

Motion Controller

GM1 Series

Reference Manual

Analog I/O Unit Edition

[Applicable models]

AGM1AD8

AGM1DA4

(MEMO)

Introduction

Thank you for purchasing a Panasonic product. Before you use the product, please carefully read through the installation instructions and the manuals, and understand them in detail to use the product properly.

Types of Manuals

- There are different types of manuals for the GM1 series, as listed below. Please refer to a relevant manual for the unit and purpose of your use.

These manuals can be downloaded from our website: <https://industry.panasonic.com/global/en/products/fasys/plc/mc/gm1>

Manuals for GM1 series

| Manual name | Manual code | Manual description |
|---|-------------|--|
| GM1 Series Reference Manual (Hardware Edition) | WUME-GM1H | Explains the functions and performance of each GM1 unit. |
| GM1 Series Reference Manual (Instructions Edition) | WUME-GM1PGR | Explains the specifications of each instruction that can be used with the GM1 Series. |
| GM1 Series Reference Manual (Analog I/O Unit Edition) | WUME-GM1AIO | Explains the functions and performance of the GM1 Analog Expansion Unit. |
| GM1 Series Reference Manual (Pulse Output Unit Edition) | WUME-GM1PG | Explains the functions and performance of the GM1 Pulse Output Unit. |
| GM1 Series Reference Manual (Serial Communication Unit Edition) | WUME-GM1SC | Explains the functions and performance of the GM1 Serial Communication Unit. |
| GM1 Series User's Manual (Operation Edition) | WUME-GM1OP | Explains how to use GM Programmer and PANATERM Lite for GM, set up each function, create projects, and perform other operations. |

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Table of Contents

| | |
|---|------------|
| 1 Before Using This Product..... | 1-1 |
| 1.1 Safety Precautions..... | 1-2 |
| 1.2 Handling Precautions..... | 1-3 |
| 2 Functions of Unit and Restrictions on Combination..... | 2-1 |
| 2.1 Unit Functions and How They Work | 2-2 |
| 2.1.1 Functions of the unit..... | 2-2 |
| 2.1.2 Unit Type and Product No..... | 2-3 |
| 2.2 Restrictions on Units Combination..... | 2-4 |
| 2.2.1 Applicable Versions of Unit and Software | 2-4 |
| 3 Project Creation | 3-1 |
| 3.1 Adding Expansion Units..... | 3-2 |
| 3.2 Setting Parameters and Performing I/O Mapping..... | 3-5 |
| 3.3 Setting the Analog Input Unit..... | 3-7 |
| 3.3.1 List of Analog_8IN Parameters | 3-7 |
| 3.3.2 List of Analog_8IN I/O Mapping | 3-8 |
| 3.4 Setting the Analog Output Unit | 3-10 |
| 3.4.1 List of Analog_4OUT Parameters | 3-10 |
| 3.4.2 List of Analog_4OUT I/O Mapping | 3-11 |
| 4 Functions of the Analog Input Unit..... | 4-1 |
| 4.1 Basic Operation | 4-2 |
| 4.1.1 Reading Analog Input Data..... | 4-2 |
| 4.1.2 Input Setting and Conversion Processing Time | 4-3 |
| 4.2 Average Processing Settings..... | 4-5 |
| 4.2.1 Count-based Average | 4-5 |
| 4.2.2 Time-based Average..... | 4-6 |
| 4.2.3 Moving Average | 4-7 |
| 4.3 Offset / Gain Processing Function | 4-8 |
| 4.4 Scale Conversion Function..... | 4-10 |
| 4.5 Upper Limit / Lower Limit Comparison Function..... | 4-11 |
| 4.6 Max. / Min. Hold Function | 4-14 |
| 4.7 Disconnection Detection Function | 4-17 |
| 5 Functions of the Analog Output Unit..... | 5-1 |
| 5.1 Basic Operation | 5-2 |
| 5.1.1 Writing Analog Output Data | 5-2 |
| 5.1.2 Timing Chart of Output Processing | 5-3 |
| 5.2 Offset / Gain Processing Function | 5-4 |
| 5.3 Scale Conversion Function..... | 5-6 |
| 5.4 Clipping Function | 5-7 |

| | |
|--|--------------|
| 5.5 Analog Output Hold Function in STOP Mode | 5-9 |
| 6 Conversion Characteristics of Analog Input Unit..... | 6-1 |
| 6.1 Voltage Range | 6-2 |
| 6.1.1 Voltage Input Range: -10 to +10 V (Resolution: 1/64,000) | 6-2 |
| 6.1.2 Voltage Input Range: 0 to +10 V (Resolution: 1/32,000)..... | 6-3 |
| 6.1.3 Voltage Input Range: -5 to +5 V (Resolution: 1/64,000) | 6-3 |
| 6.1.4 Voltage Input Range: 0 to +5 V (Resolution: 1/32,000)..... | 6-4 |
| 6.1.5 Voltage Input Range: +1 to +5 V (Resolution: 1/25,600) | 6-5 |
| 6.2 Current Range | 6-6 |
| 6.2.1 Current Input Range: 0 to +20 mA (Resolution: 1/32,000)..... | 6-6 |
| 6.2.2 Current Input Range: +4 to +20 mA (Resolution: 1/25,600) | 6-6 |
| 7 Conversion Characteristics of Analog Output..... | 7-1 |
| 7.1 Voltage Range | 7-2 |
| 7.1.1 Voltage Output Range: -10 to +10 V (Resolution: 1/64,000)..... | 7-2 |
| 7.1.2 Voltage Output Range: 0 to +10 V (Resolution: 1/32,000)..... | 7-3 |
| 7.1.3 Voltage Output Range: -5 to +5 V (Resolution: 1/64,000)..... | 7-3 |
| 7.1.4 Voltage Output Range: 0 to +5 V (Resolution: 1/32,000)..... | 7-4 |
| 7.1.5 Voltage Output Range: +1 to +5 V (Resolution: 1/25,600)..... | 7-4 |
| 7.2 Current Range | 7-6 |
| 7.2.1 Current Output Range: 0 to +20 mA (Resolution: 1/32,000)..... | 7-6 |
| 7.2.2 Current Output Range: +4 to +20 mA (Resolution: 1/25,600)..... | 7-6 |
| 8 What to Do If an Error Occurs | 8-1 |
| 8.1 What to Do If an Error Occurs (Analog Input)..... | 8-2 |
| 8.1.1 Failure in Reading Analog Input Data | 8-2 |
| 8.1.2 Unstable Analog Input Values | 8-2 |
| 8.1.3 No Proper Conversion Values Obtained with Current Input..... | 8-2 |
| 8.2 What to Do If an Error Occurs (Analog Output) | 8-3 |
| 8.2.1 Unstable Analog Output Value | 8-3 |
| 8.2.2 Unchanged Analog Output Value..... | 8-3 |
| Appendix Warranty / Cautions for Proper Use..... | App-1 |
| Warranty | App-2 |
| Warranty Period | App-2 |
| Warranty Scope | App-2 |
| Cautions for Proper Use | App-3 |

1 Before Using This Product



| | |
|-------------------------------|-----|
| 1.1 Safety Precautions..... | 1-2 |
| 1.2 Handling Precautions..... | 1-3 |



1.1 Safety Precautions





1.1 Safety Precautions










This section explains important rules that must be observed to prevent personal injury and property damage.

- Injuries and damages that may occur as a result of incorrect use are classified into the following levels and safety precautions are explained according to the level.

| | |
|--|---|
|  WARNING | Indicates that there is a risk of death or serious injury |
|  CAUTION | Indicates that there is a risk of minor injury or property damage |






| | |
|---|--|
|  | Indicates an action that is prohibited |
|  | Indicates an action that must be taken |

|  WARNING | |
|--|--|
|  | • Take safety measures outside this product to ensure the safety of the entire system even if this product fails or an error occurs due to external factors. |
|  | • Do not use this product in atmospheres that contain flammable gases. Doing so may result in explosion. |
|  | • Do not throw this product into the fire. Doing so may cause the batteries or other electronic parts to explode. |

|  CAUTION | |
|--|---|
|  | • To prevent abnormal heat generation or smoke generation, use this product with some leeway from the guaranteed characteristics and performance values of the product. |
|  | • Do not disassemble or modify this product. Doing so may result in abnormal heat generation or smoke generation. |
|  | • Do not touch any terminals while the power is on. Doing so may result in electrical shock. |
|  | • Configure emergency stop and interlock circuits outside this product. |
|  | • Connect wires and connectors properly. Failure to do so may result in abnormal heat generation or smoke generation. |
|  | • Do not perform work (such as connection or removal) with the power turned on. Doing so may result in electrical shock. |
|  | • If this product is used in any way that is not specified by Panasonic, its protection function may be impaired. |
|  | • This product has been developed and manufactured for industrial use only. |

1.2 Handling Precautions

- In this manual, the following symbols are used to indicate safety information that must be observed.

| | |
|---|--|
|  | Indicates an action that is prohibited or a matter that requires caution. |
|  | Indicates an action that must be taken. |
|  | Indicates supplemental information. |
|  | Indicates details about the subject in question or information useful to remember. |
|  | Indicates operation procedures. |

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2 Functions of Unit and Restrictions on Combination

- 2.1 Unit Functions and How They Work2-2
 - 2.1.1 Functions of the unit..... 2-2
 - 2.1.2 Unit Type and Product No..... 2-3
- 2.2 Restrictions on Units Combination.....2-4
 - 2.2.1 Applicable Versions of Unit and Software 2-4

2.1 Unit Functions and How They Work

2.1 Unit Functions and How They Work

2.1.1 Functions of the unit

■ Features of the Analog Input Unit

The analog input unit receives various analog values (i.e., voltage, current, and temperature values) from laser analog sensors and pressure sensors and converts them internally into digital values.

- The number of channels is eight.
- The input range can be selected from the following seven types.
Voltage input: -10 to +10 V, 0 to +10 V, -5 to +5 V, 0 to +5 V, +1 to +5 V
Current input: 0 to +20 mA, +4 to +20 mA
- The analog conversion speed is 50 μ s/channel.
- The resolution is 1/25,600 to 1/64,000.
Input analog signals are converted into a maximum of 16-bit digital data.

■ Features of the Analog Output Unit

This unit converts unit internal data to analog values and outputs them to analog drive devices such as inverter.

- The number of channels is four.
- The output range can be selected from the following seven types.
Voltage output : -10 to +10V, 0 to +10V, -5 ~ + 5V, 0 to +5V, +1 to +5V
Current output : 0 to +20mA, +4 to +20mA
- The digital conversion speed is 50 channel.
- The resolution is 1/25,600 to 1/64,000.
Input digital data are converted into a maximum of 16-bit analog signals.

■ Optional Functions

This product is provided with the following option setting functions.

| Function | Specifications |
|---|--|
| Average processing settings function | Selects average processing for the analog values taken in by sampling. |
| Offset / Gain processing function | Performs the correction of offset values (addition correction) or gain values (magnification correction). |
| Scale conversion function | This function is to scale-convert values to an easy-to-use data range. |
| Upper limit / lower limit comparison function | This function compares acquired analog input data with the preset upper limit and lower limit. |
| Max. / Min. hold function | This function maintains the maximum and minimum values of acquired data. |
| Disconnection detection function | Turns ON the disconnection detection status when input is disconnected or unconnected, and warns of the error state. |

2.1.2 Unit Type and Product No

| Name | Specifications | | Product No. |
|------------------------|----------------|--|-------------|
| GM1 Analog Input Unit | Input 8ch | Voltage input/output range -10 to + 10 V DC (Resolution: 1/64,000) 0 to + 10 V DC (Resolution: 1/32,000) -5 to + 5 V DC (Resolution: 1/64,000) 0 to + 5 V DC (Resolution: 1/32,000) + 1 to + 5 V DC (Resolution: 1/25,600) | AGM1AD8 |
| GM1 Analog Output Unit | Output 4ch | Current input/output range 0 to + 20 mA (Resolution: 1/32,000) +4 to + 20 mA (Resolution: 1/25,600) | AGM1DA4 |

2.2 Restrictions on Units Combination

2.2 Restrictions on Units Combination

2.2.1 Applicable Versions of Unit and Software

For using the GM1 Analog I/O Unit, the GM1 Controller and GM Programmer with the following versions are required.

| Name | | Applicable version |
|--|-------------|----------------------|
| RTEX-compatible GM1 Controller (Sink type) | AGM1CSR16T | Ver.1.2.0.0 or later |
| EtherCAT-compatible GM1 Controller (Sink type) | AGM1CSEC16T | Ver.1.2.0.0 or later |
| EtherCAT-compatible GM1 Controller (Source type) | AGM1CSEC16P | |
| GM Programmer | | Ver.1.2.0.0 or later |

3 Project Creation

| | |
|--|------|
| 3.1 Adding Expansion Units..... | 3-2 |
| 3.2 Setting Parameters and Performing I/O Mapping..... | 3-5 |
| 3.3 Setting the Analog Input Unit..... | 3-7 |
| 3.3.1 List of Analog_8IN Parameters | 3-7 |
| 3.3.2 List of Analog_8IN I/O Mapping | 3-8 |
| 3.4 Setting the Analog Output Unit | 3-10 |
| 3.4.1 List of Analog_4OUT Parameters | 3-10 |
| 3.4.2 List of Analog_4OUT I/O Mapping | 3-11 |

3.1 Adding Expansion Units

3.1 Adding Expansion Units

This section explains how to add device objects for expansion units to a project. After the addition, the parameters and I/O mapping can be checked or changed.

