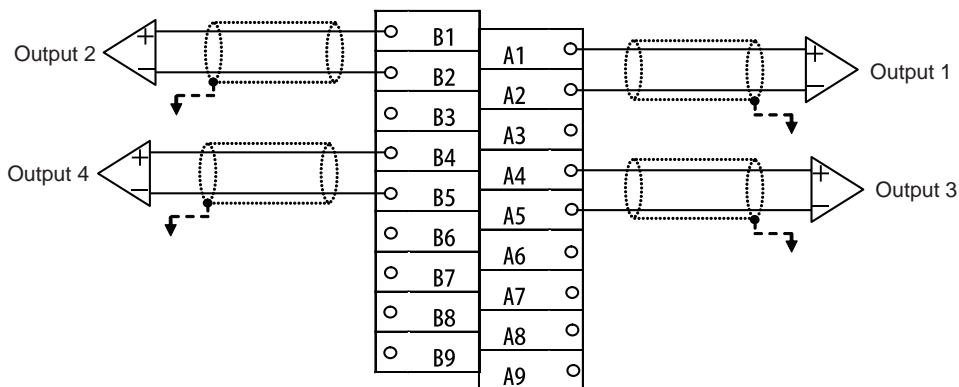
● **Output circuits**



● **Internal Configuration**



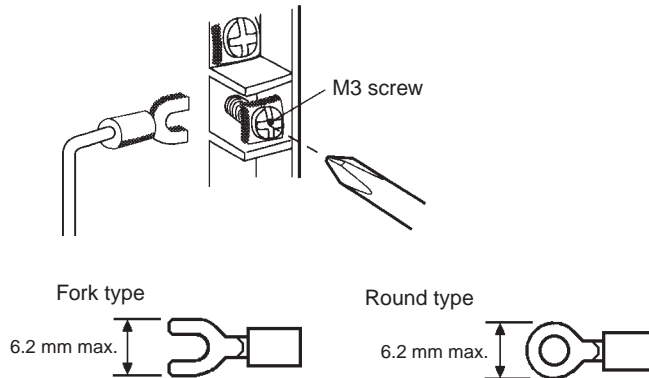
5-4-3 Output Wiring Example





Precautions for Safe Use

Crimp terminals must be used for terminal connections, and the screws must be tightened securely. M3 terminal screws are used. The applicable tightening torque is 0.5 N-m.



Additional Information

To increase noise resistance for analog output wiring, ground the shield on the output signal cable at the input device.

5-4-4 Output Wiring Considerations

When you wire outputs, apply the following points to avoid noise interference and optimize Analog Output Unit performance.

- Use two-core shielded twisted-pair cables for output connecting lines.
- Route output cables separately from the power cables (e. g., AC and three-phase lines) and do not run the Unit's cables near a main circuit cable, high voltage cable. Do not insert these cables into the same duct.
- If there is noise interference from power lines (for example, the power supply is shared with electrical welding devices or electrical discharge machines, or there is a high-frequency generation source nearby), install a noise filter at the power supply input area.

5-5 Exchanging Data with the CPU Unit

5-5-1 Outline of Data Exchange

The CPU Unit and Analog Output Unit CJ1W-DA042V exchange operation data and initial setting parameters via the I/O port generated for this Analog Output Unit.

The table and figure below show the data exchange method for each data type.

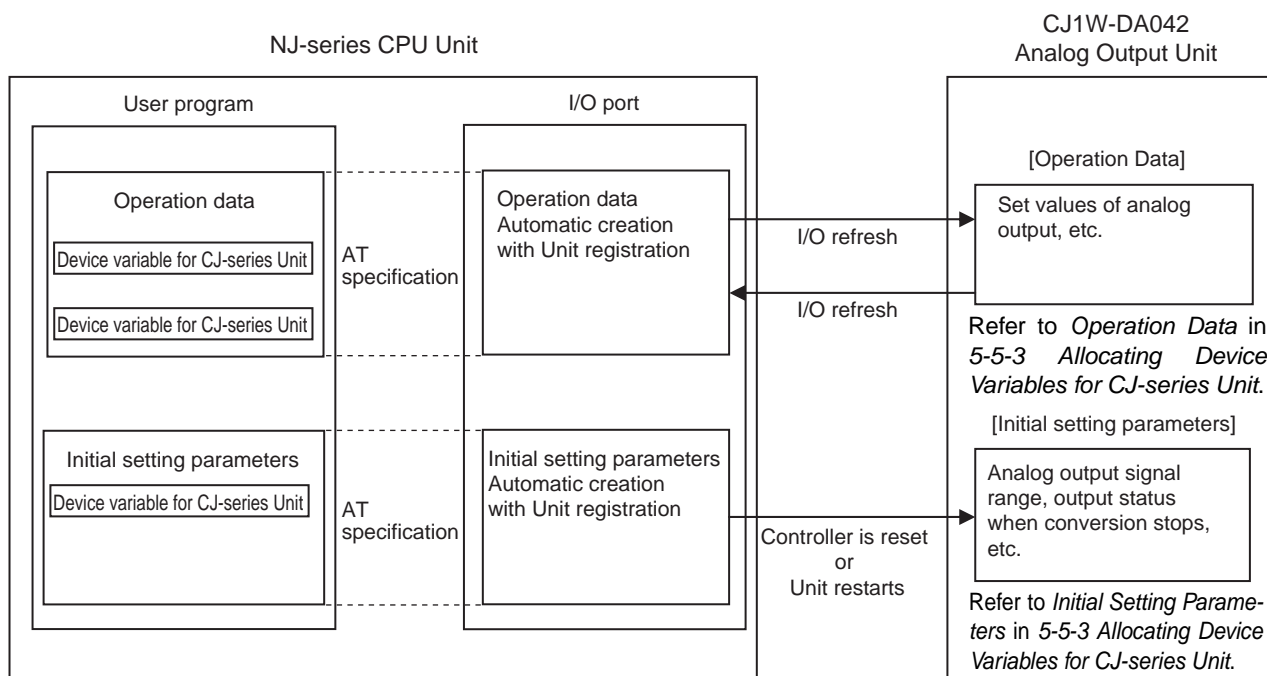
Data exchange type

Unit data type	Data contents	AT specification destination	How to access from user program	Timing of data exchange
Operation data	Analog output setting values, etc.	I/O port (operation data)	Device variable for CJ-series Unit	At I/O refreshing
Initial setting parameters	Analog output signal range, output status when conversion stops, etc.	I/O port (initial setting parameters) *	Device variable for CJ-series Unit	When the Controller is reset or the Unit restarts
Unit Restart Bit, etc.	Unit Restart Bit, etc.	None	System-defined variable	At I/O refreshing

* The initial setting parameters are retained in the CPU Unit by the battery even during power interruptions.

● Device Variable for CJ-series Unit

Device variables for CJ-series Unit are variables used for data exchange between a user program and Special I/O Units. The user program uses device variables for CJ-series Unit to control the Analog I/O Unit.



5-5-2 Accessing from the User Program

The user program uses device variables for CJ-series Unit to control the Analog Output Unit. Use device variables for CJ-series Unit with AT specification for the I/O port, which is explained below.

● I/O port

An "I/O port" is a logical interface for data exchange by a CPU Unit with an Analog I/O Unit or other configuration unit.

An I/O port has a unique predefined name for each unit model and function.

An I/O port is automatically created by preparing the Unit Configuration with Sysmac Studio.

● How to specify device variables for CJ-series Unit

Specify the AT specifications to I/O ports for device variables for CJ-series Unit with the I/O Map from Sysmac Studio.

Specify the variable name for the AT specification with one of the following methods.

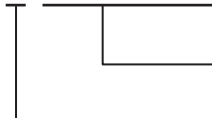
1. Select a variable already registered in the variable table
2. Input a new variable name
3. Automatically create a variable name with "Device variable creation"

When a device variable name for CJ-series Unit is assigned with method 2 or 3, the variable input by Sysmac Studio is automatically registered in the variable table.

The following is the configuration of variable names created with automatic creation in method 3.

Name of device variable for CJ-series Unit

* Ch1_ConvCmd



This is an I/O port name. The name identifies the unit function, status and parameter.

This is the device name when this unit is registered in the Unit Configuration. (By default, a device name is assigned from "J01" in the order of registration in the Unit Configuration.) This identifies the individual unit.

For details on creation of device variables for CJ-series Unit, refer to *Sysmac Studio Version 1 Operation Manual* (Cat. No. W504).

There are two types of device variables for CJ-series Unit: "Operation Data" and "Initial Setting Parameters".

In the explanations from here on, the device name automatically created is used as the device variable for CJ-series Unit, for example "*_Ch1_ConvCmd".

5-5-3 Allocating Device Variables for CJ-series Unit

Initial Setting Parameters

Perform Unit settings such as output usage setting, analog output signal range, etc.

Initial setting parameters settings are set from Special Unit Setup Editing of Sysmac Studio.

Unit settings can also be performed by setting the values in the device variables for CJ-series Unit.

Unit settings are reflected only when the Controller is reset, or when the Unit restarts. The initial setting parameters are retained in the CPU Unit by the battery even during power interruptions.



Precautions for Safe Use

- When initial setting parameters are set and transferred from Sysmac Studio, Sysmac Studio checks whether or not the Unit must be restarted. Restart the Unit after confirming the safety of the connected destination.
- The contents of initial setting parameters will be transferred to the Unit when the Controller reset or when the Unit restarts.

List of Initial Setting Parameters

Name of device variable for CJ-series Unit	Type	R/W	Name	Feature/reference page
*_OutChUseCfg	USINT	RW	Number of Analog Outputs Used	Refer to <i>Number of Output</i> in 5-6-1 <i>Output Settings and Conversion Values</i> .
*_Ch1_OutRngCfg	USINT	RW	Output 1 Output Signal Range Setting	Refer to <i>Output Signal Ranges</i> in 5-6-1 <i>Output Settings and Conversion Values</i> . 0: 0 to 10V 3: -10 to +10V 6: 1 to 5V
*_Ch2_OutRngCfg	USINT	RW	Output 2 Output Signal Range Setting	
*_Ch3_OutRngCfg	USINT	RW	Output 3 Output Signal Range Setting	
*_Ch4_OutRngCfg	USINT	RW	Output 4 Output Signal Range Setting	
*_Ch1_HdMdCfg	USINT	RW	Output 1 Output Status When Conversion Stops	Refer to 5-6-2 <i>Output Hold Function</i> . 0: CLR 1: HOLD 2: MAX
*_Ch2_HdMdCfg	USINT	RW	Output 2 Output Status When Conversion Stops	
*_Ch3_HdMdCfg	USINT	RW	Output 3 Output Status When Conversion Stops	
*_Ch4_HdMdCfg	USINT	RW	Output 4 Output Status When Conversion Stops	
*_Ch1_Scl_L_Cfg	INT	RW	Output 1 Scaling Lower Limit	Refer to 5-6-3 <i>Output Scaling Function</i> . -32000 to +32000 Set lower limit value ≠ upper limit value. (Can also set lower limit value > upper limit value.)
*_Ch1_Scl_H_Cfg	INT	RW	Output 1 Scaling Upper Limit	
*_Ch2_Scl_L_Cfg	INT	RW	Output 2 Scaling Lower Limit	
*_Ch2_Scl_H_Cfg	INT	RW	Output 2 Scaling Upper Limit	
*_Ch3_Scl_L_Cfg	INT	RW	Output 3 Scaling Lower Limit	
*_Ch3_Scl_H_Cfg	INT	RW	Output 3 Scaling Upper Limit	
*_Ch4_Scl_L_Cfg	INT	RW	Output 4 Scaling Lower Limit	
*_Ch4_Scl_H_Cfg	INT	RW	Output 4 Scaling Upper Limit	

Operation Data

Operation data includes data such as analog output setting values, etc. Operation data is exchanged constantly during I/O refreshing.

List of Operation Data

Device variables for CJ-series Unit name	Type	R/W	Name	Feature/reference page	
*_Ch1_WrAO	INT	RW	Output 1 Set Value	Refer to <i>Writing Set Values</i> in 5-6-1 <i>Output Settings and Conversion Values</i> .	
*_Ch2_WrAO	INT	RW	Output 2 Set Value		
*_Ch3_WrAO	INT	RW	Output 3 Set Value		
*_Ch4_WrAO	INT	RW	Output 4 Set Value		
*_ConvCmd	WORD	RW	Conversion Enable Settings	Refer to <i>Starting and Stopping Conversion</i> in 5-6-1 <i>Output Settings and Conversion Values</i> . WORD-type variable that combines the following BOOL-type variables:	Bit Number
*_Ch1_ConvCmd	BOOL	RW	Output 1 Conversion Enable	BOOL-type variable that specifies each output for conversion enable. 0: Stop conversion output 1: Start conversion output	00
*_Ch2_ConvCmd	BOOL	RW	Output 2 Conversion Enable		01
*_Ch3_ConvCmd	BOOL	RW	Output 3 Conversion Enable		02
*_Ch4_ConvCmd	BOOL	RW	Output 4 Conversion Enable		03
*_MVErr	BYTE	R	Output Set Value Error	Refer to 5-6-4 <i>Output Setting Errors</i> . BYTE-type variable that combines the following BOOL-type variables:	Bit Number
*_Ch1_MVErr	BOOL	R	Output 1 Output Set Value Error	BOOL-type variable to check the error status in Unit of bits per output 0: No error 1: Setting made	00
*_Ch2_MVErr	BOOL	R	Output 2 Output Set Value Error		01
*_Ch3_MVErr	BOOL	R	Output 3 Output Set Value Error		02
*_Ch4_MVErr	BOOL	R	Output 4 Output Set Value Error		03
*_UnitErr	BYTE	R	Error Flags	Refer to 7-2-2 <i>Alarms Occurring at the Unit</i> . BYTE-type variable that combines the following BOOL-type variables:	Bit Number
*_ScIErr	BOOL	R	Scaling Data Setting Error	0: No error 1: Error in initial setting parameters	00
*_CfgErr	BOOL	R	Output Signal Range Setting Error or Error In Number of Outputs Used Setting		01
*_HdErr	BOOL	R	Output Hold Setting Error		02
*_MdErr	BOOL	R	Error in Setting of Conversion Mode		04
*_ConvMd	BOOL	R	Direct Conversion Mode *	0: Cyclic Conversion Mode 1: (Direct Conversion Mode)	05

* The Direct Conversion Mode cannot be used with the NJ-series CPU Unit. On the Special Unit Setup Editing of Sysmac Studio, set "Conversion Mode Setting" to "Cyclic Conversion Mode".

5-6 Analog Output Functions and Operating Procedures

5-6-1 Output Settings and Conversion Values

Setting Outputs and Signal Ranges

● Number of Output

The Analog Output Unit performs conversion processing only for the specified number of analog outputs. Use Number of Analog Outputs Used (**_OutChUseCfg*) to set the number of analog outputs.

Variable name	Type	Setting
<i>*_OutChUseCfg</i>	USINT	0: No outputs used. 1: One output used (output 1 used). 2: Two outputs used (outputs 1 and 2 used). 3: Three outputs used (outputs 1, 2, and 3 used). 4: Four outputs used (outputs 1, 2, 3, and 4 used).

- In Cyclic Conversion Mode, set fewer analog outputs to shorten the conversion period for analog outputs (20 μ s for 1 point, 25 μ s for 2 points, 30 μ s for 3 points, 35 μ s for 4 points).
- Output numbers that you do not use will be output at 0 V.

● Output Signal Ranges

You can set each of outputs 1 to 4 to one of the following output signal ranges: 1 to 5 V, 0 to 10 V, or -10 to 10 V.

Use Output # Output Signal Range Setting (**_Ch#_OutRngCfg*) to specify the output signal range for each output.

Variable name	Type	Setting
<i>*_Ch#_OutRngCfg</i>	USINT	1: 0 to 10V 3: -10 to +10V 6: 1 to 5V

An output number from 1 to 4 is included in place of # in the variable name.



Precautions for Safe Use

- When initial setting parameters are set and transferred from Sysmac Studio, Sysmac Studio checks whether or not the Unit must be restarted. Restart the Unit after confirming the safety of the connected destination.
- The contents of initial setting parameters will be transferred to the Unit when the Controller is reset or when the Unit restarts.

Writing Set Values

Use the device variable for CJ-series Unit Output # Set Value (**_Ch#_WrAO*) shown below to set the analog output setting values.

Variable name	Type	Setting
<i>*_Ch#_WrAO</i>	INT	Refer to 5-1-3 Output Specifications.

An output number from 1 to 4 is included in place of # in the variable name.

Starting and Stopping Conversion

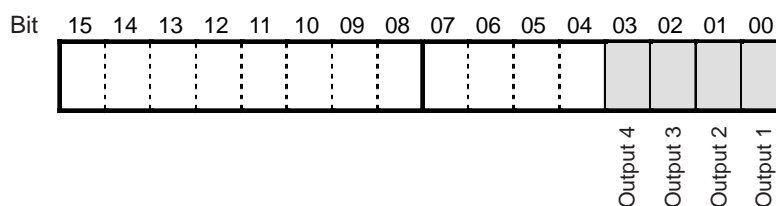
To begin analog output conversion, it is necessary to set the output used to conversion enable with the device variable for CJ-series Unit *Output # Conversion Enable* (*_Ch#_ConvCmd) shown below.

Variable name	Type	Setting
*_Ch#_ConvCmd	BOOL	0: Conversion disable 1: Conversion enable

An output number from 1 to 4 is included in place of # in the variable name.

You can also perform batch settings with the device variable for CJ-series Unit Conversion Enable Settings (*_ConvCmd) shown below.

Variable name	Type	Setting
*_ConvCmd	WORD	16#0000 to 16#000F



Additional Information

- The analog output when conversion is stopped depends on the output signal range setting and output hold function setting. Refer to *Output Signal Ranges* on page 5-17, *5-6-2 Output Hold Function*.
- Conversion will not begin under the following conditions even if the Conversion enable function is turned ON, and the output hold function will operate. Refer to *5-6-4 Output Setting Errors*.
 1. When there is an output setting error
 2. When a major fault level Controller error occurs.
- When the CPU Unit changes from the RUN Mode to PROGRAM Mode, all output for the device variable for CJ-series Unit *_ConvCmd will change to the status of conversion disabled. This also happens when the Controller is reset including when the power is turned ON. The output status at this time depends on the output hold function.

5-6-2 Output Hold Function

The Analog Output Unit stops conversion under the following conditions and outputs the value set for the output hold function.

- 1** When the Conversion Enable Bit is OFF in Cyclic Conversion Mode
Refer to *5-6-1 Output Settings and Conversion Values*.
- 2** When there is an output setting error
Refer to *5-6-4 Output Setting Errors* on page 5-21.
- 3** When a major fault level Controller error occurs

You can select CLR, HOLD, or MAX for the output status when conversion stops.

Output signal range	CLR	HOLD	MAX
1 to 5 V	0.8 V (−5% (full scale))	Voltage that was output just prior to stopping.	5.2 V (5% (full scale))
0 to 10 V	−0.5 V (−5% (full scale))	Voltage that was output just prior to stopping.	10.5 V (5% (full scale))
−10 to 10 V	0.0 V	Voltage that was output just prior to stopping.	11.0 V (5% (full scale))

Use Output # Output Status When Conversion Stops (*_Ch#_HdMdCfg) to set the output hold function.

Variable name	Type	Setting
*_Ch#_HdMdCfg	USINT	0: CLR 1: HOLD 2: MAX

An output number from 1 to 4 is included in place of # in the variable name.



Precautions for Safe Use

- When initial setting parameters are set and transferred from Sysmac Studio, Sysmac Studio checks whether or not the Unit must be restarted. Restart the Unit after confirming the safety of the connected destination.
- The contents of initial setting parameters will be transferred to the Unit when the Controller is reset or when the Unit restarts.

5-6-3 Output Scaling Function

When upper and lower limits are preset within a decimal range of −32,000 to 32,000, D/A conversion of analog output setting values is performed with the upper and lower limits taken as full scale.

This scaling eliminates the previous need to provide a numeric conversion program.



Additional Information

- The upper limit is normally set to be greater than the lower limit, but it is also possible to set the lower limit to be greater than the upper limit for reverse scaling.
- Actual D/A conversion is executed at up to −5% to +105% of full scale. If values that exceed this range are set, an output setting value error will occur and the output hold function will operate.



Precautions for Correct Use

If the scaling upper limit equals the lower limit, or if the scaling upper limit or lower limit is outside the range of −32,000, a scaling data setting error is generated and the Unit will not operate. Operation is performed without scaling if both the upper and lower limits are set to 0 (the default values).

● Setting Upper and Lower Limits for Output Scaling

Use the initial setting parameters shown below to set the output scaling upper and lower limit values.

Variable name	Type	Setting
*_Ch#_Scl_L_Cfg	INT	Scaling lower limit (-32,000 to +32,000)
*_Ch#_Scl_H_Cfg	INT	Scaling upper limit (-32,000 to +32,000)

An output number from 1 to 4 is included in place of # in the variable name.



Precautions for Safe Use

- When initial setting parameters are set and transferred from Sysmac Studio, Sysmac Studio checks whether or not the Unit must be restarted. Restart the Unit after confirming the safety of the connected destination.
- The contents of initial setting parameters will be transferred to the Unit when the Controller is reset or when the Unit restarts.

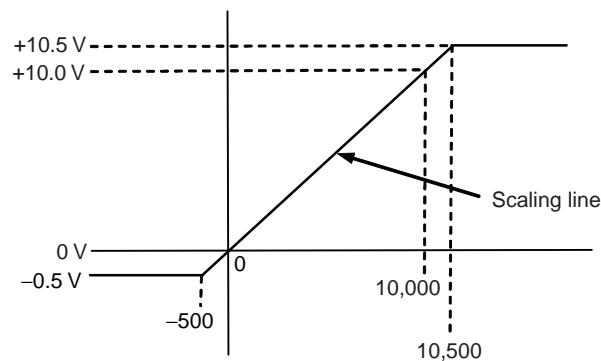
● Example Setting 1

If the output 1 signal of 0 to 10 V is to be scaled to a set value of 0 to 10000, set as follows:

Set Output 1 Scaling Lower Limit (*_Ch1_Scl_L_Cfg) to 0.

Set Output 1 Scaling Upper Limit (*_Ch1_Scl_H_Cfg) to +10,000.

The following diagram shows the correspondence between output signals and converted scaling values.



Conversion result	Output signal
0	0 V
10,000	10 V
-500	-0.5 V
10,500	10.5 V

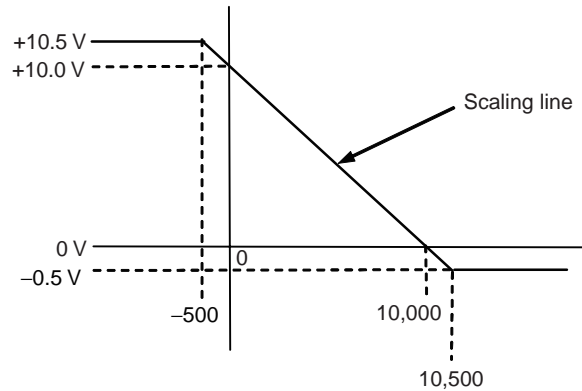
● Example Setting 2 (Reverse Scaling)

If the output 2 signal of 0 to 10 V is to be scaled to a set value of 10000 to 0, set as follows:

Set Output 2 Scaling Lower Limit (*_Ch2_Scl_L_Cfg) to +10,000.

Set Output 2 Scaling Upper Limit (*_Ch2_Scl_H_Cfg) to 0.

The following diagram shows the correspondence between output signals and converted scaling values.



Conversion result	Output signal
10,000	0 V
0	10 V
10,500	-0.5 V
-500	10.5 V

5-6-4 Output Setting Errors

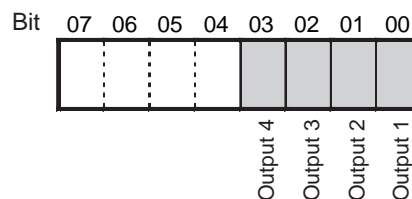
Use the device variable for CJ-series Unit Output # Output Set Value Error (*_Ch#_MVErr) shown below to acquire the error status of the analog output setting value.

Variable name	Type	Setting
*_Ch#_MVErr	BOOL	0: No error 1: Setting error

An output number from 1 to 4 is included in place of # in the variable name.

You can also perform batch readout with the device variable for CJ-series Unit Output Set Value Error (*_MVErr) shown below.

Variable name	Type
*_MVErr	BYTE



Additional Information

The voltage for an output number at which a setting error occurred will be output according to the output hold function.

6

CJ-series Analog I/O Unit (CJ1W-MAD42)

This section explains how to use the CJ1W-MAD42 Analog I/O Unit.

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6-1 Specifications

6-1-1 Specifications

Item	CJ1W-MAD42		
Unit type	CJ-series Special I/O Unit		
Isolation	Between I/O and internal signals: Photocoupler (No isolation between I/O signals.)		
External connection terminal	18-point detachable terminal block (M3 screws)		
Current consumption	580 mA max. at 5 V DC		
Dimensions (mm) *1	31 × 90 × 65 (W × H × D)		
Weight	150 g max.		
General specifications	Conforms to general specifications for NJ Series.		
Mounting position	NJ-series CPU Rack or Expansion Rack		
Maximum number of Units	Per CPU Rack or Expansion Rack *2	Power Supply Unit	No. of mountable Units
		NJ-PA3001	Max. 7 units on CPU Rack Max. 8 units per Expansion Rack
		NJ-PD3001	Max. 7 units on CPU Rack Max. 8 units per Expansion Rack
Data exchange with CPU Units	Data exchange with I/O ports For details, refer to 6-5 <i>Exchanging Data with the CPU Unit</i> .		

*1 Refer to A-1 *Dimensions* for details on the Unit's dimensions.

*2 The maximum number of Analog I/O Units that you can mount to one Rack depends on the current consumption of other units that are mounted.

• Input Specifications and Functions

Item	Voltage input	Current input
Number of analog inputs	4	
Input signal range *1	1 to 5 V 0 to 5 V 0 to 10 V -10 to 10 V	4 to 20 mA *2
Maximum rated input (for 1 point) *3	±15 V	±30 mA
Input impedance	1 MΩ min.	250 Ω (rated value)
Resolution	4,000/8,000 (full scale) *6	
Converted output data	16-bit integer (INT)	
Accuracy *4	25°C	±0.2% of full scale
	0°C to 55°C	±0.4% of full scale
A/D conversion cycle *5	1.0 ms/500 μs max. per point	
Mean value processing	Sampling data for the past N times is stored in the buffer and the average value is stored as the conversion value. (Number of samplings: N = 2, 4, 8, 16, 32, 64)	
Peak value hold	Stores the maximum conversion value while the specified Peak Value Hold Execution bit is ON.	
Scaling	Enabled only for conversion cycle of 1 ms and resolution of 4,000. Setting any values within a range of ±32,000 as the upper and lower limits allows the A/D conversion result to be output with these values as full scale.	
Input disconnection detection	Detects the disconnection and turns ON the Disconnection Detected Bit.	

*1 You can set input and output signal ranges for each input and output.

*2 Use the voltage/current switch at the back of the terminal block to choose voltage input or current input.

*3 Operate the Analog I/O Unit according to the input specifications provided here. Operating the Unit outside these specifications will cause the Unit to malfunction.

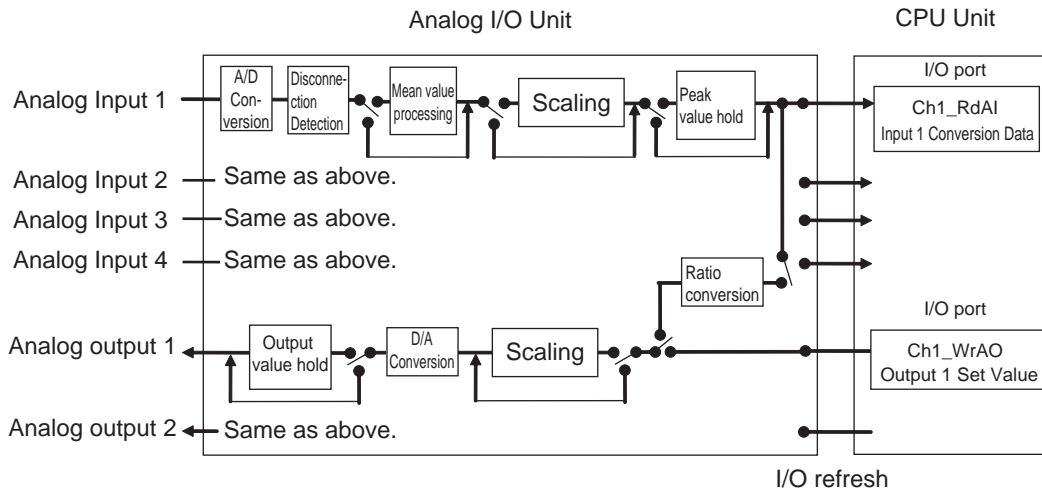
- *4 The accuracy is given for full scale. For example, when the resolution is set to 4,000, an accuracy of $\pm 0.2\%$ means a maximum error of ± 8 .
- *5 The A/D conversion cycle is the time it takes for analog signals to be stored in the internal memory of the CPU Unit to be converted and output. It takes at least one task period for data to be read into the CPU Unit.
- *6 The resolution can be set to 8,000 and the conversion cycle to 250 μs in the initial setting parameter.

- Output Specifications and Functions

Item	Voltage output		Current output
Number of analog outputs	2		
Output signal range *1	1 to 5 V 0 to 5 V 0 to 10 V -10 to 10 V		4 to 20 mA
Output impedance	0.5 Ω max.		---
Maximum external output current (for 1 point)	2.4 mA		---
Maximum allowed load resistance	---		600 Ω
Resolution	4,000/8,000 (full scale) *5		
Set data	16-bit integer (INT)		
Accuracy *2	25°C	$\pm 0.3\%$ of full scale	$\pm 0.3\%$ of full scale
	0°C to 55°C	$\pm 0.5\%$ of full scale	$\pm 0.6\%$ of full scale
D/A conversion cycle *3	1.0 ms/500 μs max. per point		
Output hold function	Outputs the specified output status (CLR, HOLD, or MAX) under any of the following circumstances. <ul style="list-style-type: none"> • When the Conversion Enable Bit is OFF *4 • In Adjustment Mode, when a value other than the output number is output during adjustment • When an output setting error occurs and CPU Unit operations stops 		
Scaling	Enabled only for conversion cycle of 1 ms and resolution of 4,000. Set values in any specified Unit within a range of $\pm 32,000$ as the upper and lower limits to allow D/A conversion to be executed and analog signals to be output using the set values as full scale.		
Ratio conversion function	Stores the results of positive and negative gradient analog inputs calculated for ratio and bias as analog output values. Positive gradient: Analog output = $A \times \text{Analog input} + B$ (A = 0 to 99.99, B = 8,000 to 7FFF hex) Negative gradient: Analog output = $F - A \times \text{Analog input} + B$ (A: 0 to 99.99, B = 8,000 to 7FFF hex, F: Output signal range maximum value)		

- *1 You can set input and output signal ranges for each input and output.
- *2 The accuracy is given for full scale. For example, when the resolution is set to 4,000, an accuracy of $\pm 0.3\%$ means a maximum error of ± 12 .
- *3 The D/A conversion time is the time it takes for data from the CPU Unit to be converted and output. It takes at least 1 task period for the CPU Unit data to be read by the Analog Output Unit.
- *4 The Output Conversion Enable Flag turns OFF when the CPU Unit shifts from RUN Mode to PROGRAM Mode, as well as when the Controller is reset including when the power turns ON. The specified output status is output in accordance with the output hold function.
- *5 The resolution can be set to 8,000 and the conversion cycle to 250 μs in the initial setting parameter.

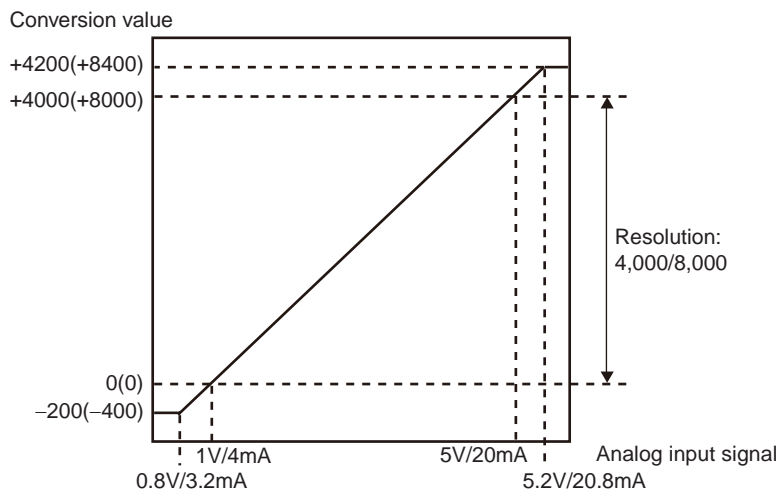
6-1-2 I/O Function Block Diagram



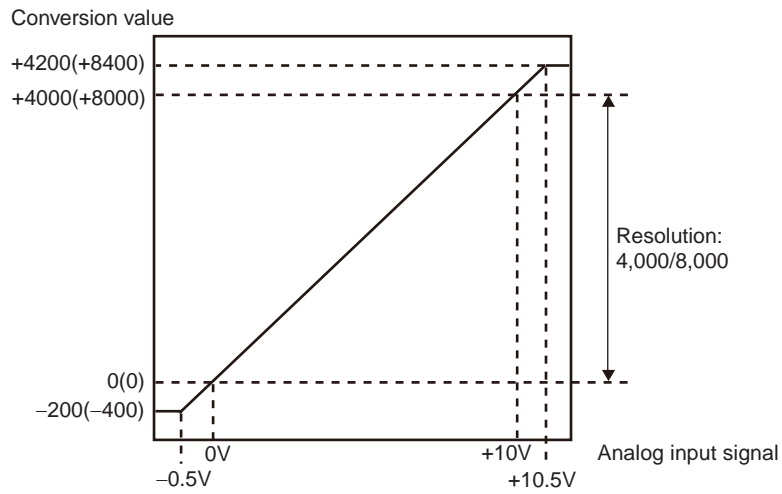
6-1-3 Input Specifications

If signals that are outside the specified range provided below are input, the conversion values used will be at either the maximum or minimum value.

- Range: 1 to 5 V (4 to 20 mA)

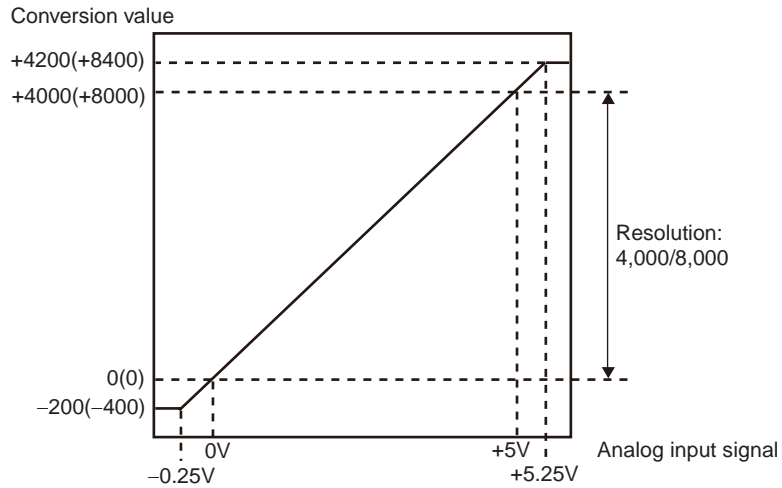


● Range: 0 to 10 V



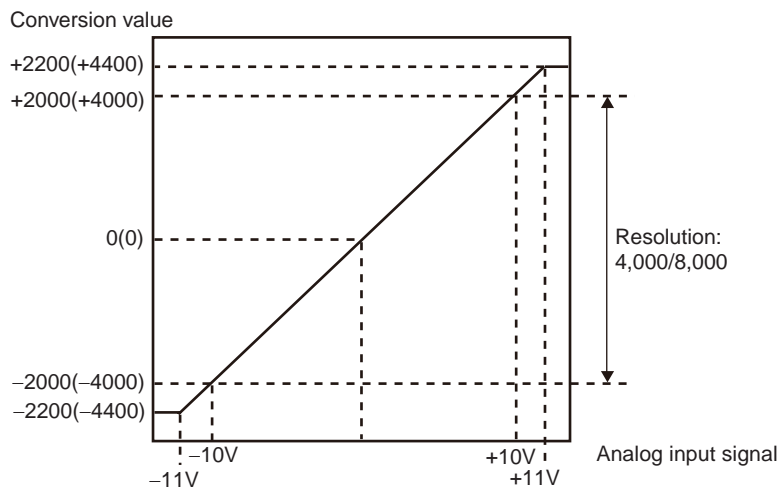
(): Values in parentheses are for a resolution of 8,000.

● Range: 0 to 5 V



(): Values in parentheses are for a resolution of 8,000.

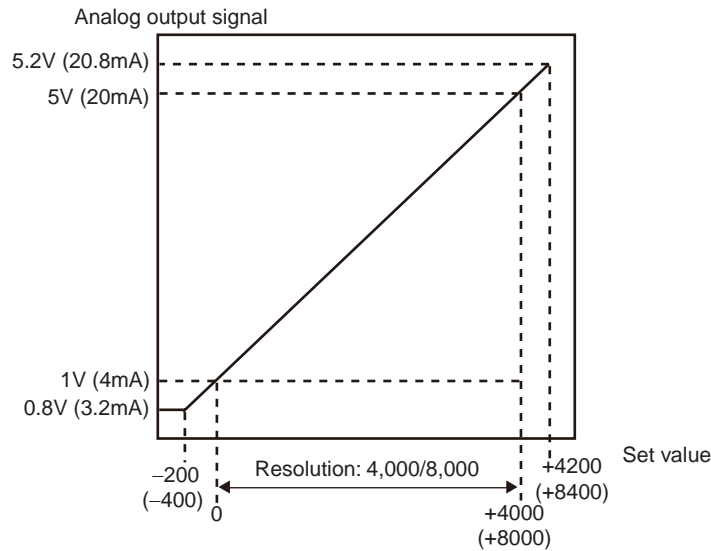
● Range: -10 to 10 V



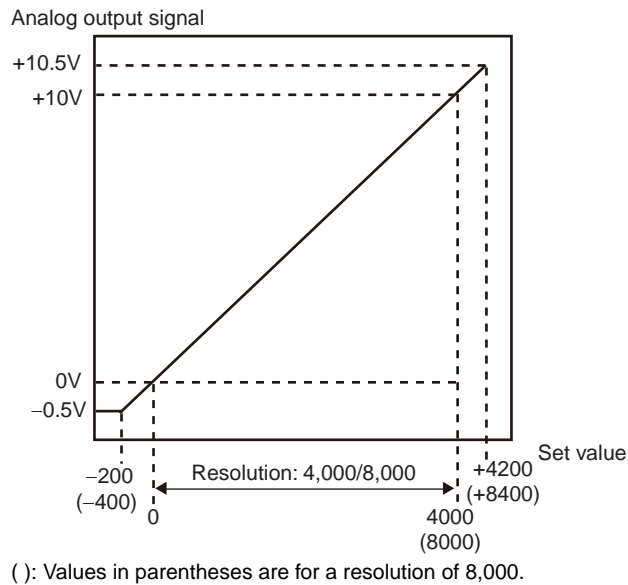
6-1-4 Output Specifications

If the set value is outside the specified range provided below, the output setting will be fixed at the maximum or the minimum value.

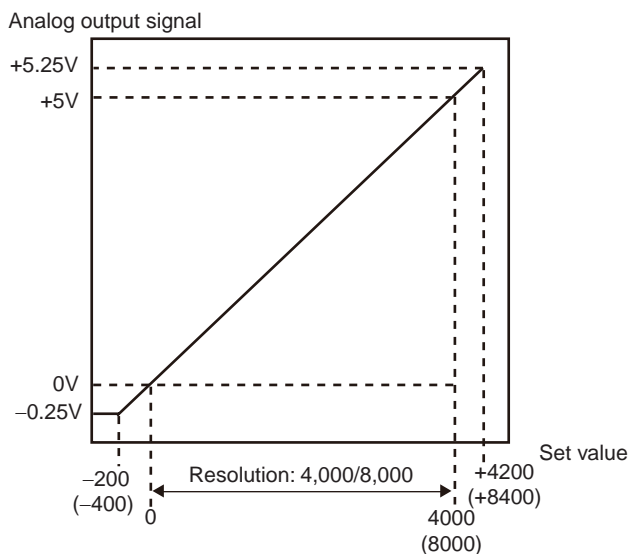
● Range: 1 to 5 V (4 to 20mA)



● Range: 0 to 10 V

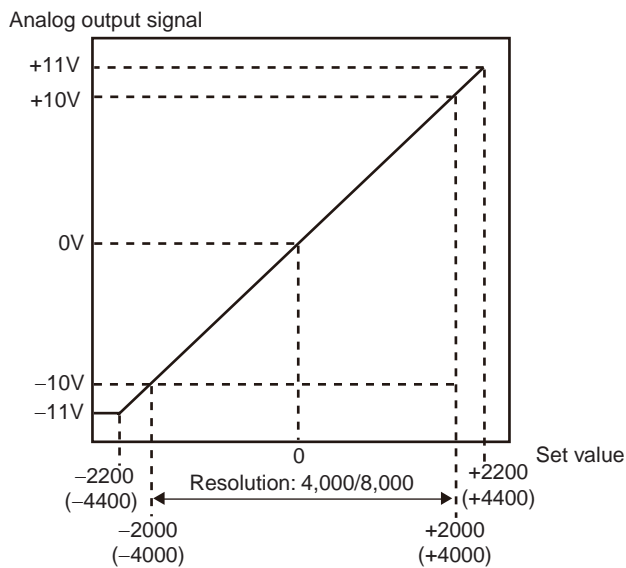


● Range: 0 to 5 V



(): Values in parentheses are for a resolution of 8,000.

● Range: -10 to 10 V



(): Values in parentheses are for a resolution of 8,000.

6-2 Operating Procedure

Follow the procedures outlined below when using the Analog I/O Unit.

There is no restriction regarding the sequence of "Programs and software settings" and "Hardware setting and Rack assembly." These tasks may be carried out concurrently or in the reverse order.

Use Sysmac Studio to create and set programs.

For operations of Sysmac Studio, refer to the *Sysmac Studio Version 1 Operation Manual* (Cat. No. W504).

● Programs and software settings

- 1** Create POU and global variables
Create Unit Configuration
 - Create and register global variables and each POU.
 - Create algorithms for each POU and register local variables of each POU.
 - Register the Unit in the Unit Configuration on the CPU/Expansion Racks screen in Configuration and Setup.
At this time, set both the device name and the unit number of the unit to be registered.
 - Create device variable for CJ-series Unit by using I/O Map.
- 2** Create Unit initial setting parameters
Create the Unit settings by using Special Unit Setup Editing.
 - Set the I/O numbers to be used.
 - Set the input and output signal ranges.
 - Set the number of mean value processing samplings.
 - Set the output hold function.
 - Set the scaling function.
 - Set the ratio conversion usage, the ratio set value, and the bias value.
 - Set the conversion cycle and resolution.
(When the program is transferred, the items set here will be reflected in the initial setting parameters.)

● Hardware setting and Rack assembly

- 1** Set the voltage/current switch at the back of the terminal block.
- 2** Mount and wire the Unit to either a CPU Rack or Expansion Rack.
- 3** Use the unit number switches on the front panel of the Unit to set the unit number.
Set the same unit number as in the Unit Configuration settings.
- 4** Turn ON the power to the Controller.
At this time, an I/O Setting Check Error occurs when there is a Unit Configuration in the CPU Unit which does not match the actual Unit Configuration. In this case, reset the Controller in steps 2, 4, and 7 *Reset the Controller or restart the Unit* of the following process to cancel the error.

● Program transfer and adjustment

- 1** Transfer programs, Unit Configuration and Setup and variable information.
- 2** Reset the Controller or restart the Unit.
- 3** Set Operating Mode Settings (**_MdCfg*) to the Adjustment Mode (16#C1) and transfer the data setup file.
Set the operating mode switch to Adjustment Mode.
- 4** Reset the Controller or restart the Unit.
 - The Special Unit is restarted and operates in the Adjustment Mode. In the Adjustment Mode, the ADJ indicator flashes.
 - Set the CPU Unit to PROGRAM Mode.
- 5** Adjust the offset and gain.
Adjusting Offset and Gain is performed if the input must be calibrated for the connected device.
- 6** Set Operating Mode Settings (**_MdCfg*) to the Normal Mode (16#00) and transfer the data setup file.
Set the operating mode switch to Normal Mode.
- 7** Reset the Controller or restart the Unit.
The Special Unit is restarted and operates in the Normal Mode. In the Normal Mode, the ADJ indicator remains unlit.

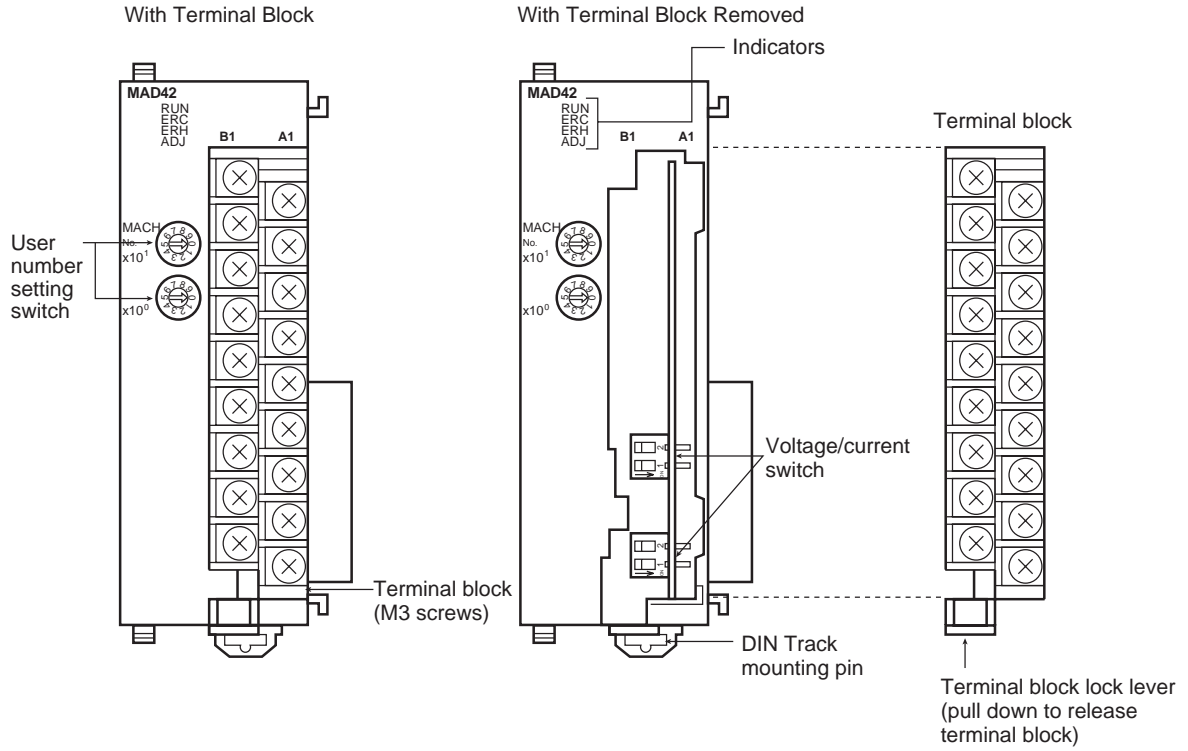
● Main Operation

- 1** Main Operation
 - Read or write set values from the user program.
 - Start and stop conversion output.
 - Specify the peak value hold function.
 - Obtain disconnection detection and error flag.

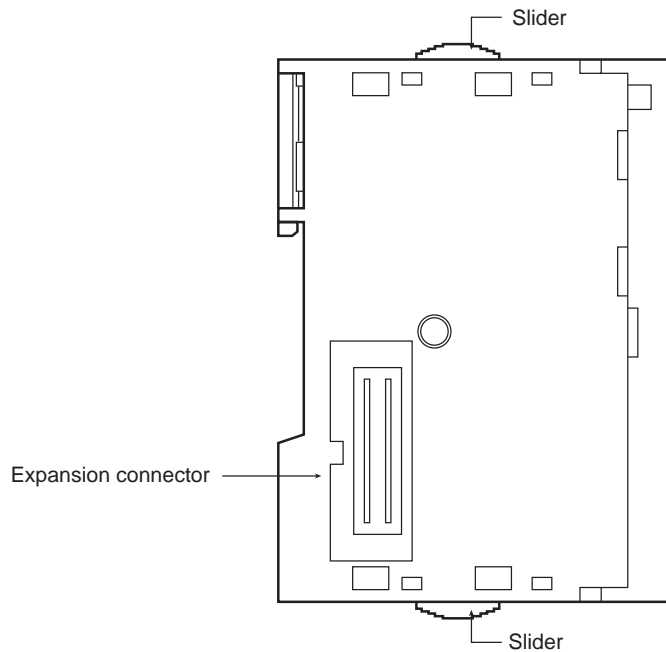
6-3 Components and Switch Settings

6-3-1 Component Names

● Front



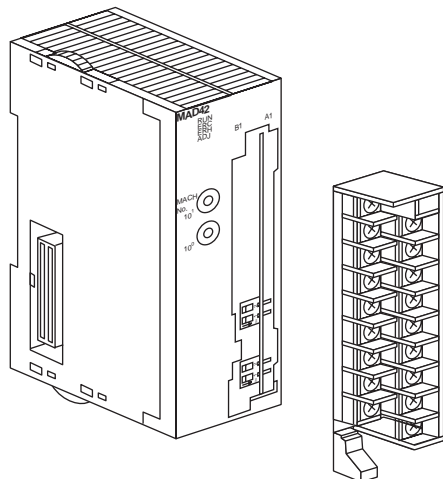
● Side





Additional Information

- Use a connector to attach the terminal block. Lower the lever at the bottom of the terminal block to remove the connector.
- Normally put the lever in the raised position. Confirm this before operation.



6-3-2 Indicators

The indicators show the operating status of the Unit. The following table shows the meanings of the indicators.

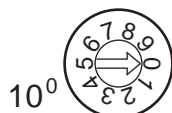
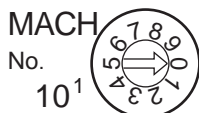
LED	Meaning	Indicator	Operating status
RUN (green)	Operating	Lit	Operating in Normal Mode.
		Not lit	Unit has stopped exchanging data with the CPU Unit.
ERC (red)	Error detected by Unit	Lit	Alarm has occurred (such as disconnection detection) or initial settings are incorrect.
		Not lit	Operating normally.
ERH (red)	Error in the CPU Unit	Lit	Error has occurred during data exchange with the CPU Unit.
		Not lit	Operating normally.
ADJ (yellow)	Adjusting	Flashing	Operating in offset/gain Adjustment Mode.
		Not lit	Other than the above.

6-3-3 Unit Number Switches

Use the unit number switches to set the specific unit number for each Special I/O Unit mounted in a CPU Rack or Expansion Rack. The unit number must be the one registered in Unit Configurations.

Turn OFF the Controller before changing the unit number setting.

Unit number
switches



Switch setting	Unit number
0	Unit #0
1	Unit #1
2	Unit #2
3	Unit #3
4	Unit #4
5	Unit #5
6	Unit #6
7	Unit #7
8	Unit #8
9	Unit #9
10	Unit #10
to	to
n	Unit #n
to	to
95	Unit #95

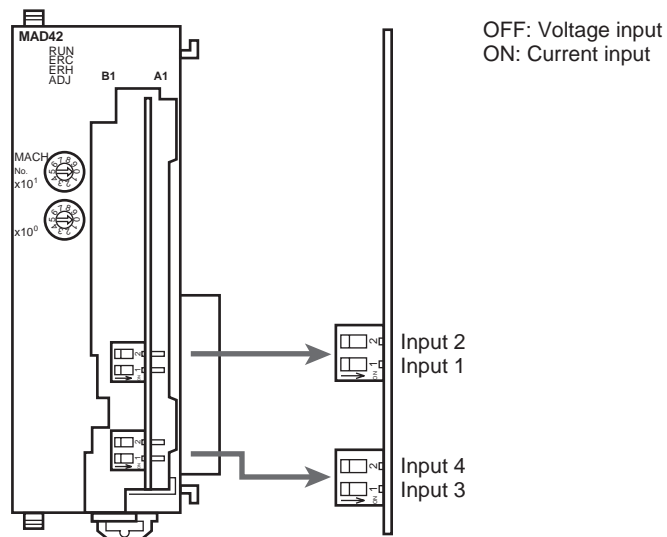


Additional Information

- If two or more Special I/O Units are assigned the same unit number, a "Duplicate Unit Number" major fault level Controller error is generated and the Controller will not operate.
- After correcting the unit number setting, cycle the power to the Controller.

6-3-4 Voltage/Current Switch

Change the pin settings on the voltage/current switch located on the back of the terminal block to switch the analog conversion input from voltage input to current input.



Precautions for Safe Use

Be sure to turn OFF the power to the Controller before you mount or remove the terminal block.

6-4 Wiring

6-4-1 Terminal Arrangement

The signal names that correspond to the connecting terminals are as shown in the following diagram.

Voltage output 2 (+)	B1	A1	Voltage output 1 (+)
Output 2 (-)	B2	A2	Output 1 (-)
Current output 2 (+)	B3	A3	Current output 1 (+)
N.C.	B4	A4	N.C.
Input 2 (+)	B5	A5	Input 1 (+)
Input 2 (-)	B6	A6	Input 1 (-)
AG	B7	A7	AG
Input 4 (+)	B8	A8	Input 3 (+)
Input 4 (-)	B9	A9	Input 3 (-)



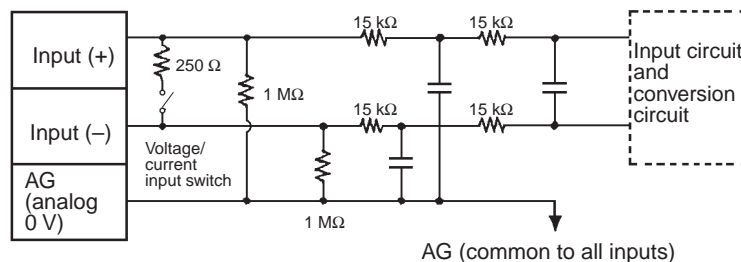
Additional Information

- You can set the analog I/O numbers you use and each I/O signal range of analog I/O from the Special Unit Setup Editing of Sysmac Studio.
- They can also be set through a setting of appropriate values in the corresponding device variables for CJ-series Unit. The analog I/O numbers to be used are set in Input and Output Use Settings (*_ChUseCfg) and the I/O signal ranges for analog I/Os are set in Range Settings (*_RngCfg). The setting can be made for each I/O number.
- The AG terminal (A7, B7) is connected to the 0-V analog circuit in the Unit. Connect shielded input lines to improve noise resistance.
- The N.C. terminals (A4, B4) are not connected to internal circuit.

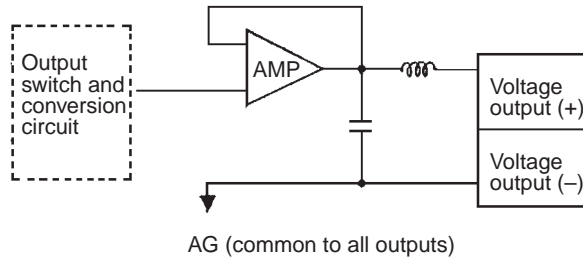
6-4-2 Internal Circuit

The following diagrams show the internal circuit of the analog I/O section.

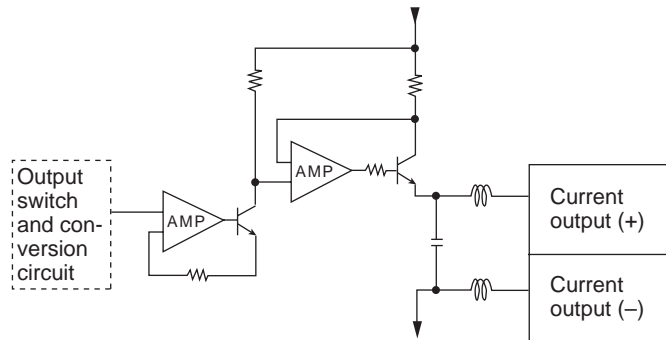
● Internal Circuit



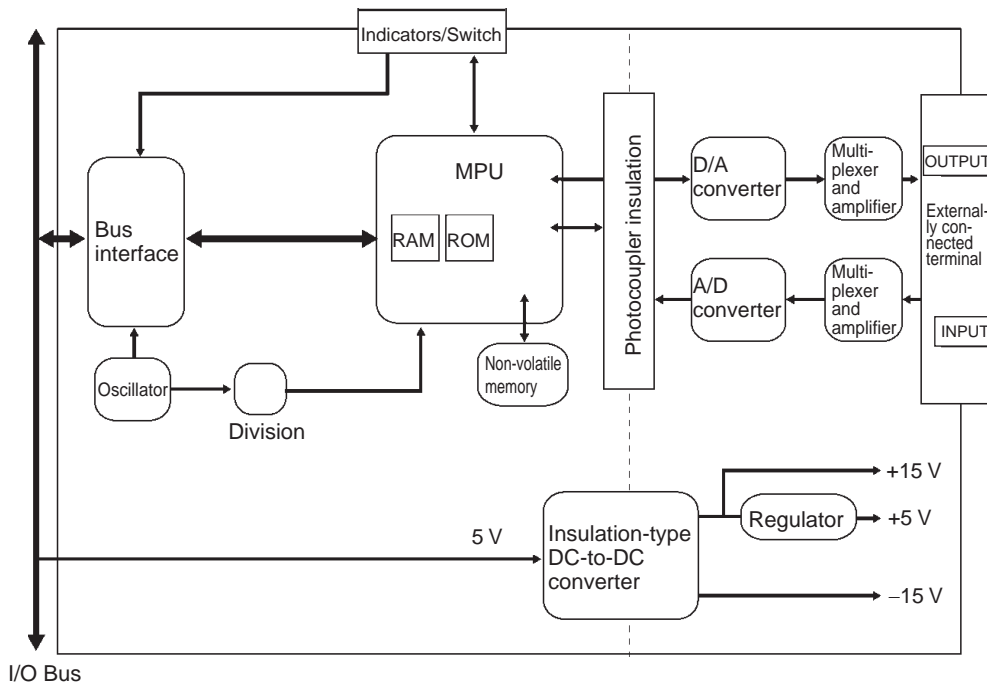
● Output Circuit



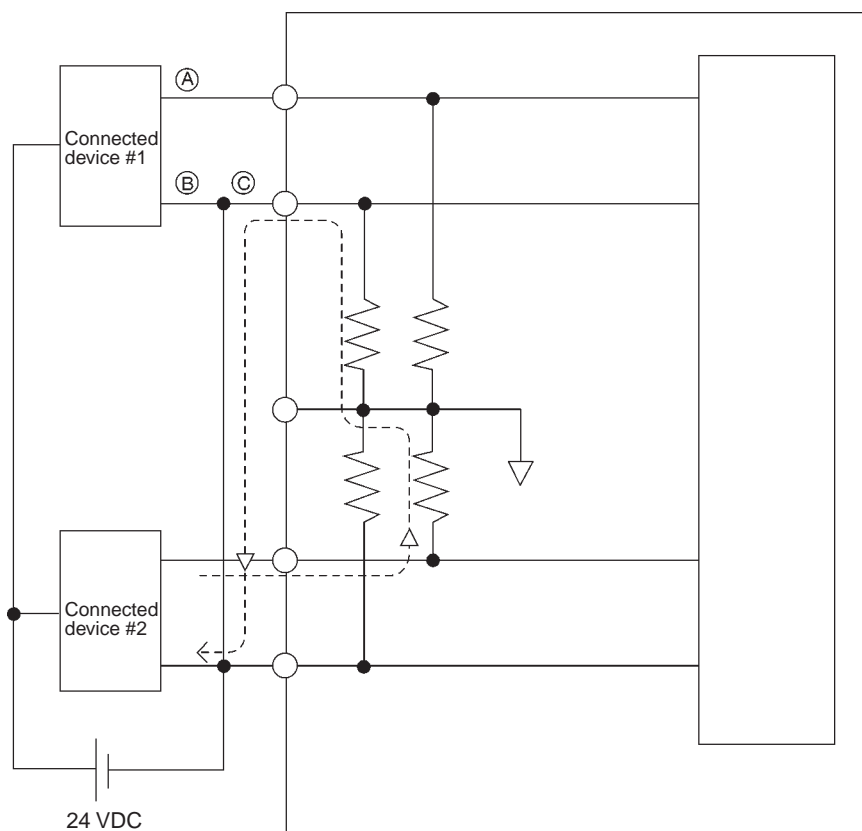
● Current Output Circuit



● Internal Configuration



6-4-3 Voltage Input Disconnection



(Example)

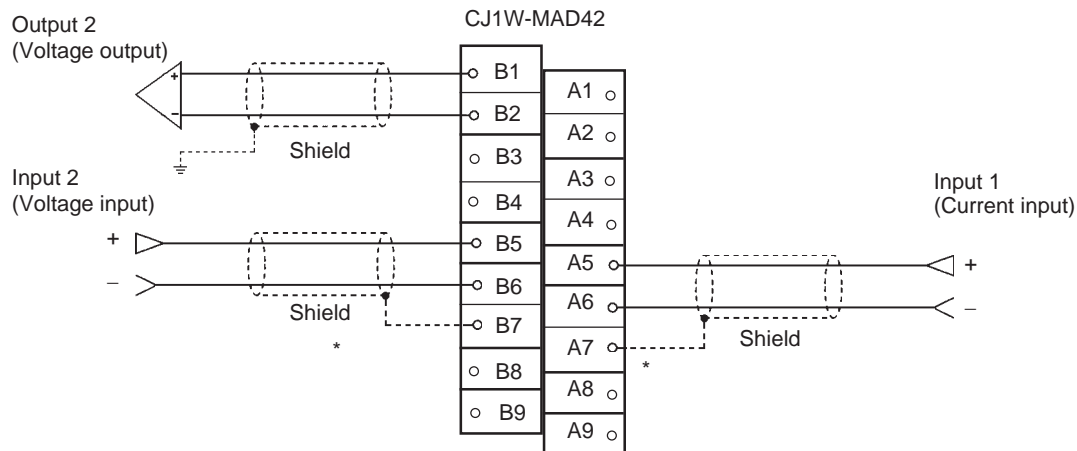
If the connected device #2 in the above example outputs 5 V and the power supply is shared by 2 channels as shown in the above diagram, approximately one-third of the voltage, or 1.6 V, will be input at input 1.

When voltage inputs are used and a disconnection occurs, separate the power supply at the side of the connected devices or use an insulating device (isolator) for each input to avoid the following problems.

When the power supply at the connected devices is shared and section A or B is disconnected, power will flow in the direction of the broken line and the output voltage of the other connected devices will be reduced to between a third to a half of the voltage. If 1 to 5 V is used and reduced voltage output, disconnection may not be detectable. If section C is disconnected, the power at the (-) input terminal will be shared and disconnection will not be detectable.

For current inputs, you can share the power supply between the connected devices without causing any problems.

6-4-4 I/O Wiring Example



The input AG terminal need not be connected in normal conditions, but if noise is of concern, connect the shielded wire for each input by one of the following methods:

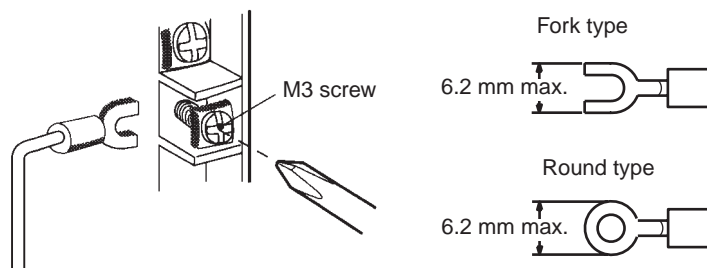
- Connect the end of the shielded wire * on AD Unit side, to the AG terminals, as shown in the above diagram, use a wire that is 30 cm or shorter if possible. In this case, do not connect the end of the shielded wire on output device side to any other device or FG.
- Ground the end of the shielded wire on AD Unit side to the FG on the control panel. In this case, keep the AG terminal open and do not connect the end of the shielded wire on output device side to any other device or FG.

To increase noise resistance for analog output wiring, ground the shield on the output signal cable at the input device.



Precautions for Safe Use

Crimp terminals must be used for terminal connections, and the screws must be tightened securely. M3 terminal screws are used. The applicable tightening torque is 0.5 N·m.



Precautions for Correct Use

- When current inputs are used, pins IN1 to IN4 of the voltage/current switch must be set to ON. Refer to 6-3-4 *Voltage/Current Switch* for further details. Also set the voltage and current ranges in the device variable for CJ-series Unit Range Settings (*_RngCfg) and Voltage/Current Input Switch (*_RngVICfg). Refer to 6-7-1 *Output Settings and Conversion Values*.
- For inputs you do not use, set them to Not Used in the input number settings (refer to *Setting Inputs and Signal Ranges* in 6-6-1 *Input Settings and Conversion Values*). If they are set to Used and actually not used, unintended conversion data may be input. To prevent this, short-circuit the voltage input terminals (V+) and (V-). Take note that, in the case of a range from 1 to 5-V or 4 to 20-mA, short-circuiting (V+) and (V-) causes the Disconnection Detected bit to turn ON.

6-4-5 I/O Wiring Considerations

When you wire inputs, apply the following points to avoid noise interference and optimize Analog I/O Unit performance.

- Use two-core shielded twisted-pair cables for external connecting lines.
- Route I/O cables separately from the power cables (e. g., AC and three-phase lines) and do not run the Unit's cables near a main circuit cable or a high voltage cable. Do not insert these cables into the same duct.
- If there is noise interference from power lines (for example, the power supply is shared with electrical welding devices or electrical discharge machines, or there is a high-frequency generation source nearby) install a noise filter at the power supply input area.

6-5 Exchanging Data with the CPU Unit

6-5-1 Outline of Data Exchange

The CPU Unit and Analog I/O Unit CJ1W-MAD42 exchange operation data and initial setting parameters via the I/O port generated for this Analog I/O Unit.

The table and figure below show the data exchange method for each data type.

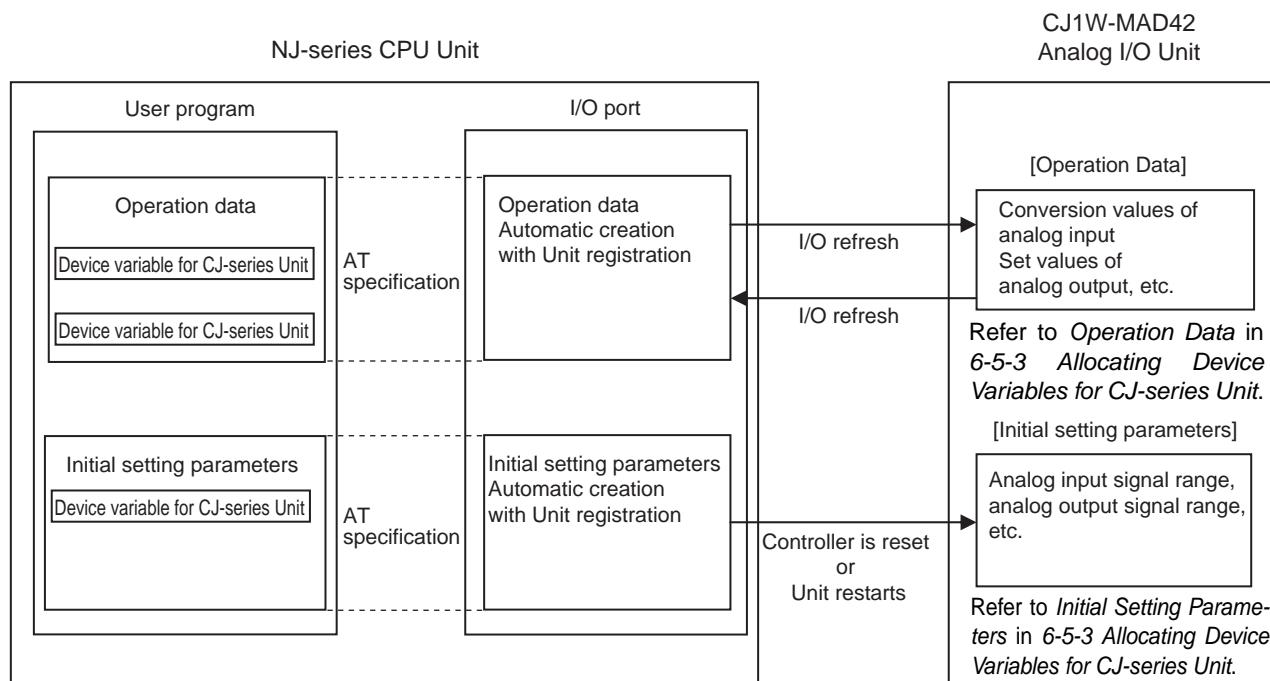
Data exchange type

Unit data type	Data contents	AT specification destination	How to access from user program	Timing of data exchange
Operation data	Analog input conversion values, analog output setting values, etc.	I/O port (operation data)	Device variable for CJ-series Unit	At I/O refreshing
Initial setting parameters	Analog input signal range, analog output signal range, etc.	I/O port (initial setting parameters) *	Device variable for CJ-series Unit	When the Controller is reset or the Unit restarts
Unit Restart Bit, etc.	Unit Restart Bit, etc.	None	System-defined variable	At I/O refreshing

* The initial setting parameters are retained in the CPU Unit by the battery even during power interruptions.

● Device Variable for CJ-series Unit

Device variables for CJ-series Unit are used for data exchange between a user program and Special I/O Units. The user program uses device variables for CJ-series Unit to control the Analog I/O Unit.



6-5-2 Accessing from the User Program

The user program uses device variables for CJ-series Unit to control the Analog I/O Unit. Use device variables for CJ-series Unit with AT specification for the I/O port, which is explained below.

● I/O port

An "I/O port" is a logical interface for data exchange by a CPU Unit with an Analog I/O Unit or other configuration unit.

An I/O port has a unique predefined name for each unit model and function.

An I/O port is automatically created by preparing the Unit Configuration with Sysmac Studio.