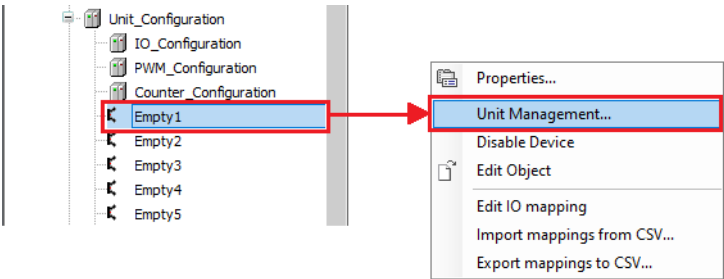
The following explanation is provided for a case where a digital input unit (product number: AGM1X64D2) is added to Empty1.

The procedure is as follows:

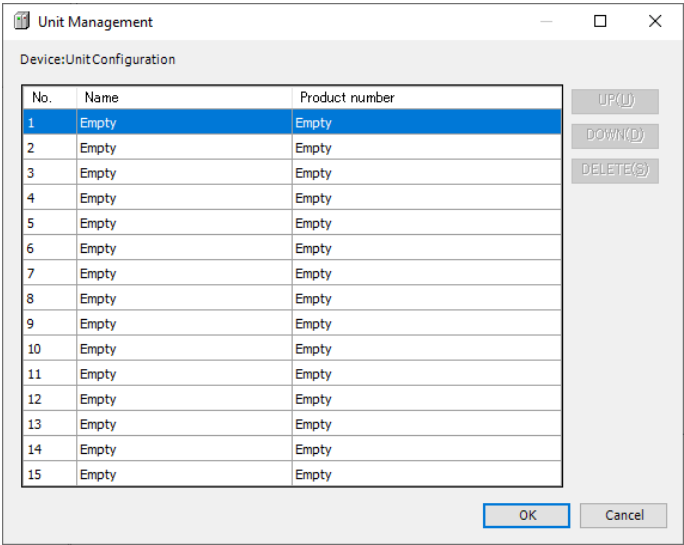
12

Procedure

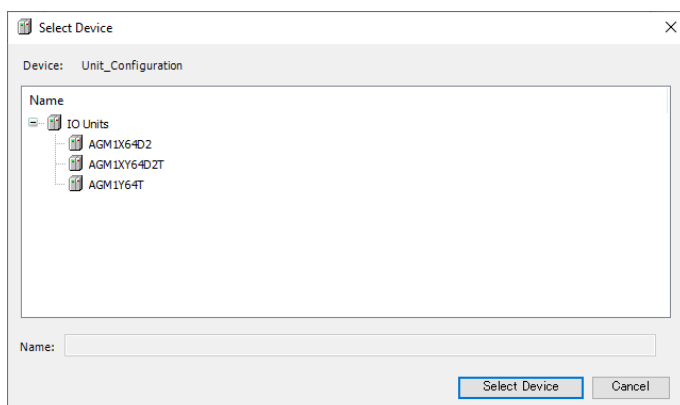
1. Right-click the [Empty1] object in the navigation pane and then select "Unit Management" from the context-sensitive menu that is displayed.



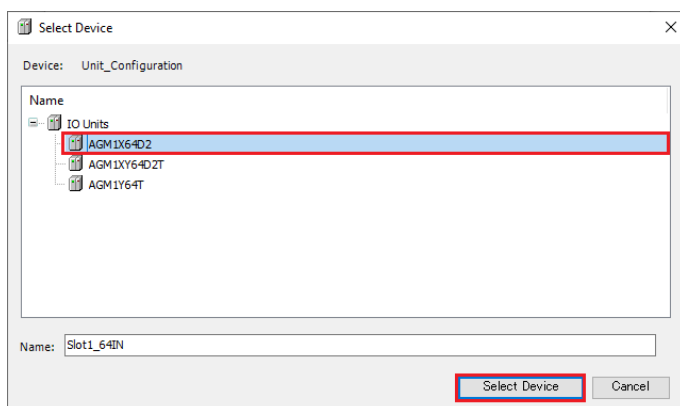
The "Unit Management" dialog box will be displayed.



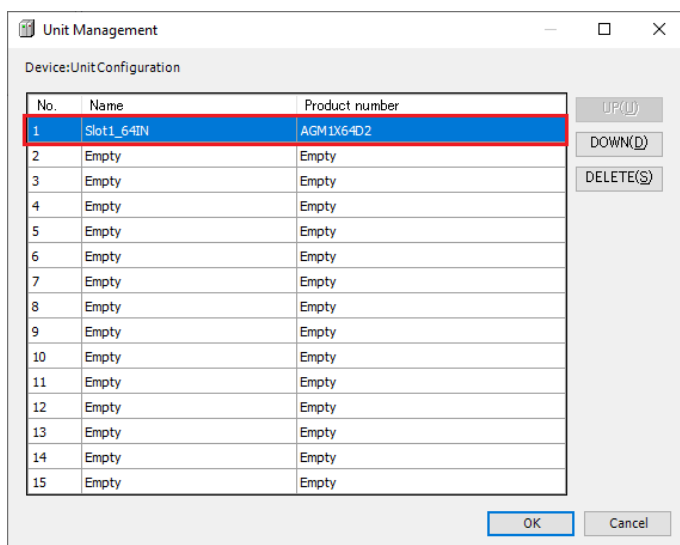
2. Double-click the first row in the "Device: Unit_Configuration" table. The "Select Device" dialog box will be displayed.



3. Select a device object for the expansion unit to be added.



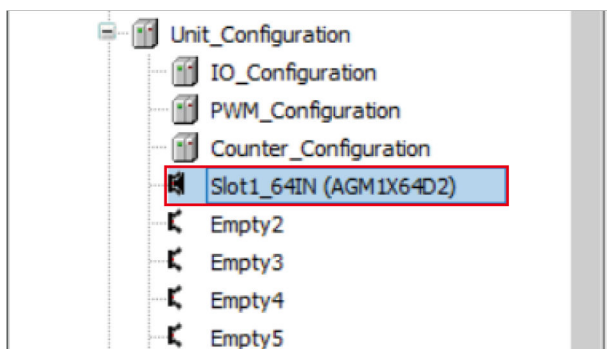
4. Click the [Select Device] button.
The selected device object of the expansion unit will be added.



5. Click the [OK] button.

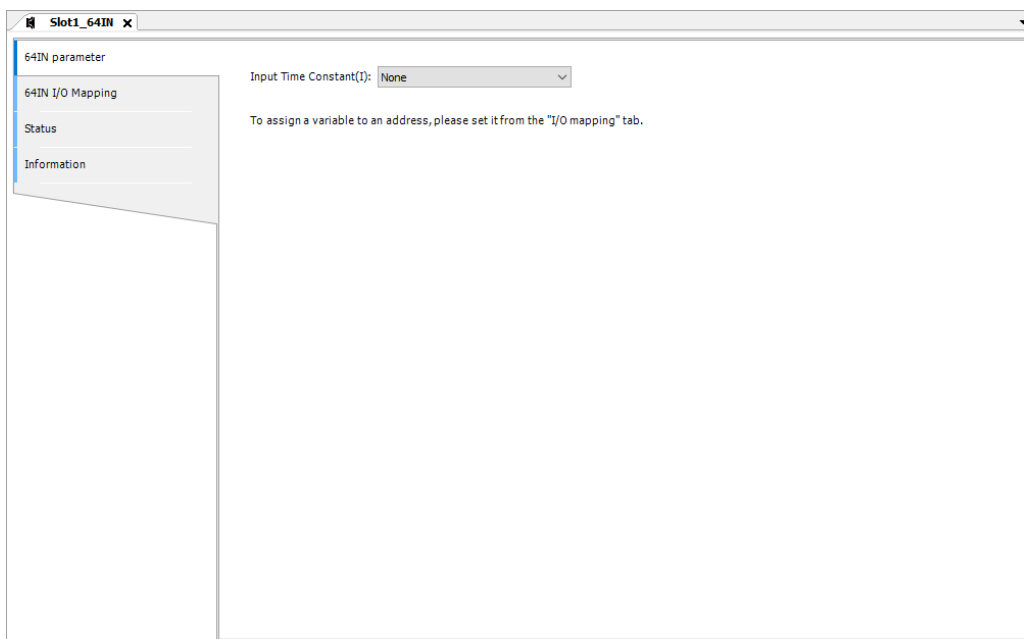
3.1 Adding Expansion Units

The selected device object of the expansion unit will be added to the navigation pane.



6. Double-click the added object.

The setting pane will be displayed in the main pane. Specify settings related to the expansion unit.



i Info.

- To remove the device object of an expansion unit that has been added, select the expansion unit to be removed in the "Unit Management" dialog box and press the "Delete" key or click the [Delete] button.

3.2 Setting Parameters and Performing I/O Mapping

- Specify operations of analog input units and analog output units by setting parameters.
- Perform the following using I/O mapping.
 - You can create variables for each channel and use them in the control program.
 - Map them to existing variables so that variables correspond to channels.

■ Overview

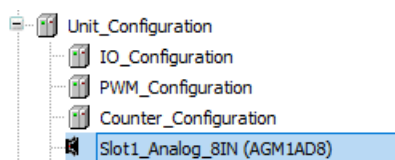
- After adding analog I/O units to the project, select them from the device pane to change its parameters and to perform I/O.
- The analog I/O units are displayed as follows in the device pane.
 - The segments indicated by * differ according to the expansion location.

| | |
|--------------------|-----------------------------|
| Analog input unit | Slot*_Analog_8IN (AGM1AD8) |
| Analog output unit | Slot*_Analog_4OUT (AGM1DA4) |

1 2 Procedure

Setting parameters of the analog input unit connected to the 1st unit

1. Double-click "Slot1_Analog_8IN(AGM1AD8)" in the device pane.



2. Click the "Analog_8IN Parameters" tab.
3. Set parameters for each channel.

Parameter setting example

Category Selection(T)

- [-] Unit specific configuration settings
 - Ch0_Unit specific configuration settings
 - Ch1_Unit specific configuration settings
 - Ch2_Unit specific configuration settings
 - Ch3_Unit specific configuration settings
 - Ch4_Unit specific configuration settings
 - Ch5_Unit specific configuration settings
 - Ch6_Unit specific configuration settings
 - Ch7_Unit specific configuration settings

Parameter Setting (R)


| Parameter | Value |
|-------------------|--------------------|
| ConversionProcess | Execute |
| RangeSetting | 0 ~ 20mA ▾ |
| AveragingProcess | Time-based average |
| AverageConstant | 200 |
| OffsetGainProcess | Not Execute |
| OffsetValue | 0 |
| GainValue | 1.0000 |

(Note 1) In this example, the analog input range for channel 3 is set to "0 to 20 mA".





4. Click the "Analog_8IN I/O Mapping" tab.
5. Individually map variables that can be used for the program to the channel to be used.



3.2 Setting Parameters and Performing I/O Mapping

- By directly inputting a variable name, you can create a new variable in the "I/O Mapping" window.
- Click  to map to an existing variable.

I/O mapping input example

| | |
|---|---|
|  Application.PRG_Sample.iCh0_ConversionValue |  Ch0_ConversionValue |
|  iCh0_MaxHoldingValue |  Ch0_MaxHoldingValue |

(Note 1) In this example, variables are registered as shown in the following table.

| Channel | Variables |
|---------------------|---|
| Ch0_ConversionValue | Map to the variable "iCh0_MaxHoldingValue" created in the program "PRG_Sample". |
| Ch0_MaxHoldingValue | Create a new variable "iCh0_MaxHoldingValue". |



Note

- For the description of parameters to be set and channels, see the next page.

3.3 Setting the Analog Input Unit

3.3.1 List of Analog_8IN Parameters

The following table shows a list of changeable parameters for the GM1 Analog Input Unit. Set parameter for each channel.

| Setting item | Default | Description |
|------------------------------|------------------------------|---|
| ConversionProcess | Execute | Select "Execute / Not Execute" of the analog input. |
| RangeSetting | -10 to +10 V | Select the input range. -10 to +10 V 0 to +10 V -5 to +5 V 0 to +5 V +1 to +5 V 0 to +20 mA +4 to +20 mA |
| AveragingProcess | Not execute | Select the operation for input average processing. No averaging / Count-based average / Time-based average / Moving average |
| AverageConstant | 200 | Specify the constant for input average processing Count-based average Average count: 2 to 60,000 [times] Time-based average Average time: 1 to 1,500 [ms] Moving average Average count: 2 to 2,000 [times] |
| OffsetGainProcess | Not Execute | Select "Execute / Not Execute" for the Offset / Gain processing. |
| OffsetValue | 0 | Specify the offset value for when the Offset / Gain processing is executed. -3000 to +3000 |
| Gain value | 10000 (multiplied by 1.0) | Specify the gain value for when the Offset / Gain processing is executed. +9000 to +11000 (multiplied by 0.9 to 1.1) |
| ScaleConversion | Not execute | Select "Execute / Not execute" for the scale conversion. |
| ScaleConversionMaxValue | 10000 | Specify the maximum value after scale conversion is executed. -32768 to +32767 |
| ScaleConversionMinValue | 0 | Specify the minimum value after scale conversion is executed. -32768 to +32767 |
| UpperAndLowerLimitComparison | Not Execute | Select "Execute / Not Execute" for the upper limit / lower limit comparison. |

3.3 Setting the Analog Input Unit

| Setting item | Default | Description |
|------------------------------|-----------------|--|
| UpperLimitComparisonONLevel | 1000 | Specify the upper limit comparison ON level. -32768 to +32767 |
| UpperLimitComparisonOFFLevel | 1000 | Specify the upper limit comparison OFF level. -32768 to +32767 |
| LowerLimitComparisonONLevel | 0 | Specify the lower limit comparison ON level. -32768 to +32767 |
| LowerLimitComparisonOFFLevel | 0 | Specify the lower limit comparison OFF level. -32768 to +32767 |
| MaxMinValueRetention | Not execute | Select "Not execute / Execute" for the Max. / Min. hold. |
| DisconnectionDetection | Not execute | Select "Not execute / Execute" for the disconnection detection. |
| DisconnectionDetectionReset | Automatic reset | Select reset operation when disconnection detection is executed. Automatic reset / Manual reset |

3.3.2 List of Analog_8IN I/O Mapping

This section explains operations of channels used by the GM1 Analog Input Unit.

■ InputArea (input area)

- The asterisk "*" represents the channel number. (0 to 7)

| Channel | Type | Description | Operation |
|-----------------------------------|------|------------------------------------|--|
| Ch*_InputValue | INT | Ch*_Analog Input Value | Stores a digital value equivalent to the analog input signal. Stores a value before "Offset / Gain processing" and "scale conversion" are executed. |
| Ch*_ConversionValue | INT | Ch*_Analog Conversion Value | Stores a digital conversion value equivalent to the analog input signal. Stores a value after "Offset / Gain processing" and "scale conversion" are executed. |
| Ch*_MaxHoldingValue | INT | Ch*_Max Holding Value | Holds the maximum value of the digital conversion value while the Max. / Min. hold is executed. |
| Ch*_MinHoldingValue | INT | Ch*_Min Holding Value | Holds the minimum value of the digital conversion value while the Max. / Min. hold is executed. |
| Ch*_StatusRegister | WORD | Ch*_Status Register | Sets the following statuses in bulk in units of WORD. |
| Ch*_DisconnectionDetection Status | BOOL | Ch*_Disconnection Detection Status | When disconnection is detected: ON, when disconnection is restored: OFF Enabled only when 1-5 V, 4-20 mA range is selected. |

| Channel | Type | Description | Operation |
|-------------------------------------|------|--|--|
| Ch*_UpperLimitComparisonStatus | BOOL | Ch*_Upper Limit Comparison Status | Turns ON when the comparison value exceeds the preset upper limit while the upper limit / lower limit comparison function is executed. |
| Ch*_LowerLimitComparisonStatus | BOOL | Ch*_Lower Limit Comparison Status | Turns ON when the comparison value falls below the preset lower limit while the upper limit / lower limit comparison function is executed. |
| Ch*_UpperLowerLimitComparisonStatus | BOOL | Ch*_Upper /Lower Limit Value Comparison Status | While the upper limit / lower limit comparison function is executed: ON |
| Ch*_MaxMinHoldingStatus | BOOL | Ch*_Max/Min. Holding Value Status | While the Max. / Min. hold is executed: ON While the Max. / Min. hold is stopped: OFF |
| Ch*_SettingErrorStatus | BOOL | Ch*_Error Status | Turns ON when an error occurs. |

■ OutputArea (output area)

- The asterisk "*" represents the channel number. (0 to 7)

| Channel | Type | Description | Operation |
|--|------|---|---|
| Ch*_RequestRegister | WORD | Ch*_Request Register | Sets the following request in bulk in units of WORD. |
| Ch*_DisconnectionDetectionExecutionRequest | BOOL | Ch*_Disconnection Detection Request | ON: Disconnection detection is executed. OFF: Disconnection detection is stopped. Validity condition: Level |
| Ch*_UpperLowerLimitComparisonRequest | BOOL | Ch*_Upper /Lower Limit Value Comparison Request | ON: Upper limit / lower limit comparison is executed. OFF: Upper limit / lower limit comparison is stopped. Validity condition: Level |
| Ch*_MaxMinHoldingRequest | BOOL | Ch*_Max/Min Holding Value Request | ON: Max. / Min. hold is executed. OFF: Max. / Min. hold is stopped. Validity condition: Level |

3.4 Setting the Analog Output Unit

3.4 Setting the Analog Output Unit

3.4.1 List of Analog_4OUT Parameters

The following table shows a list of changeable parameters for the GM1 Analog Output Unit. Set parameter for each channel.

| Parameter | Default | Settings |
|-----------------------------|--------------------------------|--|
| OutputProcess | Output | Select "Output / No output" of the analog output. |
| RangeSetting | -10 V to +10 V | Select the output range. -10 to +10 V 0 to +10 V -5 to +5 V 0 to +5 V +1 to +5 V 0 to +20 mA +4 to +20 mA |
| OutputValueSettingAtStop | Hold with user-specified value | Select the operation of the analog output hold function in the STOP mode. Hold with user-specified value / Hold at current value |
| OutputValueAtStop | 0 | Specify the output value when OutputValueAtStop is set to "Desired output value". -32640 to +32640 (For -10 to +10 V, -5 to +5 V range) 0 to +32640 (For 0 to +10 V, 0 to +5 V, 0 to +20 mA) 0 to +25600 (For +1 to +5 V, +4 to +20 mA) |
| OffsetGainProcess | No output | Select "Output / No output" for the Offset / Gain processing. |
| OffsetValue | 0 | Specify the offset value for when the Offset / Gain processing is executed. -3000 to +3000 |
| GainValue | 10000 (multiplied by 1.0) | Specify the gain value for when the Offset / Gain processing is executed. +9000 to +11000 (multiplied by 0.9 to 1.1) |
| ScaleConversion | No output | Select "Output / No output" of the scale conversion. |
| ScaleConversionMaxValue | 10000 | Specify the maximum value after scale conversion is executed. -32768 to +32767 |
| ScaleConversionMinValue | 0 | Specify the minimum value after scale conversion is executed. -32768 to +32767 |
| UpperAndLowerOutputClipping | No output | Select "Output / No output" of the clipping function. |

| Parameter | Default | Settings |
|---|---------|---|
| UpperAndLowerOutputClipping UpperLimit | 0 | Specify the upper limit of the clipping function. -32640 to +32640 |
| UpperAndLowerOutputClipping LowerLimit | 0 | Specify the lower limit of the clipping function. -32640 to +32640 |

3.4.2 List of Analog_4OUT I/O Mapping

The analog output unit is controlled by reading from and writing to the applicable channel using the user program.

■ InputArea (input area)

- The asterisk "*" represents the channel number. (0 to 3)

| Channel type | Type | Description | Remarks |
|------------------------------|------|---|--|
| Ch*_StatusRegister | WORD | Ch*_Status Register | Sets the following statuses in bulk in units of WORD. |
| Ch*_SettingErrorStatus | BOOL | Ch*_Setting Error Status | Turns ON when an error occurs. |
| Ch*_ClippingUpperLimitStatus | BOOL | Ch*_Clipping Upper Limit Status | Turns ON when the value exceeds the output clipping upper limit while the clipping function is executed. |
| Ch*_ClippingLowerLimitStatus | BOOL | Ch*_Upper and lower output clipping Lower limit | Turns ON when the value falls below the output clipping lower limit while the clipping function is executed. |

■ OutputArea (output area)

- The asterisk "*" represents the channel number. (0 to 3)

| Channel | Type | Description | Remarks |
|--------------------------------------|------|--|---|
| Ch*_OutputValue | INT | Ch*_Analog Output Value | Stores the digital value for the analog output. The range of the stored value varies depending on the setting range and scale. |
| Ch*_RequestRegister | WORD | Ch*_Request Register | Sets the following request in bulk in units of WORD. |
| Ch*_ClippingFunctionExecutionRequest | BOOL | Ch*_Upper and lower output clipping Function execution relay | ON: The clipping function is executed. OFF: "Ch*_ClippingUpperLimit" and "Ch*_ClippingLowerLimit" are turned OFF. Validity condition: Level |

(MEMO)

4 Functions of the Analog Input Unit

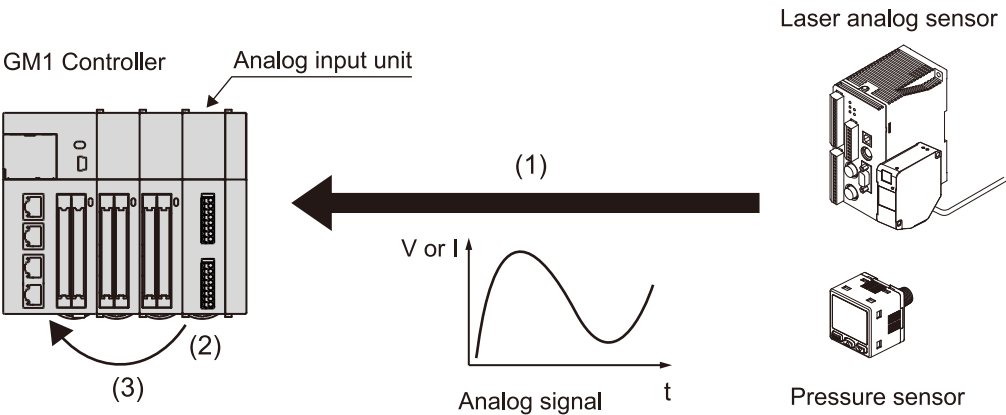
| | |
|--|------|
| 4.1 Basic Operation | 4-2 |
| 4.1.1 Reading Analog Input Data | 4-2 |
| 4.1.2 Input Setting and Conversion Processing Time | 4-3 |
| 4.2 Average Processing Settings | 4-5 |
| 4.2.1 Count-based Average | 4-5 |
| 4.2.2 Time-based Average | 4-6 |
| 4.2.3 Moving Average | 4-7 |
| 4.3 Offset / Gain Processing Function | 4-8 |
| 4.4 Scale Conversion Function | 4-10 |
| 4.5 Upper Limit / Lower Limit Comparison Function | 4-11 |
| 4.6 Max. / Min. Hold Function | 4-14 |
| 4.7 Disconnection Detection Function | 4-17 |

4.1 Basic Operation

4.1.1 Reading Analog Input Data

Analog input is processed as explained below.

■ Operation of the analog input unit



(1) Receiving analog input

The analog input unit receives analog input signal from analog devices, such as laser analog sensors and pressure sensors

(2) Digital conversion processing

Analog input signal received by the unit is converted into digital values in sequence automatically.

(3) Storage of digital values

The converted digital values are stored in the channel next to "Analog_8IN I/O Mapping".

- The asterisk "*" represents the channel number. (0 to 7)

| Channel | Remarks |
|----------------------|---|
| Ch*_InputValue | Stores a value before "Offset / Gain processing" and "scale conversion" are executed. |
| Ch*_ ConversionValue | Stores a value after "Offset / Gain processing" and "scale conversion" are executed. |

■ Sample program

The following program reads analog input data of ch0 into the variable "iLocal".

Declaration section

```
PROGRAM PRG_AI01
VAR
    iCh0_ConversionValue: INT;
    iLocal: INT;
END_VAR
```


Implementation section

```
iLocal := iCh0_ConversionValue; // Read Analog data
```

(Note 1) Separately link corresponding channels in "Analog_8IN I/O Mapping".