● How to specify device variables for CJ-series Unit

Specify the AT specifications to I/O ports for device variables for CJ-series Unit with the I/O Map from Sysmac Studio.

Specify the variable name for the AT specification with one of the following methods.

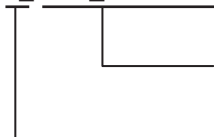
1. Select a variable already registered in the variable table
2. Input a new variable name
3. Automatically create a variable name with "Device variable creation"

When a device variable name for CJ-series Unit is assigned with method 2 or 3, the variable input by Sysmac Studio is automatically registered in the variable table.

The following is the configuration of variable names created with automatic creation in method 3.

Name of device variable for CJ-series Unit

* Ch1_ConvCmd



This is an I/O port name. The name identifies the unit function, status and parameter.

This is the device name when this unit is registered in the Unit Configuration. (By default, a device name is assigned from "J01" in the order of registration in the Unit Configuration.) This identifies the individual unit.

For details on creation of device variables for CJ-series Unit, refer to *Sysmac Studio Version 1 Operation Manual* (Cat. No. W504).

There are two types of device variables for CJ-series Unit: "Operation Data" and "Initial Setting Parameters".

In the explanations from here on, the device name automatically created is used as the device variable for CJ-series Unit, for example "*_ Ch1_ConvCmd".

Switching Operating Mode

You can switch between the Normal Mode and Adjustment Mode (during offset and gain adjustments, etc.) with Operating Mode Settings (*_MdCfg).

Variable name	Type	Setting
*_MdCfg	BYTE	16#00: Normal Mode 16#C1: Adjustment Mode

6-5-3 Allocating Device Variables for CJ-series Unit

Initial Setting Parameters

Perform Unit settings such as output usage setting, analog output signal range, etc.

Initial setting parameters settings are set from Special Unit Setup Editing of Sysmac Studio.

Unit settings can also be performed by setting the values in the device variables for CJ-series Unit.

Unit settings are reflected only when the Controller is reset, or when the Unit restarts. The initial setting parameters are retained in the CPU Unit by the battery even during power interruptions.



Precautions for Safe Use

- When initial setting parameters are set and transferred from Sysmac Studio, Sysmac Studio checks whether or not the Unit must be restarted. Restart the Unit after confirming the safety of the connected destination.
- The contents of initial setting parameters will be transferred to the Unit when the Controller reset or when the Unit restarts.

List of Initial Setting Parameters (common to both Normal Mode and Adjustment Mode)

Name of device variable for CJ-series Unit	Type	R/W	Name	Feature/reference page
*_ChUseCfg	BYTE	RW	Input and Output Use Settings	Refer to <i>Input Numbers</i> in 6-6-1 <i>Input Settings and Conversion Values</i> , 6-7-1 <i>Output Settings and Conversion Values</i> . BYTE-type variable that combines the following BOOL-type variables:
*_Ch1_OutChUseCfg	BOOL	RW	Output 1 Use Setting	BOOL type variables to specify usage per output and input. 0: Not used 1: Used
*_Ch2_OutChUseCfg	BOOL	RW	Output 2 Use Setting	
*_Ch1_InChUseCfg	BOOL	RW	Input 1 Use Setting	
*_Ch2_InChUseCfg	BOOL	RW	Input 2 Use Setting	
*_Ch3_InChUseCfg	BOOL	RW	Input 3 Use Setting	
*_Ch4_InChUseCfg	BOOL	RW	Input 4 Use Setting	
*_RngCfg	WORD	RW	Range Settings	Refer to 6-6-1 <i>Input Settings and Conversion Values</i> , 6-7-1 <i>Output Settings and Conversion Values</i> .
*_RngVICfg	WORD	RW	Voltage/Current Input Switch	
*_Ch1_AveCfg	UINT	RW	Input 1 Number of Samplings for Mean Value Processing	Refer to 6-6-2 <i>Mean Value Processing</i> . 0: Number of samplings 2 1: No mean value processing 2: Number of samplings 4 3: Number of samplings 8 4: Number of samplings 16 5: Number of samplings 32 6: Number of samplings 64
*_Ch2_AveCfg	UINT	RW	Input 2 Number of Samplings for Mean Value Processing	
*_Ch3_AveCfg	UINT	RW	Input 3 Number of Samplings for Mean Value Processing	
*_Ch4_AveCfg	UINT	RW	Input 4 Number of Samplings for Mean Value Processing	

Name of device variable for CJ-series Unit	Type	R/W	Name	Feature/reference page
*_Ch1_Scl_L_Cfg	INT	RW	Output 1 Scaling Lower Limit	Refer to 6-7-3 <i>Output Scaling Function</i> .
*_Ch1_Scl_H_Cfg	INT	RW	Output 1 Scaling Upper Limit	–32000 to +32000
*_Ch2_Scl_L_Cfg	INT	RW	Output 2 Scaling Lower Limit	Set lower limit value ≠ upper limit value. (Can also set lower limit value > upper limit value.)
*_Ch2_Scl_H_Cfg	INT	RW	Output 2 Scaling Upper Limit	
*_Ch3_Scl_L_Cfg	INT	RW	Input 1 Scaling Lower Limit	Refer to 6-6-4 <i>Input Scaling Function</i> .
*_Ch3_Scl_H_Cfg	INT	RW	Input 1 Scaling Upper Limit	–32000 to +32000
*_Ch4_Scl_L_Cfg	INT	RW	Input 2 Scaling Lower Limit	Set lower limit value ≠ upper limit value. (Can also set lower limit value > upper limit value.)
*_Ch4_Scl_H_Cfg	INT	RW	Input 2 Scaling Upper Limit	
*_Ch5_Scl_L_Cfg	INT	RW	Input 3 Scaling Lower Limit	
*_Ch5_Scl_H_Cfg	INT	RW	Input 3 Scaling Upper Limit	
*_Ch6_Scl_L_Cfg	INT	RW	Input 4 Scaling Lower Limit	
*_Ch6_Scl_H_Cfg	INT	RW	Input 4 Scaling Upper Limit	
*_Ch1_HdMdCfg	USINT	RW	Output 1 Output Status When Conversion Stops	Refer to 6-7-2 <i>Output Hold Function</i> . 0: CLR
*_Ch2_HdMdCfg	USINT	RW	Output 2 Output Status When Conversion Stops	1: HOLD 2: MAX
*_UseRatioBias	BYTE	RW	Ratio Conversion Use Setting	Refer to 6-8 <i>Ratio Conversion Function</i> . 16#00: Not used 16#01: Positive gradient conversion 16#10: Negative gradient conversion 16#11: Not used
*_Ch1_Cfg_Const_A	WORD	RW	Loop 1 Ratio Conversion Constant A	Refer to <i>Specifying Ratio Set Value and Bias</i> in 6-8 <i>Ratio Conversion Function</i> .
*_Ch1_Cfg_Const_B	INT	RW	Loop 1 Ratio Conversion Constant B	
*_Ch2_Cfg_Const_A	WORD	RW	Loop 2 Ratio Conversion Constant A	
*_Ch2_Cfg_Const_B	INT	RW	Loop 2 Ratio Conversion Constant B	
*_MdCfg	BYTE	RW	Operating Mode Settings	Refer to <i>Switching Operating Mode</i> in 6-5-2 <i>Accessing from the User Program</i> . 16#00: Normal Mode 16#C1: Adjustment Mode
*_ResolutionCfg	BYTE	RW	Resolution/Conversion Time Settings	Refer to <i>Conversion Cycle and Resolution Setting</i> in 6-6-1 <i>Input Settings and Conversion Values</i> . 16#00: 4,000 resolutions/1 ms cycle 16#C1: 8,000 resolutions/500 μs cycle

Operation Data

Operation data includes data such as analog input conversion value, analog output setting, etc. Operation data is exchanged constantly during I/O refreshing.

Operation Data (during Normal Mode)

Name of device variable for CJ-series Unit	Type	R/W	Name	Feature/reference page	
*_Ch1_WrAO	INT	RW	Output 1 Set Value	Refer to <i>Setting Use Settings and Output Signal Ranges and Writing Set Values</i> in 6-7-1 <i>Output Settings and Conversion Values</i> .	
*_Ch2_WrAO	INT	RW	Output 2 Set Value		
*_Ch1_RdAI	INT	R	Input 1 Conversion Data	Refer to <i>Reading Conversion Values</i> in 6-6-1 <i>Input Settings and Conversion Values</i> .	
*_Ch2_RdAI	INT	R	Input 2 Conversion Data		
*_Ch3_RdAI	INT	R	Input 3 Conversion Data		
*_Ch4_RdAI	INT	R	Input 4 Conversion Data		
*_ConvPkHdCmd	BYTE	RW	Peak Value Hold and Output Conversion Enable Settings	BYTE-type variable that combines the following BOOL-type variables:	Bit Number
*_Ch1_ConvCmd	BOOL	RW	Output 1 Conversion Enable	Refer to <i>Starting and Stopping Conversion</i> in 6-7-1 <i>Output Settings and Conversion Values</i> . 0: Stop conversion output 1: Start conversion output	00
*_Ch2_ConvCmd	BOOL	RW	Output 2 Conversion Enable		01
*_Ch1_PkHdCmd	BOOL	RW	Input 1 Peak Value Hold Execution	Refer to 6-6-3 <i>Peak Value Hold Function</i> . 0: Do not perform peak value hold 1: Perform peak value hold	04
*_Ch2_PkHdCmd	BOOL	RW	Input 2 Peak Value Hold Execution		05
*_Ch3_PkHdCmd	BOOL	RW	Input 3 Peak Value Hold Execution		06
*_Ch4_PkHdCmd	BOOL	RW	Input 4 Peak Value Hold Execution		07
*_MVSensErr	BYTE	R	Set value Errors and Disconnection Detected	BYTE-type variable that combines the following BOOL-type variables:	Bit Number
*_Ch1_MvErr	BOOL	R	Output 1 Output Set Value Error	Refer to 6-7-4 <i>Output Setting Errors</i> . 0: No error 1: Setting error	00
*_Ch2_MvErr	BOOL	R	Output 2 Output Set Value Error		01
*_Ch1_SensErr	BOOL	R	Input 1 Disconnection Detected	Refer to 6-6-5 <i>Input Disconnection Detection Function</i> . 0: No disconnection 1: Disconnection	04
*_Ch2_SensErr	BOOL	R	Input 2 Disconnection Detected		05
*_Ch3_SensErr	BOOL	R	Input 3 Disconnection Detected		06
*_Ch4_SensErr	BOOL	R	Input 4 Disconnection Detected		07
*_UnitErr	BYTE	R	Error Flags	Refer to 7-2-2 <i>Alarms Occurring at the Unit</i> . BYTE-type variable that combines the following BOOL-type variables:	Bit Number

Name of device variable for CJ-series Unit	Type	R/W	Name	Feature/reference page	
*_SclErr	BOOL	R	Scaling Data Setting Error/Ratio Conversion Use Setting Error	0: No error 1: Error in initial setting parameters	
*_RatioCfgErr	BOOL	R	Ratio Set Value Error		00
*_HdErr	BOOL	R	Output Hold Setting Error		01
*_AveErr	BOOL	R	Mean Value Processing Setting Error		02
*_MdErr	BOOL	R	Conversion Time/Resolution or Operation Mode Setting Error		03
					04

List of Operation Data (during Adjustment Mode)

Name of device variable for CJ-series Unit	Type	R/W	Name	Feature/reference page	
*_AdjCh	BYTE	RW	Input and Outputs to Be Adjusted	Refer to 7-1 <i>Adjusting Offset and Gain</i> . Instruction setting and flag for I/O adjustments.	
*_AdjOfs	BOOL	RW	Offset Flag		
*_AdjGain	BOOL	RW	Gain Flag		
*_AdjDwn	BOOL	RW	Adjustment Value Down Flag		
*_AdjUp	BOOL	RW	Adjustment Value Up Flag		
*_AdjSet	BOOL	RW	Adjustment Value Set Flag		
*_AdjClr	BOOL	RW	Adjustment Value Clear Flag		
*_AdjPV	INT	R	Conversion value for adjustment		
*_AdjUnitErr	BYTE	R	Error Flags	Refer to 7-2-2 <i>Alarms Occurring at the Unit</i> . BYTE-type variable that combines the following BOOL-type variables:	
				Bit Number	
*_AdjSclErr	BOOL	R	Scaling Data Setting Error/Ratio Conversion Use Setting Error	0: No error 1: Error in initial setting parameters	
*_AdjRatioCfgErr	BOOL	R	Ratio Set Value Error		00
*_AdjHdErr	BOOL	R	Output Hold Setting Error		01
*_AdjAveErr	BOOL	R	Mean Value Processing Setting Error		02
*_AdjInMdErr	BOOL	R	Conversion Time/Resolution or Operation Mode Setting Error		03
					04
*_AdjIONoErr	BOOL	R	Input/Output Value Adjustment Number Setting Error	0: No error 1: "AdjCh" is outside setting range	05
*_AdjMemErr	BOOL	R	Non-volatile Memory Error	0: No error 1: Adjustment data could not be written properly	06
*_AdjMd	BOOL	R	Starting Adjustment Mode	0: Running in the Normal Mode 1: Running in the Adjustment Mode	07

6-6 Analog Input Functions and Operating Procedures

6-6-1 Input Settings and Conversion Values

Setting Inputs and Signal Ranges

● Input Numbers

The Analog I/O Unit converts only the analog inputs specified among input numbers 1 to 4 and skips unused inputs for sampling.

Accordingly, the conversion cycle per unit is calculated by conversion cycle × used input points.

For the conversion cycle setting, refer to *Conversion Cycle and Resolution Setting* on page 6-28.

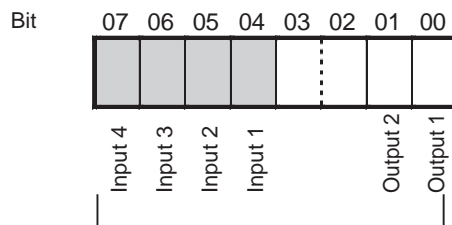
Use Input # Use Setting (*Ch#_InChUseCfg*) to set the analog inputs to be used.

Variable name	Type	Setting
<i>*_Ch#_InChUseCfg</i>	BOOL	0: Not used 1: Used

An input number from 1 to 4 is included in place of # in the variable name.

In addition to output usage specification, you can also perform batch settings with Input and Output Use Settings (**_ChUseCfg*).

Variable name	Type	Setting
<i>*_ChUseCfg</i>	BYTE	16#00 to 16#F3

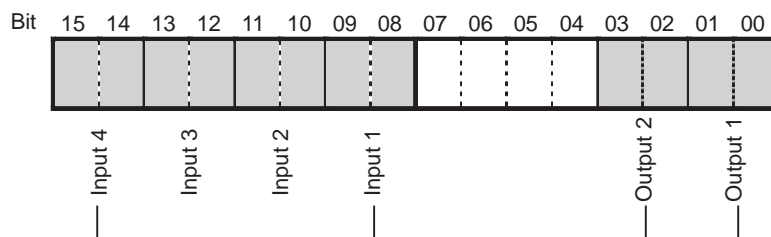


0: Not used
1: Used

● Input Signal Ranges

You can select any of four types of input signal range (–10 to 10 V, 0 to 10 V, 1 to 5 V, and 4 to 20 mA) for each of the inputs (i.e., input numbers 1 to 4). To specify the input signal range for each output along with the output range, use Range Settings (**_RngCfg*).

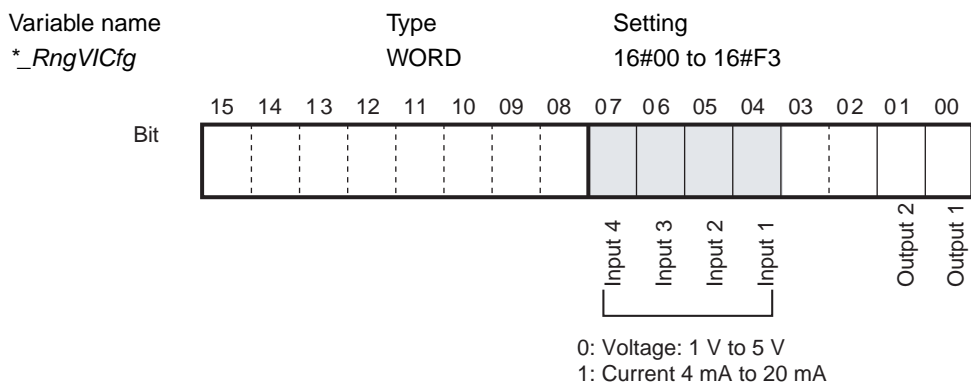
Variable name	Type	Setting
<i>*_RngCfg</i>	WORD	16#0000 to 16#FF0F



00: –10 to 10 V
01: 0 to 10 V
10: 1 to 5 V/4 to 20 mA
11: 0 to 5 V

Voltage/Current Range Setting

When 1 to 5 V/4 to 20 mA is selected for the input signal range settings, set the 1 to 5V or 4 to 20 mA range for both the output voltage and current settings with Voltage/Current Input Switch (*_RngVICfg).



Additional Information

For the input signal ranges 1 to 5 V and 4 to 20 mA, it is necessary to set the voltage/current switch according to the setting made with the device variables for CJ-series Unit.

Precautions for Safe Use

- When initial setting parameters are set and transferred from Sysmac Studio, Sysmac Studio checks whether or not the Unit must be restarted. Restart the Unit after confirming the safety of the connected destination.
- The contents of initial setting parameters will be transferred to the Unit when the Controller is reset or when the Unit restarts.

Reading Conversion Values

Analog input conversion values are output to the device variable for CJ-series Unit Input # Conversion Data (*_Ch#_RdAI) shown below.

Variable name	Type
*_Ch#_RdAI	INT

An input number from 1 to 4 is included in place of # in the variable name.

Conversion Cycle and Resolution Setting

For the CJ1W-MAD42, you can set the conversion cycle and resolution with Resolution/Conversion Time Settings (*_ResolutionCfg). This is common to all analog input and output settings.

Variable name	Type	Setting
*_ResolutionCfg	BYTE	16#00: 4,000 resolutions/1 ms cycle 16#C1: 8,000 resolutions/500 μ s cycle

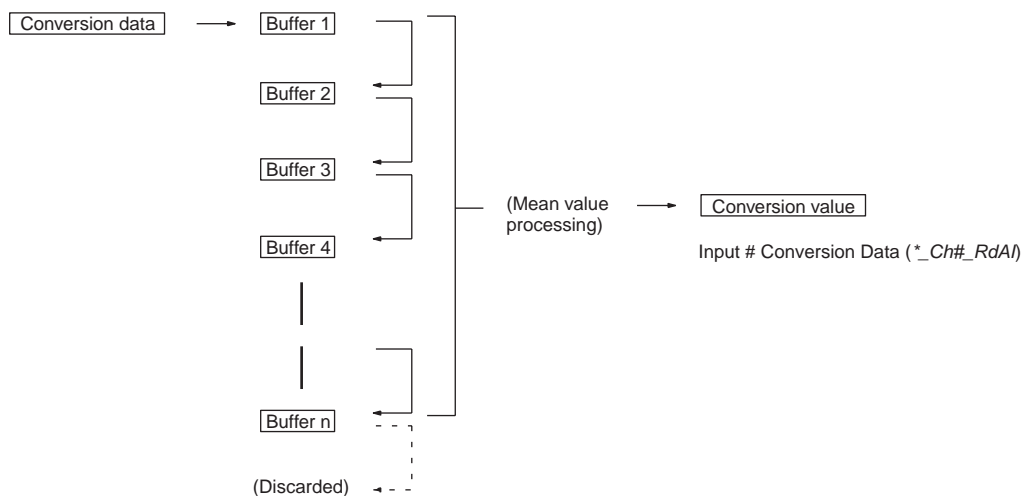


Precautions for Safe Use

- When initial setting parameters are set and transferred from Sysmac Studio, Sysmac Studio checks whether or not the Unit must be restarted. Restart the Unit after confirming the safety of the connected destination.
- The contents of initial setting parameters will be transferred to the Unit when the Controller is reset or when the Unit restarts.

6-6-2 Mean Value Processing

In Cyclic Conversion Mode, the Analog Input Unit can compute the mean value of the conversion values of analog inputs that are previously sampled several times. Mean value processing uses operational mean values in the history buffers. It has no effect on the data refresh cycle. (The number of history buffers that can be set for mean value processing is 2, 4, 8, 16, 32, 64, 128, 256, or 512.)



Additional Information

- The first conversion data is stored for all buffers for the number of mean value processing set immediately after data conversion has begun and after a disconnection is restored.
- When mean value processing set is used together with the peak value hold function, the mean value will be held.

Use Input # Number of Samplings for Mean Value Processing (*_Ch#_AveCfg) to set whether to perform mean value processing and the number of samplings

in the case the process is performed.

Variable name	Type	Setting
*_Ch#_AveCfg	UINT	0: Mean value processing with 2 samplings 1: No mean value processing 2: Mean value processing with 4 samplings 3: Mean value processing with 8 samplings 4: Mean value processing with 16 samplings 5: Mean value processing with 32 samplings 6: Mean value processing with 64 samplings

An input number from 1 to 4 is included in place of # in the variable name.



Precautions for Safe Use

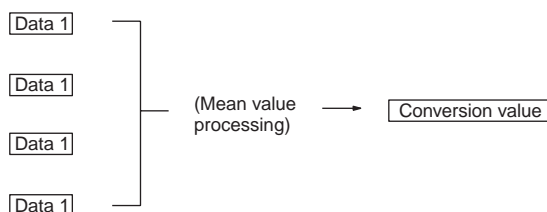
- When initial setting parameters are set and transferred from Sysmac Studio, Sysmac Studio checks whether or not the Unit must be restarted. Restart the Unit after confirming the safety of the connected destination.
- The contents of initial setting parameters will be transferred to the Unit when the Controller is reset or when the Unit restarts.



Additional Information

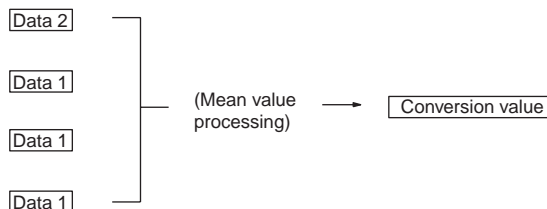
The history buffer moving average is calculated as shown in the following diagram. (In this example, there are four buffers.)

- 1 With the first cycle, Data 1 is stored in all the history buffers.



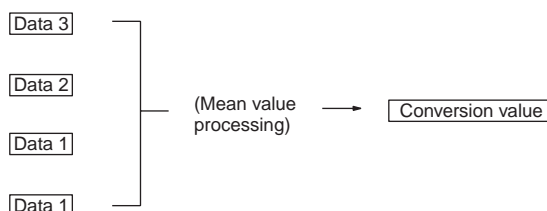
$$\text{Mean value} = (\text{Data 1} + \text{Data 1} + \text{Data 1} + \text{Data 1}) \div 4$$

- 2 With the second cycle, Data 2 is stored in the first history buffer.



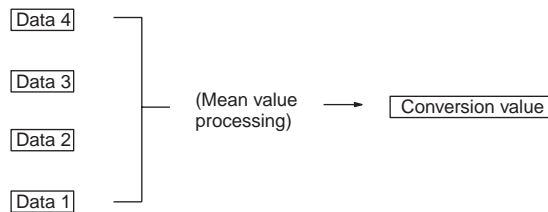
$$\text{Mean value} = (\text{Data 2} + \text{Data 1} + \text{Data 1} + \text{Data 1}) \div 4$$

- 3 With the third cycle, Data 3 is stored in the first history buffer.



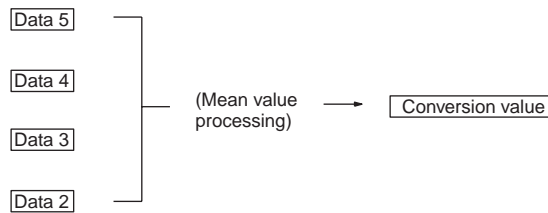
$$\text{Mean value} = (\text{Data 3} + \text{Data 2} + \text{Data 1} + \text{Data 1}) \div 4$$

4 With the fourth cycle, the Data 4 is stored in the first history buffer.



$$\text{Mean value} = (\text{Data 4} + \text{Data 3} + \text{Data 2} + \text{Data 1}) \div 4$$

5 With the fifth cycle, Data 5 is stored in the first history buffer.



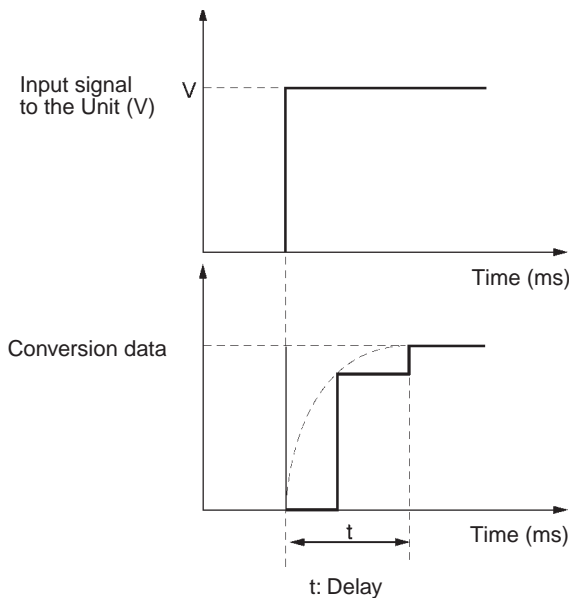
$$\text{Mean value} = (\text{Data 5} + \text{Data 4} + \text{Data 3} + \text{Data 2}) \div 4$$

- When a disconnection is restored, the mean value processing function begins again from step 1.



Additional Information

- When the mean value processing function is used, the delay to refresh converted data for input signal changes is as shown in the following diagram.
- Specify "no mean value processing" to follow conversion of a rapid change in input signals.



For V = 20 V (-10 to 10 V)

When Resolution is 1 ms/4,000

- For One Word
 $t = n + (2 \text{ to } 3)$
- For m Words ($1 < m \leq 4$)
 No mean value processing ($n = 1$) or 2 samplings ($n = 2$):
 $t = n \times (m + 2)$
 Number of samplings = n ($4 \leq n \leq 64$)
 $t = (n - 2) \times m + 10.5$

When Resolution is 500 μs/8,000

- For One Word
 $t = [n + (2 \text{ to } 3)] \times 1/2$
- For m Words ($1 < m \leq 4$)
 No mean value processing ($n = 1$) or 2 samplings ($n = 2$):
 $t = n \times (m + 2) \times 1/2$
 Number of samplings = n ($4 \leq n \leq 64$)
 $t = [(n - 2) \times m + 10.5] \times 1/2$

● Response Time for a Resolution of 1 ms/4,000

Unit: ms

m	n						
	64	32	16	8	4	2	1
4	258.5	130.5	66.5	34.5	18.5	12	6
3	196.5	100.5	52.5	28.5	16.5	10	5
2	134.5	70.5	38.5	22.5	14.5	8	4
1	67	35	19	11	7	5	3

● Response Time for a Resolution of 500 μ s/8,000

Unit: ms

m	n						
	64	32	16	8	4	2	1
4	129.25	65.25	33.25	17.25	9.25	6	3
3	98.25	50.25	26.25	14.25	8.25	5	2.5
2	67.25	35.25	19.25	11.25	7.25	4	2
1	33.5	17.5	9.5	5.5	3.5	2.5	1.5

The above response times are not affected by the number of analog I/O points that are used.

● Symbols

m: Number of input words used in initial setting parameters

n: Average number of samplings set for the input number for which to find the response time

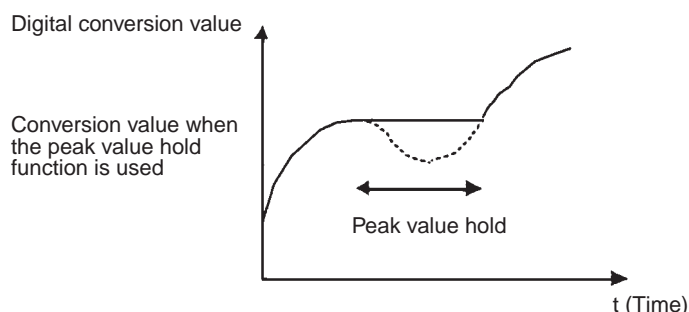
● Calculation Example

The following example calculations are for a resolution of 8,000 with an application using inputs 1 and 4, 64 samplings set for input 1, and no averaging set for input 4.

- Response time for input 1: $t = \{(64 - 2) \times 2 + 10.5\} \times 1/2 = 67.25$ (ms)
- Response time for input 4: $t = 1 \times (2 + 2) \times 1/2 = 2$ (ms)

6-6-3 Peak Value Hold Function

The peak value hold function holds the maximum digital conversion value for every input (this includes mean value processing).

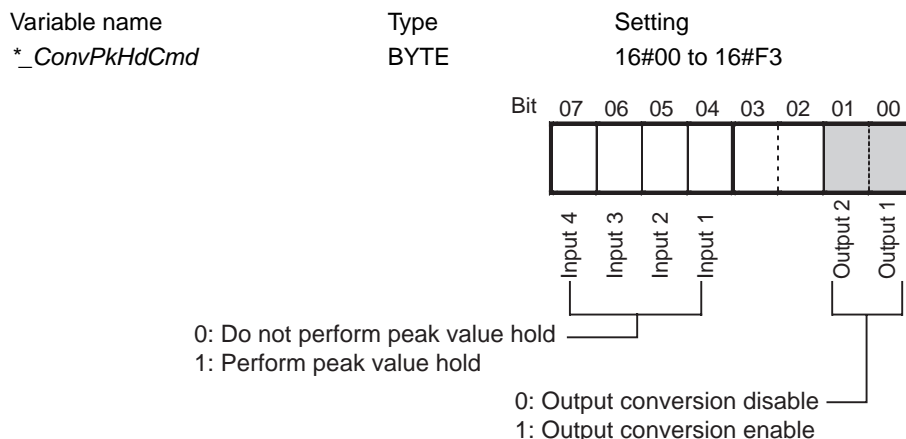


The peak value hold function is executed with the device variable for CJ-series Unit Input # Peak Value Hold Execution Settings (*_Ch#_PkHdCmd) shown below.

Variable name	Type	Setting
*_Ch#_PkHdCmd	BOOL	0: Do not perform peak value hold 1: Perform peak value hold

An input number from 1 to 4 is included in place of # in the variable name.

In addition to output conversion enable, you can also perform batch settings with the device variable for CJ-series Unit Peak Value Hold and Output Conversion Enable Settings (**_ConvPkHdCmd*) shown below.



Additional Information

- When mean value processing is used together with the peak value hold function, the mean value will be held.
- As long as the peak value hold function is executing, the peak value hold will be held even in the event of a disconnection.

6-6-4 Input Scaling Function

When upper and lower limits (within a range of $-32,000$ to $+32,000$) are preset, analog input values can then be automatically converted into a user-specified industrial unit, with the upper and lower limits taken as full scale based on that resolution value.

The scaling function is enabled for only a conversion cycle of 1 ms and a resolution of 4,000 (and not for a conversion time of 500 μ s and a resolution of 8,000).



Additional Information

- The upper limit is normally set to be greater than the lower limit, but it is also possible to set the lower limit to be greater than the upper limit for reverse scaling.
- Actual A/D conversion is executed at up to -5% to $+105\%$ of full scale.



Precautions for Correct Use

- You cannot use the scaling function when the ratio conversion function is used.
- If the scaling upper limit equals the lower limit, or if the scaling upper limit or lower limit is outside the range of $\pm 32,000$, a scaling data setting error is generated and the Unit will not operate. Operation is performed without scaling if both the upper and lower limits are set to 0.

● Setting Upper and Lower Limits for Input Scaling

Use the initial setting parameters shown below to set the input scaling upper and lower limit values.

Variable name	Type	Setting
<i>*_Ch#_Scl_L_Cfg</i>	INT	Scaling lower limit ($-32,000$ to $+32,000$)
<i>*_Ch#_Scl_H_Cfg</i>	INT	Scaling upper limit ($-32,000$ to $+32,000$)

The I/O number from 1 to 6 is included in place of # in the variable name (Output: 1 to 2, Input: 3 to 6).

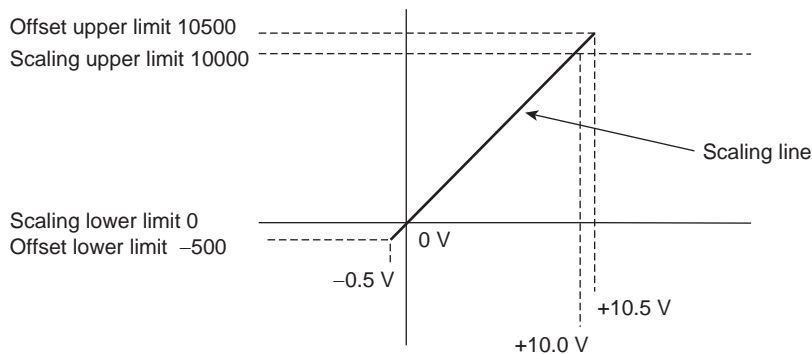
● Example Setting 1

If the input 1 signal of 0 to 10 V is to be scaled to 0 to 10000, set as follows:

Set Input 1 Scaling Lower Limit (*_Ch3_Scl_L_Cfg) to 0.

Set Input 1 Scaling Upper Limit (*_Ch3_Scl_H_Cfg) to +10,000.

The following diagram shows the correspondence between input signals and converted scaling values.



Input signal	Conversion result
0 V	0
10 V	10,000
-0.5 V	-500
10.5 V	10,500

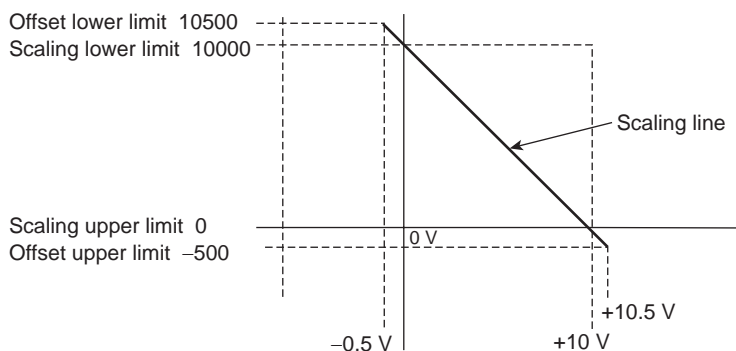
● Example Setting 2 (Reverse Scaling)

If the input 2 signal of 0 to 10 V is to be scaled to 10000 to 0, set as follows:

Set Input 2 Scaling Lower Limit (*_Ch4_Scl_L_Cfg) to +10,000.

Set Input 2 Scaling Upper Limit (*_Ch4_Scl_H_Cfg) to 0.

The following diagram shows the correspondence between input signals and converted scaling values.



Input signal	Conversion result
0 V	10,000
10 V	0
-0.5 V	10,500
10.5 V	-500

6-6-5 Input Disconnection Detection Function

When an input signal range of 1 to 5 V (4 to 20 mA) is used, you can detect input circuit disconnections. The detection conditions for each of the input signal ranges are shown in the following table.

Range	Current/voltage *
1 to 5 V	0.3 V max.
4 to 20 mA	1.2 mA max.

* The current/voltage level will fluctuate according to the offset/gain adjustment.

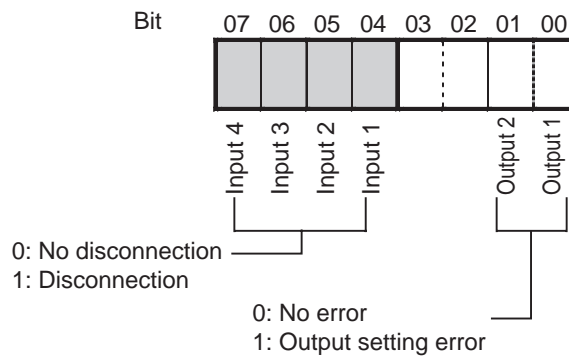
The disconnection detection status of each input is output to the device variable for CJ-series Unit Input # Disconnection Detected (*_Ch#_SensErr) shown below.

Variable name	Type	Setting
*_Ch#_SensErr	BOOL	0: No disconnection 1: Disconnection

An input number from 1 to 4 is included in place of # in the variable name.

In addition to output set value error, you can also perform batch readout with the device variable for CJ-series Unit Set value Errors and Disconnection Detected (*_MvSensErr) shown below.

Variable name	Type
*_MvSensErr	BYTE



Additional Information

The conversion value during a disconnection will be 0.

6-7 Analog Output Functions and Operating Procedures

6-7-1 Output Settings and Conversion Values

Setting Use Settings and Output Signal Ranges

● Output Use Settings

The Analog I/O Unit converts only the analog outputs specified among output numbers 1 and 2 and skips converting unused outputs.

Accordingly, the conversion cycle per unit is calculated by conversion cycle × number of output used.

For the conversion cycle setting, refer to *Conversion Cycle and Resolution Setting* on page 6-37.

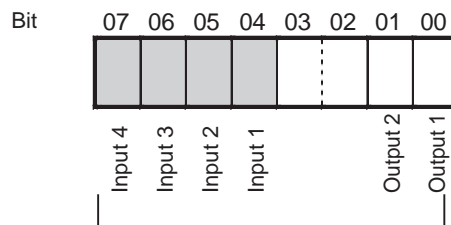
Use the Output # Use Setting (*_Ch#_OutChUseCfg) to set the analog outputs to be used.

Variable name	Type	Setting
*_Ch#_OutChUseCfg	BOOL	0: Not used 1: Used

An input number from 1 to 2 is included in place of # in the variable name.

In addition to input use setting, you can also perform batch settings with Input and Output Use Settings (*_ChUseCfg).

Variable name	Type	Setting
*_ChUseCfg	BYTE	16#00 to 16#F3



0: Not used
1: Used



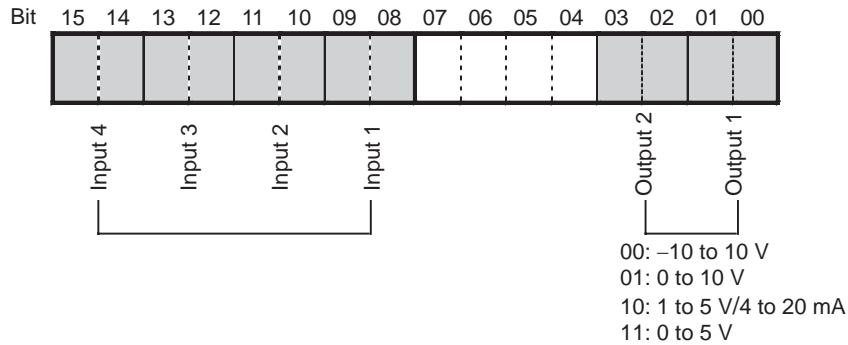
Additional Information

- The output value of the output number set to "Not used" will be 0 V.
- This value will be 500 μs when the setting is for 500 μs and a resolution of 8,000.

● Output Signal Ranges

You can select any of four types of output signal range (–10 to 10 V, 0 to 10 V, 1 to 5 V/4 to 20 mA, and 0 to 5 V) for each of the outputs (i.e., output numbers 1 to 4). To specify the output signal range, also set the input signal range with Signal Range Settings (*_RngCfg).

Variable name	Type	Setting
*_RngCfg	WORD	16#0000 to 16#FF0F



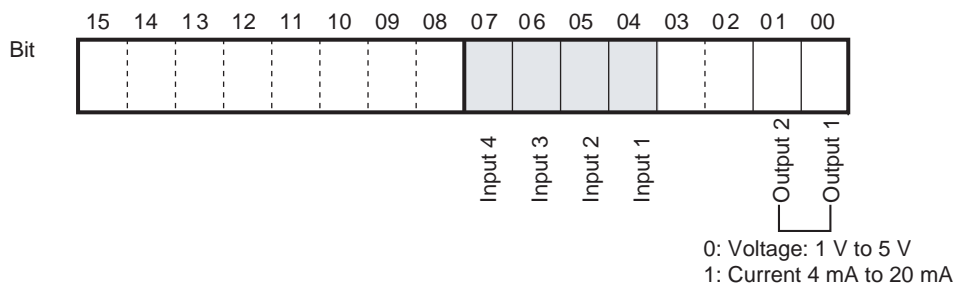
Precautions for Safe Use

- When initial setting parameters are set and transferred from Sysmac Studio, Sysmac Studio checks whether or not the Unit must be restarted. Restart the Unit after confirming the safety of the connected destination.
- The contents of initial setting parameters will be transferred to the Unit when the Controller is reset or when the Unit restarts.

Voltage/Current Range Setting

When 1 to 5 V/4 to 20 mA is selected for the output signal range settings, set the 1 to 5 V or 4 to 20 mA range for both the input voltage and current settings with the Voltage/Current Input Switch (*_RngVICfg).

Variable name	Type	Setting
*_RngVICfg	BYTE	16#00 to 16#F3



Writing Set Values

Use the device variable for CJ-series Unit Output # Set Value (*_Ch#_WrAO) shown below to set the analog output setting values.

Variable name	Type	Setting
*_Ch#_WrAO	INT	Refer to 6-1-4 Output Specifications.

Variable name # is output number 1 to 2



Additional Information

If the set value is written outside the specified range, an output setting error will occur and output hold function will activate.

Conversion Cycle and Resolution Setting

You can use Resolution/Conversion Time Settings (*_ResolutionCfg) to set the conversion cycle and resolution for the CJ1W-MAD42. This setting is common to all analog input and output settings.

Variable name	Type	Setting
*_ResolutionCfg	BYTE	16#00: 4,000 resolutions/1 ms cycle 16#C1: 8,000 resolutions/500 μs cycle



Precautions for Safe Use

- When initial setting parameters are set and transferred from Sysmac Studio, Sysmac Studio checks whether or not the Unit must be restarted. Restart the Unit after confirming the safety of the connected destination.
- The contents of initial setting parameters will be transferred to the Unit when the Controller is reset or when the Unit restarts.

Starting and Stopping Conversion

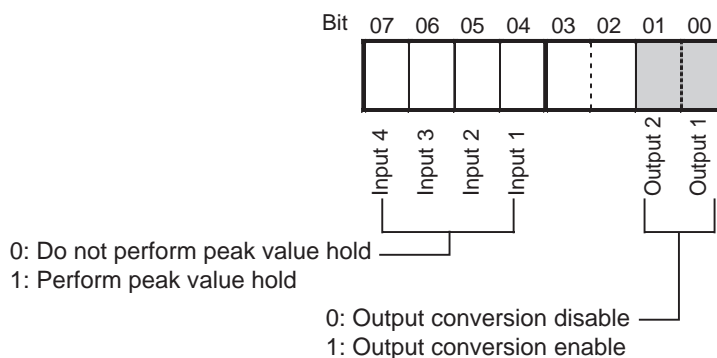
To begin analog output conversion, it is necessary to set the output used to conversion enable with the device variable for CJ-series Unit Output # Conversion Enable Settings (**_Ch#_ConvCmd*) shown below.

Variable name	Type	Setting
<i>*_Ch#_ConvCmd</i>	BOOL	0: Conversion disable
		1: Conversion enable

An output number from 1 to 2 is included in place of # in the variable name.

In addition to input peak value hold, you can also perform batch settings with the device variable for CJ-series Unit Peak Value Hold and Output Conversion Enable Settings (**_ConvPkJdCmd*) shown below.

Variable name	Type	Setting
<i>*_ConvPkJdCmd</i>	BYTE	16#00 to 16#F3



(n = 2000 + unit number × 10)



Additional Information

- The analog output when conversion is stopped will differ depending on the output signal range setting and output hold setting. Refer to *Output Signal Ranges* on page 6-36, *6-7-2 Output Hold Function*.
- Conversion will not begin under the following conditions even if the Conversion Enable Bit is turned ON.
 1. In Adjustment Mode, when something other than the output number is output during adjustment.
 2. When there is an output setting error
 3. When a major fault level Controller error occurs at the CPU Unit.
- When the CPU Unit changes from the RUN Mode to PROGRAM Mode, all output for the device variable for CJ-series Unit **_ConvCmd* will change to the status of conversion disabled. This also happens when the Controller is reset including when the power is turned ON. The output status at this time depends on the output hold function.

6-7-2 Output Hold Function

The Analog Output Unit stops conversion under the following circumstances and outputs the value set by the output hold function.

- 1** When the Conversion Enable Bit is OFF.
Refer to 6-7-1 *Output Settings and Conversion Values*.
- 2** In Adjustment Mode, when something other than the output number is output during adjustment.
Refer to 6-5-2 *Accessing from the User Program*.
- 3** When there is an output setting error.
Refer to 6-7-4 *Output Setting Errors* on page 6-42.
- 4** When a major fault level Controller error occurs.
- 5** When there is an input disconnection during ratio conversion.

You can select CLR, HOLD, or MAX for the output status when conversion is stopped.

Output signal range	CLR	HOLD	MAX
0 to 10 V	-0.5 V (Min. -5% of full scale)	Voltage that was output just prior to stop.	10.5 V (Max. +5% of full scale)
-10 to 10 V	0.0 V	Voltage that was output just prior to stop.	11.0 V (Max. +5% of full scale)
1 to 5 V	0.8 V (Min. -5% of full scale)	Voltage that was output just prior to stop.	5.2 V (Max. +5% of full scale)
0 to 5 V	-0.25 V (Min. -5% of full scale)	Voltage that was output just prior to stop.	5.25 V (Max. +5% of full scale)
4 to 20 mA	3.2 mA (Min. -0.5% of full scale)	Voltage that was output just prior to stop.	20.8 mA (Max. +5% of full scale)

The above values may fluctuate if offset/gain adjustment has been applied.

Use Output # Output Status When Conversion Stops (*_Ch#_HdMdCfg) to set the output hold function.

Variable name	Type	Setting
*_Ch#_HdMdCfg	USINT	0: CLR 1: HOLD 2: MAX

An output number from 1 to 2 is included in place of # in the variable name.



Precautions for Safe Use

- When initial setting parameters are set and transferred from Sysmac Studio, Sysmac Studio checks whether or not the Unit must be restarted. Restart the Unit after confirming the safety of the connected destination.
- The contents of initial setting parameters will be transferred to the Unit when the Controller is reset or when the Unit restarts.

6-7-3 Output Scaling Function

When upper and lower limits (within a range of $-32,000$ to $+32,000$) are preset, analog output setting values with the upper and lower limits taken as full scale are converted from digital to analog.

This scaling eliminates the previous need to provide a numeric conversion program. It is only enabled, however, for a conversion cycle of 1 ms and a resolution of 4,000 (and not for a conversion cycle of 500 μ s and a resolution of 8,000.)



Additional Information

- Besides setting the upper limit $>$ lower limit, it is also possible to set the lower limit $<$ upper limit. (Reverse scaling is supported.)
- Actual D/A conversion is executed at up to -5% to $+105\%$ of full scale.
- You cannot use the scaling function when the ratio conversion function is used.
- If the scaling upper limit equals the lower limit, or if the scaling upper limit or lower limit is outside the range of $\pm 32,000$, a scaling data setting error is generated and scaling cannot be executed. Operation starts normally when both the upper and lower limits are set to 0000 (the default values).

● Setting Upper and Lower Limits for Output Scaling

Use the initial setting parameters shown below to set the output scaling upper and lower limit values.

Variable name	Type	Setting
*_Ch#_Scl_L_Cfg	INT	Scaling lower limit ($-32,000$ to $+32,000$)
*_Ch#_Scl_H_Cfg	INT	Scaling upper limit ($-32,000$ to $+32,000$)

The I/O number is included in place of # in the variable name (Output = 1 to 2, Input = 3 to 6)



Precautions for Safe Use

- When initial setting parameters are set and transferred from Sysmac Studio, Sysmac Studio checks whether or not the Unit must be restarted. Restart the Unit after confirming the safety of the connected destination.
- The contents of initial setting parameters will be transferred to the Unit when the Controller is reset or when the Unit restarts.

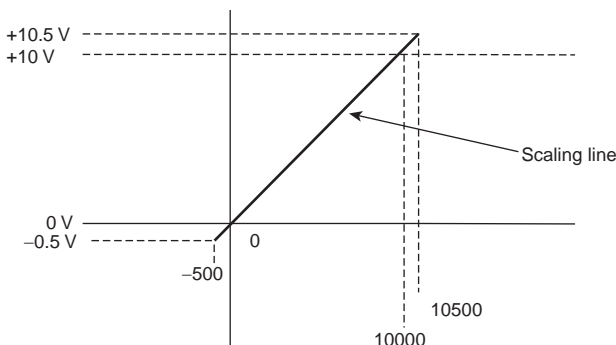
● **Example Setting 1**

If the output 1 signal of 0 to 10 V is to be scaled to a set value of 0 to 10000, set as follows:

Set Output 1 Scaling Lower Limit (*_Ch1_Scl_L_Cfg) to 0.

Set Output 1 Scaling Upper Limit (*_Ch1_Scl_H_Cfg) to +10,000.

The following diagram shows the correspondence between output signals and converted scaling values.



Output set value	Output signal
0	0 V
10,000	10 V
-500	-0.5 V
10,500	10.5 V

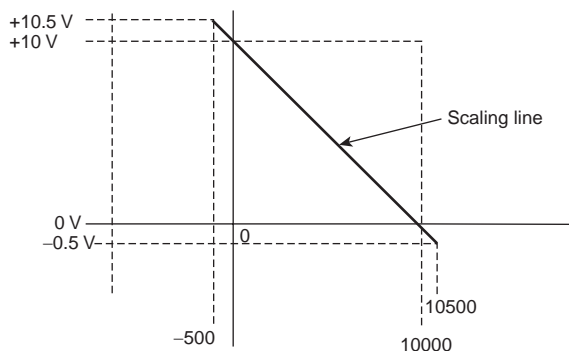
● **Example Setting 2 (Reverse Scaling)**

If the output 2 signal of 0 to 10 V is to be scaled to a set value of 10000 to 0, set as follows:

Set Output 2 Scaling Lower Limit (*_Ch2_Scl_L_Cfg) to +10,000.

Set Output 2 Scaling Upper Limit (*_Ch2_Scl_H_Cfg) to 0.

The following diagram shows the correspondence between input signals and converted scaling values.



Conversion result	Output signal
10,000	0 V
0	10 V
10,500	-0.5 V
-500	10.5 V

6-7-4 Output Setting Errors

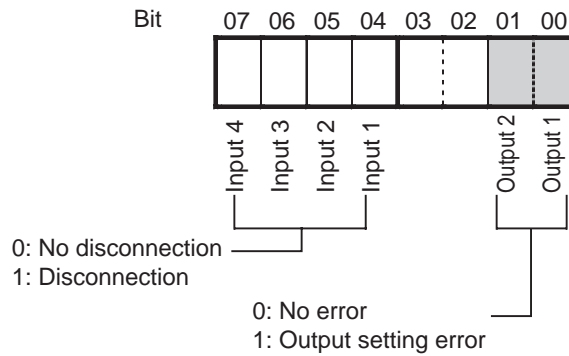
Use the device variable for CJ-series Unit Output # Output Set Value Error (**_Ch#_MVErr*) shown below to acquire the error status of the analog output setting value.

Variable name	Type	Setting
<i>*_Ch#_MVErr</i>	BOOL	0: No error 1: Setting error

An output number from 1 to 2 is included in place of # in the variable name.

In addition to input disconnection detected, you can perform batch readout with the device variable for CJ-series Unit Set value Errors and Disconnection Detected (**_MvSensErr*) shown below.

Variable name	Type
<i>*_MvSensErr</i>	BYTE



Additional Information

The voltage for an output number at which a setting error occurred will be output according to the output hold function.

6-8 Ratio Conversion Function

The Analog I/O Unit has a ratio conversion function that enables it to perform analog-to-analog conversions by itself, without use of the PLC. It can use either Loop 1 (input number 1 → output number 1) or Loop 2 (input number 2 → output number 2).

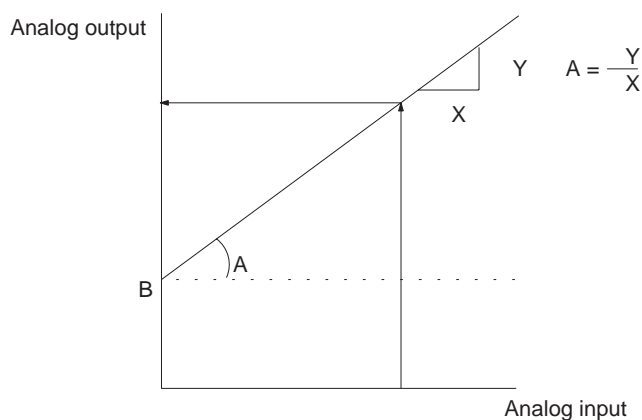
Input 1 → Ratio bias calculation → Output 1

Input 2 → Ratio bias calculation → Output 2

The relationship between the analog input and the analog output is expressed by the following conversion equations.

● Positive Gradient Conversion

$$(\text{Analog output}) = A \times (\text{Analog input}) + B$$



A: Ratio set value 0 to 99.99 (BCD)
B: Bias -32768 to +32767

The following example is for an I/O signal range of -10 to 10 V.

Constant A: 0050 (0.5)
Constant B: +400 (400/4000 resolutions × 20V = 2.0V)
Analog input: -10 to 10 V
Analog output = 0.5 × (-10 to 10 V) + 2.0 V
 = -3.0 to 7.0 V

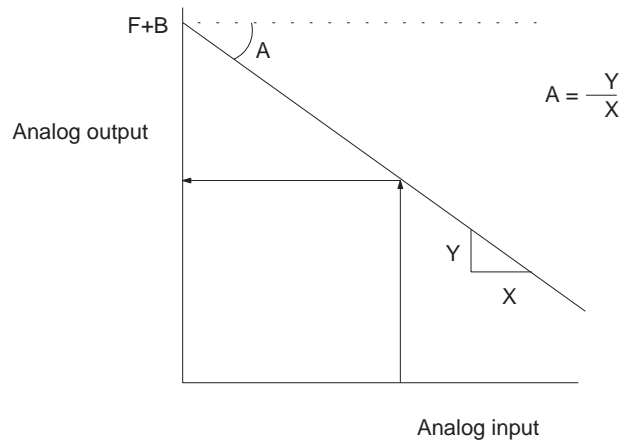


Additional Information

You cannot use the scaling function simultaneously with the ratio conversion function.

● Negative Gradient Conversion

$$(\text{Analog output}) = F - A \times (\text{Analog input}) + B$$



F: Output signal range maximum value
 A: Ratio set value 0 to 99.99 (BCD)
 B: Bias -32768 to +32767

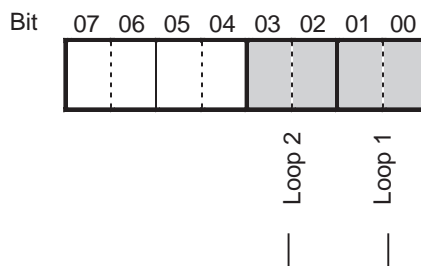
The following example is for an I/O range of 0 to 10 V.

Constant A: 1000 (10.0)
 Constant B: +200 (200/4000×10V=0.5V)
 F: 10 V
 Analog input: 0 to 1 V
 Analog output = 10 V - 10 × (0 to 1 V) + 0.5 V
 = 10.5 to 0.5 V

Specifying Ratio Conversion Function

To specify the use of Loop 1 and Loop 2 and their I/O relationships, set Ratio Conversion Use Setting (*_UseRatioBias).

Variable name	Type	Setting
UseRatioBias	BYTE	16#00 to 16#FF



00: Not used
 01: Use positive gradient conversion
 10: Use negative gradient conversion
 11: Same as 00 above



Additional Information

The response time of ratio conversion (input-to-output conversion) is 850 μs for a resolution of 4,000 and 420 μs for a resolution of 8,000.

Specifying Ratio Set Value and Bias

Set the initial setting parameters shown below for ratio conversion constant A (ratio set value) and ratio conversion constant B (bias value).

● Ratio conversion constant A

Loop # Ratio Conversion Constant A (*_Ch#_Cfg_Const_A)

Variable name	Type	Setting
*_Ch#_Cfg_Const_A	WORD	16#0000 to 16#9999 (0.00 to 99.99)

Variable name # is Loop 1 to 2

● Ratio conversion constant B

Loop # Ratio Conversion Constant B (*_Ch#_Cfg_Const_B)

Variable name	Type	Setting
*_Ch#_Cfg_Const_B	INT	-32768 to +32767

Variable name # is Loop 1 to 2



Precautions for Safe Use

- When initial setting parameters are set and transferred from Sysmac Studio, Sysmac Studio checks whether or not the Unit must be restarted. Restart the Unit after confirming the safety of the connected destination.
- The contents of initial setting parameters will be transferred to the Unit when the Controller is reset or when the Unit restarts.



Additional Information

- During use of the ratio conversion function, the device variable for CJ-series Unit Input # Conversion Data (*_Ch#_RdAI) of the input conversion value outputs the calculation result.
- If the Conversion Enable Flag is set to "disabled", the analog output value will be sent according to the output hold function.
- If an input cable is disconnected, the calculation result will become 0, and the analog output value will be output according to the output hold function.
- If the ratio conversion result exceeds the output signal range, the calculation result and analog output value are scaled out to the upper limit or lower limit, whichever corresponds to the direction of the limit exceeded by the ratio conversion result.



Common Items

This chapter explains usage common among Analog Input Units, Output Units and I/O Units.

7-1	Adjusting Offset and Gain	7-2
7-1-1	Adjustment Mode Operational Flow	7-3
7-1-2	Input Offset and Gain Adjustment Procedures	7-4
7-1-3	Output Offset and Gain Adjustment Procedures	7-9
7-2	When Errors and Alarms Occur	7-14
7-2-1	Indicators and Error Flowchart	7-14
7-2-2	Alarms Occurring at the Unit	7-16
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7-2-4	Restarting Special I/O Units	7-20
7-2-5	Troubleshooting	7-20
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7-1 Adjusting Offset and Gain

You can use these functions to calibrate inputs or outputs according to the devices that are connected.

● [Input Calibration Function]

When the resolution is set to 4,000, this function takes an output device's offset voltage (or current) and gain voltage (or current) as the analog input conversion data 0 and +4000 (or +2000 when the range is ± 10 V).

For example, when used in a range of 1 to 5 V, a range of 0.95 to 4.98 V may be output even if the external device specifications are for 1 to 5 V.

In such cases, when the external device outputs an offset voltage of 0.95 V, the conversion data at the Analog Input Unit will be -50 at the resolution of 4,000. When a gain voltage of 4.98 V is output, the conversion data will be +3980.

With the offset and gain adjustment functions, the values are converted from 0.95 V to 4.98 V to 0 to +4000 respectively (instead of -50 to 3980).

Output device offset and gain voltage	Converted data before adjustment	Converted data after adjustment
100.0	-50 (-100)	0
500.0	+3980 (+7960)	+4000 (+8000)

Resolution: 8,000

● [Output Calibration Function]

This function adjusts output voltages according to input device offset values and gain values, and takes the presently set values of the Unit to be 0 and +4000 (or +2000 when the range is ± 10 V) respectively.

For example, assume that the specifications for an external input device (such as a display device) are 100.0 to 500.0. If voltage is output by the Analog Output Unit at a set value of 0000, and the actual display at the external input device shows not 100.0 but 100.5, you can adjust the output voltage (lowered in this case) so that the display will show 100.0, and you can set the set value (-5 in this case) when the display shows exactly 100.0 to 0.

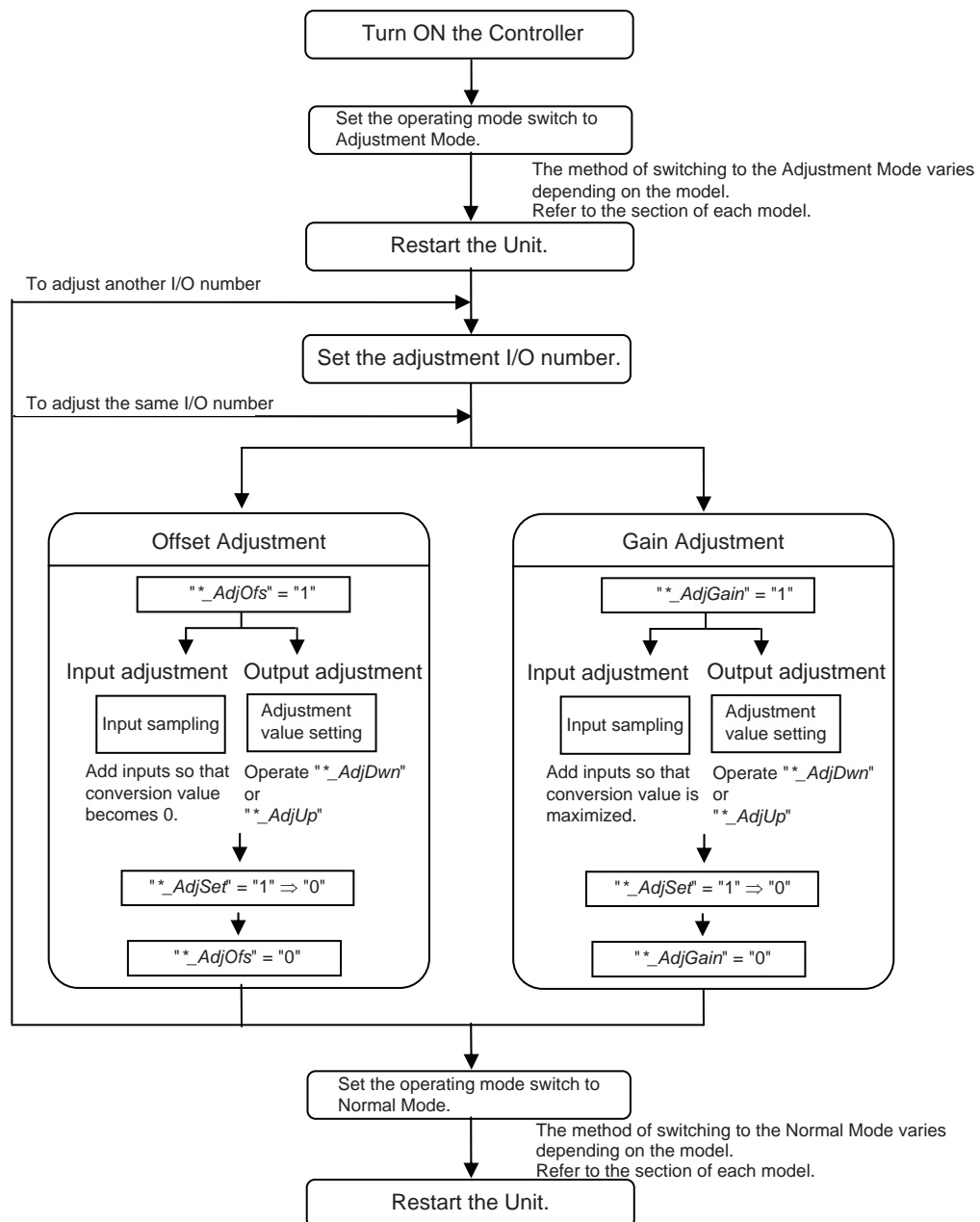
Similarly, for the gain value, if the Analog Output Unit outputs voltage at a set value of +4000, and the actual display at the external input device shows not 500.0 but 500.5, you can adjust the output voltage (lowered in this case) so that the display will show 500.0, and you can set the set value (+3995 in this case) when the display shows exactly 500.0 to +4000.

Display at external input device	Set value before adjustment	Set value after adjustment
100.0	-5 (-10)	0
500.0	+3995 (+7990)	+4000 (+8000)

Resolution: 8,000

7-1-1 Adjustment Mode Operational Flow

The following diagram shows the flow of operations when using the Adjustment Mode to adjust offset and gain.



Precautions for Correct Use

- Set the CPU Unit to PROGRAM Mode when the Analog I/O Unit is used in Adjustment Mode. If the CPU Unit is in RUN Mode, operation of the Unit stops, and the input and output values that existed immediately before this stoppage will be retained.
- To make adjustments, be sure to perform both the offset adjustment and gain adjustment at the same time.



Additional Information

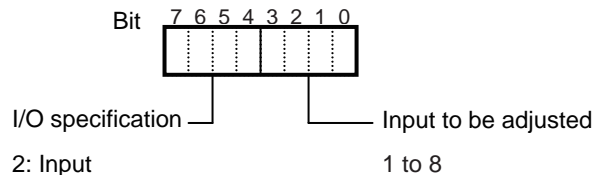
You can perform input adjustments more accurately in conjunction with mean value processing.

7-1-2 Input Offset and Gain Adjustment Procedures

Specifying Input Number to be Adjusted

Use the device variable for CJ-series Unit Inputs to Be Adjusted (**_AdjCh*) shown below to specify the input number to be adjusted.

Variable name	Type	Setting
<i>*_AdjCh</i>	BYTE	16#21 to 16#28



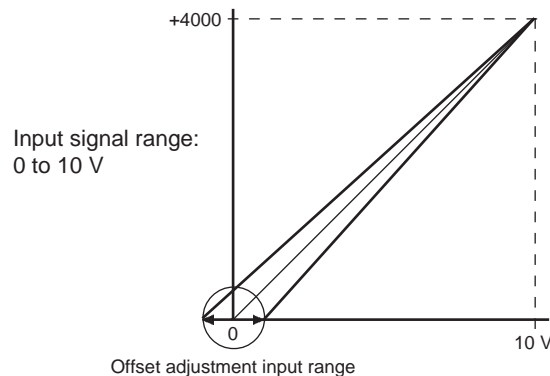
Bits Used for Adjusting Offset and Gain

Use the device variables for CJ-series Unit shown below to adjust offset and gain.

Variable name	Type	Function
<i>*_AdjOfs</i>	BOOL	Offset Flag
<i>*_AdjGain</i>	BOOL	Gain Flag
<i>*_AdjSet</i>	BOOL	Adjustment Value Set Flag: Confirm the adjustment (offset/gain).
<i>*_AdjClr</i>	BOOL	Adjustment Value Clear Flag: Cancel the adjusted value currently set and restore the original adjusted value.

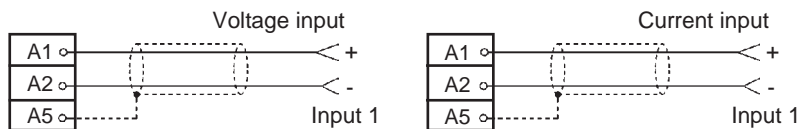
Offset Adjustment

The procedure to adjust the analog input offset is explained below. As shown in the following diagram, the offset is adjusted by sampling inputs so that the conversion value becomes 0.



The following example uses input number 1 adjustment.

- 1** Set the device variable for CJ-series Unit Inputs to Be Adjusted (**_AdjCh*) to 16#21. (Adjustment of input 1)
- 2** Set the device variable for CJ-series Unit Offset Flag (**_AdjOfs*) to 1.
The device variable for CJ-series Unit Conversion value for adjustment (**_AdjPV*) will monitor the analog input's digital conversion values while the Offset Flag is ON.
- 3** Check whether the input devices are connected.



For current input, check that the voltage/current switch is ON.

- 4** Input the voltage or current so that the conversion value becomes "0". The following table shows the offset adjustment voltages and currents to be input according to the input signal range.

Input signal range	Input range	"*_AdjPV" monitor value
0 to 10 V	-0.5 V to +0.5 V	-200 to +200 (-400 to +400)
-10 V to +10 V	-1.0 V to +1.0 V	
1 to 5 V	0.8 V to 1.2 V	
0 to 5 V	-0.25 V to +0.25 V	
4 to 20 mA	3.2 mA to 4.8 mA	

(Values in parentheses are for a resolution of 8,000.)

- 5** After you input the voltage or current so that the conversion value for the analog input terminal is 0, set the device variable for CJ-series Unit Adjustment Value Set Flag (**_AdjSet*) to 1, and then return it to 0.
While the device variable for CJ-series Unit Offset Flag (**_AdjOfs*) is set to 1, the offset value will be saved to the Unit's non-volatile memory when Adjustment Value Set Flag (**_AdjSet*) turns ON.
- 6** To finish the offset adjustment, set the device variable for CJ-series Unit Offset Flag (**_AdjOfs*) to 0.



Precautions for Correct Use

- Do not turn OFF the power supply or restart the Unit while the Adjustment Value Set Flag is ON (while data is written to the non-volatile memory). Otherwise, illegal data may be written in the Unit's non-volatile memory and "Non-volatile Memory Error" may occur when the power supply is turned ON or when the Unit is restarted, which will cause a malfunction.
- To make adjustments, be sure to perform both the offset adjustment and gain adjustment at the same time.

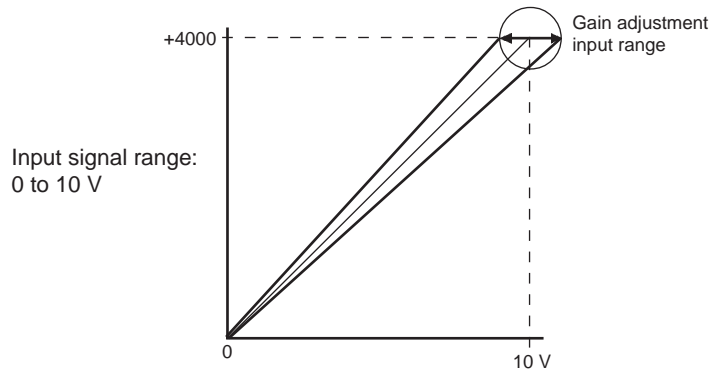


Additional Information

- You can overwrite the non-volatile memory 50,000 times.
- While the Offset Flag or the Gain Flag is ON, the present conversion data displays in device variable for CJ-series Unit Conversion value for adjustment (*_AdjPV).
If the Offset Flag is OFF, the value immediately before you turned the bit OFF is held.

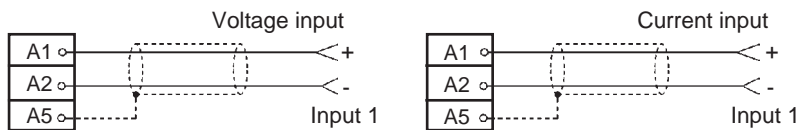
Gain Adjustment

The procedure to adjust the analog input gain is explained below. As shown in the following diagram, the gain is adjusted by sampling inputs so that the conversion value is maximized.



The following example uses input number 1 adjustment.