REFERENCE

3.2 Setting Parameters and Performing I/O Mapping

4.1.2 Input Setting and Conversion Processing Time

The conversion processing time varies with the "Input setting" of the Analog_8IN parameter.

Select "Not execute / Execute" for the analog input conversion processing on a channel-by-channel basis.

This can save the conversion time for channels that do not execute conversion processing. The conversion time per channel is 50 μ s.

Example: Conversion time for converting one channel (when channels other than CH0 are set to "Disable")

Converts only ch0 repeatedly.

1 cycle = 50 μ s

Example: Conversion time for converting four channels (when CH4 to CH7 are set to "Disable")

Conversion is executed in the order of ch0→ch1→ch2→ch3→ch0→ch1→ch2→ch3→... And the conversion time for CH4 to CH7, which are set to non-execution, is saved.

1 cycle = 200 μ s

Timing Chart of Input Processing

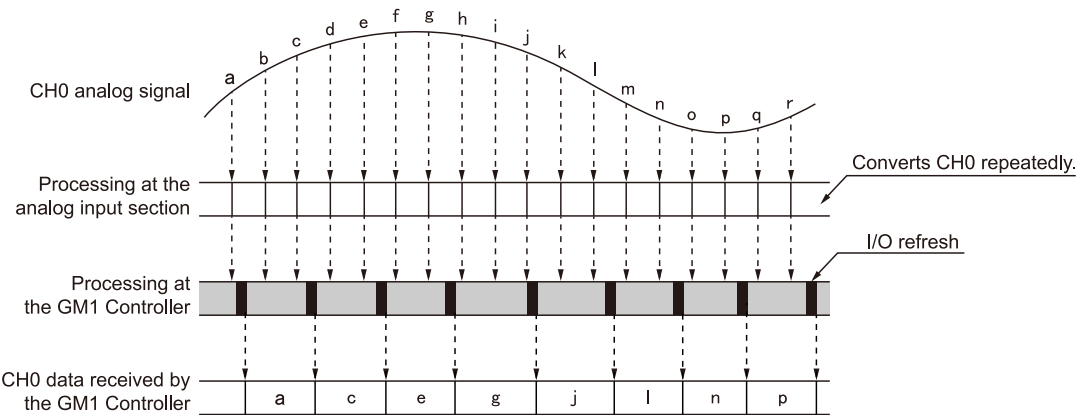
The conversion processing of the analog input unit is not synchronized with the I/O refresh of the GM1 Controller. Therefore, it is necessary to consider the I/O refresh of the GM1 Controller in addition to the conversion processing time.

■ Timing chart

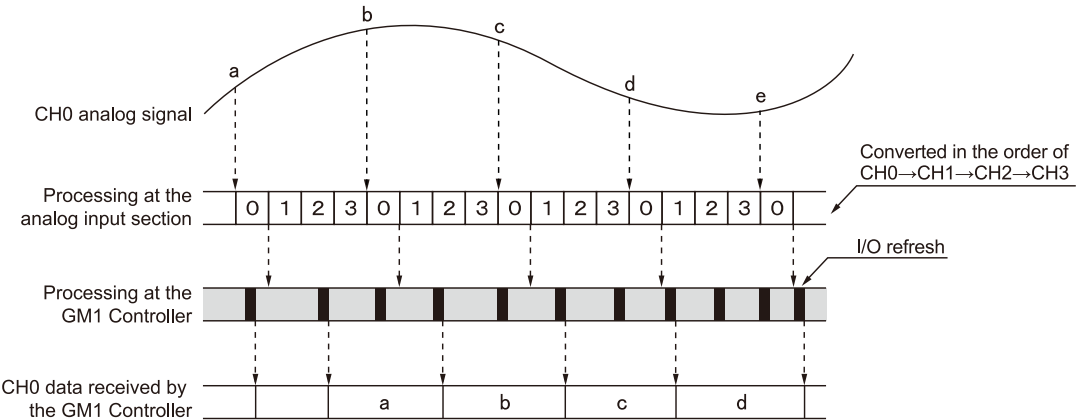
- The data converted by the analog input unit is retrieved into the GM1 Controller at the I/O refresh timing.
- At the time when the GM1 Controller performs an I/O refresh, the latest data is retrieved into the "Ch0 input value" of the GM1 Controller.

4.1 Basic Operation

For 1 channel (Conversion processing time: 50 us)



For 4 channels (Conversion processing time: 200 us)



4.2 Average Processing Settings

Average processing is selected for the analog values taken in by sampling.

4.2.1 Count-based Average

■ Overview of the function

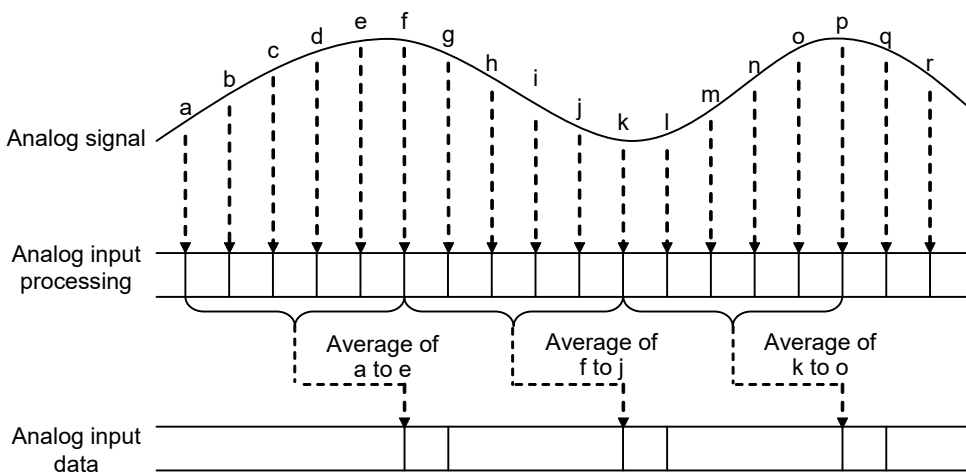
- If the average processing is set to "Count-based average", analog input data acquired will be processed to find an average for the number of times and stored as digital values when the number of analog input data items reaches the number of averaging times.
- If the number of data items acquired is less than the number of averaging times, the data acquired for the first time will be stored in the I/O area.
- In processing the number of averaging times, obtain the number of averaging from the following input.

Input: The sum of analog input data for the number of averaging times set as averaging setting

Output: Number of averaging times value

■ Processing during the count-based average

Average processing example: "Count-based average" is set to 5 for the number of sampling times.



■ Analog_8IN parameters

| Name | Default | Description |
|-------------------|-------------|--|
| Averaging process | Not execute | Select "Count-based average". |
| Average constant | 200 | Specify the number of averaging times. Count: 2 to 60,000 [times] |

4.2 Average Processing Settings

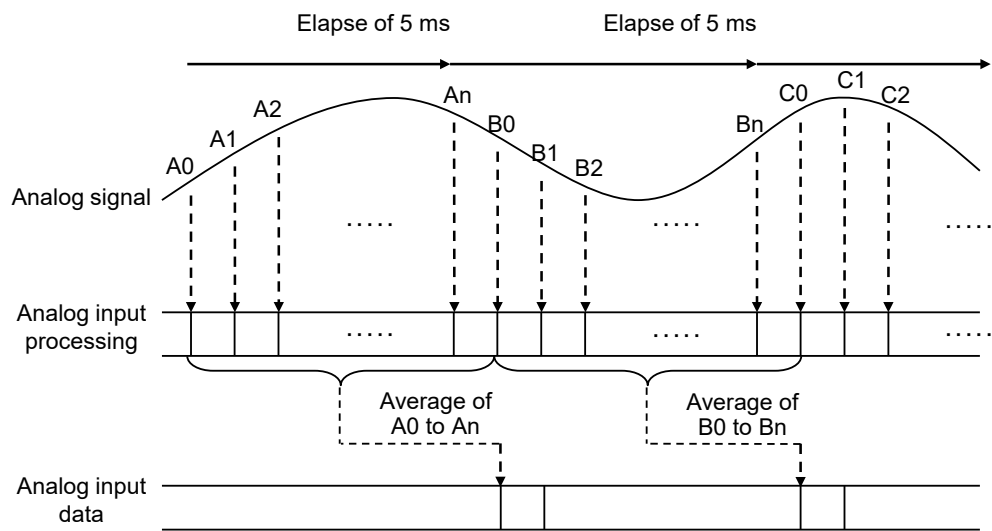
4.2.2 Time-based Average

■ Overview of the function

- If the average processing is set to "Time-based average", analog input data acquired will be processed to find an average time and stored as digital values when the acquisition period of the analog input data items reaches the set averaging time
- In processing the time average, obtain the time average from the following input.
Input: The sum of analog input data for the time set as averaging setting
Output: Time average value

■ Processing during time average

Average processing example: "Time-based average" is set to an averaging time of 5 ms



■ Analog_8IN parameters

| Name | Default | Description |
|-------------------|-------------|--|
| Averaging process | Not execute | Select "Time-based average". |
| Average constant | 200 | Specify the averaging time. Time: 1 to 1,500 [ms] |

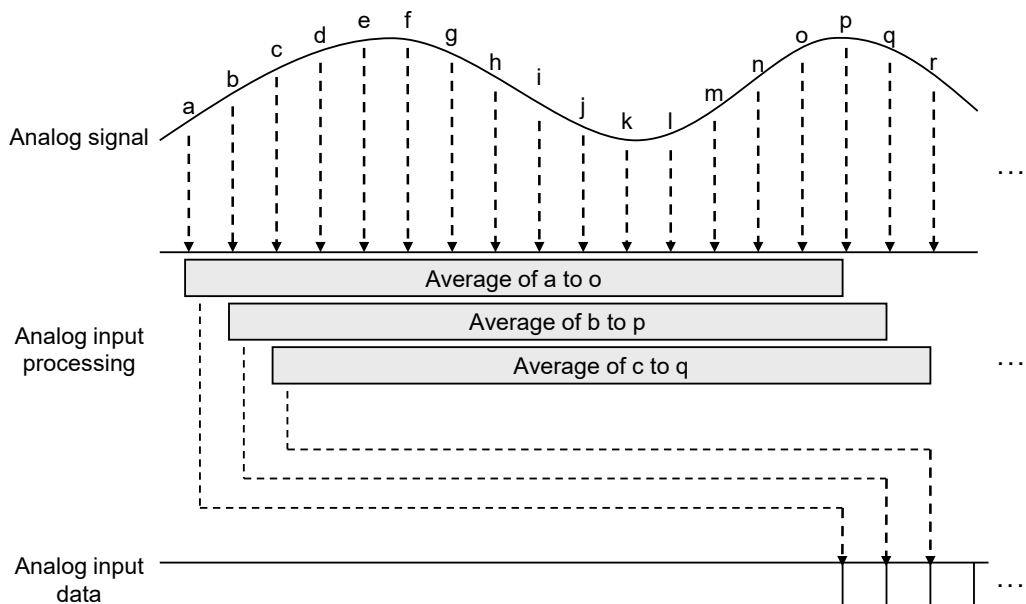
4.2.3 Moving Average

■ Overview of the function

- If the average processing is set to "Moving average", analog input data acquired will be processed to a moving average and stored as digital values when the number of analog input data items reaches the number of averaging times.
- In the moving average, obtain output (moving average value) from the following input.
 Input: The number of average times, analog input data for the number of average times, the latest analog input data, and old analog input data
 Output: Moving average value

■ Processing during moving average

Average processing example: "Moving average" is set to 15 for the number of average times.



■ Analog_8IN parameters

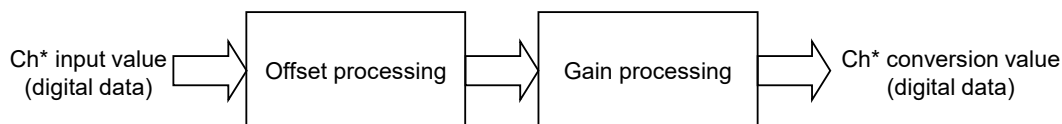
| Name | Default | Description |
|-------------------|-------------|---|
| Averaging process | Not execute | Select "Moving average". |
| Average constant | 200 | Specify the number of averaging times. Count: 2 to 2,000 [times] |

4.3 Offset / Gain Processing Function

4.3 Offset / Gain Processing Function

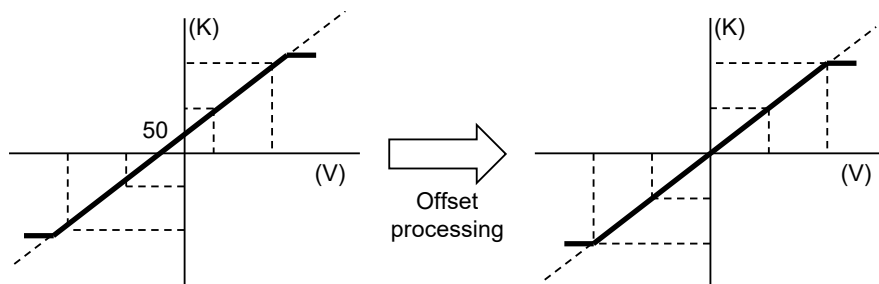
■ Overview of the function

- This function performs the correction of offset values (addition correction) or gain values (magnification correction).
- Stores the data after offset processing and gain processing in the I/O mapping.
- Offset / Gain processing is executed on a channel-by-channel basis.