- 1** Set the device variable for CJ-series Unit Inputs to Be Adjusted (*_AdjCh) to 16#21. (Adjustment of input 1)
- 2** Set the device variable for CJ-series Unit Gain Flag (*_AdjGain) to 1.
The device variable for CJ-series Unit Conversion value for adjustment (*_AdjPV) will monitor the analog input's digital conversion values while the Gain Flag is ON.
- 3** Check whether the input devices are connected.



For current input, check that the voltage/current switch is ON.

- 4** Input the voltage or current so that the conversion value is maximized (+4000 or +8000 (for a resolution of 8,000)). The following table shows the gain adjustment voltages and currents to be input according to the input signal range.

Input signal range	Input range	"*_AdjPV" monitor value
0 to +10 V	9.5 V to 10.5 V	+3800 to +4200 (+7600 to +8400)
-10 V to +10 V	9.0 V to 11.0 V	+1800 to +2200 (+3600 to +4400)
1 to 5 V	4.8 V to 5.2 V	+3800 to +4200 (+7600 to +8400)
0 to 5 V	4.75 V to 5.25 V	+3800 to +4200 (+7600 to +8400)
4 to 20 mA	19.2 mA to 20.8 mA	+3800 to 4200 (+7600 to +8400)

(Values in parentheses are for a resolution of 8,000.)

- 5** After inputting the voltage or current so that the conversion value is maximized (+4000 or +8000 (for a resolution of 8,000)), set the device variable for CJ-series Unit Adjustment Value Set Flag (*_AdjSet) to 1, and then return it to 0.

While the device variable for CJ-series Unit Gain Flag (*_AdjGain) is set to 1, the gain value will be saved to the Unit's non-volatile memory when Adjustment Value Set Flag (*_AdjSet) turns ON.

- 6** To finish the gain adjustment, set the device variable for CJ-series Unit Gain Flag (*_AdjGain) to 0.



Precautions for Correct Use

- Do not turn OFF the power supply or restart the Unit while the Adjustment Value Set Flag is ON (while data is written to the non-volatile memory). Otherwise, illegal data may be written in the Unit's non-volatile memory and "Non-volatile Memory Error" may occur when the power supply is turned ON or when the Unit is restarted, which will cause a malfunction.
- To make adjustments, be sure to perform both the offset adjustment and gain adjustment at the same time.



Additional Information

- You can overwrite the non-volatile memory 50,000 times.
- While the Offset Flag or the Gain Flag is ON, the present conversion data will be displayed in the device variable for CJ-series Unit Conversion value for adjustment (*_AdjPV). If the Gain Flag OFF, the value immediately before you turned the Bit OFF is held.

Clearing Offset and Gain Adjusted Values

Follow the procedure outlined below to return the offset and gain adjusted values to their default settings.

The following example uses input number 1 adjustment. (The unit number is 0.)

- 1** Set the device variable for CJ-series Unit Inputs to Be Adjusted (**_AdjCh*) to 16#21. (Adjustment of input 1)
- 2** Set the device variable for CJ-series Unit Adjustment Value Clear Flag (**_AdjClr*) to 1.
Regardless of the input value, the device variable for CJ-series Unit Conversion Value for Adjustment (**_AdjPV*) will monitor 0.
- 3** Set the device variable for CJ-series Unit Adjustment Value Set Flag (**_AdjSet*) to 1 and return it to 0.
While the device variable for CJ-series Unit Adjustment Value Clear Flag (**_AdjClr*) is set to 1, the adjustment value will be cleared and reset to the default offset and gain values when Adjustment Value Set Flag (**_AdjSet*) turns ON.
- 4** To finish clearance of adjustment values, set the device variable for CJ-series Unit Adjustment Value Clear Flag (**_AdjClr*) to 0.



Precautions for Correct Use

Do not turn OFF the power supply or restart the Unit while the Adjustment Value Set Flag is ON (while data is written to the non-volatile memory). Otherwise, illegal data may be written in the Unit's non-volatile memory and "Non-volatile Memory Error" may occur when the power supply is turned ON or when the Unit is restarted, which will cause a malfunction.



Additional Information

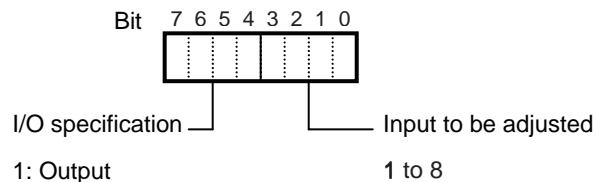
You can overwrite the non-volatile memory 50,000 times.

7-1-3 Output Offset and Gain Adjustment Procedures

Specifying Output Number to be Adjusted

Use the device variable for CJ-series Unit Outputs to Be Adjusted (**_AdjCh*) shown below to specify the output number to be adjusted.

Variable name	Type	Setting
<i>*_AdjCh</i>	BYTE	16#11 to 16#18



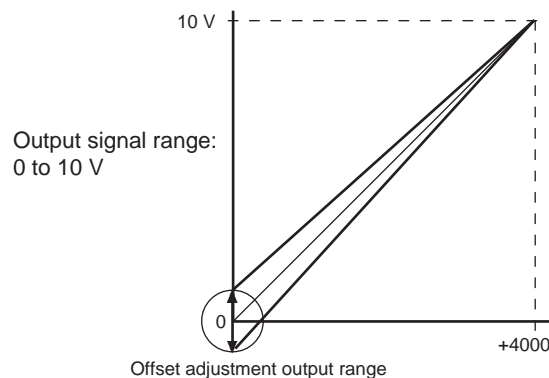
Bits Used to Adjust Offset and Gain

Use bit operation of the device variables for CJ-series Unit shown below to adjust offset and gain.

Variable name	Type	Function
<i>*_AdjOfs</i>	BOOL	Offset Flag
<i>*_AdjGain</i>	BOOL	Gain Flag
<i>*_AdjDwn</i>	BOOL	Adjustment Value Down Flag: Decrease the adjusted value by one resolution.
<i>*_AdjUp</i>	BOOL	Adjustment Value Up Flag: Increase the adjusted value by one resolution.
<i>*_AdjSet</i>	BOOL	Adjustment Value Set Flag: Confirm the adjustment (offset/gain).
<i>*_AdjClr</i>	BOOL	Adjustment Value Clear Flag: Cancel the adjusted value currently set and restore the original adjusted value.

Offset Adjustment

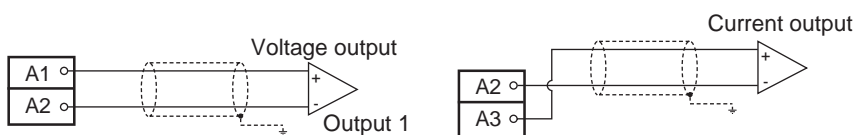
The procedure to adjust the analog output offset is explained below. As shown in the following diagram, the set value is adjusted so that the analog output reaches the standard value (0 V/1 V/4 mA).



The following example uses output number 1 adjustment.

- 1** Set the device variable for CJ-series Unit Outputs to Be Adjusted (**_AdjCh*) to 16#11. (Adjustment of output 1)
- 2** Set the device variable for CJ-series Unit Offset Flag (**_AdjOfs*) to 1.

- 3** Check whether the output devices are connected.



- 4** Monitor the device variable for CJ-series Unit Conversion value for adjustment (**_AdjPV*) and check the output value while the Offset Flag is ON.

- 5** Change the output value so that the output voltage reaches the standard value. You can adjust the output value within the indicated ranges in the following table.

Output signal range	Possible output voltage/ current adjustment	Output range
0 to 10 V	-0.5 to +0.5 V	-200 to +200 (-400 to +400)
-10 V to +10 V	-1.0 to +1.0 V	
1 to 5 V	0.8 to 1.2 V	
0 to 5 V	-0.25 to +0.25 V	
4 to 20 mA	3.2 to 4.8 mA	

Use bit operation of the device variables for CJ-series Unit shown below to adjust the output value.

Variable name	Type	Function
<i>*_AdjDwn</i>	BOOL	Adjustment Value Down Flag: Decrease the adjusted value by one resolution.
<i>*_AdjUp</i>	BOOL	Adjustment Value Up Flag: Increase the adjusted value by one resolution.

With both the Up Flag and Down Flag, the output changes by one resolution every 0.5 second while the flag is ON. If the Bit remains ON for 3 seconds, the output changes by one resolution every 0.1 seconds.

- 6** Check the 0-V/1-V/4-mA output, and then set the device variable for CJ-series Unit Adjustment Value Set Flag (**_AdjSet*) to 1 and then return it to 0.

While the device variable for CJ-series Unit Offset Flag (**_AdjOfs*) is set to 1, the offset value will be save to the Unit's non-volatile memory when Adjustment Value Set Flag (**_AdjSet*) turns ON.

- 7** To finish the offset adjustment, set the device variable for CJ-series Unit Offset Flag (**_AdjOfs*) to 0.



Precautions for Correct Use

- Do not turn OFF the power supply or restart the Unit while the Adjustment Value Set Flag is ON (while data is written to the non-volatile memory). Otherwise, illegal data may be written in the Unit's non-volatile memory and "Non-volatile Memory Error" may occur when the power supply is turned ON or when the Unit is restarted, which will cause a malfunction.
- To make adjustments, be sure to perform both the offset adjustment and gain adjustment at the same time.

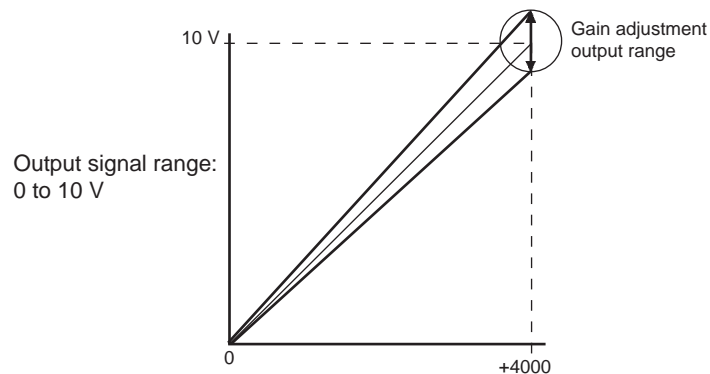


Additional Information

You can overwrite the non-volatile memory 50,000 times.

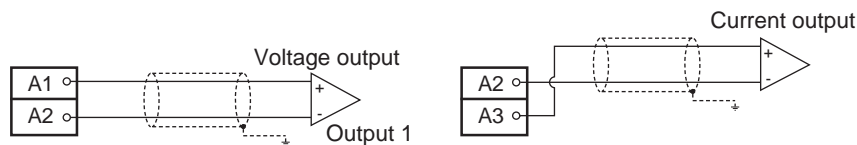
Gain Adjustment

The procedure to adjust the analog output gain is explained below. As shown in the following diagram, the set value is adjusted so that the analog output is maximized (to 10 V/5 V/20 mA).



The following example uses output number 1 adjustment.

- 1** Set the device variable for CJ-series Unit Outputs to Be Adjusted (**_AdjCh*) to 16#11. (Adjustment of output 1)
- 2** Set the device variable for CJ-series Unit Gain Flag (**_AdjGain*) to 1.
- 3** Check whether the output devices are connected.



- 4** Monitor the device variable for CJ-series Unit Conversion value for adjustment (**_AdjPV*) and check the output value while the Gain Flag is ON.
- 5** Change the output value so that the output voltage reaches the standard value. You can adjust the output value within the indicated ranges in the following table.

Output signal range	Possible output voltage/ current adjustment	Output range
0 to 10 V	9.5 to 10.5 V	+3800 to +4200 (+7600 to +8400)
-10 V to +10 V	9 to 11 V	+1800 to +2200 (+3600 to +4400)
1 to 5 V	4.8 to 5.2 V	+3800 to +4200 (+7600 to +8400)
0 to 5 V	4.75 to 5.25 V	+3800 to +4200 (+7600 to +8400)
4 to 20 mA	19.2 to 20.8 mA	+3800 to +4200 (+7600 to +8400)

(Values in parentheses are for a resolution of 8,000.)

Use bit operation of the device variables for CJ-series Unit shown below to adjust the output value.

Variable name	Type	Function
<i>*_AdjDwn</i>	BOOL	Adjustment Value Down Flag: Decrease the adjusted value by one resolution.
<i>*_AdjUp</i>	BOOL	Adjustment Value Up Flag: Increase the adjusted value by one resolution.

With both the Up Flag and Down Flag, the output changes by one resolution every 0.5 second while the Bit is ON. If the Bit remains ON for 3 seconds, the output changes by one resolution every 0.1 seconds.

- 6** Check the 10-V/5-V/20-mA output, and then set the device variable for CJ-series Unit Adjustment Value Set Flag (**_AdjSet*) to 1 and then return it to 0.

While the device variable for CJ-series Unit Gain Flag (**_AdjGain*) is set to 1, the gain value will be saved to the Unit's non-volatile memory when Adjustment Value Set Flag (**_AdjSet*) turns ON.

- 7** To finish the offset adjustment, set the device variable for CJ-series Unit Offset Flag (**_AdjOfs*) to 0.



Precautions for Correct Use

- Do not turn OFF the power supply or restart the Unit while the Set Flag is ON (while data is written to the non-volatile memory). Otherwise, illegal data may be written in the Unit's non-volatile memory and "Non-volatile Memory Error" may occur when the power supply is turned ON or when the Unit is restarted, which will cause a malfunction.
 - To make adjustments, be sure to perform both the offset adjustment and gain adjustment at the same time.
-



Additional Information

You can overwrite the non-volatile memory 50,000 times.

Clearing Offset and Gain Adjusted Values

Follow the procedure outlined below to return the offset and gain adjusted values to their default settings.

The following example uses output number 1 adjustment.

- 1** Set the device variable for CJ-series Unit Outputs to Be Adjusted (**_AdjCh*) to 16#11. (Adjustment of output 1)
- 2** Set the device variable for CJ-series Unit Adjustment Value Clear Flag (**_AdjClr*) to 1.
Regardless of the output value, the device variable for CJ-series Unit Conversion value for adjustment (**_AdjPV*) will monitor 0.
- 3** Set the device variable for CJ-series Unit Adjustment Value Set Flag (**_AdjSet*) to 1 and return it to 0.
While the device variable for CJ-series Unit Adjustment Value Clear Flag (**_AdjClr*) is set to 1, the adjustment value will be cleared and reset to the default offset and gain values when Adjustment Value Set Flag (**_AdjSet*) turns ON.
- 4** To finish the clearance of adjustment values, set the device variable for CJ-series Unit Adjustment Value Clear Flag (**_AdjClr*) to 0.



Precautions for Correct Use

Do not turn OFF the power supply or restart the Unit while the Adjustment Value Set Flag is ON (while data is written to the non-volatile memory). Otherwise, illegal data may be written in the Unit's non-volatile memory and "Non-volatile Memory Error" may occur when the power supply is turned ON or when the Unit is restarted, which will cause a malfunction.



Additional Information

You can overwrite the non-volatile memory 50,000 times.

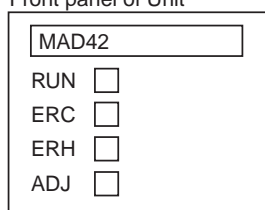
7-2 When Errors and Alarms Occur

7-2-1 Indicators and Error Flowchart

Indicators

If an alarm or error occurs in the Analog Input, Analog Output or Analog I/O Units, the ERC or ERH indicators on the front panel of the Unit will light.

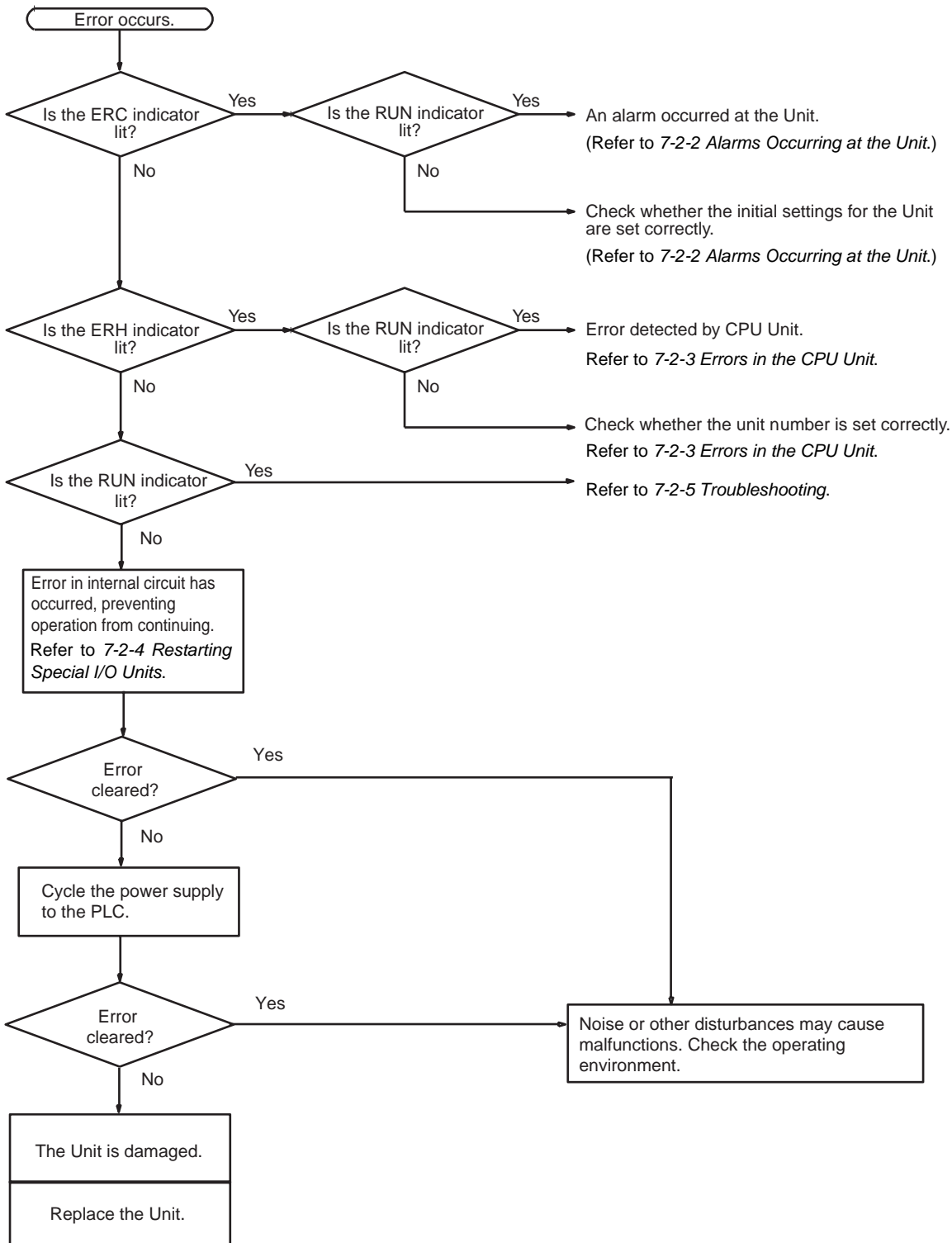
Front panel of Unit



LED	Meaning	Indicator	Operating status
RUN (green)	Operating	Lit	Operating in Normal Mode.
		Not lit	Unit has stopped exchanging data with the CPU Unit.
ERC (red)	Error detected by Unit	Lit	Alarm has occurred (such as disconnection detection) or initial settings are incorrect.
		Not lit	Operating normally.
ERH (red)	Error in the CPU Unit	Lit	Error has occurred during data exchange with the CPU Unit.
		Not lit	Operating normally.
ADJ (yellow)	Adjusting	Flashing	Operating in offset/gain Adjustment Mode.
		Not lit	Other than the above.

Troubleshooting Procedure

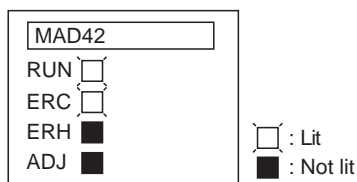
Use the following procedure for troubleshooting the Unit errors.



7-2-2 Alarms Occurring at the Unit

When an alarm occurs at the Unit, the ERC indicator lights and the error information is output to the device variable for CJ-series Unit.

● ERC and RUN Indicators: Lit



The ERC and RUN indicators will light if an error occurs while Unit operation is normal.

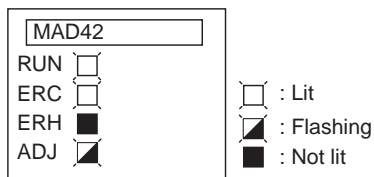
The alarm information is output to the device variable for CJ-series Unit shown below.

These alarm flags will turn OFF automatically when the error is cleared.

Variable name (applicable model)	Alarm name	Error contents	I/O status	Countermeasure
* <i>Ch#_MVErr</i> (DA0□1/DA08□/DA042V/MAD42)	Output Set Value Error	The output setting range was exceeded.	Output value set by output hold function.	Correct the set value.
* <i>Ch#_SensErr</i> (AD0□1-V1/AD042/MAD42)	Disconnection Detected	A disconnection was detected. *	Conversion data becomes 0.	The inputs may be disconnected. Restore any disconnected inputs.
* <i>AdjMemErr</i> (AD0□1-V1/DA0□1/DA08□/MAD42)	(Adjustment Mode) Non-volatile Memory Error	A Non-volatile Memory Error occurred while in Adjustment Mode.	Output status immediately prior to error held.	<ul style="list-style-type: none"> Operate the Adjustment Value Set Flag again. If the error persists even after rewriting the adjustment value, replace the Unit.
* <i>ConvErr</i> (AD042)	A/D Conversion Error	An error occurred in the A/D converter or in A/D conversion.	Values immediately prior to error held. No data is changed.	<ul style="list-style-type: none"> If the error persists even after the power supply is cycled or the Unit is restarted, check for a source of noise in the environment. If the error persists even when there is no source of noise, replace the Unit.

* Disconnection detection operates for input numbers used with a range of 1 to 5 V (4 to 20 mA).

● ERC Indicator and RUN Indicator: Lit, ADJ Indicator: Flashing

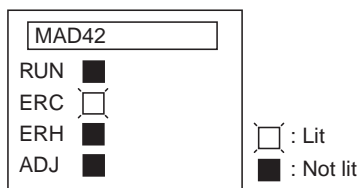


This alarm will occur in the case of incorrect operation while in the Adjustment Mode.

The alarm information is output to the device variables for CJ-series Unit shown below.

Variable name (applicable model)	Alarm name	Error contents	I/O status	Countermeasure
*_AdjInErr (AD0□1-V1) *_AdjInMdErr (MAD42)	(Adjustment Mode) Conversion Time/Resolution or Operation Mode Setting Error	In Adjustment Mode, you cannot adjust offset or gain because input value is out of the permissible range for adjustment.	Conversion data that corresponds to the input signal is monitored in the device variable for CJ-series Unit "_AdjPV".	If you make the adjustment by means of a connected input device, first adjust the input device before adjusting the Analog I/O Unit.
*_AdjInNoErr (AD0□1-V1) *_AdjOutNoErr (DA0□1/DA08□) *_AdjIONoErr (MAD42)	(Adjustment Mode) Input Value Adjustment Number Setting Error Output Value Adjustment Number Setting Error Input/Output Value Adjustment Number Setting Error	In Adjustment Mode, you cannot perform adjustment because the specified input or output number is not set for use or because the wrong input or output number is specified.	Values immediately prior to error held. No data is changed.	<ul style="list-style-type: none"> Check whether the device variable for CJ-series Unit "_AdjCh" is set correctly. Check whether the input or output number to be adjusted is set for use by means of the DM setting.

● ERC Indicator: Lit, RUN Indicator: Not Lit



The ERC indicator will light when the initial settings for the Unit are not set correctly.

The alarm information is output to the device variables for CJ-series Unit shown below.

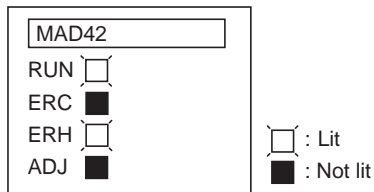
These alarm flags will turn OFF when the error is cleared and the Unit is restarted.

Variable name (applicable model)	Alarm name	Error contents	I/O status	Countermeasure
*_SciErr (AD042/DA08□/ DA042V/MAD42) *_AdjSciErr (DA08□/MAD42)	Ratio Conversion Use Setting Error (MAD42 only)	The I/O number for the ratio con- version func- tion has been to be not used.	Conversion does not start and data becomes "0".	Check the setting ranges of initial set- ting parameters spec- ified in the section of each model and cor- rect the settings.
	Scaling Data Set- ting Error	There is a mis- take in the upper or lower limit set- ting when scaling is used. The set value is exceeded, the upper limit equals the lower limit (not 0000), etc.		
*_RatioCfgErr AdjRatioCfgErr (MAD42)	Ratio Set Value Error	Data outside the setting range was specified for the ratio set value with the ratio conver- sion function.		
*_HdErr (DA0□1/DA08□/ DA042V/MAD42) *_AdjHdErr (DA0□1/DA08□/MA D42)	Output Hold Set- ting Error	The wrong output status for when conversion is stopped has been specified.		
*_AveErr (AD0□1-V1/AD042/ MAD42) *_AdjAveErr (AD0□1-V1/MAD42)	Mean Value Pro- cessing Setting Error	The wrong num- ber of samplings has been specified for mean value processing.		
*_CfgErr (AD042/DA042V)	Input Signal Range Setting Error or Error in Number of Inputs Setting Output Signal Range Setting Error or Error In Number of Out- puts Used Setting	The setting for the number of analog inputs used or the input signal range is wrong. The number of analog outputs used or output sig- nal range setting is wrong.		
*_MdErr (DA08□/MAD42)	Conversion Time/Resolution or Operation Mode Setting Error	The conversion cycle/resolution setting or Opera- tion Mode setting is incorrect.		
*_MdErr (AD042/DA042V)	Error in Setting of Conversion Mode	The conversion mode setting is wrong.		

7-2-3 Errors in the CPU Unit

When errors occur in the CPU Unit or I/O bus, and I/O refresh with the Special I/O Unit is not performed correctly resulting in the Unit malfunctioning, the ERH indicator will light.

● ERH and RUN Indicators: Lit

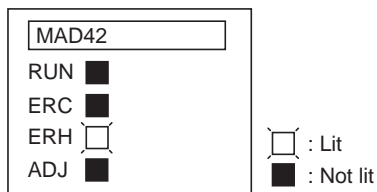


The ERH and RUN indicators will light if an error occurs in the I/O bus causing a WDT (watchdog timer) error in the CPU Unit, resulting in incorrect I/O refresh with the Unit.

Correct the cause of error and then reset the Controller or cycle the power.

Error	Error contents	Input status	Output status
I/O bus check error	An error occurred during data transmission with the CPU Unit.	Conversion data becomes 0000.	Output value set by output hold function.
CPU Unit monitoring error (see note)	No response from CPU Unit during fixed period.	Maintains the condition existing before the error.	Status from before error is maintained.
CPU Unit WDT error	An error was generated in CPU Unit.	Changes to undefined state.	Output value set by output hold function.

● ERH Indicator: Lit, RUN Indicator: Not Lit



The unit number for the Unit has not been set correctly.

Error	Error contents	Input status	Output status
Duplicate Unit Number	The same unit number has been assigned to more than one Unit or the unit number was set to a value other than 00 to 95.	Conversion does not start and data becomes 0000.	The output value will be 0 V.
I/O Setting Check Error	The Special I/O Units registered in the Unit Configuration in the CPU Unit are different from the ones actually mounted.		

7-2-4 Restarting Special I/O Units

To restart operation after you change initial setting parameters or remove the cause of an error, perform the following to restart the Unit:

Initial setting parameters are reflected after restart.

- Reset the Controller from Sysmac Studio.
- Restart from Sysmac Studio when initial setting parameters are transferred from Sysmac Studio.
- Turn the Controller power supply OFF and ON to reset the Controller.
- Issue a ResetUnit instruction to restart from the program.
- Restart with system-defined variables. (Restart from 0 to 1.)

Variable name	Type	
<code>_CJB_SIO**Restart</code>	BOOL	00 to 95 appears in place of ** to indicate the unit number.



Precautions for Correct Use

- If the error is not cleared even after restart, then replace the Unit.
- Input data will be 0000 and output will be 0 V or 0 mA during restart.

7-2-5 Troubleshooting

The following tables explain the probable causes of troubles that may occur, and the countermeasures for dealing with them.

Troubleshooting for Analog Input

● Conversion Data Does Not Change

Probable cause	Countermeasure	Page
The input is not set to be used.	Set the input to be used.	Refer to 2-6-1 <i>Input Settings and Conversion Values</i> . Refer to 3-6-1 <i>Input Settings and Conversion Values</i> . Refer to 6-6-1 <i>Input Settings and Conversion Values</i> .
The peak value hold function is in operation.	Turn OFF the peak value hold function if it is not required.	Refer to 2-6-3 <i>Peak Value Hold Function</i> . Refer to 3-6-4 <i>Peak Value Hold Function</i> . Refer to 6-6-3 <i>Peak Value Hold Function</i> .
The input device does not work, the input wiring is wrong, or there is a disconnection.	Use a tester to check for changes in the input voltage or current.	---
	Use Unit's error flags to check for a disconnection.	Refer to 2-6-4 <i>Input Disconnection Detection Function</i> . Refer to 3-6-5 <i>Input Disconnection Detection Function</i> . Refer to 6-6-5 <i>Input Disconnection Detection Function</i> .

● Value Does Not Change as Intended

Probable cause	Countermeasure	Page
The input device's signal range does not match the input signal range for the relevant input number at the Unit.	Check the specifications of the input device, and match the input signal range settings.	Refer to 2-6-1 <i>Input Settings and Conversion Values</i> . Refer to 3-6-1 <i>Input Settings and Conversion Values</i> . Refer to 6-6-1 <i>Input Settings and Conversion Values</i> .
The offset and gain are not adjusted.	Adjust the offset and gain.	Refer to 7-1 <i>Adjusting Offset and Gain</i> .
The voltage/current switch is not turned ON during use of the 4 mA to 20 mA range.	Turn ON the voltage/current switch.	Refer to 2-3-5 <i>Voltage/Current Switch</i> . Refer to 6-3-4 <i>Voltage/Current Switch</i> .
The ratio conversion function is set to be used, so the calculation results are monitored.	Correct the conversion settings.	Refer to 6-8 <i>Ratio Conversion Function</i> .

● Conversion Values are Inconsistent

Probable cause	Countermeasure	Page
The input signals are affected by external noise.	Change the shielded cable connection to the Unit's COM terminal.	Refer to 2-4-4 <i>Input Wiring Example</i> . Refer to 3-4-4 <i>Input Wiring Example</i> . Refer to 6-4-4 <i>I/O Wiring Example</i> .
	Insert a 0.01- μ F to 0.1- μ F ceramic capacitor or film capacitor between the input's (+) and (-) terminals.	---
	Increase the number of mean value processing samplings.	Refer to 2-6-2 <i>Mean Value Processing</i> . Refer to 3-6-2 <i>Mean Value Processing</i> . Refer to 6-6-2 <i>Mean Value Processing</i> .

Troubleshooting for Analog Output

● Analog Output Does Not Change

Probable Cause	Countermeasure	Page
The output is not set to be used.	Set the output to be used.	Refer to 4-6-1 <i>Output Settings and Conversion Values</i> . Refer to 5-6-1 <i>Output Settings and Conversion Values</i> . Refer to 6-7-1 <i>Output Settings and Conversion Values</i> .
The output hold function is in operation.	Turn ON the Output Conversion Enable Bit.	Refer to 4-6-2 <i>Output Hold Function</i> . Refer to 5-6-2 <i>Output Hold Function</i> . Refer to 6-7-2 <i>Output Hold Function</i> .
The conversion value is set outside of the permissible range.	Set the data within the range.	Refer to 4-6-1 <i>Output Settings and Conversion Values</i> . Refer to 5-6-1 <i>Output Settings and Conversion Values</i> . Refer to 6-7-1 <i>Output Settings and Conversion Values</i> .

● Output Does Not Change as Intended

Probable Cause	Countermeasure	Page
The output signal range setting is wrong.	Correct the output signal range setting.	Refer to 4-6-1 <i>Output Settings and Conversion Values</i> . Refer to 5-6-1 <i>Output Settings and Conversion Values</i> . Refer to 6-7-1 <i>Output Settings and Conversion Values</i> .
The I/O specifications of the output device do not match those of the Unit (e.g., input signal range, input impedance).	Change the output device.	Refer to 4-1-1 <i>Specifications</i> . Refer to 5-1-1 <i>Specifications</i> . Refer to 6-1-1 <i>Specifications</i> .
The offset or gain is not adjusted.	Adjust the offset or gain.	Refer to 7-1 <i>Adjusting Offset and Gain</i> .
The ratio conversion function is set to be used.	Correct the conversion settings.	Refer to 6-8 <i>Ratio Conversion Function</i> .

● Outputs are Inconsistent

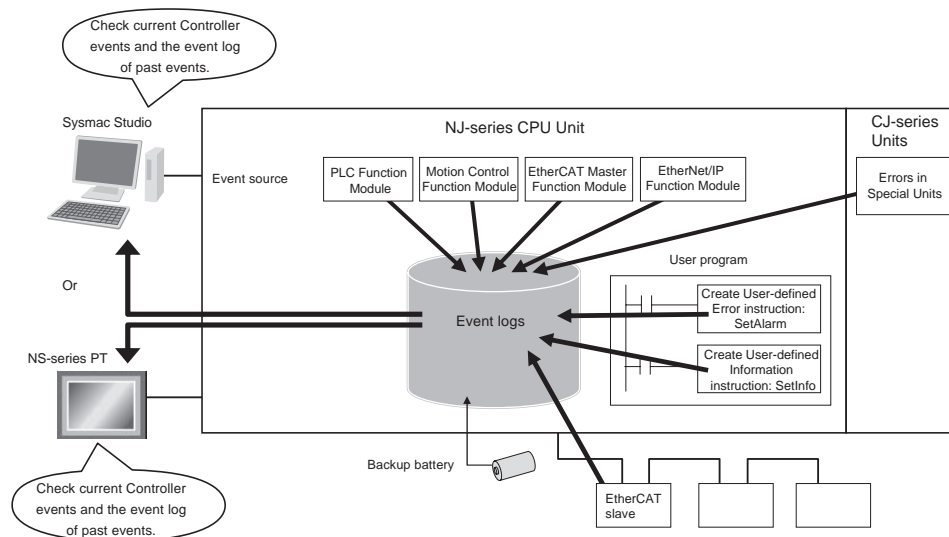
Probable Cause	Countermeasure	Page
The output signals are affected by external noise.	Change the shielded cable connection (e.g., the grounding at the output device).	---

7-3 Event Logs

7-3-1 Overview of the Event Logs

You use the same methods to manage all of the events that occur on the NJ-series Controller. (The events include errors and information.) You can use the Sysmac Studio or an NS-series PT to confirm current Controller events and the logs of events that have occurred. These logs are called event logs. Controller errors that occur for this Unit are also reported as events in the NJ-series CPU Unit.

Refer to the *NJ-series CPU Unit Software User's Manual* (Cat. No. W501) for details on the event logs in an *NJ-series CPU Unit*. Refer to the *NJ-series Troubleshooting Manual* (Cat. No. W503) for details on Controller errors, confirmation methods, and corrections.