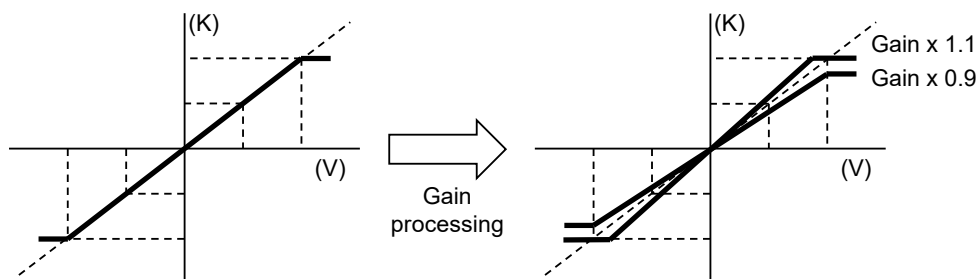
■ Offset value setting

- Offset value settings are used as a function (zero-point adjustment) to make offset error adjustments between load devices.
- If the analog input value is "50" when the analog input signal is "0 V", the analog conversion data is corrected to "0" based on "-50" as an offset value.



■ Gain value setting

- Gain value settings are used as a function to adjust scale errors between load devices.
- The gain value slope can be changed in a range of $\times 0.9$ to $\times 1.1$.



■ Analog_8IN parameters

| Name | Default | Description |
|-----------------------|-------------|--|
| Offset / Gain process | Not execute | Select "Execute". |
| Offset value | 0 | Set the offset value. Setting range: -3000 to +3000 |
| Gain value | 10000 | Set the gain value. Setting range: +9000 to +11000 (multiplied by 0.9 to 1.1) |

i Info.

- The offset value is corrected to a value corresponding to the resolution of the output range before scale conversion regardless of whether scale conversion is set or not.

4.4 Scale Conversion Function

4.4 Scale Conversion Function

■ Overview of the function

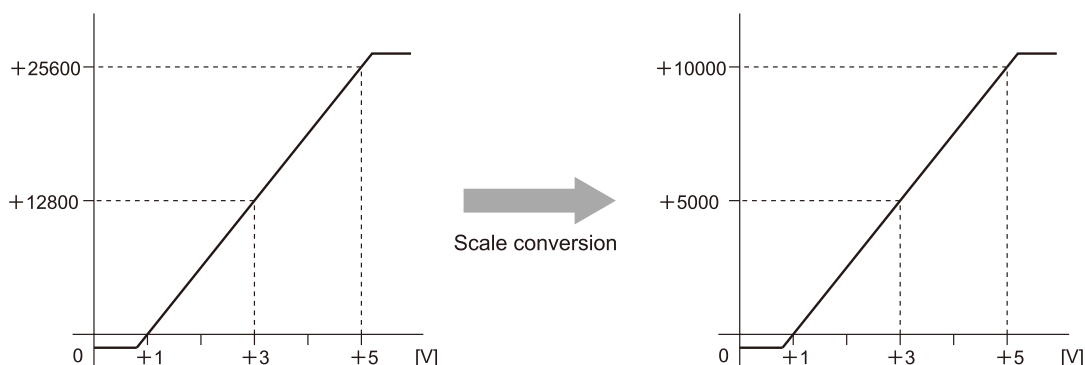
- This function is to scale-convert analog input values to an easy-to-use data range.
- When the minimum value and the maximum value are set, analog input values are converted to digital values in the range between the minimum and maximum values as the full scale.
- The data after scale conversion is stored in the I/O mapping.
- The function can be used for unit conversion, etc.
- Scale conversion processing is executed on a channel-by-channel basis.

i Info.

- Conversion values read from the analog input unit are numbers including fractions. Therefore, convert the values to easy-to-handle figures if needed.

■ Scale conversion processing

Voltage input range: Scale conversion when the input range of 1 to +5 V is converted to a scale between the minimum value of 0 and the maximum value of +10000



i Info.

- The input value ranges from the minimum scale value -2% to the maximum scale value +2%.
- If data outside this range is input, scale conversion will be disabled. The the minimum scale value -2% or the maximum scale value +2% will be stored as a converted value.

■ Analog_8IN parameters

| Name | Default | Setting range and description |
|----------------------------|-------------|--|
| Scale conversion | Not execute | Select "Execute". |
| Scale conversion max value | +10000 | Set the maximum value after scale conversion is executed. Setting range: -32768 to +32767 |
| Scale conversion min value | 0 | Set the minimum value after scale conversion is executed. Setting range: -32768 to +32767 |

4.5 Upper Limit / Lower Limit Comparison Function

■ Overview of the function

- This function compares acquired analog input data with the preset upper limit and lower limit.

When the acquired data exceeds the upper limit (digital conversion value is larger than the upper limit comparison ON level)

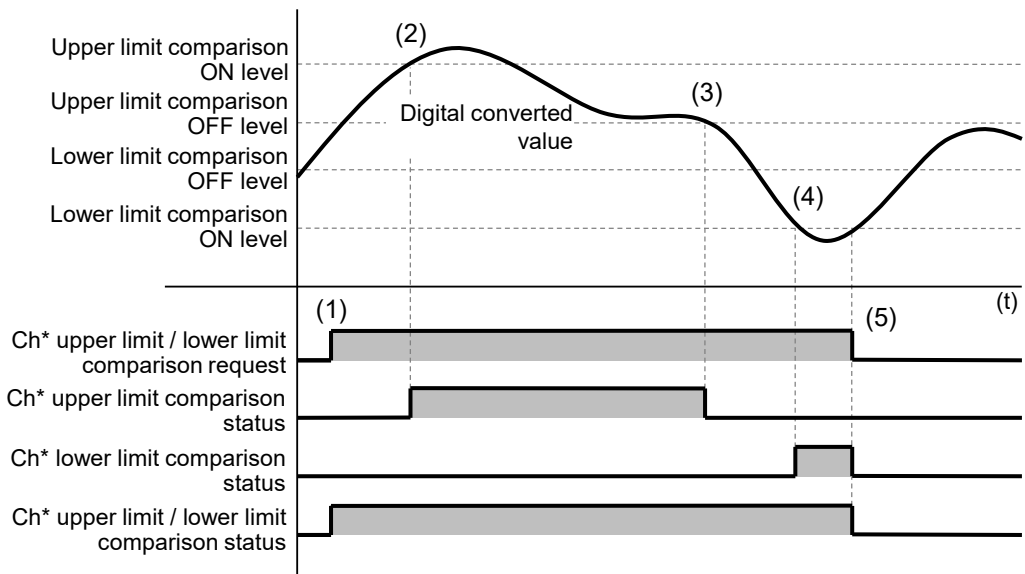
Turns ON the "Ch* upper limit comparison status".

When the acquired data exceeds the lower limit (digital conversion value is smaller than the lower limit comparison ON level)

Turns ON the "Ch* lower limit comparison status".

- When **Analog_8IN parameters>Upper and lower limit comparison** is set to "Execute", turn ON "Ch* upper limit/lower limit comparison request" to execute the function.
- The upper limit / lower limit comparison processing is executed on a channel-by-channel basis.

■ Upper limit / lower limit comparison processing



| | |
|-----|--|
| (1) | Turn ON "Ch* upper limit / lower limit comparison request" to execute the function. |
| (2) | When a value that is equal to or larger than the upper limit comparison ON level is detected, "Ch* upper limit comparison status" will turn ON. |
| (3) | When a value that is equal to or smaller than the upper limit comparison OFF level is detected, "Ch* upper limit comparison status" will turn OFF. |
| (4) | When a value that is equal to or smaller than the lower limit comparison ON level is detected, "Ch* lower limit comparison status" will turn ON. |
| (5) | The following I/O will be forcibly turned OFF if "Ch* upper limit / lower limit comparison request" is turned OFF. "Ch* upper limit comparison status" "Ch* lower limit comparison status" |

4.5 Upper Limit / Lower Limit Comparison Function

| | |
|--|---|
| | "Ch* upper limit / lower limit comparison status" |
|--|---|

■ Analog_8IN parameters

| Setting item | Default | Description |
|----------------------------------|-------------|---|
| Upper and lower limit comparison | Not execute | Select "Execute". |
| Upper limit comparison ON level | 1000 | Specify the upper limit comparison ON level. -32768 to +32767 |
| Upper limit comparison OFF level | 1000 | Specify the upper limit comparison OFF level. -32768 to +32767 |
| Lower limit comparison ON level | 0 | Specify the lower limit comparison ON level. -32768 to +32767 |
| Lower limit comparison OFF level | 0 | Specify the lower limit comparison OFF level. -32768 to +32767 |

■ Analog_8IN I/O Mapping

| Channel | Description | Remarks |
|--------------------------------------|--|---|
| Ch*_UpperLowerLimitComparisonRequest | Ch* upper limit / lower limit comparison request | ON: Upper limit / lower limit comparison is executed. OFF: Upper limit / lower limit comparison is stopped. Validity condition: Level |
| Ch*_UpperLimitComparisonStatus | Ch* upper limit comparison status | Turns ON when the value exceeds the set upper limit. |
| Ch*_LowerLimitComparisonStatus | Ch* lower limit comparison status | Turns ON when the value exceeds the set lower limit. |
| Ch*_UpperLowerLimitComparisonStatus | Ch* upper limit / lower limit comparison status | Turns ON when the upper limit / lower limit comparison function is executed. |

■ Sample program

The following program executes the upper limit / lower limit comparison function of the ch0. Specify a desired operation when the upper limit is detected or when the lower limit is detected.

Declaration section

```
PROGRAM PRG_AI01
VAR
    bCh0_UpperLimitComparisonStatus: BOOL;
    bCh0_LowerLimitComparisonStatus: BOOL;
    bCh0_UpperLowerLimitComparisonRequest: BOOL;
    bCh0_UpperLowerLimitComparisonStatus: BOOL;
END_VAR
```



Implementation section

```
bCh0_UpperLowerLimitComparisonRequest := TRUE; // Start detection
IF bCh0_UpperLowerLimitComparisonStatus = TRUE THEN //Detection enabled
```


4.5 Upper Limit / Lower Limit Comparison Function

```
IF bCh0_UpperLimitComparisonStatus = TRUE THEN //Exceeded the upper limit
;
END_IF
IF bCh0_LowerLimitComparisonStatus = TRUE THEN //Below the lower limit
;
END_IF
END_IF
```

(Note 1) Separately link corresponding channels in "Analog_8IN I/O Mapping".

| | |
|--|--|
|  Application.PRG_AIO1.bCh0_UpperLimitComparisonStatus |  Ch0_UpperLimitComparisonStatus |
|  Application.PRG_AIO1.bCh0_LowerLimitComparisonStatus |  Ch0_LowerLimitComparisonStatus |
|  Application.PRG_AIO1.bCh0_UpperLowerLimitComparisonStatus |  Ch0_UpperLowerLimitComparisonStatus |
|  Application.PRG_AIO1.bCh0_UpperLowerLimitComparisonRequest |  Ch0_UpperLowerLimitComparisonRequest |

REFERENCE

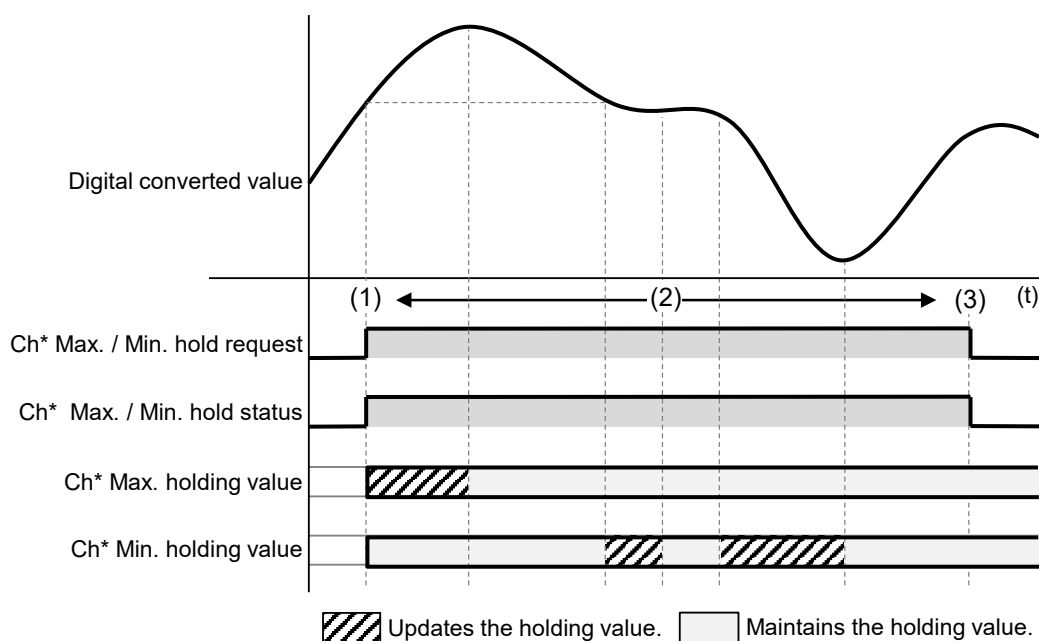
3.2 Setting Parameters and Performing I/O Mapping

4.6 Max. / Min. Hold Function

■ Overview of the function

- This function maintains the maximum and minimum values of acquired analog input data.
- When **Analog_8IN parameters>Max. / Min. value retention** is set to "Execute", turn ON "Ch* Max. / Min. hold request" to execute the function.
- The maximum value and the minimum value stored in the input area of the I/O mapping are held even in the following cases.
 - When "Ch* Max. / Min. hold request" is turned OFF
 - When the GM1 Controller is set to the STOP mode
- The Max. / Min. hold is executed on a channel-by-channel basis.