To use an NS-series PT to check events, connect the PT to the built-in EtherNet/IP port on the CPU Unit.

7-3-2 Error Table

The errors that may occur for this Unit are listed below.

The following abbreviations and symbols are used in the event level column.

Abbreviation	Name
Maj	Major fault level
Prt	Partial fault level
Min	Minor fault level
Obs	Observation
Info	Information

Symbol	Meaning
S	Event levels that are defined by the system.
U	Event levels that can be changed by the user.*

* This symbol appears only for events for which the user can change the event level.

A version in parentheses in the *Event code* column is the unit version of the CPU Unit when the event was added.

Refer to the *NJ-series Troubleshooting Manual* (Cat. No. W503) for all of the event codes that may occur in an NJ-series Controller.

Event code	Event name	Meaning	Assumed cause	Level					Reference
				Maj	Prt	Min	Obs	Info	
04600000 hex	A/D Conversion Error	An error occurred in A/D conversion.	<ul style="list-style-type: none"> There is a source of noise nearby. A/D converter failed. 			S	U		page 27
04620000 hex	Non-volatile Memory Error	An error occurred in non-volatile memory.	<ul style="list-style-type: none"> There is a source of noise nearby. Non-volatile memory failed. 			S			page 27
34800000 hex	Mean Value Processing Setting Error	There is a mistake in the setting of the number of samplings for mean value processing.	<ul style="list-style-type: none"> There is a mistake in the setting of the number of samplings for mean value processing. 			S			page 28
34830000 hex	Scaling Data Setting Error	There is a mistake in the scaling data settings.	<ul style="list-style-type: none"> The upper or lower limit data for scaling is outside the setting range. Or, the maximum value and minimum value are not 0 and they are the same. 			S			page 28
34840000 hex	Input Signal Range Setting Error or Error in Number of Inputs Setting	There is a mistake in the input signal range setting or in the number of inputs setting.	<ul style="list-style-type: none"> The settings of the input signal range or the setting of the number of analog inputs that are used is incorrect. 			S			page 29
34850000 hex	Mean Value Processing Setting Error	There is a mistake in the setting of the number of samplings for mean value processing.	<ul style="list-style-type: none"> There is a mistake in the setting of the number of samplings for mean value processing. 			S			page 30
34860000 hex	Error in Setting of Conversion Mode	There is a mistake in the Conversion Mode setting.	<ul style="list-style-type: none"> The specification of the Cyclic Conversion Mode or Direct Conversion Mode is not correct. 			S			page 30
34870000 hex	Output Hold Setting Error	There is a mistake in the output hold setting.	<ul style="list-style-type: none"> The setting for output status when conversion stops is incorrect. 			S			page 31

Event code	Event name	Meaning	Assumed cause	Level					Reference
				Maj	Prt	Min	Obs	Info	
34890000 hex	Conversion Time/Resolution or Operation Mode Setting Error	There is a mistake in the conversion time/resolution or operation mode setting.	<ul style="list-style-type: none"> There is a mistake in the conversion time/resolution or operation mode setting. 			S			page 31
348A0000 hex	Output Signal Range Setting Error or Error In Number of Outputs Used Setting	There is a mistake in the output signal range setting or in the number of outputs setting.	<ul style="list-style-type: none"> There is a mistake in the output signal range setting or in the number of outputs setting. 			S			page 32
38010000 hex	Scaling Data Setting Error/Ratio Conversion Use Setting Error	There is an error in the scaling data setting or ratio conversion use setting.	<ul style="list-style-type: none"> The upper or lower limit data for scaling is outside the setting range. Or, the maximum value and minimum value are not 0 and they are the same. The I/O number for ratio conversion is set to <i>Not used</i> in the I/O specifications. 			S			page 32
38020000 hex	Ratio Set Value Error	There is a mistake in the ratio setting for ratio conversion.	<ul style="list-style-type: none"> A value other than 16#0000 to 16#9999 (0.00 to 99.99) was specified for the ratio conversion A constant for ratio conversion. 			S			page 33
64780000 hex	Input Disconnection Detected	The input is disconnected.	<ul style="list-style-type: none"> Input wiring is broken. Input wiring disconnection 			S	U		page 33
64790000 hex	Output Set Value Error	The output setting is out of range.	<ul style="list-style-type: none"> An output set value setting is out of range. 			S	U		page 34
34810000 hex	Input Value Exceeded Adjustment Range in Adjustment Mode	In Adjustment Mode, the input value exceeded the range for which adjustment is possible.	<ul style="list-style-type: none"> In Adjustment Mode, the input value exceeded the range for which adjustment is possible, so the offset and gain cannot be adjusted. 			U	S		page 34
34820000 hex	Input Number Specification Error in Adjustment Mode	The input number specified in Adjustment Mode is not enabled or the input number is wrong.	<ul style="list-style-type: none"> The input number that was specified in Adjustment Mode is not enabled. The setting of the Adjustment Input Number (device variable *_AdjCh) is incorrect, so adjustment is not possible. 			U	S		page 35
34880000 hex	Output Number Specification Error in Adjustment Mode	The output number specified in Adjustment Mode is not enabled or the output number is wrong.	<ul style="list-style-type: none"> The output number that was specified in Adjustment Mode is not enabled. The setting of the Adjustment Output Number (device variable *_AdjCh) is incorrect, so adjustment is not possible. 			U	S		page 35
348C0000 hex	I/O Number Specification Error in Adjustment Mode	The I/O numbers specified in Adjustment Mode are not enabled or the I/O numbers are wrong.	<ul style="list-style-type: none"> The I/O numbers that were specified in Adjustment Mode are not enabled. The setting of the Adjustment I/O Number (device variable *_AdjCh) is incorrect, so adjustment is not possible. 			U	S		page 36

7-3-3 Error Descriptions

This section describes the information that is given for individual errors.

Controller Error Descriptions

The items that are used to describe individual errors (events) are described in the following copy of an error table.

Event name	Gives the name of the error.		Event code	Gives the code of the error.		
Meaning	Gives a short description of the error.					
Source	Gives the source of the error.		Source details	Gives details on the source of the error.	Detection timing	Tells when the error is detected.
Error attributes	Level	Tells the level of influence on control.*1	Recovery	Gives the recovery method.*2	Log category	Tells which log the error is saved in.*3
Effects	User program	Tells what will happen to execution of the user program.*4	Operation	Provides special information on the operation that results from the error (event).		
System-defined variables	Variable	Data type		Name		
	Lists the variable names, data types, and meanings for system-defined variables that provide direct error notification, that are directly affected by the error, or that contain settings that cause the error.					
Cause and correction	Assumed cause		Correction		Prevention	
	Lists the possible causes, corrections, and preventive measures for the error.					
Attached information	This is the attached information that is displayed by the Sysmac Studio or an NS-series PT.					
Precautions/Remarks	Provides precautions, restrictions, and supplemental information. If the user can set the event level, the event levels that can be set, the recovery method, operational information, and other information are also provided.					

*1 One of the following:

Major fault: Major fault level
 Partial fault: Partial fault level
 Minor fault: Minor fault level
 Observation
 Information

*2 One of the following:

Automatic recovery: Normal status is restored automatically when the cause of the error is removed.
 Error reset: Normal status is restored when the error is reset after the cause of the error is removed.
 Cycle the power supply: Normal status is restored when the power supply to the Controller is turned OFF and then back ON after the cause of the error is removed.
 Controller reset: Normal status is restored when the Controller is reset after the cause of the error is removed.
 Depends on cause: The recovery method depends on the cause of the error.

*3 One of the following:

System: System event log
 Access: Access event log

*4 One of the following:

Continues: Execution of the user program will continue.
 Stops: Execution of the user program stops.
 Starts: Execution of the user program starts.

Error Descriptions

Event name	A/D Conversion Error			Event code	04600000 hex	
Meaning	An error occurred in A/D conversion.					
Source	PLC Function Module		Source details	CJ-series Unit	Detection timing	Continuously
Error attributes	Level	Minor fault	Recovery	Cycle the power supply.	Log category	System
Effects	User program	Continues.	Operation	Immediately previous values are held in the Unit and data is not updated.		
System-defined variables	Variable		Data type		Name	
	None		---		---	
Cause and correction	Assumed cause		Correction		Prevention	
	There is a source of noise nearby.		Implement noise countermeasures.		Use the Unit away from sources of noise. Implement noise countermeasures.	
	A/D converter failed.		If the above cause does not apply, replace the Unit.		None	
Attached information	None					
Precautions/Remarks	AD042: If conversion can be performed normally, A/D conversion will be performed with the A/D Conversion Error Flag turned ON. You can change the event level to the observation level. If you change the level to the observation level, recovery procedures are not required.					

Event name	Non-volatile Memory Error			Event code	04620000 hex	
Meaning	An error occurred in non-volatile memory.					
Source	PLC Function Module		Source details	CJ-series Unit	Detection timing	Continuously
Error attributes	Level	Minor fault	Recovery	Cycle the power supply.	Log category	System
Effects	User program	Continues.	Operation	The Unit will stop if this error is detected in self-diagnosis when the power supply is turned ON. Operation continues if the error occurs during operation.		
System-defined variables	Variable		Data type		Name	
	None		---		---	
Cause and correction	Assumed cause		Correction		Prevention	
	There is a source of noise nearby.		Implement countermeasures if there are nearby sources of noise.		Use the Unit away from sources of noise. Implement noise countermeasures.	
	Non-volatile memory failed.		If the above cause does not apply, replace the Unit.		None	
Attached information	None					
Precautions/Remarks	None					

7 Common Items

Event name	Mean Value Processing Setting Error			Event code	34800000 hex	
Meaning	There is a mistake in the setting of the number of samplings for mean value processing.					
Source	PLC Function Module		Source details	CJ-series Unit	Detection timing	At power ON, Controller reset, or restart
Error attributes	Level	Minor fault	Recovery	Error reset	Log category	System
Effects	User program	Continues.	Operation	Conversion will not start for the Unit and the data will be 0.		
System-defined variables	Variable		Data type		Name	
	None		---		---	
Cause and correction	Assumed cause		Correction		Prevention	
	There is a mistake in the setting of the number of samplings for mean value processing.		Correct the number of average samplings to a value between 0 and 6. Change the setting, and then restart the Unit.		Set the number of average samplings to a value between 0 and 6.	
Attached information	None					
Precautions/Remarks	None					

Event name	Scaling Data Setting Error			Event code	34830000 hex	
Meaning	There is a mistake in the scaling data settings.					
Source	PLC Function Module		Source details	CJ-series Unit	Detection timing	At power ON, Controller reset, or restart
Error attributes	Level	Minor fault	Recovery	Error reset	Log category	System
Effects	User program	Continues.	Operation	Conversion will not start at the Unit. The output will be 0 V for D/A conversion, and the data will be 0 for A/D conversion.		
System-defined variables	Variable		Data type		Name	
	None		---		---	
Cause and correction	Assumed cause		Correction		Prevention	
	The upper or lower limit data for scaling is outside the setting range. Or, the maximum value and minimum value are not 0 and they are the same.		Correct the set values of the scaling upper limit and scaling lower limit so that they are within the setting range. Set the ranges so that the upper limit does not equal the lower limit.		Set the set values of the scaling upper limit and scaling lower limit so that they are within the setting range. Set the ranges so that the upper limit does not equal the lower limit.	
Attached information	None					
Precautions/Remarks	None					

Event name	Input Signal Range Setting Error or Error in Number of Inputs Setting		Event code	34840000 hex		
Meaning	There is a mistake in the input signal range setting or in the number of inputs setting.					
Source	PLC Function Module		Source details	CJ-series Unit	Detection timing	At power ON, Controller reset, or restart
Error attributes	Level	Minor fault	Recovery	Error reset	Log category	System
Effects	User program	Continues.	Operation	Conversion will not start for the Unit and the data will be 0.		
System-defined variables	Variable		Data type		Name	
	None		---		---	
Cause and correction	Assumed cause		Correction		Prevention	
	The settings of the input signal range or the setting of the number of analog inputs that are used is incorrect.		<ul style="list-style-type: none"> If you set the number of analog inputs to use in device variable <code>*_InChUseCfg</code>, set the value to between 0 and 4. If you set the input signal range in device variable <code>*_Ch#_InRngCfg</code>, set the value to 0, 2, 3, 6, or 7. 0: -10 to 10 V 2: 0 to 10 V 3: 4 to 20 mA 6: -5 to 5 V 7: 1 to 5 V "#" in the variable name is the input number. 		<ul style="list-style-type: none"> If you set the number of analog inputs to use in device variable <code>*_InChUseCfg</code>, set the value to between 0 and 4. If you set the input signal range in device variable <code>*_Ch#_InRngCfg</code>, set the value to 0, 2, 3, 6, or 7. 0: -10 to 10 V 2: 0 to 10 V 3: 4 to 20 mA 6: -5 to 5 V 7: 1 to 5 V "#" in the variable name is the input number. 	
Attached information	None					
Precautions/Remarks	None					

Event name	Mean Value Processing Setting Error			Event code	34850000 hex	
Meaning	There is a mistake in the setting of the number of samplings for mean value processing.					
Source	PLC Function Module		Source details	CJ-series Unit	Detection timing	At power ON, Controller reset, or restart
Error attributes	Level	Minor fault	Recovery	Error reset	Log category	System
Effects	User program	Continues.	Operation	Conversion will not start for the Unit and the data will be 0000 hex.		
System-defined variables	Variable		Data type		Name	
	None		---		---	
Cause and correction	Assumed cause		Correction		Prevention	
	There is a mistake in the setting of the number of samplings for mean value processing.		Correct the number of average samplings to a value between 0 and 9. Change the setting, and then restart the Unit.		Set the number of average samplings to a value between 0 and 9.	
Attached information	None					
Precautions/Remarks	None					

Event name	Error in Setting of Conversion Mode			Event code	34860000 hex	
Meaning	There is a mistake is the Conversion Mode setting.					
Source	PLC Function Module		Source details	CJ-series Unit	Detection timing	At power ON, Controller reset, or restart
Error attributes	Level	Minor fault	Recovery	Error reset	Log category	System
Effects	User program	Continues.	Operation	Conversion will not start at the Unit. The output will be 0 V for D/A conversion, and the data will be 0 for A/D conversion.		
System-defined variables	Variable		Data type		Name	
	None		---		---	
Cause and correction	Assumed cause		Correction		Prevention	
	The specification of the Cyclic Conversion Mode or Direct Conversion Mode is not correct.		Set the Conversion Mode in the Special Unit Setup to Cyclic Mode. This error will not occur with A5 hex (Direct Conversion Mode), but the Direct Conversion Mode cannot be used with an NJ-series Controller.		Set the Conversion Mode in the Special Unit Setup to Cyclic Mode. This error will not occur with A5 hex (Direct Conversion Mode), but the Direct Conversion Mode cannot be used with an NJ-series Controller.	
Attached information	None					
Precautions/Remarks	None					

Event name	Output Hold Setting Error			Event code	34870000 hex	
Meaning	There is a mistake in the output hold setting.					
Source	PLC Function Module		Source details	CJ-series Unit	Detection timing	At power ON, Controller reset, or restart
Error attributes	Level	Minor fault	Recovery	Error reset	Log category	System
Effects	User program	Continues.	Operation	Conversion will not start for the Unit and the output will be 0 V.		
System-defined variables	Variable		Data type		Name	
	None		---		---	
Cause and correction	Assumed cause		Correction		Prevention	
	The setting for output status when conversion stops is incorrect.		<p>Correct the setting of the Output Status When Conversion Stopped (device variable <i>*_Ch#_HdMdCfg</i>) to 0, 1, or 2.</p> <p>0: CLR (Output 0 or minimum value of range.) 1: HOLD (Hold output value prior to stop.) 2: MAX (Output maximum value of range.)</p> <p>"#" in the variable name is the output number.</p>		<p>Set the Output Status When Conversion Stopped (device variable <i>*_Ch#_HdMdCfg</i>) to 0, 1, or 2.</p> <p>0: CLR (Output 0 or minimum value of range.) 1: HOLD (Hold output value prior to stop.) 2: MAX (Output maximum value of range.)</p> <p>"#" in the variable name is the output number.</p>	
Attached information	None					
Precautions/Remarks	None					

Event name	Conversion Time/Resolution or Operation Mode Setting Error			Event code	34890000 hex	
Meaning	There is a mistake in the conversion time/resolution or operation mode setting.					
Source	PLC Function Module		Source details	CJ-series Unit	Detection timing	At power ON, Controller reset, or restart
Error attributes	Level	Minor fault	Recovery	Error reset	Log category	System
Effects	User program	Continues.	Operation	Conversion will not start at the Unit. The output will be 0 V for D/A conversion, and the data will be 0 for A/D conversion.		
System-defined variables	Variable		Data type		Name	
	None		---		---	
Cause and correction	Assumed cause		Correction		Prevention	
	There is a mistake in the conversion time/resolution or operation mode setting.		<ul style="list-style-type: none"> If you set the conversion time and resolution in device variable <i>*_ResolutionCfg</i>, set the value to 16#00 or 16#C1. 16#00: 1 ms with resolution of 4,000 16#C1: 250 μs with resolution of 8,000 If you set the operation mode in device variable <i>*_MdCfg</i>, set the value to 16#00 or 16#C1. 16#00: Normal Mode 16#C1: Adjustment Mode 		<ul style="list-style-type: none"> If you set the conversion time and resolution in device variable <i>*_ResolutionCfg</i>, set the value to 16#00 or 16#C1. 16#00: 1 ms with resolution of 4,000 16#C1: 250 μs with resolution of 8,000 If you set the operation mode in device variable <i>*_MdCfg</i>, set the value to 16#00 or 16#C1. 16#00: Normal Mode 16#C1: Adjustment Mode 	
Attached information	None					
Precautions/Remarks	None					

Event name	Output Signal Range Setting Error or Error In Number of Outputs Used Setting		Event code	348A0000 hex		
Meaning	There is a mistake in the output signal range setting or in the number of outputs setting.					
Source	PLC Function Module		Source details	CJ-series Unit	Detection timing	At power ON, Controller reset, or restart
Error attributes	Level	Minor fault	Recovery	Error reset	Log category	System
Effects	User program	Continues.	Operation	Conversion will not start for the Unit and the output will be 0 V.		
System-defined variables	Variable		Data type		Name	
	None		---		---	
Cause and correction	Assumed cause		Correction		Prevention	
	There is a mistake in the output signal range setting or in the number of outputs setting.		<ul style="list-style-type: none"> If you set the number of analog outputs to use in device variable <code>*_OutChUseCfg</code>, set the value to between 0 and 4. If you set the output range in device variable <code>*_Ch#_OutRngCfg</code>, set the value to 1, 3, or 6. 1: 0 to 10 V 3: -10 to 10 V 6: 1 to 5 V “#” in the variable name is the output number. 		<ul style="list-style-type: none"> If you set the number of analog outputs to use in device variable <code>*_OutChUseCfg</code>, set the value to between 0 and 4. If you set the output range in device variable <code>*_Ch#_OutRngCfg</code>, set the value to 1, 3, or 6. 1: 0 to 10 V 3: -10 to 10 V 6: 1 to 5 V “#” in the variable name is the output number. 	
Attached information	None					
Precautions/Remarks	None					

Event name	Scaling Data Setting Error/Ratio Conversion Use Setting Error		Event code	38010000 hex		
Meaning	There is an error in the scaling data setting or ratio conversion use setting.					
Source	PLC Function Module		Source details	CJ-series Unit	Detection timing	At power ON, Controller reset, or restart
Error attributes	Level	Minor fault	Recovery	Error reset	Log category	System
Effects	User program	Continues.	Operation	Conversion will not start at the Unit. The output will be 0 V for D/A conversion, and the data will be 0 for A/D conversion.		
System-defined variables	Variable		Data type		Name	
	None		---		---	
Cause and correction	Assumed cause		Correction		Prevention	
	The upper or lower limit data for scaling is outside the setting range. Or, the maximum value and minimum value are not 0 and they are the same.		Correct the set values of the scaling upper limit and scaling lower limit so that they are within the setting range. Set the ranges so that the upper limit does not equal the lower limit.		Set the set values of the scaling upper limit and scaling lower limit so that they are within the setting range. Set the ranges so that the upper limit does not equal the lower limit.	
	The I/O number for ratio conversion is set to <i>Not used</i> in the I/O specifications.		Set the I/O for use.		Set the I/O for use.	
Attached information	None					
Precautions/Remarks	None					

Event name	Ratio Set Value Error			Event code	38020000 hex	
Meaning	There is a mistake is the ratio setting for ratio conversion.					
Source	PLC Function Module		Source details	CJ-series Unit	Detection timing	At power ON, Controller reset, or restart
Error attributes	Level	Minor fault	Recovery	Error reset	Log category	System
Effects	User program	Continues.	Operation	Conversion will not start at the Unit. The output will be 0 V for D/A conversion, and the data will be 0 for A/D conversion.		
System-defined variables	Variable		Data type		Name	
	None		---		---	
Cause and correction	Assumed cause		Correction		Prevention	
	A value other than 16#0000 to 16#9999 (0.00 to 99.99) was specified for the ratio conversion A constant for ratio conversion.		Correct the ratio conversion A constant to between 16#0000 and 16#9999 (0.00 to 99.99).		Set the ratio conversion A constant for ratio conversion to between 16#0000 and 16#9999 (0.00 to 99.99).	
Attached information	None					
Precautions/Remarks	None					

Event name	Input Disconnection Detected			Event code	64780000 hex	
Meaning	The input is disconnected.					
Source	PLC Function Module		Source details	CJ-series Unit	Detection timing	Continuously
Error attributes	Level	Minor fault	Recovery	Error reset	Log category	System
Effects	User program	Continues.	Operation	The conversion value will be 0 or 32767 depending on the model of Analog I/O Unit. Operation will continue and the conversion value will return to normal when the connection is restored.		
System-defined variables	Variable		Data type		Name	
	None		---		---	
Cause and correction	Assumed cause		Correction		Prevention	
	Input wiring is broken.		Check the wiring for any inputs for which the I/O Disconnection Detection error indicates a disconnection to see if the line is broken. Replace the cable if necessary.		Check to see if the wiring is broken.	
	Input wiring disconnection		Check the wiring for any inputs for which the I/O Disconnection Detection error indicates a disconnection to see if the lines are connected securely. Reconnect any lines with faulty connections.		Confirm that the wiring is connected securely.	
Attached information	Attached information 1: Input number where error was detected					
Precautions/Remarks	Check the manual of the Unit for information on the conversion value when an error occurs. You can change the event level to the observation level. If you change the level to the observation level, recovery procedures are not required.					

Event name	Output Set Value Error		Event code	64790000 hex		
Meaning	The output setting is out of range.					
Source	PLC Function Module		Source details	CJ-series Unit	Detection timing	Continuously
Error attributes	Level	Minor fault	Recovery	Error reset	Log category	System
Effects	User program	Continues.	Operation	The output values of the Unit will follow the output hold function.		
System-defined variables	Variable		Data type		Name	
	None		---		---	
Cause and correction	Assumed cause		Correction		Prevention	
	An output set value setting is out of range.		Correct the program so that the output set value is within range.		Make sure the set value does not exceed the setting range.	
Attached information	Attached information 1: Output number where error was detected					
Precautions/Remarks	You can change the event level to the observation level. If you change the level to the observation level, recovery procedures are not required.					

Event name	Input Value Exceeded Adjustment Range in Adjustment Mode		Event code	34810000 hex		
Meaning	In Adjustment Mode, the input value exceeded the range for which adjustment is possible.					
Source	PLC Function Module		Source details	CJ-series Unit	Detection timing	When adjustment is started
Error attributes	Level	Observation	Recovery	---	Log category	System
Effects	User program	Continues.	Operation	The Unit stores the data converted from the input signal in device variable *_AdjPV.		
System-defined variables	Variable		Data type		Name	
	None		---		---	
Cause and correction	Assumed cause		Correction		Prevention	
	In Adjustment Mode, the input value exceeded the range for which adjustment is possible, so the offset and gain cannot be adjusted.		Adjust the input device so that the input value does not exceed the range for which adjustment is possible.		Adjust the input device in advance so that the input value does not exceed the range for which adjustment is possible.	
Attached information	None					
Precautions/Remarks	You can change the event level to the minor fault level. If you change the level to the minor fault level, the <i>Recovery</i> column above will be changed to "Error reset."					

Event name	Input Number Specification Error in Adjustment Mode		Event code	34820000 hex		
Meaning	The input number specified in Adjustment Mode is not enabled or the input number is wrong.					
Source	PLC Function Module		Source details	CJ-series Unit	Detection timing	When adjustment is started
Error attributes	Level	Observation	Recovery	---	Log category	System
Effects	User program	Continues.	Operation	The Unit retains the immediately previous input values and does not update the data.		
System-defined variables	Variable		Data type		Name	
	None		---		---	
Cause and correction	Assumed cause		Correction		Prevention	
	The input number that was specified in Adjustment Mode is not enabled.		Correct the use setting of the input that is specified by the Adjustment Input Number (device variable *_AdjCh) to enable using the input.		Set the use setting of the input that is used for adjustment to enable using the input.	
	The setting of the Adjustment Input Number (device variable *_AdjCh) is incorrect, so adjustment is not possible.		Correct the Adjustment Input Number (device variable *_AdjCh) to between 16#21 and 16#24 for the CJ1W-AD041-V1 and to between 16#21 and 16#28 for other Units.		Set the Adjustment Input Number (device variable *_AdjCh) to between 16#21 and 16#24 for the CJ1W-AD041-V1 and to between 16#21 and 16#28 for other Units.	
Attached information	None					
Precautions/Remarks	You can change the event level to the minor fault level. If you change the level to the minor fault level, the <i>Recovery</i> column above will be changed to "Error reset."					

Event name	Output Number Specification Error in Adjustment Mode		Event code	34880000 hex		
Meaning	The output number specified in Adjustment Mode is not enabled or the output number is wrong.					
Source	PLC Function Module		Source details	CJ-series Unit	Detection timing	When adjustment is started
Error attributes	Level	Observation	Recovery	---	Log category	System
Effects	User program	Continues.	Operation	The output from the Unit is 0 V or 0 mA.		
System-defined variables	Variable		Data type		Name	
	None		---		---	
Cause and correction	Assumed cause		Correction		Prevention	
	The output number that was specified in Adjustment Mode is not enabled.		Correct the use setting of the output that is specified by the Adjustment output Number (device variable *_AdjCh) to enable using the output.		Set the use setting of the output that is specified by the Adjustment Output Number (device variable *_AdjCh) to enable using the output.	
	The setting of the Adjustment Output Number (device variable *_AdjCh) is incorrect, so adjustment is not possible.		Correct the setting of the Adjustment Output Number (device variable *_AdjCh) to within the following range. CJ1W-DA021: 16#11 to 16#12 CJ1W-DA041: 16#11 to 16#14 CJ1W-DA08V/DA08C: 16#11 to 16#18		Set the Adjustment Output Number (device variable *_AdjCh) to within the following range. CJ1W-DA021: 16#11 to 16#12 CJ1W-DA041: 16#11 to 16#14 CJ1W-DA08V/DA08C: 16#11 to 16#18	
Attached information	None					
Precautions/Remarks	You can change the event level to the minor fault level. If you change the level to the minor fault level, the <i>Recovery</i> column above will be changed to "Error reset."					

Event name	I/O Number Specification Error in Adjustment Mode		Event code	348C0000 hex		
Meaning	The I/O numbers specified in Adjustment Mode are not enabled or the I/O numbers are wrong.					
Source	PLC Function Module		Source details	CJ-series Unit	Detection timing	When adjustment is started
Error attributes	Level	Observation	Recovery	---	Log category	System
Effects	User program	Continues.	Operation	The Unit retains the immediately previous input values and does not update the data. The output from the Unit will be 0 V or 0 mA.		
System-defined variables	Variable		Data type		Name	
	None		---		---	
Cause and correction	Assumed cause		Correction		Prevention	
	The I/O numbers that were specified in Adjustment Mode are not enabled.		Correct the use setting of the input/output that is specified by the Adjustment I/O Number (device variable *_AdjCh) to enable using the input/output.		Set the use setting of the input/output that is specified by the Adjustment I/O Number (device variable *_AdjCh) to enable using the input/output.	
	The setting of the Adjustment I/O Number (device variable *_AdjCh) is incorrect, so adjustment is not possible.		Correct the Adjustment I/O Numbers (device variable *_AdjCh) to 16#11, 16#12, or between 16#21 and 16#24.		Set the Adjustment I/O Numbers (device variable *_AdjCh) to between 16#11, 16#12, or between 16#21 and 16#24.	
Attached information	None					
Precautions/Remarks	You can change the event level to the minor fault level. If you change the level to the minor fault level, the <i>Recovery</i> column above will be changed to "Error reset."					

App

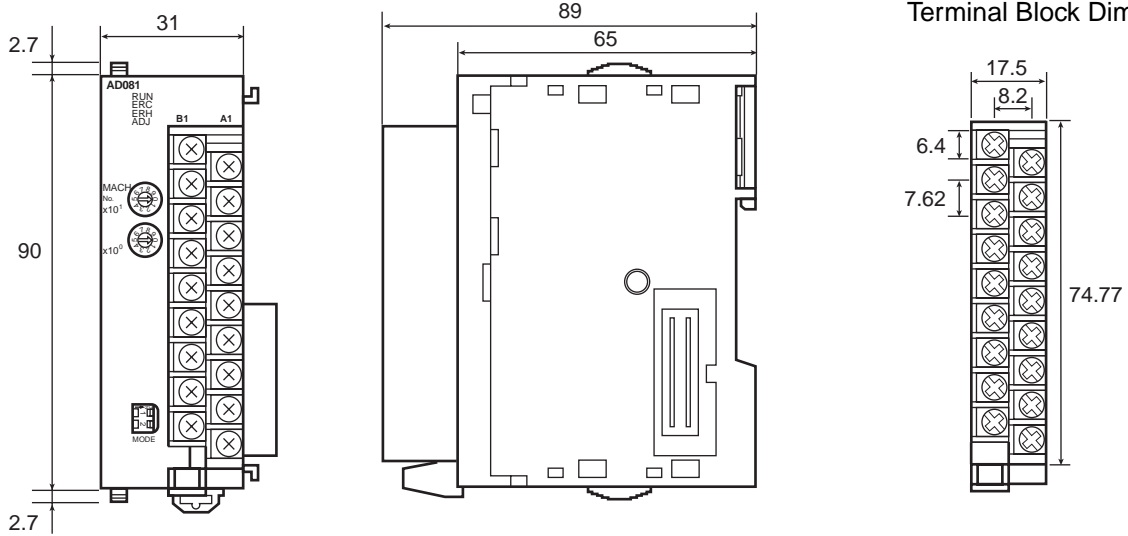
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A-1 Dimensions

CJ-series Units: CJ1W-AD041-V1/AD081-V1/AD042,
CJ1W-DA021/DA041/DA08V/DA08C/DA042V, CJ1W-MAD42

- CJ-series Unit Terminal Block Dimensions



Note The appearance varies with the model.

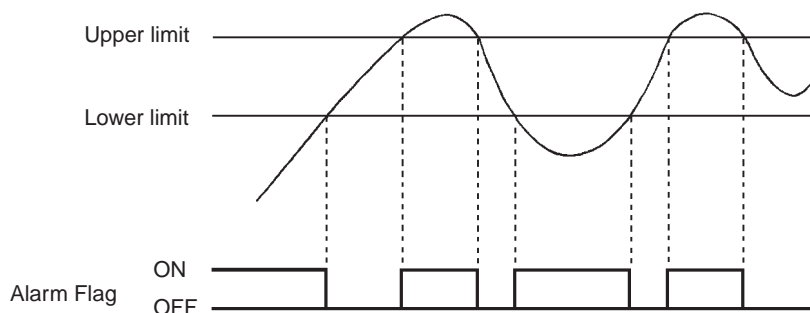
A-2 Sample Programs

A-2-1 Upper and Lower-limit Alarm (Constant Monitoring)

● Outline

Comparisons are made to the upper and lower limits of the A/D conversion values or D/A output values from the beginning of operation. If they fall outside the specified range, the Alarm Flag will turn ON.

In this example, the upper limit is 3,900 and the lower limit is 100.



● Unit Settings

Name	Setting target	Setting contents
Unit Configuration	CPU/Expansion Racks in Configuration and Setup of Sysmac Studio	Mount CJ1W-AD081-V1 in slot 0 of the CPU Rack.
Device name of this unit		J01
Unit number	Unit number switch and Unit Configuration (CPU/Expansion Racks screen in Configuration and Setup of Sysmac Studio)	Unit number 0 ($\times 10^1:0, \times 10^0:0$)
Operating mode	Operating mode switch Initial setting parameters	Normal Mode
Resolution/conversion time settings	Initial setting parameters	4000/1 ms
Use settings		Use input 1.
Input signal range settings		0 to 10 V

● Defined-variables

System-defined variable

Name	Data type	Factory setting	Comments	Contents
P_On	BOOL	---	Always ON Flag	ON when the power is supplied.

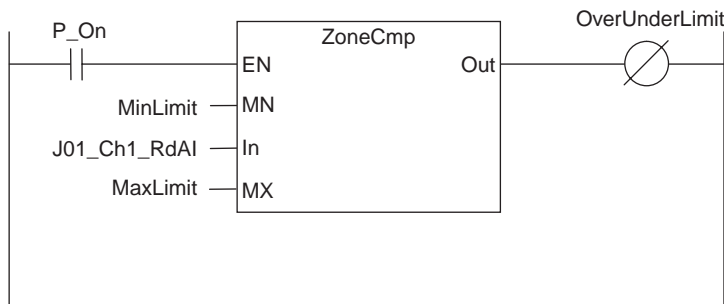
User-defined variables (To be defined before or when creating a program)

Name	Data type	Factory setting	Allocated address (AT)	Contents
OverUnder-Limit	BOOL	False	---	Alarm Flag indicating value is outside the range of upper/lower limits.
MinLimit	INT	100	---	Sets the lower limit.
MaxLimit	INT	3900	---	Sets the upper limit.

Device variables for CJ-series Unit (Create them on the I/O Map screen after the Unit Configuration is created.)

Name	Data type	Factory setting	Allocated address (AT)	Comments	Contents
J01_Ch1_RdAI	INT	---	IOBus://rack#0/slot#0/Ch1_RdAI	Input 1 Conversion Data	Indicates the input 1 A/D conversion value.

● Program Example

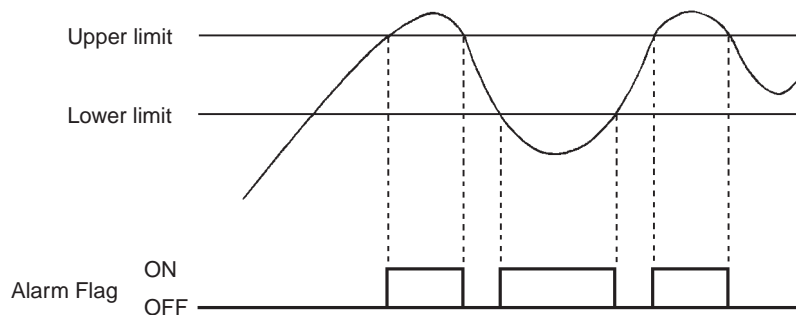


A-2-2 Upper and Lower-limit Alarm (with Standby Sequence)

● Outline

Comparisons are made to the upper and lower limits of the A/D conversion values or D/A output values after the value falls within the range between the upper limit and lower limit following the beginning of operation. If they fall outside the specified range, the Alarm Flag will turn ON.

In this example, the upper limit is 3,900 and the lower limit is 100.



● Unit Settings

Name	Setting target	Setting contents
Unit Configuration	CPU/Expansion Racks in Configuration and Setup of Sysmac Studio	Mount CJ1W-AD081-V1 in slot 0 of the CPU Rack.
Device name of this unit		J01
Unit number	Unit number switch and Unit Configuration (CPU/Expansion Racks screen in Configuration and Setup of Sysmac Studio)	Unit number 0 (×10 ¹ :0, ×10 ⁰ :0)
Operating mode	Operating mode switch Initial setting parameters	Normal Mode
Resolution/conversion time settings	Initial setting parameters	4000/1 ms
Use settings		Use input 1.
Input signal range settings		0 to 10 V

● Defined-variables

System-defined variable

Name	Data type	Factory setting	Comments	Contents
P_On	BOOL	---	Always ON Flag	ON when the power is supplied.

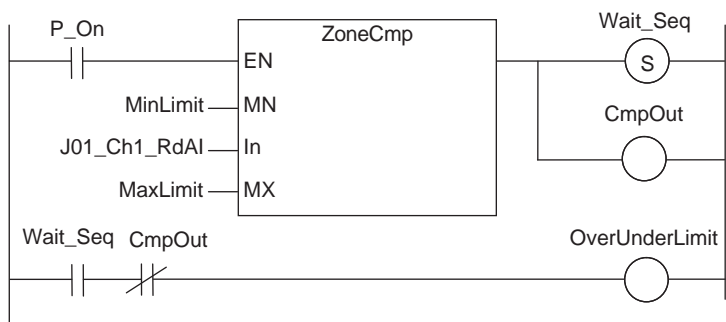
User-defined variables (To be defined before or when creating a program)

Name	Data type	Factory setting	Allocated address (AT)	Comments
OverUnder-Limit	BOOL	False	---	Alarm Flag indicating value is outside the range of upper/lower limits.
MinLimit	INT	100	---	Sets the lower limit.
MaxLimit	INT	3900	---	Sets the upper limit.
Wait_Seq	BOOL	False	---	Indicates that the value has entered the range of upper/lower limits once after the start of operation.
CmpOut	BOOL	False	---	Indicates the results of comparison between the upper and lower limits.

Device variables for CJ-series Unit (Create them on the I/O Map screen after the Unit Configuration is created.)

Name	Data type	Factory setting	Allocated address (AT)	Comments	Details
J01_Ch1_RdAI	INT	---	IOBus://rack#0/slot#0/Ch1_RdAI	Input 1 Conversion Data	Indicates the input 1 A/D conversion value.

● Program Example



A-2-3 Scaling

Using the Scaling Functions

This function is supported only by the CJ1W-MAD42, CJ1W-DA08V/08C/042V, and CJ1W-AD042.

● Outline

A pressure sensor is connected to analog input 1 of CJ1W-MAD42. The pressure sensor outputs an analog signal of between 4 and 20 mA for a pressure between 0 and 500 Pa. Therefore, for a 4 to 20-mA input, a value of 0 to 500 in industrial units for the pressure in Pa is directly set. The analog input scaling function of the CJ1W-MAD42 is used here. Therefore, scaling in the user program is not required to convert the solution value 0000 to 4000 to the industrial units value 0000 to 500.

● Unit Settings

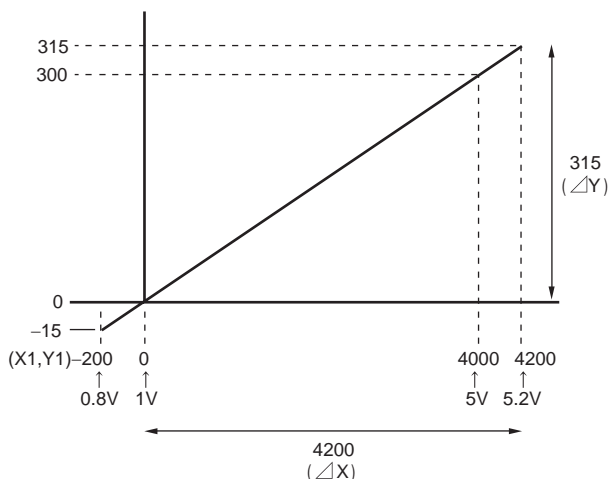
Name	Setting target	Setting contents
Unit Configuration	CPU/Expansion Racks in Configuration and Setup of Sysmac Studio	Mount CJ1W-MAD42 in slot 0 of the CPU Rack.
Device name of this unit		J01
Unit number	Unit number switch and Unit Configuration (CPU/Expansion Racks screen in Configuration and Setup of Sysmac Studio)	Unit number 0 ($\times 10^1:0$, $\times 10^0:0$)
Operating mode	Initial setting parameters	Normal Mode
Resolution/conversion time settings		4000/1 ms
Use settings		Use input 1.
Input signal range settings		1 to 5 V/4 to 20 mA
Voltage/current input switch		Current: 4 to 20 mA
Input 1 scaling lower limit		0
Input 1 scaling upper limit		500

Not Using the Scaling Function

● Outline

Use broken line approximation instructions to convert A/D conversion values (–400 to +4400) to temperature data (–15 to +315°C).

- The following example uses a resolution of 4,000 and an input signal range of 1 to 5 V where 1 to 5 V is scaled to 0°C to 300°C.



● Unit settings

Name	Setting target	Setting contents
Unit Configuration	CPU/Expansion Racks in Configuration and Setup of Sysmac Studio	Mount CJ1W-AD081-V1 in slot 0 of the CPU Rack.
Device name of this unit		J01
Unit number	Unit number switch and Unit Configuration (CPU/Expansion Racks screen in Configuration and Setup of Sysmac Studio)	Unit number 0 ($\times 10^1:0$, $\times 10^0:0$)
Operating mode	Operating mode switch Initial setting parameters	Normal Mode
Resolution/conversion time settings	Initial setting parameters	4000/1 ms
Use settings		Use input 1.
Input signal range settings		0 to 5 V

● Defined-variables

System-defined variable

Name	Data type	Factory setting	Comments	Contents
P_On	BOOL	---	Always ON Flag	ON when power is supplied.

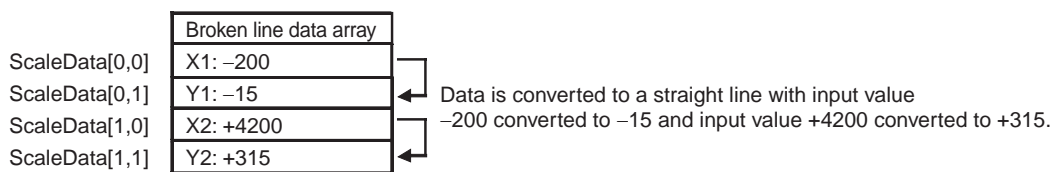
User-defined variables (To be defined before or when creating a program)

Name	Data type	Factory setting	Comments
Data_Temp	INT	0	Indicates data after temperature scaling.
ScaleData	ARRAY[0..1,0..1] OF INT	[-200, -15, 4200, 315]	Indicates data to be scaled.

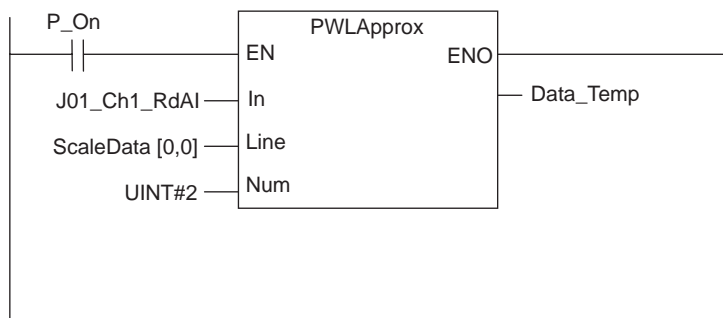
Device variables for CJ-series Unit (Create them on the I/O Map screen after the Unit Configuration is created.)

Name	Data type	Factory setting	Allocated address (AT)	Comments	Contents
J01_Ch1_RdAI	INT	---	IOBus://rack#/slot#/Ch1_RdAI	Input 1 Conversion Data	Indicates the input 1 A/D conversion value.

● Data Array Setting



● Program Example



A-2-4 Square Root Calculation

● Outline

Data expressed as quadratic curves, such as thermocouple inputs, is converted and output to linear data (0000 to +4000).

● Unit settings

Name	Setting target	Setting contents
Unit Configuration	CPU/Expansion Racks in Configuration and Setup of Sysmac Studio	Mount CJ1W-AD081-V1 in slot 0 of the CPU Rack.
Device name of this unit		J01
Unit number	Unit number switch and Unit Configuration (CPU/Expansion Racks screen in Configuration and Setup of Sysmac Studio)	Unit number 0 ($\times 10^1:0$, $\times 10^0:0$)
Operating mode	Operating mode switch Initial setting parameters	Normal Mode
Resolution/conversion time settings	Initial setting parameters	4000/1 ms
Use settings		Use input 1.
Input signal range settings		0 to 10 V

● Defined-variables

System-defined variable

Name	Data type	Factory setting	Comments	Contents
P_On	BOOL	---	Always ON Flag	ON when power is supplied.

User-defined variables (To be defined before or when creating a program)

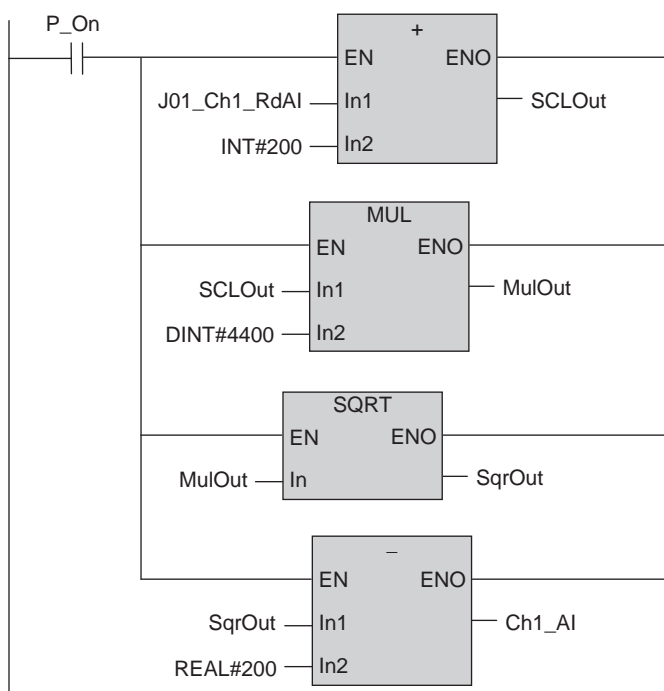
Name	Data type	Factory setting	Comments
SCLOut	INT	0	Raised value corresponding to the negative portion (-5%)
MulOut	DINT	0	Multiplies the raised value by 4,400.
SqrOut	LREAL	0.0	Calculates the square root.
Ch1_AI	LREAL	0.0	Returns the raised portion (-5%) and extracts the square root.

Note Ch1_AI is the LREAL data type. After the data conversion, perform type conversion if necessary.

Device variables for CJ-series Unit (Create them on the I/O Map screen after the Unit Configuration is created.)

Name	Data type	Factory setting	Allocated address (AT)	Comments	Details
J01_Ch1_RdAI	INT	---	IOBus://rack#0/ slot#0/Ch1_RdAI	Input 1 Conversion Data	Indicates the input 1 A/D conversion value.

● Program Example



A-2-5 Mean Value Processing

● Outline

Data is taken for the set number of samplings and the mean value is calculated.

● Unit settings

Name	Setting target	Setting contents
Unit Configuration	CPU/Expansion Racks in Configuration and Setup of Sysmac Studio	Mount CJ1W-AD081-V1 in slot 0 of the CPU Rack.
Device name of this unit		J01
Unit number	Unit number switch and Unit Configuration (CPU/Expansion Racks screen in Configuration and Setup of Sysmac Studio)	Unit number 0 (×10 ¹ :0, ×10 ⁰ :0)
Operating mode	Operating mode switch Initial setting parameters	Normal Mode
Resolution/conversion time settings	Initial setting parameters	4000/1 ms
Use settings		Use input 1.
Input signal range settings		0 to 10 V

● Defined-variables

System-defined variable

Name	Data type	Factory setting	Comments	Contents
P_First_RunMode	BOOL	---	First RUN Period Flag	When the PROGRAM Mode changes to the RUN Mode, the result will become TRUE for only one task period.

User-defined variables (To be defined before or when creating a program)

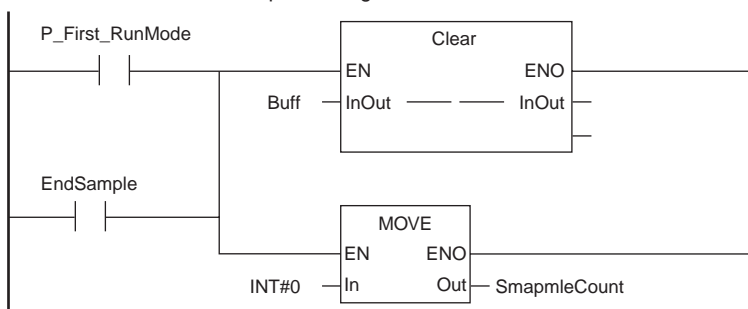
Name	Data type	Factory setting	Comments
Sample	BOOL	False	Mean value acquisition command
StartSample	BOOL		Mean value acquisition processing start flag
EndSample	BOOL		Mean value processing completion flag
Buff	ARRAY[0..64] OF INT	[65(0)]	Mean value processing data buffer
SmampleCount	UINT		Mean value processing data acquisition counter
Average	INT	0	Mean value

Device variables for CJ-series Unit (Create them on the I/O Map screen after the Unit Configuration is created.)

Name	Data type	Factory setting	Allocated address (AT)	Comments	Details
J01_Ch1_RdAI	INT	---	IOBus://rack#0/slot#0/Ch1_RdAI	Input 1 Conversion Data	Indicates the input 1 A/D conversion value.

● Program Example

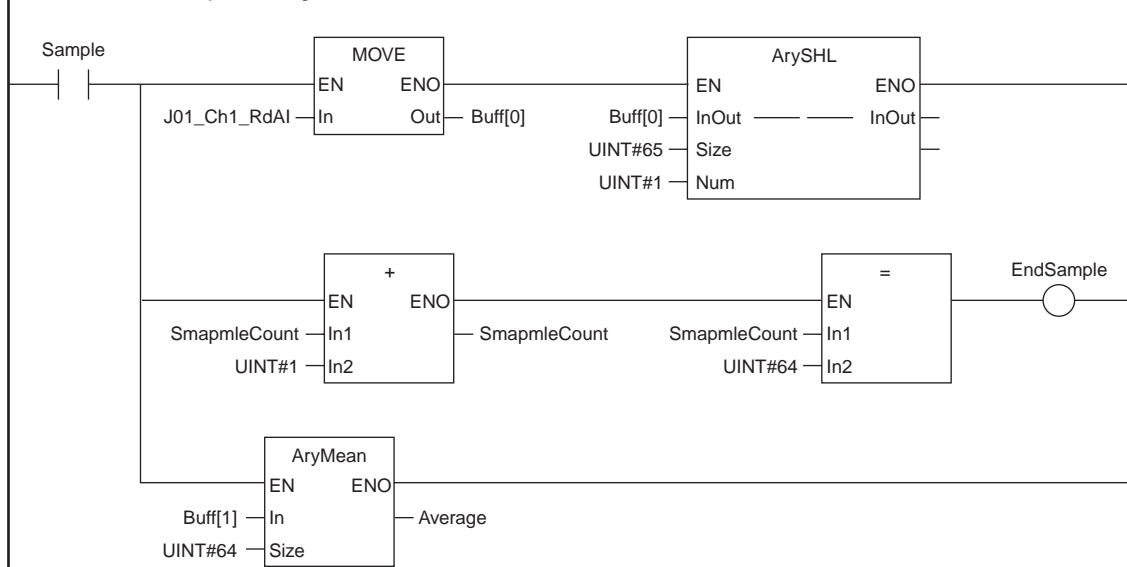
Initialization of mean value processing data buffer and counter



Acceptance of mean value processing instruction



Perform mean value processing

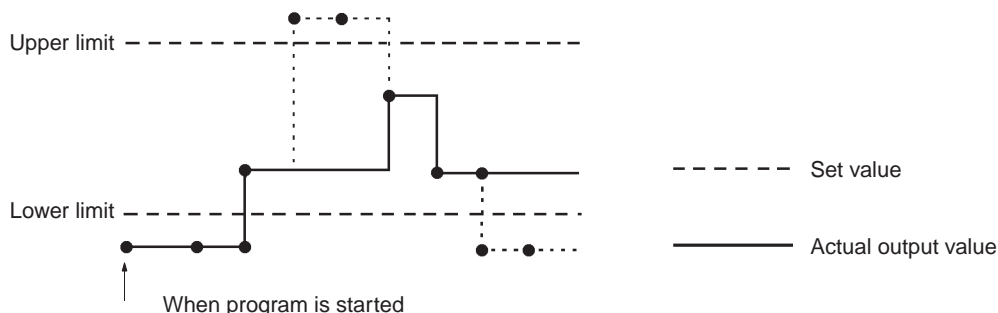


A-2-6 Limit

● Outline

If the output value range is exceeded, the output voltage is held when the Conversion Enable Bit turns OFF.

In this example, the upper limit is 3,900 and the lower limit is 100.



● Unit settings

Name	Setting target	Setting contents
Unit Configuration	CPU/Expansion Racks in Configuration and Setup of Sysmac Studio	Mount CJ1W-DA08V in slot 0 of the CPU Rack.
Device name of this unit		J01
Unit number	Unit number switch and Unit Configuration (CPU/Expansion Racks screen in Configuration and Setup of Sysmac Studio)	Unit number 0 ($\times 10^1:0, \times 10^0:0$)
Operating mode	Initial setting parameters	Normal Mode
Resolution/conversion time settings		4000/1 ms
Use settings		Use output 1.
Output signal range settings		0 to 10 V
Output 1 output status when conversion stops		HOLD

● Defined-variables

System-defined variable

Name	Data type	Factory setting	Comments	Contents
P_On	BOOL	---	Always ON Flag	ON when power is supplied.

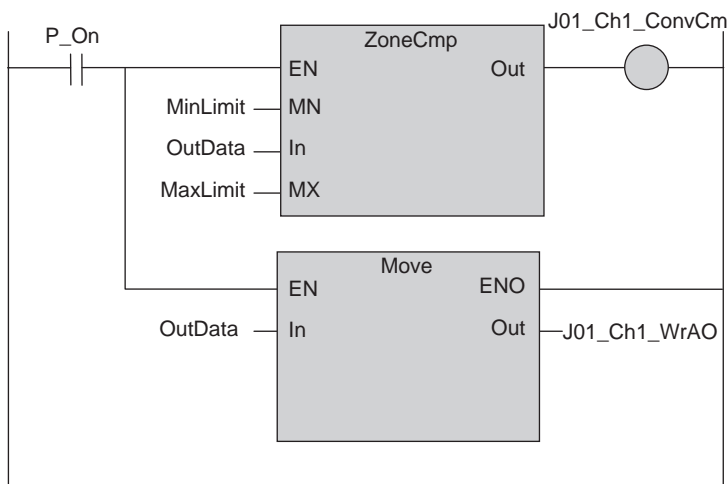
User-defined variables (To be defined before or when creating a program)

Name	Data type	Factory setting	Comments
MinLimit	INT	100	Sets the lower limit.
MaxLimit	INT	3900	Sets the upper limit.
OutData	INT	0	Indicates the output 1 set value.

Device variables for CJ-series Unit (Create them on the I/O Map screen after the Unit Configuration is created.)

Name	Data type	Factory setting	Allocated address (AT)	Comments	Contents
J01_Ch1_WrAO	INT		IOBus://rack#0/ slot#0/Ch1_WrAO	Output 1 Set Value	Indicates the output 1 D/A conversion value.
J01_Ch1_ConvCmd	BOOL		IOBus://rack#0/ slot#0/ConvCmd/ Ch1_ConvCmd	Output 1 Conversion Enable	

● Program Example



A-3 Functional Differences due to CPU Units (NJ/CJ-series) to be Connected

This unit can be used with NJ-series CPU Units.

If this unit is used with the NJ Series, some functions become unavailable compared to when it is used with the CJ-series.

The following explains how each function of this unit changes when a CJ-series CPU Unit is connected, compared to when an NJ-series CPU Unit is connected.

Functional Difference

	Type	Functional Difference
Analog Input Units	CJ1W-AD041-V1/AD081-V1	There is no difference.
	CJ1W-AD042	The direct conversion function using the AIDC instruction cannot be used.
Analog Output Units	CJ1W-DA021/DA041/DA08V/DA08C	There is no difference.
	CJ1W-DA042V	The direct conversion function using the AODC instruction cannot be used.
Analog I/O Units	CJ1W-MAD42	There is no difference.

A-4 Correspondence Tables for Device Variables for CJ-series Units and Memory Addresses for CJ-series Units

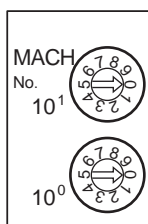
If this Unit is used with an NJ-series CPU Unit, the user program uses device variables for CJ-series Unit that reference the CJ-series Unit memory to use the functions.

Correspondence for word addresses, bit numbers and device variables of the CJ-series Unit between the I/O memory of the CJ-series CPU Unit and CJ-series Unit memory of the NJ-series CPU Unit is shown below.

Start address of the words allocated in CIO Area: $n = 2000 + \text{Unit number} \times 10$ (Unit number: 0 to 95)

Start address of the words allocated in DM Area: $m = D20000 + \text{Unit number} \times 100$ (Unit number: 0 to 95)

Set the unit number switches on the front panel of the Unit to set the words that are allocated to each Analog I/O Unit in the Special I/O Unit Area in the CIO Area and DM Area.



Switch No.	Unit No.	Words allocated in Special I/O Unit Area in CIO Area	Words allocated in Data Memory Area in DM Area
0	Unit #0	CIO 2000 to CIO 2009	D20000 to D20099
1	Unit #1	CIO 2010 to CIO 2019	D20100 to D20199
2	Unit #2	CIO 2020 to CIO 2029	D20200 to D20299
3	Unit #3	CIO 2030 to CIO 2039	D20300 to D20399
4	Unit #4	CIO 2040 to CIO 2049	D20400 to D20499
5	Unit #5	CIO 2050 to CIO 2059	D20500 to D20599
6	Unit #6	CIO 2060 to CIO 2069	D20600 to D20699
7	Unit #7	CIO 2070 to CIO 2079	D20700 to D20799
8	Unit #8	CIO 2080 to CIO 2089	D20800 to D20899
9	Unit #9	CIO 2090 to CIO 2099	D20900 to D20999
⋮	⋮	⋮	⋮
n	Unit #n	CIO 2000 + (n × 10) to CIO 2000 + (n × 10) + 9	D20000 + (n × 100) to D20000 + (n × 100) + 99 words
⋮	⋮	⋮	⋮
95	Unit #95	CIO 2950 to CIO 2959	D29500 to D29599



Additional Information

- If two or more Special I/O Units are assigned the same unit number, a "Duplicate Unit Number" major fault level Controller error is generated and the Controller will not operate.
- After correcting the unit number setting, cycle the power to the Controller.

A-4-1 CJ1W-AD041-V1

Special I/O Unit CIO Area (in Normal Mode)

I/O	CJ-series I/O memory address		NJ-series device variable for CJ-series Unit		
	CIO No.	Bit No.	Variable name	Description	Data type
Output (CPU to this Unit)	n	00 to 15	*_PkHdCmd	Peak Value Hold Execution Settings	WORD
		00	*_Ch1_PkHdCmd	Input 1 Peak Value Hold Execution	BOOL
		01	*_Ch2_PkHdCmd	Input 2 Peak Value Hold Execution	BOOL
		02	*_Ch3_PkHdCmd	Input 3 Peak Value Hold Execution	BOOL
		03	*_Ch4_PkHdCmd	Input 4 Peak Value Hold Execution	BOOL
Input (This Unit to CPU)	n+1	00 to 15	*_Ch1_RdAI	Input 1 Conversion Data	INT
	n+2	00 to 15	*_Ch2_RdAI	Input 2 Conversion Data	INT
	n+3	00 to 15	*_Ch3_RdAI	Input 3 Conversion Data	INT
	n+4	00 to 15	*_Ch4_RdAI	Input 4 Conversion Data	INT
	n+9	00 to 07	*_SensErr	Disconnection Detected	BYTE
		00	*_Ch1_SensErr	Input 1 Disconnection Detected	BOOL
		01	*_Ch2_SensErr	Input 2 Disconnection Detected	BOOL
		02	*_Ch3_SensErr	Input 3 Disconnection Detected	BOOL
	n+9	03	*_Ch4_SensErr	Input 4 Disconnection Detected	BOOL
		08 to 15	*_UnitErr	Error Flags	BYTE
n+9	11	*_AveErr	Mean Value Processing Setting Error	BOOL	

Special I/O Unit CIO Area (in Adjustment Mode)

I/O	CJ-series I/O memory address		NJ-series device variable for CJ-series Unit			
	CIO No.	Bit No.	Variable name	Description	Data type	
Output (CPU to this Unit)	n	00 to 07	*_AdjCh	Inputs to Be Adjusted	BYTE	
		n+1	00	*_AdjOfs	Offset Flag	BOOL
			01	*_AdjGain	Gain Flag	BOOL
			02	*_AdjDwn	Adjustment Value Down Flag	BOOL
			03	*_AdjUp	Adjustment Value Up Flag	BOOL
			04	*_AdjSet	Adjustment Value Set Flag	BOOL
			05	*_AdjClr	Adjustment Value Clear Flag	BOOL

I/O	CJ-series I/O memory address		NJ-series device variable for CJ-series Unit		
	CIO No.	Bit No.	Variable name	Description	Data type
Input (This Unit to CPU)	n+8	00 to 15	*_AdjPV	Conversion value for adjustment	INT
	n+9	00 to 07	*_SensErr	Disconnection Detected	BYTE
		00	*_Ch1_SensErr	Input 1 Disconnection Detected	BOOL
		01	*_Ch2_SensErr	Input 2 Disconnection Detected	BOOL
		02	*_Ch3_SensErr	Input 3 Disconnection Detected	BOOL
		03	*_Ch4_SensErr	Input 4 Disconnection Detected	BOOL
		08 to 15	*_AdjUnitErr	Error Flags	BYTE
		11	*_AdjAveErr	Mean Value Processing Setting Error	BOOL
		12	*_AdjInErr	Input Value Adjustment Range Exceeded	BOOL
		13	*_AdjInNoErr	Input Value Adjustment Number Setting Error	BOOL
		14	*_AdjMemErr	Non-volatile Memory Error	BOOL
	15	*_AdjMd	Starting Adjustment Mode	BOOL	

Special I/O Unit DM Area (common to both Normal Mode and Adjustment Mode)

CJ-series I/O memory address		NJ-series device variable for CJ-series Unit		
DM No.	Bit No.	Variable name	Description	Data type
D(m)	00 to 15	*_InChUseCfg	Input Use Settings	WORD
	00	*_Ch1_InChUseCfg	Input 1 Use Settings	BOOL
	01	*_Ch2_InChUseCfg	Input 2 Use Settings	BOOL
	02	*_Ch3_InChUseCfg	Input 3 Use Settings	BOOL
	03	*_Ch4_InChUseCfg	Input 4 Use Settings	BOOL
D(m+1)	00 to 15	*_InRngCfg	Input Signal Range Settings	WORD
	00 to 01		Input 1 Input Signal Range Setting	
	02 to 03		Input 2 Input Signal Range Setting	
	04 to 05		Input 3 Input Signal Range Setting	
	06 to 07		Input 4 Input Signal Range Setting	
D(m+2)	00 to 15	*_Ch1_AveCfg	Input 1 Number of Samplings for Mean Value Processing	UINT
D(m+3)	00 to 15	*_Ch2_AveCfg	Input 2 Number of Samplings for Mean Value Processing	UINT
D(m+4)	00 to 15	*_Ch3_AveCfg	Input 3 Number of Samplings for Mean Value Processing	UINT

CJ-series I/O memory address		NJ-series device variable for CJ-series Unit		
DM No.	Bit No.	Variable name	Description	Data type
D(m+5)	00 to 15	*_Ch4_AveCfg	Input 4 Number of Samplings for Mean Value Processing	UINT
D(m+18)	00 to 07	*_MdCfg	Operating Mode Settings	BYTE
	08 to 15	*_ResolutionCfg	Resolution/Conversion Time Settings	BYTE

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Special I/O Unit CIO Area (in Normal Mode)

I/O	CJ-series I/O memory address		NJ-series device variable for CJ-series Unit		
	CIO No.	Bit No.	Variable name	Description	Data type
Output (CPU to this Unit)	n	00 to 15	<i>*_PkHdCmd</i>	Peak Value Hold Execution Settings	WORD
		00	<i>*_Ch1_PkHdCmd</i>	Input 1 Peak Value Hold Execution	BOOL
		01	<i>*_Ch2_PkHdCmd</i>	Input 2 Peak Value Hold Execution	BOOL
		02	<i>*_Ch3_PkHdCmd</i>	Input 3 Peak Value Hold Execution	BOOL
		03	<i>*_Ch4_PkHdCmd</i>	Input 4 Peak Value Hold Execution	BOOL
		04	<i>*_Ch5_PkHdCmd</i>	Input 5 Peak Value Hold Execution	BOOL
		05	<i>*_Ch6_PkHdCmd</i>	Input 6 Peak Value Hold Execution	BOOL
		06	<i>*_Ch7_PkHdCmd</i>	Input 7 Peak Value Hold Execution	BOOL
		07	<i>*_Ch8_PkHdCmd</i>	Input 8 Peak Value Hold Execution	BOOL

A-4 Correspondence Tables for Device Variables for CJ-series Units and Memory Addresses for CJ-series Units

App

A-4-2 CJ1W-AD081-V1

I/O	CJ-series I/O memory address		NJ-series device variable for CJ-series Unit		
	CIO No.	Bit No.	Variable name	Description	Data type
Input (This Unit to CPU)	n+1	00 to 15	*_Ch1_RdAI	Input 1 Conversion Data	INT
	n+2	00 to 15	*_Ch2_RdAI	Input 2 Conversion Data	INT
	n+3	00 to 15	*_Ch3_RdAI	Input 3 Conversion Data	INT
	n+4	00 to 15	*_Ch4_RdAI	Input 4 Conversion Data	INT
	n+5	00 to 15	*_Ch5_RdAI	Input 5 Conversion Data	INT
	n+6	00 to 15	*_Ch6_RdAI	Input 6 Conversion Data	INT
	n+7	00 to 15	*_Ch7_RdAI	Input 7 Conversion Data	INT
	n+8	00 to 15	*_Ch8_RdAI	Input 8 Conversion Data	INT
	n+9	00 to 07	*_SensErr	Disconnection Detected	BYTE
		00	*_Ch1_SensErr	Input 1 Disconnection Detected	BOOL
		01	*_Ch2_SensErr	Input 2 Disconnection Detected	BOOL
		02	*_Ch3_SensErr	Input 3 Disconnection Detected	BOOL
		03	*_Ch4_SensErr	Input 4 Disconnection Detected	BOOL
	04	*_Ch5_SensErr	Input 5 Disconnection Detected	BOOL	
	05	*_Ch6_SensErr	Input 6 Disconnection Detected	BOOL	
	06	*_Ch7_SensErr	Input 7 Disconnection Detected	BOOL	
	07	*_Ch8_SensErr	Input 8 Disconnection Detected	BOOL	
	08 to 15	*_UnitErr	Error Flags	BYTE	
	11	*_AveErr	Mean Value Processing Set- ting Error	BOOL	

Special I/O Unit CIO Area (in Adjustment Mode)

I/O	CJ-series I/O memory address		NJ-series device variable for CJ-series Unit		
	CIO No.	Bit No.	Variable name	Description	Data type
Output (CPU to this Unit)	n	00 to 07	*_AdjCh	Inputs to Be Adjusted	BYTE
	n+1	00	*_AdjOfs	Offset Flag	BOOL
		01	*_AdjGain	Gain Flag	BOOL
		02	*_AdjDwn	Adjustment Value Down Flag	BOOL
		03	*_AdjUp	Adjustment Value Up Flag	BOOL
		04	*_AdjSet	Adjustment Value Set Flag	BOOL
		05	*_AdjClr	Adjustment Value Clear Flag	BOOL
Input (This Unit to CPU)	n+8	00 to 15	*_AdjPV	Conversion value for adjustment	INT
	n+9	00 to 07	*_SensErr	Disconnection Detected	BYTE
		00	*_Ch1_SensErr	Input 1 Disconnection Detected	BOOL
		01	*_Ch2_SensErr	Input 2 Disconnection Detected	BOOL
		02	*_Ch3_SensErr	Input 3 Disconnection Detected	BOOL
		03	*_Ch4_SensErr	Input 4 Disconnection Detected	BOOL
		08 to 15	*_AdjUnitErr	Error Flags	BYTE
		11	*_AdjAveErr	Mean Value Processing Setting Error	BOOL
		12	*_AdjInErr	Input Value Adjustment Range Exceeded	BOOL
		13	*_AdjInNoErr	Input Value Adjustment Number Setting Error	BOOL
		14	*_AdjMemErr	Non-volatile Memory Error	BOOL
		15	*_AdjMd	Starting Adjustment Mode	BOOL

Special I/O Unit DM Area (common to both Normal Mode and Adjustment Mode)

CJ-series I/O memory address		NJ-series device variable for CJ-series Unit		
DM No.	Bit No.	Variable name	Description	Data type
D(m)	00 to 15	*_InChUseCfg	Input Use Settings	WORD
	00	*_Ch1_InChUseCfg	Input 1 Use Setting	BOOL
	01	*_Ch2_InChUseCfg	Input 2 Use Setting	BOOL
	02	*_Ch3_InChUseCfg	Input 3 Use Setting	BOOL
	03	*_Ch4_InChUseCfg	Input 4 Use Setting	BOOL
	04	*_Ch5_InChUseCfg	Input 5 Use Setting	BOOL
	05	*_Ch6_InChUseCfg	Input 6 Use Setting	BOOL
	06	*_Ch7_InChUseCfg	Input 7 Use Setting	BOOL
	07	*_Ch8_InChUseCfg	Input 8 Use Setting	BOOL

CJ-series I/O memory address		NJ-series device variable for CJ-series Unit		
DM No.	Bit No.	Variable name	Description	Data type
D(m+1)	00 to 15	*_InRngCfg	Input Signal Range Settings	WORD
	00 to 01		Input 1 Input Signal Range Setting	
	02 to 03		Input 2 Input Signal Range Setting	
	04 to 05		Input 3 Input Signal Range Setting	
	06 to 07		Input 4 Input Signal Range Setting	
	08 to 09		Input 5 Input Signal Range Setting	
	10 to 11		Input 6 Input Signal Range Setting	
	12 to 13		Input 7 Input Signal Range Setting	
	14 to 15		Input 8 Input Signal Range Setting	
D(m+2)	00 to 15	*_Ch1_AveCfg	Input 1 Number of Samplings for Mean Value Processing	UINT
D(m+3)	00 to 15	*_Ch2_AveCfg	Input 2 Number of Samplings for Mean Value Processing	UINT
D(m+4)	00 to 15	*_Ch3_AveCfg	Input 3 Number of Samplings for Mean Value Processing	UINT
D(m+5)	00 to 15	*_Ch4_AveCfg	Input 4 Number of Samplings for Mean Value Processing	UINT
D(m+6)	00 to 15	*_Ch5_AveCfg	Input 5 Number of Samplings for Mean Value Processing	UINT
D(m+7)	00 to 15	*_Ch6_AveCfg	Input 6 Number of Samplings for Mean Value Processing	UINT
D(m+8)	00 to 15	*_Ch7_AveCfg	Input 7 Number of Samplings for Mean Value Processing	UINT
D(m+9)	00 to 15	*_Ch8_AveCfg	Input 8 Number of Samplings for Mean Value Processing	UINT
D(m+18)	00 to 07	*_MdCfg	Operating Mode Settings	BYTE
	08 to 15	*_ResolutionCfg	Resolution/Conversion Time Settings	BYTE

A-4-3 CJ1W-AD042

Special I/O Unit CIO Area

I/O	CJ-series I/O memory address		NJ-series device variable for CJ-series Unit		
	CIO No.	Bit No.	Variable name	Description	Data type
Output (CPU to this Unit)	n	00 to 15	*_PkHdCmd	Peak Value Hold Execution Settings	WORD
		00	*_Ch1_PkHdCmd	Input 1 Peak Value Hold Execution	BOOL
		01	*_Ch2_PkHdCmd	Input 2 Peak Value Hold Execution	BOOL
		02	*_Ch3_PkHdCmd	Input 3 Peak Value Hold Execution	BOOL
		03	*_Ch4_PkHdCmd	Input 4 Peak Value Hold Execution	BOOL
Input (This Unit to CPU)	n+1	00 to 15	*_Ch1_RdAI	Input 1 Conversion Data	INT
	n+2	00 to 15	*_Ch2_RdAI	Input 2 Conversion Data	INT
	n+3	00 to 15	*_Ch3_RdAI	Input 3 Conversion Data	INT
	n+4	00 to 15	*_Ch4_RdAI	Input 4 Conversion Data	INT
	n+9	00 to 07	*_SensErr	Disconnection Detected	BYTE
		00	*_Ch1_SensErr	Input 1 Disconnection Detected	BOOL
		01	*_Ch2_SensErr	Input 2 Disconnection Detected	BOOL
		02	*_Ch3_SensErr	Input 3 Disconnection Detected	BOOL
	08 to 15	03	*_Ch4_SensErr	Input 4 Disconnection Detected	BOOL
			*_UnitErr	Error Flags	BYTE
		08	*_SclErr	Scaling Data Setting Error	BOOL
		09	*_CfgErr	Input Signal Range Setting Error or Error in Number of Inputs Setting	BOOL
		11	*_AveErr	Mean Value Processing Setting Error	BOOL
		12	*_MdErr *	Error in Setting of Conversion Mode	BOOL
13		*_ConvMd *	Direct Conversion Mode	BOOL	
14	*_ConvErr	A/D Conversion Error	BOOL		

* The Direct Conversion Mode cannot be used with the NJ-series CPU Unit. On the Special Unit Setup Editing of Sysmac Studio, set "Conversion Mode Setting" to "Cyclic Conversion Mode".