■ Max. / Min. hold processing



| | |
|-----|--|
| (1) | Turn ON "Ch* Max. / Min. hold request". The function is executed and "Ch* Max. / Min. hold status" is turned ON. The digital conversion values when the status is turned ON are preset into "Ch* Max. holding value" and "Ch* Min. holding value". |
| (2) | While "Ch* Max. / Min. hold status" is ON The maximum value and the minimum value of the digital conversion values are held and updated to "Ch* Max. holding value" and "Ch* Min. holding value". |
| (3) | Turn OFF "Ch* Max. / Min. hold request". "Ch* Max. / Min. hold status" is turned OFF. The maximum value and the minimum value stored in "Ch*Max. holding value" and "Ch* Min. holding value" are held. |

■ Analog_8IN parameters

| Setting item | Default | Description |
|-----------------------------|-------------|-------------------|
| Max. / Min. value retention | Not execute | Select "Execute". |

■ Analog_8IN I/O Mapping

| Channel | Description | Remarks |
|--------------------------|------------------------------|---|
| Ch*_MaxMinHoldingRequest | Ch* Max. / Min. hold request | ON: Max. / Min. hold is executed. OFF: Max. / Min. hold is stopped. Validity condition: Level |
| Ch*_MaxHoldingValue | Ch* Max. holding value | Holds the maximum value of the digital conversion value. |
| Ch*_MinHoldingValue | Ch* Min. holding value | Holds the minimum value of the digital conversion value. |
| Ch*_MaxMinHoldingStatus | Ch* Max. / Min. hold status | While the Max. / Min. hold is executed: ON While the Max. / Min. hold is stopped: OFF |

■ Sample program

The following program executes the Max. / Min. hold function of the ch0 Specify a desired operation when "Ch0_MaxHoldingValue" exceeds 10000 or when "Ch0_MinHoldingValue" becomes less than 10000.









Declaration section

```
PROGRAM PRG_AIO1
VAR
    iCh0_MaxHoldingValue: INT;
    iCh0_MinHoldingValue: INT;
    bCh0_MaxMinHoldingRequest: BOOL;
    bCh0_MaxMinHoldingStatus: BOOL;
END_VAR
```

Implementation section

```
bCh0_MaxMinHoldingRequest := TRUE; // Start detection
IF bCh0_MaxMinHoldingStatus = TRUE THEN //Detection enabled
    IF iCh0_MaxHoldingValue > 10000 OR iCh0_MinHoldingValue < -10000 THEN //Check holding value
        ;
    END_IF
END_IF
```

(Note 1) Separately link corresponding channels in "Analog_8IN I/O Mapping".

| | |
|--|--|
|  Application.PRG_AIO1.iCh0_MaxHoldingValue |  Ch0_MaxHoldingValue |
|  Application.PRG_AIO1.iCh0_MinHoldingValue |  Ch0_MinHoldingValue |
|  Application.PRG_AIO1.bCh0_MaxMinHoldingStatus |  Ch0_MaxMinHoldingStatus |
|  Application.PRG_AIO1.bCh0_MaxMinHoldingRequest |  Ch0_MaxMinHoldingRequest |

4.6 Max. / Min. Hold Function

REFERENCE

[3.2 Setting Parameters and Performing I/O Mapping](#)

4.7 Disconnection Detection Function

■ Overview of the function

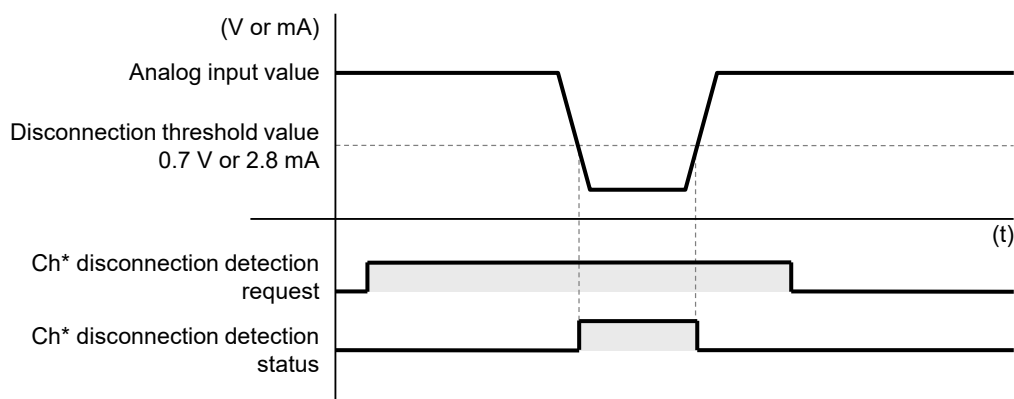
- This function turns ON the disconnection detection status when input is disconnected or unconnected, and warns of the error state.
- The disconnection detection function operates only in the following ranges.

| Range | Detecting level |
|------------|-----------------|
| 1 to 5 V | 0.7 V or less |
| 4 to 20 mA | 2.8 mA or less |

- When **Analog_8IN parameters>Disconnection detection** is set to "Execute", turn ON "Ch* disconnection detection request" to execute the function.

■ Operation when "Disconnection detection reset" is set to "Auto"

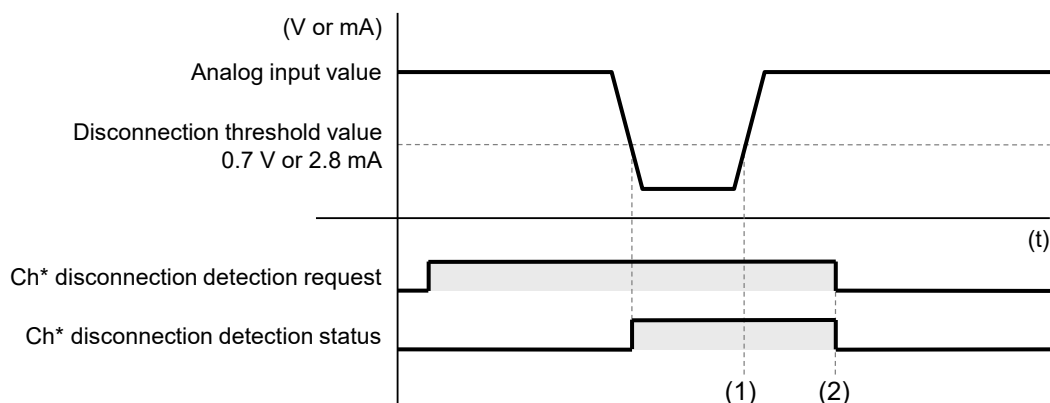
When the input value exceeds the detection level while "Ch* disconnection detection request" is ON, "Ch* disconnection detection status" automatically turns OFF.



■ Operation when "Disconnection detection reset" is set to "Manual"

In the manual setting, turn OFF "Ch* disconnection detection request" using the user program, and "Ch* disconnection detection status" will be turned OFF.

4.7 Disconnection Detection Function



| | |
|-----|---|
| (1) | "Ch* disconnection detection status" does not turn OFF automatically even when the disconnection is restored. |
| (2) | When "Ch* disconnection detection request" is set to OFF, "Ch* disconnection detection status" turns OFF. |

■ Analog_8IN parameters

| Setting item | Default | Description |
|-------------------------------|-------------|---|
| Disconnection detection | Not execute | Select "Execute". |
| Disconnection detection reset | Auto reset | Select reset operation when disconnection detection is executed. Auto reset / manual reset |

■ Analog_8IN I/O Mapping

| Channel | Description | Remarks |
|--|-------------------------------------|--|
| Ch*_DisconnectionDetectionExecutionRequest | Ch* disconnection detection request | ON: Disconnection detection is executed. OFF: Disconnection detection is stopped. Validity condition: Level |
| Ch*_DisconnectionDetectionStatus | Ch* disconnection detection status | When disconnection is detected: ON, when disconnection is restored: OFF Enabled only when the 1 to 5 V or 4 to 20 mA range is selected. |

■ Sample program

The following program executes the disconnection detection function of the ch0. Specify a desired operation when a disconnection is detected.





Declaration section

```
PROGRAM PRG_AI01
VAR
    bCh0_DisconnectionDetectionExecutionRequest: BOOL;
    bCh0_DisconnectionDetectionStatus: BOOL;
END_VAR
```


Implementation section

```
bCh0_DisconnectionDetectionExecutionRequest := TRUE; // Start detection
IF bCh0_DisconnectionDetectionStatus = TRUE THEN //Disconnection occurred
;
END_IF
```

(Note 1) Separately link corresponding channels in "Analog_8IN I/O Mapping".

| | | |
|--|---|--|
|  Application.PRG_AIO1.bCh0_DisconnectionDetectionStatus |  | Ch0_DisconnectionDetectionStatus |
|  Application.PRG_AIO1.bCh0_DisconnectionDetectionExecutionRequest |  | Ch0_DisconnectionDetectionExecutionRequest |

REFERENCE

3.2 Setting Parameters and Performing I/O Mapping

(MEMO)

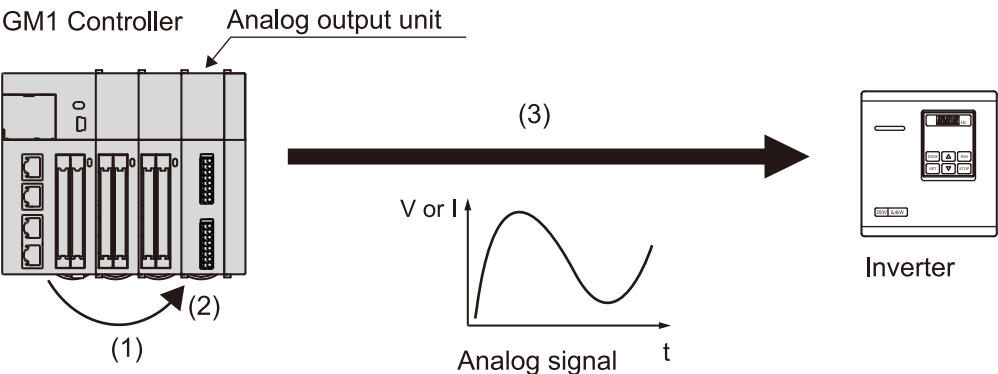
5 Functions of the Analog Output Unit

| | |
|--|-----|
| 5.1 Basic Operation | 5-2 |
| 5.1.1 Writing Analog Output Data | 5-2 |
| 5.1.2 Timing Chart of Output Processing | 5-3 |
| 5.2 Offset / Gain Processing Function | 5-4 |
| 5.3 Scale Conversion Function | 5-6 |
| 5.4 Clipping Function | 5-7 |
| 5.5 Analog Output Hold Function in STOP Mode | 5-9 |

5.1 Basic Operation

5.1.1 Writing Analog Output Data

■ Basic operation of analog output



(1) Writing digital data

A user program is used to write digital data to the variable that corresponds to the analog output unit channel "Ch*_OutputValue".
The converted analog signal varies with the setting of the range.

(2) Analog conversion processing

Data written to the unit is converted to an analog signal in sequence automatically.

(3) Output to analog-driven equipment

Converted analog signal are output to inverters or other analog-driven equipment.

■ Sample program

In the following program, analog output data of ch0 "1000" of the analog output unit is written.

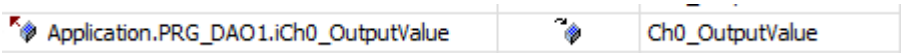
Declaration section

```
PROGRAM PRG_DAO1
VAR
  iCh0_OutputValue: INT;
END_VAR
```

Implementation section

```
iCh0_OutputValue := 10000;
```

(Note 1) Separately link corresponding channels in "Analog_4OUT I/O Mapping".



REFERENCE

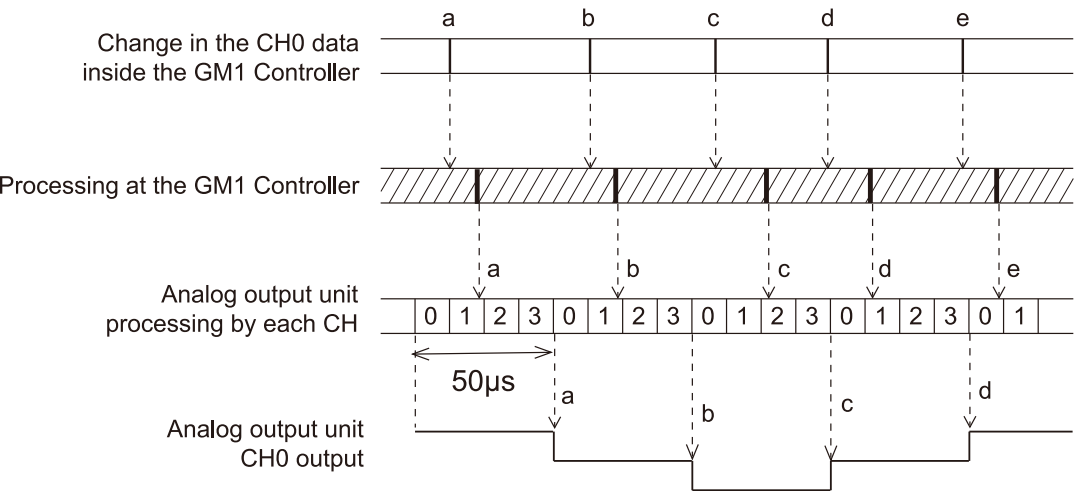
3.2 Setting Parameters and Performing I/O Mapping

5.1.2 Timing Chart of Output Processing

The processing of the analog output unit is not synchronized with the processing of the GM1 Controller. Therefore, it is necessary to consider the I/O refresh of the GM1 Controller in addition to the conversion time of 50 μ s.

■ Timing chart

- The "Ch0 output value" written to the GM1 Controller is received by the analog output unit at the I/O refresh timing.
- The analog output unit converts the latest data received from the GM1 Controller into analog values and outputs the converted values.

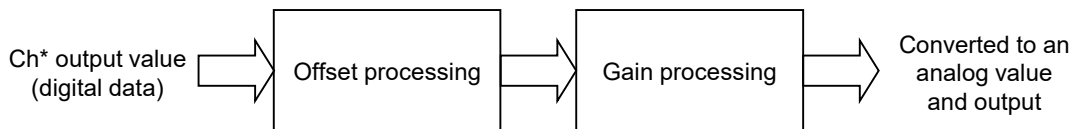


- (Note 1) The processing time of the analog output unit is 50 μ s regardless of the number of channels.
- (Note 2) The unit outputs converted values when all processing is completed for CH0 to CH3.

5.2 Offset / Gain Processing Function

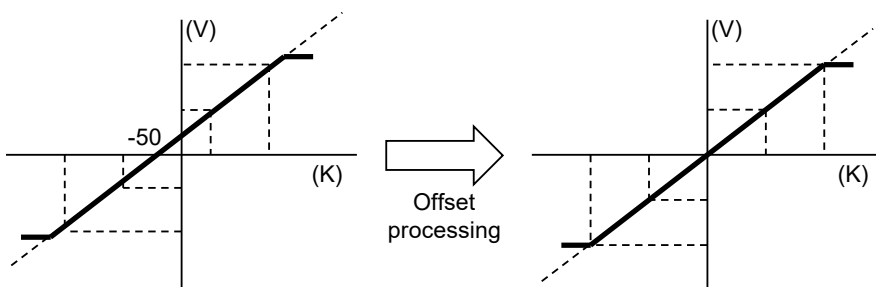
■ Overview of the function

- This function performs the correction of offset values (addition correction) or gain values (magnification correction).
- Offset / Gain processing is executed on a channel-by-channel basis.



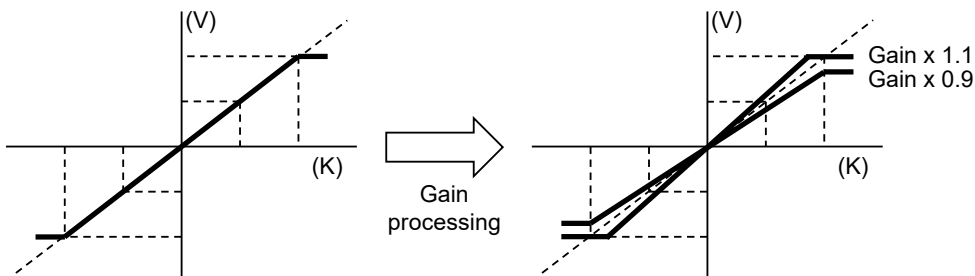
■ Offset value setting

- Offset value settings are used as a function (zero-point adjustment) to make offset error adjustments between load devices.
- If the analog output signal is "0 V" when "-50" is stored as the analog output value:
When the offset value is set to "50", the analog output signal is corrected to "0 V".



■ Gain value setting

- Gain value settings are used as a function to adjust scale errors between load devices.
- The gain value slope can be changed in a range of x0.9 to x1.1.



■ Analog_4OUT parameters

| Name | Default | Description |
|-----------------------|---------|-----------------------|
| Offset / Gain process | Disable | Select "Enable". |
| Offset value | 0 | Set the offset value. |

| Name | Default | Description |
|------------|---------|--|
| | | Setting range: -3000 to +3000 |
| Gain value | 10000 | Set the gain value. Setting range: +9000 to +11000 (multiplied by 0.9 to 1.1) |

Info.

- The offset value is corrected to a value corresponding to the resolution of the output range before scale conversion regardless of whether scale conversion is set or not.

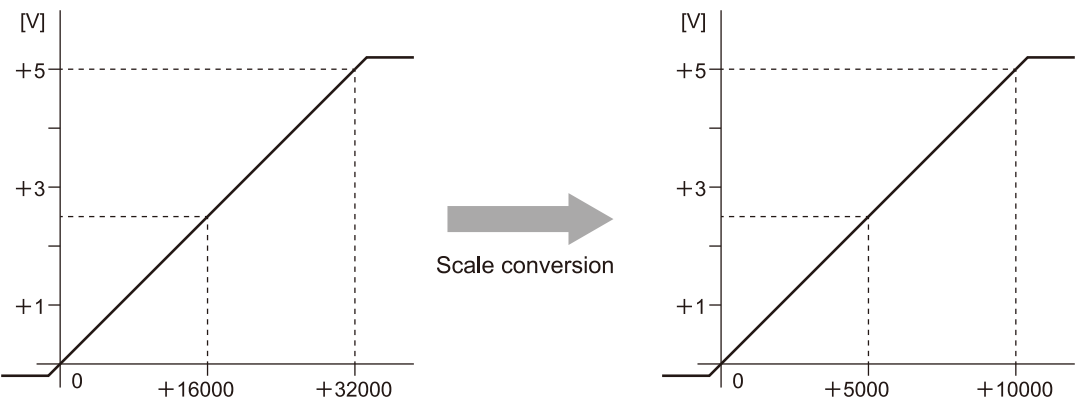
5.3 Scale Conversion Function

■ Overview of the function

- This function is to scale-convert values to an easy-to-use analog output range.
- When the minimum value and the maximum value are set in advance, D/A conversion is made in the range between the minimum and maximum values as the full scale.
- Scale conversion processing is executed on a channel-by-channel basis.

■ Scale conversion processing

Voltage output range: Scale conversion when the input range of 0 to +5 V is converted to a scale between the minimum value of 0 and the maximum value of +10,000



i Info.

- The output value ranges from the minimum scale value -2% to the maximum scale value +2%.
- If data is outside this range, scale conversion will be disabled. The value equivalent to the minimum scale value -2% or the value equivalent to the maximum scale value +2% will be converted and output as an analog value.

■ Analog_4OUT parameters

| Name | Default | Setting range and description |
|----------------------------|---------|--|
| Scale conversion | Disable | Select "Enable". |
| Scale conversion max value | 10000 | Set the maximum value after scale conversion is executed. -32768 to +32767 |
| Scale conversion min value | 0 | Set the minimum value after scale conversion is executed. -32768 to +32767 |

5.4 Clipping Function

■ Overview of the function

- This function sets in advance the upper limit and lower limit for the analog output value.
- When a numerical value that exceeds the upper limit or lower limit is stored in the analog output value, the output is clipped by the preset values.
- This function makes it possible to prevent the wrong application of voltages or currents out of the specifications to equipment to be connected.
- When **Analog_4OUT parameters>Upper and lower output clipping** is set to "Execute", turn ON "Ch* clipping function execution request" to execute the function.
- The clipping function is set on a channel-by-channel basis.

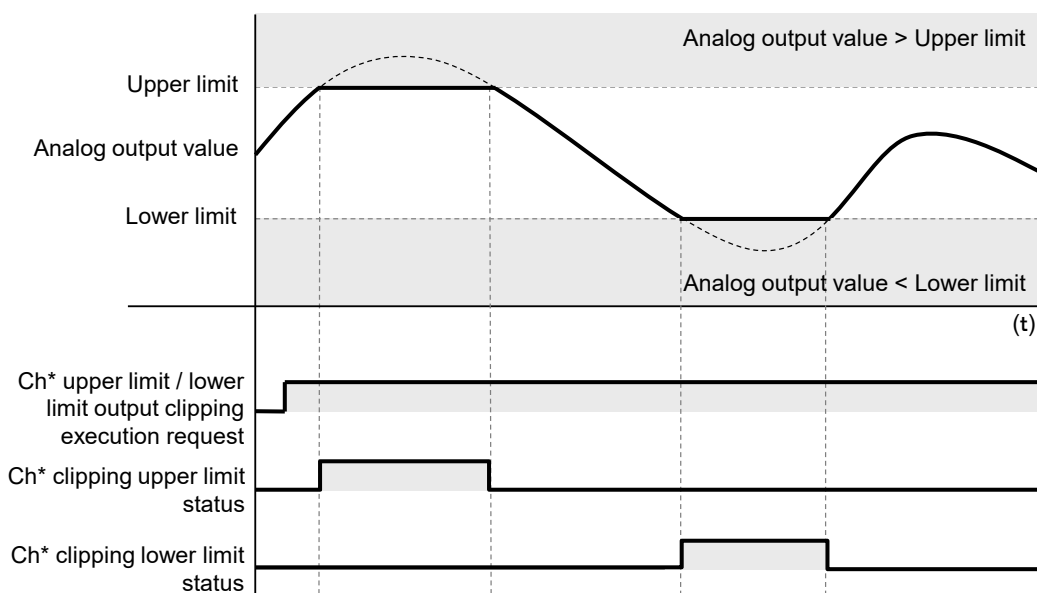
■ Upper limit / lower limit clipping processing

For [Digital output value > Upper limit]

"Ch* clipping upper limit status" turns ON.

For [Digital output value < Lower limit]

"Ch* clipping lower limit status" turns ON.



■ Analog_4OUT parameters

| Setting item | Default | Settings |
|---|-------------|---|
| Upper and lower output clipping | Not execute | Select "Execute". |
| Upper and lower output clipping upper limit | 0 | Specify the upper limit of the clipping function. -32640 to +32640 |
| Upper and lower output clipping lower limit | 0 | Specify the lower limit of the clipping function. -32640 to +32640 |

5.4 Clipping Function

■ Analog_4OUT I/O Mapping

| Channel | Description | Remarks |
|--------------------------------------|--|---|
| Ch*_ClippingFunctionExecutionRequest | Ch* clipping function execution request | ON: The clipping function is executed. OFF: "Ch* clipping function upper limit" and "Ch* clipping function lower limit" are turned OFF. Validity condition: Level |
| Ch*_ClippingUpperLimitStatus | Ch* clipping function upper limit status | Turns ON when the value exceeds the output clipping upper limit while the clipping function is executed. |
| Ch*_ClippingLowerLimitStatus | Ch* clipping function lower limit status | Turns ON when the value falls below the output clipping lower limit while the clipping function is executed. |

Info.