Special I/O Unit DM Area

CJ-series I/O memory address		NJ-series device variable for CJ-series Unit		
DM No.	Bit No.	Variable name	Description	Data type
D(m)	00 to 07	*_InChUseCfg	Number of Analog Inputs Used	USINT
D(m+1)	00 to 07	--- *	Conversion Mode Setting	---
D(m+2)	00 to 07	*_Ch1_InRngCfg	Input 1 Input Signal Range Setting	USINT
D(m+3)	00 to 07	*_Ch1_AveCfg	Input 1 Number of Samplings for Mean Value Processing	UINT
D(m+4)	00 to 15	*_Ch1_Scl_L_Cfg	Input 1 Scaling Lower Limit	INT
D(m+5)	00 to 15	*_Ch1_Scl_H_Cfg	Input 1 Scaling Upper Limit	INT
D(m+6)	00 to 07	*_Ch2_InRngCfg	Input 2 Input Signal Range Setting	USINT
D(m+7)	00 to 07	*_Ch2_AveCfg	Input 2 Number of Samplings for Mean Value Processing	UINT
D(m+8)	00 to 15	*_Ch2_Scl_L_Cfg	Input 2 Scaling Lower Limit	INT
D(m+9)	00 to 15	*_Ch2_Scl_H_Cfg	Input 2 Scaling Upper Limit	INT
D(m+10)	00 to 07	*_Ch3_InRngCfg	Input 3 Input Signal Range Setting	USINT
D(m+11)	00 to 07	*_Ch3_AveCfg	Input 3 Number of Samplings for Mean Value Processing	UINT
D(m+12)	00 to 15	*_Ch3_Scl_L_Cfg	Input 3 Scaling Lower Limit	INT
D(m+13)	00 to 15	*_Ch3_Scl_H_Cfg	Input 3 Scaling Upper Limit	INT
D(m+14)	00 to 07	*_Ch4_InRngCfg	Input 4 Input Signal Range Setting	USINT
D(m+15)	00 to 07	*_Ch4_AveCfg	Input 4 Number of Samplings for Mean Value Processing	UINT
D(m+16)	00 to 15	*_Ch4_Scl_L_Cfg	Input 4 Scaling Lower Limit	INT
D(m+17)	00 to 15	*_Ch4_Scl_H_Cfg	Input 4 Scaling Upper Limit	INT

* The Direct Conversion Mode cannot be used with the NJ-series CPU Unit. On the Special Unit Setup Editing of Sysmac Studio, set "Conversion Mode Setting" to "Cyclic Conversion Mode".

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Special I/O Unit CIO Area (in Normal Mode)

I/O	CJ-series I/O memory address		NJ-series device variable for CJ-series Unit		
	CIO No.	Bit No.	Variable name	Description	Data type
Output (CPU to this Unit)	n	00 to 15	*_ConvCmd	Conversion Enable Settings	WORD
		00	*_Ch1_ConvCmd	Output 1 Conversion Enable	BOOL
		01	*_Ch2_ConvCmd	Output 2 Conversion Enable	BOOL
	n+1	00 to 15	*_Ch1_WrAO	Output 1 Set Value	INT
	n+2	00 to 15	*_Ch2_WrAO	Output 2 Set Value	INT
Input (This Unit to CPU)	n+9	00 to 07	*_MVErr	Output Set Value Error	BYTE
		00	*_Ch1_MVErr	Output 1 Output Set Value Error	BOOL
		01	*_Ch2_MVErr	Output 2 Output Set Value Error	BOOL
		08 to 15	*_UnitErr	Error Flags	BYTE
		10	*_HdErr	Output Hold Setting Error	BOOL

Special I/O Unit CIO Area (in Adjustment Mode)

I/O	CJ-series I/O memory address		NJ-series device variable for CJ-series Unit		
	CIO No.	Bit No.	Variable name	Description	Data type
Output (CPU to this Unit)	n	00 to 07	*_AdjCh	Outputs to Be Adjusted	BYTE
	n+1	00	*_AdjOfs	Offset Flag	BOOL
		01	*_AdjGain	Gain Flag	BOOL
		02	*_AdjDwn	Adjustment Value Down Flag	BOOL
		03	*_AdjUp	Adjustment Value Up Flag	BOOL
		04	*_AdjSet	Adjustment Value Set Flag	BOOL
		05	*_AdjClr	Adjustment Value Clear Flag	BOOL
Input (This Unit to CPU)	n+8	00 to 15	*_AdjPV	Conversion value for adjustment	INT
	n+9	08 to 15	*_AdjUnitErr	Error Flags	BYTE
		13	*_AdjOutNoErr	Output Value Adjustment Number Setting Error	BOOL
		14	*_AdjMemErr	Non-volatile Memory Error	BOOL
		15	*_AdjMd	Starting Adjustment Mode	BOOL

Special I/O Unit DM Area (common to both Normal Mode and Adjustment Mode)

CJ-series I/O memory address		NJ-series device variable for CJ-series Unit		
DM No.	Bit No.	Variable name	Description	Data type
D(m)	00 to 15	*_OutChUseCfg	Output Use Settings	WORD
	00	*_Ch1_OutChUseCfg	Output 1 Use Setting	BOOL
	01	*_Ch2_OutChUseCfg	Output 2 Use Setting	BOOL
D(m+1)	00 to 15	*_OutRngCfg	Output Signal Range Setting	WORD
	00 to 01		Output 1 Output Signal Range Setting	
	02 to 03		Output 2 Output Signal Range Setting	
D(m+2)	00 to 07	*_Ch1_HdMdCfg	Output 1 Output Status When Conversion Stops	USINT
D(m+3)	00 to 07	*_Ch2_HdMdCfg	Output 2 Output Status When Conversion Stops	USINT

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Special I/O Unit CIO Area (in Normal Mode)

I/O	CJ-series I/O memory address		NJ-series device variable for CJ-series Unit		
	CIO No.	Bit No.	Variable name	Description	Data type
Output (CPU to this Unit)	n	00 to 15	*_ConvCmd	Conversion Enable Settings	WORD
		00	*_Ch1_ConvCmd	Output 1 Conversion Enable	BOOL
		01	*_Ch2_ConvCmd	Output 2 Conversion Enable	BOOL
		02	*_Ch3_ConvCmd	Output 3 Conversion Enable	BOOL
		03	*_Ch4_ConvCmd	Output 4 Conversion Enable	BOOL
	n+1	00 to 15	*_Ch1_WrAO	Output 1 Set Value	INT
	n+2	00 to 15	*_Ch2_WrAO	Output 2 Set Value	INT
	n+3	00 to 15	*_Ch3_WrAO	Output 3 Set Value	INT
Input (This Unit to CPU)	n+9	00 to 07	*_MVErr	Output Set Value Error	BYTE
		00	*_Ch1_MVErr	Output 1 Output Set Value Error	BOOL
		01	*_Ch2_MVErr	Output 2 Output Set Value Error	BOOL
		02	*_Ch3_MVErr	Output 3 Output Set Value Error	BOOL
		03	*_Ch4_MVErr	Output 4 Output Set Value Error	BOOL
		08 to 15	*_UnitErr	Error Flags	BYTE
	10	*_HdErr	Output Hold Setting Error	BOOL	

Special I/O Unit CIO Area (in Adjustment Mode)

I/O	CJ-series I/O memory address		NJ-series device variable for CJ-series Unit		
	CIO No.	Bit No.	Variable name	Description	Data type
Output (CPU to this Unit)	n	00 to 07	*_AdjCh	Outputs to Be Adjusted	BYTE
	n+1	00	*_AdjOfs	Offset Flag	BOOL
		01	*_AdjGain	Gain Flag	BOOL
		02	*_AdjDwn	Adjustment Value Down Flag	BOOL
		03	*_AdjUp	Adjustment Value Up Flag	BOOL
		04	*_AdjSet	Adjustment Value Set Flag	BOOL
		05	*_AdjClr	Adjustment Value Clear Flag	BOOL
Input (This Unit to CPU)	n+8	00 to 15	*_AdjPV	Conversion value for adjustment	INT
	n+9	08 to 15	*_AdjUnitErr	Error Flags	BYTE
		13	*_AdjOutNoErr	Output Value Adjustment Number Setting Error	BOOL
		14	*_AdjMemErr	Non-volatile Memory Error	BOOL
		15	*_AdjMd	Starting Adjustment Mode	BOOL

Special I/O Unit DM Area (common to both Normal Mode and Adjustment Mode)

CJ-series I/O memory address		NJ-series device variable for CJ-series Unit		
DM No.	Bit No.	Variable name	Description	Data type
D(m)	00 to 15	*_OutChUseCfg	Output Use Settings	WORD
	00	*_Ch1_OutChUseCfg	Output 1 Use Setting	BOOL
	01	*_Ch2_OutChUseCfg	Output 2 Use Setting	BOOL
	02	*_Ch3_OutChUseCfg	Output 3 Use Setting	BOOL
	03	*_Ch4_OutChUseCfg	Output 4 Use Setting	BOOL
D(m+1)	00 to 15	*_OutRngCfg	Output Signal Range Setting	WORD
	00 to 01		Output 1 Output Signal Range Setting	
	02 to 03		Output 2 Output Signal Range Setting	
	04 to 05		Output 3 Output Signal Range Setting	
	06 to 07		Output 4 Output Signal Range Setting	
D(m+2)	00 to 07	*_Ch1_HdMdCfg	Output 1 Output Status When Conversion Stops	USINT
D(m+3)	00 to 07	*_Ch2_HdMdCfg	Output 2 Output Status When Conversion Stops	USINT
D(m+4)	00 to 07	*_Ch3_HdMdCfg	Output 3 Output Status When Conversion Stops	USINT
D(m+5)	00 to 07	*_Ch4_HdMdCfg	Output 4 Output Status When Conversion Stops	USINT

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Special I/O Unit CIO Area (in Normal Mode)

I/O	CJ-series I/O memory address		NJ-series device variable for CJ-series Unit		
	CIO No.	Bit No.	Variable name	Description	Data type
Output (CPU to this Unit)	n	00 to 15	*_ConvCmd	Conversion Enable Settings	WORD
		00	*_Ch1_ConvCmd	Output 1 Conversion Enable	BOOL
		01	*_Ch2_ConvCmd	Output 2 Conversion Enable	BOOL
		02	*_Ch3_ConvCmd	Output 3 Conversion Enable	BOOL
		03	*_Ch4_ConvCmd	Output 4 Conversion Enable	BOOL
		04	*_Ch5_ConvCmd	Output 5 Conversion Enable	BOOL
		05	*_Ch6_ConvCmd	Output 6 Conversion Enable	BOOL
		06	*_Ch7_ConvCmd	Output 7 Conversion Enable	BOOL
		07	*_Ch8_ConvCmd	Output 8 Conversion Enable	BOOL
	n+1	00 to 15	*_Ch1_WrAO	Output 1 Set Value	INT
	n+2	00 to 15	*_Ch2_WrAO	Output 2 Set Value	INT
	n+3	00 to 15	*_Ch3_WrAO	Output 3 Set Value	INT
	n+4	00 to 15	*_Ch4_WrAO	Output 4 Set Value	INT
	n+5	00 to 15	*_Ch5_WrAO	Output 5 Set Value	INT
	n+6	00 to 15	*_Ch6_WrAO	Output 6 Set Value	INT
	n+7	00 to 15	*_Ch7_WrAO	Output 7 Set Value	INT
n+8	00 to 15	*_Ch8_WrAO	Output 8 Set Value	INT	
Input (This Unit to CPU)	n+9	00 to 07	*_MVErr	Output Set Value Error	BYTE
		00	*_Ch1_MVErr	Output 1 Output Set Value Error	BOOL
		01	*_Ch2_MVErr	Output 2 Output Set Value Error	BOOL
		02	*_Ch3_MVErr	Output 3 Output Set Value Error	BOOL
		03	*_Ch4_MVErr	Output 4 Output Set Value Error	BOOL
		04	*_Ch5_MVErr	Output 5 Output Set Value Error	BOOL
		05	*_Ch6_MVErr	Output 6 Output Set Value Error	BOOL
		06	*_Ch7_MVErr	Output 7 Output Set Value Error	BOOL
		07	*_Ch8_MVErr	Output 8 Output Set Value Error	BOOL
		08 to 15	*_UnitErr	Error Flags	BYTE
		08	*_ScErr	Scaling Data Setting Error	BOOL
		10	*_HdErr	Output Hold Setting Error	BOOL
		12	*_MdErr	Conversion Time/Resolution or Operation Mode Setting Error	BOOL

Special I/O Unit CIO Area (in Adjustment Mode)

I/O	CJ-series I/O memory address		NJ-series device variable for CJ-series Unit		
	CIO No.	Bit No.	Variable name	Description	Data type
Output (CPU to this Unit)	n	00 to 07	*_AdjCh	Outputs to Be Adjusted	BYTE
	n+1	00	*_AdjOfs	Offset Flag	BOOL
		01	*_AdjGain	Gain Flag	BOOL
		02	*_AdjDwn	Adjustment Value Down Flag	BOOL
		03	*_AdjUp	Adjustment Value Up Flag	BOOL
		04	*_AdjSet	Adjustment Value Set Flag	BOOL
		05	*_AdjClr	Adjustment Value Clear Flag	BOOL
Input (This Unit to CPU)	n+8	00 to 15	*_AdjPV	Conversion value for adjustment	INT
	n+9	08 to 15	*_AdjUnitErr	Error Flags	BYTE
		13	*_AdjOutNoErr	Output Value Adjustment Number Setting Error	BOOL
		14	*_AdjMemErr	Non-volatile Memory Error	BOOL
		15	*_AdjMd	Starting Adjustment Mode	BOOL

Special I/O Unit DM Area (common to both Normal Mode and Adjustment Mode)

CJ-series I/O memory address		NJ-series device variable for CJ-series Unit		
DM No.	Bit No.	Variable name	Description	Data type
D(m)	00 to 15	*_OutChUseCfg	Output Use Settings	WORD
	00	*_Ch1_OutChUseCfg	Output 1 Use Setting	BOOL
	01	*_Ch2_OutChUseCfg	Output 2 Use Setting	BOOL
	02	*_Ch3_OutChUseCfg	Output 3 Use Setting	BOOL
	03	*_Ch4_OutChUseCfg	Output 4 Use Setting	BOOL
	04	*_Ch5_OutChUseCfg	Output 5 Use Setting	BOOL
	05	*_Ch6_OutChUseCfg	Output 6 Use Setting	BOOL
	06	*_Ch7_OutChUseCfg	Output 7 Use Setting	BOOL
	07	*_Ch8_OutChUseCfg	Output 8 Use Setting	BOOL

CJ-series I/O memory address		NJ-series device variable for CJ-series Unit		
DM No.	Bit No.	Variable name	Description	Data type
D(m+1)	00 to 15	*_OutRngCfg	Output Signal Range Setting	WORD
	00 to 01		Output 1 Output Signal Range Setting	
	02 to 03		Output 2 Output Signal Range Setting	
	04 to 05		Output 3 Output Signal Range Setting	
	06 to 07		Output 4 Output Signal Range Setting	
	08 to 09		Output 5 Output Signal Range Setting	
	10 to 11		Output 6 Output Signal Range Setting	
	12 to 13		Output 7 Output Signal Range Setting	
	14 to 15		Output 8 Output Signal Range Setting	
D(m+2)	00 to 07	*_Ch1_HdMdCfg	Output 1 Output Status When Conversion Stops	USINT
D(m+3)	00 to 07	*_Ch2_HdMdCfg	Output 2 Output Status When Conversion Stops	USINT
D(m+4)	00 to 07	*_Ch3_HdMdCfg	Output 3 Output Status When Conversion Stops	USINT
D(m+5)	00 to 07	*_Ch4_HdMdCfg	Output 4 Output Status When Conversion Stops	USINT
D(m+6)	00 to 07	*_Ch5_HdMdCfg	Output 5 Output Status When Conversion Stops	USINT
D(m+7)	00 to 07	*_Ch6_HdMdCfg	Output 6 Output Status When Conversion Stops	USINT
D(m+8)	00 to 07	*_Ch7_HdMdCfg	Output 7 Output Status When Conversion Stops	USINT
D(m+9)	00 to 07	*_Ch8_HdMdCfg	Output 8 Output Status When Conversion Stops	USINT
D(m+18)	00 to 07	*_MdCfg	Operating Mode Settings	BYTE
	08 to 15	*_ResolutionCfg	Resolution/Conversion Time Settings	BYTE
D(m+19)	00 to 15	*_Ch1_Scl_L_Cfg	Output 1 Scaling Lower Limit	INT
D(m+20)	00 to 15	*_Ch1_Scl_H_Cfg	Output 1 Scaling Upper Limit	INT
D(m+21)	00 to 15	*_Ch2_Scl_L_Cfg	Output 2 Scaling Lower Limit	INT
D(m+22)	00 to 15	*_Ch2_Scl_H_Cfg	Output 2 Scaling Upper Limit	INT
D(m+23)	00 to 15	*_Ch3_Scl_L_Cfg	Output 3 Scaling Lower Limit	INT
D(m+24)	00 to 15	*_Ch3_Scl_H_Cfg	Output 3 Scaling Upper Limit	INT
D(m+25)	00 to 15	*_Ch4_Scl_L_Cfg	Output 4 Scaling Lower Limit	INT
D(m+26)	00 to 15	*_Ch4_Scl_H_Cfg	Output 4 Scaling Upper Limit	INT
D(m+27)	00 to 15	*_Ch5_Scl_L_Cfg	Output 5 Scaling Lower Limit	INT
D(m+28)	00 to 15	*_Ch5_Scl_H_Cfg	Output 5 Scaling Upper Limit	INT
D(m+29)	00 to 15	*_Ch6_Scl_L_Cfg	Output 6 Scaling Lower Limit	INT
D(m+30)	00 to 15	*_Ch6_Scl_H_Cfg	Output 6 Scaling Upper Limit	INT
D(m+31)	00 to 15	*_Ch7_Scl_L_Cfg	Output 7 Scaling Lower Limit	INT

CJ-series I/O memory address		NJ-series device variable for CJ-series Unit		
DM No.	Bit No.	Variable name	Description	Data type
D(m+32)	00 to 15	*_Ch7_Scl_H_Cfg	Output 7 Scaling Upper Limit	INT
D(m+33)	00 to 15	*_Ch8_Scl_L_Cfg	Output 8 Scaling Lower Limit	INT
D(m+34)	00 to 15	*_Ch8_Scl_H_Cfg	Output 8 Scaling Upper Limit	INT

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Special I/O Unit CIO Area

I/O	CJ-series I/O memory address		NJ-series device variable for CJ-series Unit		
	CIO No.	Bit No.	Variable name	Description	Data type
Output (CPU to this Unit)	n	00 to 15	*_ConvCmd	Conversion Enable Settings	WORD
		00	*_Ch1_ConvCmd	Output 1 Conversion Enable	BOOL
		01	*_Ch2_ConvCmd	Output 2 Conversion Enable	BOOL
		02	*_Ch3_ConvCmd	Output 3 Conversion Enable	BOOL
		03	*_Ch4_ConvCmd	Output 4 Conversion Enable	BOOL
	n+1	00 to 15	*_Ch1_WrAO	Output 1 Set Value	INT
	n+2	00 to 15	*_Ch2_WrAO	Output 2 Set Value	INT
	n+3	00 to 15	*_Ch3_WrAO	Output 3 Set Value	INT
Input (This Unit to CPU)	n+9	00 to 07	*_MVErr	Output Set Value Error	BYTE
		00	*_Ch1_MVErr	Output 1 Output Set Value Error	BOOL
		01	*_Ch2_MVErr	Output 2 Output Set Value Error	BOOL
		02	*_Ch3_MVErr	Output 3 Output Set Value Error	BOOL
		03	*_Ch4_MVErr	Output 4 Output Set Value Error	BOOL
		08 to 15	*_UnitErr	Error Flags	BYTE
		08	*_ScErr	Scaling Data Setting Error	BOOL
		09	*_CfgErr	Output Signal Range Setting Error or Error In Number of Outputs Used Setting	BOOL
		10	*_HdErr	Output Hold Setting Error	BOOL
		12	*_MdErr *	Error in Setting of Conversion Mode	BOOL
		13	*_ConvMd *	Direct Conversion Mode	BOOL

* The Direct Conversion Mode cannot be used with the NJ-series CPU Unit. On the Special Unit Setup Editing of Sysmac Studio, set "Conversion Mode Setting" to "Cyclic Conversion Mode".

Special I/O Unit DM Area

CJ-series I/O memory address		NJ-series device variable for CJ-series Unit		
DM No.	Bit No.	Variable name	Description	Data type
D(m)	00 to 07	*_OutChUseCfg	Number of Analog Outputs Used	USINT
D(m+1)	00 to 07	--- *	Conversion Mode Setting	---
D(m+2)	00 to 07	*_Ch1_OutRngCfg	Output 1 Output Signal Range Setting	USINT
D(m+3)	00 to 07	*_Ch1_HdMdCfg	Output 1 Output Status When Conversion Stops	USINT

CJ-series I/O memory address		NJ-series device variable for CJ-series Unit		
DM No.	Bit No.	Variable name	Description	Data type
D(m+4)	00 to 15	*_Ch1_Scl_L_Cfg	Output 1 Scaling Lower Limit	INT
D(m+5)	00 to 15	*_Ch1_Scl_H_Cfg	Output 1 Scaling Upper Limit	INT
D(m+6)	00 to 07	*_Ch2_OutRngCfg	Output 2 Output Signal Range Setting	USINT
D(m+7)	00 to 07	*_Ch2_HdMdCfg	Output 2 Output Status When Conversion Stops	USINT
D(m+8)	00 to 15	*_Ch2_Scl_L_Cfg	Output 2 Scaling Lower Limit	INT
D(m+9)	00 to 15	*_Ch2_Scl_H_Cfg	Output 2 Scaling Upper Limit	INT
D(m+10)	00 to 07	*_Ch3_OutRngCfg	Output 3 Output Signal Range Setting	USINT
D(m+11)	00 to 07	*_Ch3_HdMdCfg	Output 3 Output Status When Conversion Stops	USINT
D(m+12)	00 to 15	*_Ch3_Scl_L_Cfg	Output 3 Scaling Lower Limit	INT
D(m+13)	00 to 15	*_Ch3_Scl_H_Cfg	Output 3 Scaling Upper Limit	INT
D(m+14)	00 to 07	*_Ch4_OutRngCfg	Output 4 Output Signal Range Setting	USINT
D(m+15)	00 to 07	*_Ch4_HdMdCfg	Output 4 Output Status When Conversion Stops	USINT
D(m+16)	00 to 15	*_Ch4_Scl_L_Cfg	Output 4 Scaling Lower Limit	INT
D(m+17)	00 to 15	*_Ch4_Scl_H_Cfg	Output 4 Scaling Upper Limit	INT

* The Direct Conversion Mode cannot be used with the NJ-series CPU Unit. On the Special Unit Setup Editing of Sysmac Studio, set "Conversion Mode Setting" to "Cyclic Conversion Mode".

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Special I/O Unit CIO Area (in Normal Mode)

I/O	CJ-series I/O memory address		NJ-series device variable for CJ-series Unit		
	CIO No.	Bit No.	Variable name	Description	Data type
Output (CPU to this Unit)	n	00 to 07	*_ConvPkHdCmd	Peak Value Hold and Output Conversion Enable Settings	BYTE
		00	*_Ch1_ConvCmd	Output 1 Conversion Enable	BOOL
		01	*_Ch2_ConvCmd	Output 2 Conversion Enable	BOOL
		04	*_Ch1_PkHdCmd	Input 1 Peak Value Hold Execution	BOOL
		05	*_Ch2_PkHdCmd	Input 2 Peak Value Hold Execution	BOOL
		06	*_Ch3_PkHdCmd	Input 3 Peak Value Hold Execution	BOOL
		07	*_Ch4_PkHdCmd	Input 4 Peak Value Hold Execution	BOOL
	n+1	00 to 15	*_Ch1_WrAO	Output 1 Set Value	INT
	n+2	00 to 15	*_Ch2_WrAO	Output 2 Set Value	INT
Input (This Unit to CPU)	n+5	00 to 15	*_Ch1_RdAI	Input 1 Conversion Data	INT
	n+6	00 to 15	*_Ch2_RdAI	Input 2 Conversion Data	INT
	n+7	00 to 15	*_Ch3_RdAI	Input 3 Conversion Data	INT
	n+8	00 to 15	*_Ch4_RdAI	Input 4 Conversion Data	INT
	n+9	00 to 07	*_MVSensErr	Set Value Errors and Disconnection Detected	BYTE
		00	*_Ch1_MVErr	Output 1 Output Set Value Error	BOOL
		01	*_Ch2_MVErr	Output 2 Output Set Value Error	BOOL
		04	*_Ch1_SensErr	Input 1 Disconnection Detected	BOOL
		05	*_Ch2_SensErr	Input 2 Disconnection Detected	BOOL
		06	*_Ch3_SensErr	Input 3 Disconnection Detected	BOOL
		07	*_Ch4_SensErr	Input 4 Disconnection Detected	BOOL
		08 to 15	*_UnitErr	Error Flags	BYTE
		08	*_ScIErr	Scaling Data Setting Error/Ratio Conversion Use Setting Error	BOOL
		09	*_RatioCfgErr	Ratio Set Value Error	BOOL
		10	*_HdErr	Output Hold Setting Error	BOOL
	11	*_AveErr	Mean Value Processing Setting Error	BOOL	
	12	*_MdErr	Conversion Time/Resolution or Operation Mode Setting Error	BOOL	

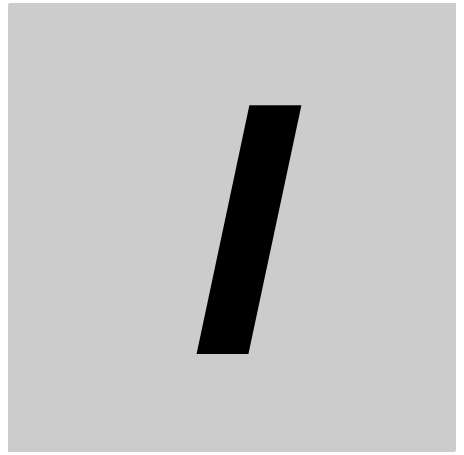
Special I/O Unit CIO Area (in Adjustment Mode)

I/O	CJ-series I/O memory address		NJ-series device variable for CJ-series Unit		
	CIO No.	Bit No.	Variable name	Description	Data type
Output (CPU to this Unit)	n	00 to 07	*_AdjCh	Input and Outputs to Be Adjusted	BYTE
	n+1	00	*_AdjOfs	Offset Flag	BOOL
		01	*_AdjGain	Gain Flag	BOOL
		02	*_AdjDwn	Adjustment Value Down Flag	BOOL
		03	*_AdjUp	Adjustment Value Up Flag	BOOL
		04	*_AdjSet	Adjustment Value Set Flag	BOOL
	05	*_AdjClr	Adjustment Value Clear Flag	BOOL	
Input (This Unit to CPU)	n+8	00 to 15	*_AdjPV	Conversion value for adjustment	INT
	n+9	08 to 15	*_AdjUnitErr	Error Flags	BYTE
		11	*_AdjAveErr	Mean Value Processing Setting Error	BOOL
		12	*_AdjInMdErr	Conversion Time/Resolution or Operation Mode Setting Error	BOOL
		13	*_AdjIONoErr	Input/Output Value Adjustment Number Setting Error	BOOL
		14	*_AdjMemErr	Non-volatile Memory Error	BOOL
	15	*_AdjMd	Starting Adjustment Mode	BOOL	

Special I/O Unit DM Area (common to both Normal Mode and Adjustment Mode)

CJ-series I/O memory address		NJ-series device variable for CJ-series Unit			
DM No.	Bit No.	Variable name	Description	Data type	
D(m)	00 to 15	*_ChUseCfg	Input and Output Use Settings	BYTE	
	00	*_Ch1_OutChUseCfg	Output 1 Use Setting	BOOL	
	01	*_Ch2_OutChUseCfg	Output 2 Use Setting	BOOL	
	04	*_Ch1_InChUseCfg	Input 1 Use Setting	BOOL	
	05	*_Ch2_InChUseCfg	Input 2 Use Setting	BOOL	
	06	*_Ch3_InChUseCfg	Input 3 Use Setting	BOOL	
	07	*_Ch4_InChUseCfg	Input 4 Use Setting	BOOL	
	08 to 09	*_UseRatioBias		Loop 1 Ratio Conversion Use Setting	BYTE
	10 to 11			Loop 2 Ratio Conversion Use Setting	

CJ-series I/O memory address		NJ-series device variable for CJ-series Unit		
DM No.	Bit No.	Variable name	Description	Data type
D(m+1)	00 to 15	*_RngCfg	Range Settings	WORD
	00 to 01		Output 1 Output Signal Range Setting	
	02 to 03		Output 2 Output Signal Range Setting	
	08 to 09		Input 1 Input Signal Range Setting	
	10 to 11		Input 2 Input Signal Range Setting	
	12 to 13		Input 3 Input Signal Range Setting	
	14 to 15		Input 4 Input Signal Range Setting	
D(m+2)	00 to 07	*_Ch1_HdMdCfg	Output 1 Output Status When Conversion Stops	USINT
D(m+3)	00 to 07	*_Ch2_HdMdCfg	Output 2 Output Status When Conversion Stops	USINT
D(m+6)	00 to 15	*_Ch1_AveCfg	Input 1 Number of Samplings for Mean Value Processing	UINT
D(m+7)	00 to 15	*_Ch2_AveCfg	Input 2 Number of Samplings for Mean Value Processing	UINT
D(m+8)	00 to 15	*_Ch3_AveCfg	Input 3 Number of Samplings for Mean Value Processing	UINT
D(m+9)	00 to 15	*_Ch4_AveCfg	Input 4 Number of Samplings for Mean Value Processing	UINT
D(m+10)	00 to 15	*_Ch1_Cfg_Const_A	Loop 1 Ratio Conversion Constant A	WORD
D(m+11)	00 to 15	*_Ch1_Cfg_Const_B	Loop 1 Ratio Conversion Constant B	INT
D(m+12)	00 to 15	*_Ch2_Cfg_Const_A	Loop 2 Ratio Conversion Constant A	WORD
D(m+13)	00 to 15	*_Ch2_Cfg_Const_B	Loop 2 Ratio Conversion Constant B	INT
D(m+18)	00 to 07	*_MdCfg	Operating Mode Settings	BYTE
	08 to 15	*_ResolutionCfg	Resolution/Conversion Time Settings	BYTE
D(m+19)	00 to 15	*_Ch1_Scl_L_Cfg	Output 1 Scaling Lower Limit	INT
D(m+20)	00 to 15	*_Ch1_Scl_H_Cfg	Output 1 Scaling Upper Limit	INT
D(m+21)	00 to 15	*_Ch2_Scl_L_Cfg	Output 2 Scaling Lower Limit	INT
D(m+22)	00 to 15	*_Ch2_Scl_H_Cfg	Output 2 Scaling Upper Limit	INT
D(m+27)	00 to 15	*_Ch3_Scl_L_Cfg	Input 1 Scaling Lower Limit	INT
D(m+28)	00 to 15	*_Ch3_Scl_H_Cfg	Input 1 Scaling Upper Limit	INT
D(m+29)	00 to 15	*_Ch4_Scl_L_Cfg	Input 2 Scaling Lower Limit	INT
D(m+30)	00 to 15	*_Ch4_Scl_H_Cfg	Input 2 Scaling Upper Limit	INT
D(m+31)	00 to 15	*_Ch5_Scl_L_Cfg	Input 3 Scaling Lower Limit	INT
D(m+32)	00 to 15	*_Ch5_Scl_H_Cfg	Input 3 Scaling Upper Limit	INT
D(m+33)	00 to 15	*_Ch6_Scl_L_Cfg	Input 4 Scaling Lower Limit	INT
D(m+34)	00 to 15	*_Ch6_Scl_H_Cfg	Input 4 Scaling Upper Limit	INT
D(m+35)	00 to 07	*_RngVICfg	Voltage/Current Input Switch	WORD



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