- The upper limit and lower limit clip the output at the original output range resolution regardless of whether scale conversion is executed or not.

■ Sample program

The following program executes the clipping function of the ch0. Specify a desired operation when the upper limit is detected or when the lower limit is detected.







Declaration section

```
PROGRAM PRG_DAO1
VAR
    bCh0_ClippingFunctionExecutionRequest: BOOL;
    bCh0_ClippingUpperLimitStatus: BOOL;
    bCh0_ClippingLowerLimitStatus: BOOL;
END_VAR
```

Implementation section

```
bCh0_ClippingFunctionExecutionRequest := TRUE; // Start detection
IF bCh0_ClippingUpperLimitStatus = TRUE THEN //Exceeded the upper limit
;
END_IF
IF bCh0_ClippingLowerLimitStatus = TRUE THEN //Below the lower limit
;
END_IF
```

(Note 1) Separately link corresponding channels in "Analog_4OUT I/O Mapping".

| | |
|--|--|
|  Application.PRG_DAO1.bCh0_ClippingUpperLimitStatus |  Ch0_ClippingUpperLimitStatus |
|  Application.PRG_DAO1.bCh0_ClippingLowerLimitStatus |  Ch0_ClippingLowerLimitStatus |
|  Application.PRG_DAO1.bCh0_ClippingFunctionExecutionRequest |  Ch0_ClippingFunctionExecutionRequest |

REFERENCE

3.2 Setting Parameters and Performing I/O Mapping

5.5 Analog Output Hold Function in STOP Mode

■ Overview of the function

This function holds the analog output when the operation mode of the GM1 Controller changes from RUN to STOP.

- The analog output hold is set on a channel-by-channel basis.
- The analog output value can be set to "Desired output value" or "Current output value" for each channel.

Info.

- The analog signal to be output varies with the setting of the range if "Desired output value" is selected.

■ Analog_4OUT parameters

| Name | Default | Setting range and description |
|-------------------------------|----------------------|--|
| Output value at STOP | Desired output value | Select the operation of the analog output hold function in the STOP mode. Desired output value / current output value |
| Output value at STOP (Note 1) | 0 | Specify the output value when the output setting in the STOP mode is set to "Desired output value". -32640 to +32640 (For -10 to +10 V, -5 to +5 V range) 0 to +32640 (For 0 to +10 V, 0 to +5 V, 0 to +20 mA) 0 to +25600 (For +1 to +5 V, +4 to +20 mA) |

(Note 1) This is enabled when the output setting in the STOP mode is set to "Desired output value".

Info.

- The output will be turned OFF (0 V or 0 mA) if an error occurs.

(MEMO)

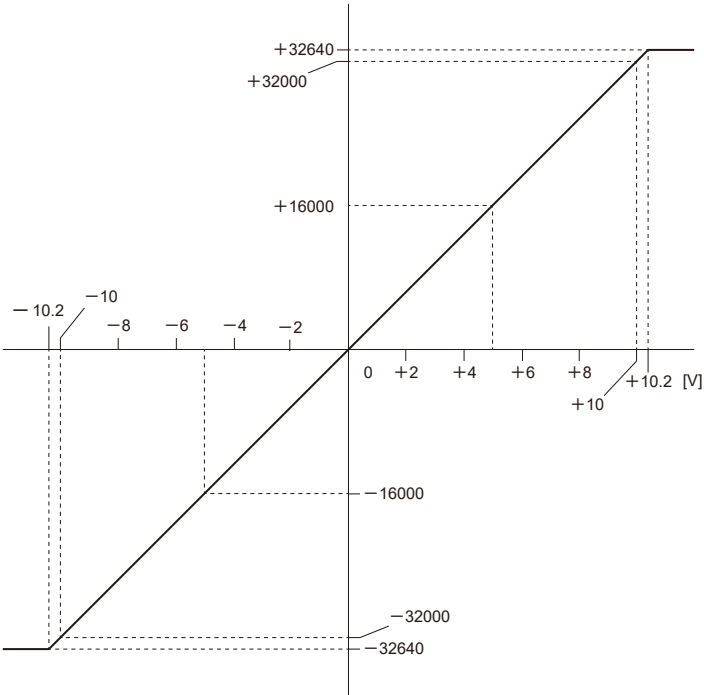
6 Conversion Characteristics of Analog Input Unit

| | |
|--|-----|
| 6.1 Voltage Range | 6-2 |
| 6.1.1 Voltage Input Range: -10 to +10 V (Resolution: 1/64,000) | 6-2 |
| 6.1.2 Voltage Input Range: 0 to +10 V (Resolution: 1/32,000)..... | 6-3 |
| 6.1.3 Voltage Input Range: -5 to +5 V (Resolution: 1/64,000) | 6-3 |
| 6.1.4 Voltage Input Range: 0 to +5 V (Resolution: 1/32,000)..... | 6-4 |
| 6.1.5 Voltage Input Range: +1 to +5 V (Resolution: 1/25,600) | 6-5 |
| 6.2 Current Range | 6-6 |
| 6.2.1 Current Input Range: 0 to +20 mA (Resolution: 1/32,000)..... | 6-6 |
| 6.2.2 Current Input Range: +4 to +20 mA (Resolution: 1/25,600) | 6-6 |

6.1 Voltage Range

6.1 Voltage Range

6.1.1 Voltage Input Range: -10 to +10 V (Resolution: 1/64,000)



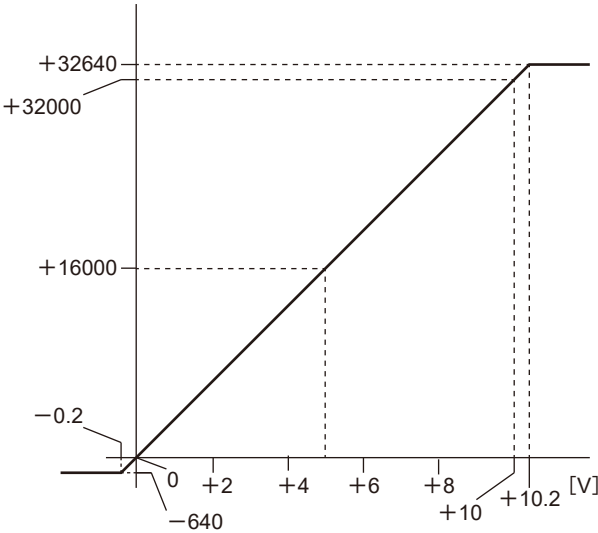
Input range: -10 to +10 V

| Analog input value (V) | Digital converted value |
|------------------------|-------------------------|
| +10 | +32000 |
| +8 | +25600 |
| +6 | +19200 |
| +4 | +12800 |
| +2 | +6400 |
| 0 | 0 |
| -2 | -6400 |
| -4 | -12800 |
| -6 | -19200 |
| -8 | -25600 |
| -10 | -32000 |

When exceeding the rated range

| Analog input value | Converted value |
|--------------------|-----------------|
| +10.2 V or more | +32640 |
| -10.2 V or less | -32640 |

6.1.2 Voltage Input Range: 0 to +10 V (Resolution: 1/32,000)



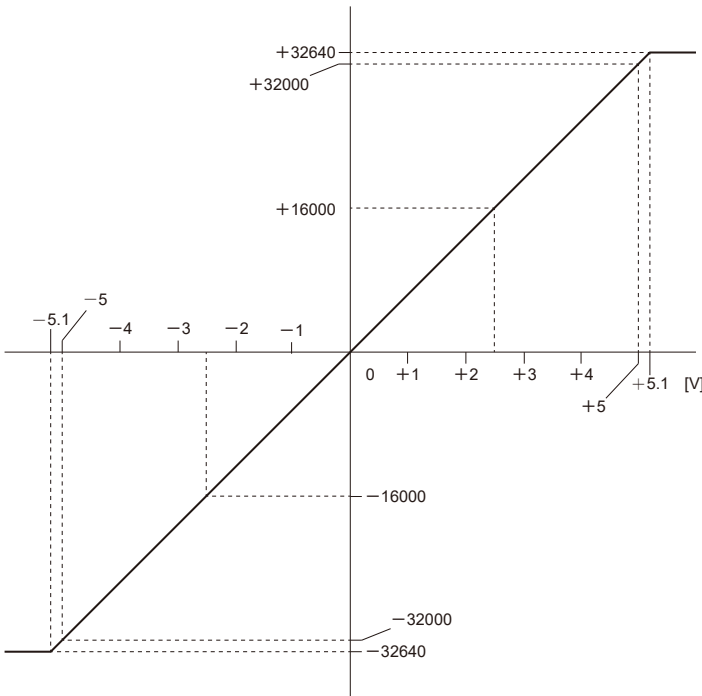
Input range: 0 to +10 V

| Analog input value (V) | Digital converted value |
|------------------------|-------------------------|
| +10 | +32000 |
| +8 | +25600 |
| +6 | +19200 |
| +4 | +12800 |
| +2 | +6400 |
| 0 | 0 |

When exceeding the rated range

| Analog input value | Converted value |
|--------------------|-----------------|
| +10.2 V or more | +32640 |
| -0.2 V or less | -640 |

6.1.3 Voltage Input Range: -5 to +5 V (Resolution: 1/64,000)



Input range: -5 to +5 V

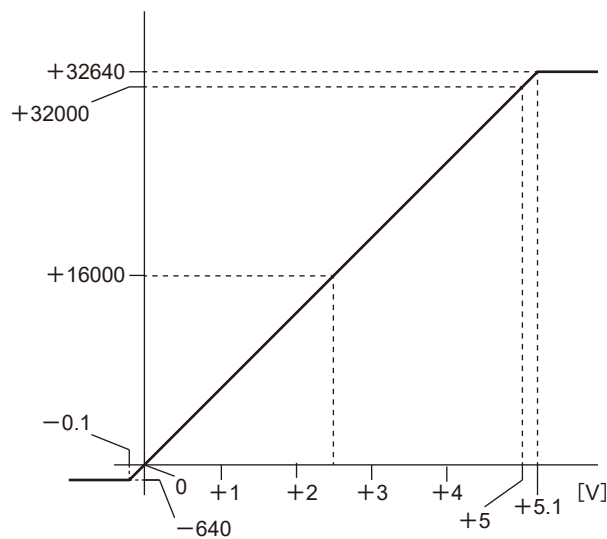
| Analog input value (V) | Digital converted value |
|------------------------|-------------------------|
| +5 | +32000 |
| +4 | +25600 |
| +3 | +19200 |
| +2 | +12800 |
| +1 | +6400 |
| 0 | 0 |
| -1 | -6400 |
| -2 | -12800 |
| -3 | -19200 |
| -4 | -25600 |
| -5 | -32000 |

6.1 Voltage Range

When exceeding the rated range

| Analog input value | Converted value |
|--------------------|-----------------|
| +5.1 V or more | +32640 |
| -5.1 V or less | -32640 |

6.1.4 Voltage Input Range: 0 to +5 V (Resolution: 1/32,000)



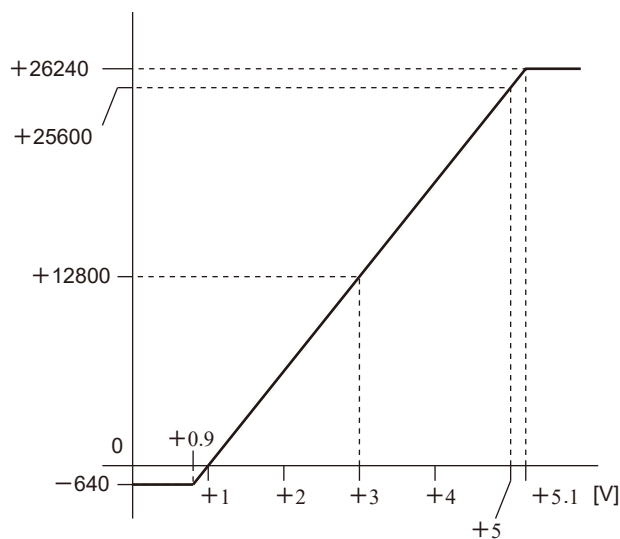
Input range: 0 to +5 V

| Analog input value (V) | Digital converted value |
|------------------------|-------------------------|
| +5 | +32000 |
| +4 | +25600 |
| +3 | +19200 |
| +2 | +12800 |
| +1 | +6400 |
| 0 | 0 |

When exceeding the rated range

| Analog input value | Converted value |
|--------------------|-----------------|
| +5.1 V or more | +32640 |
| -0.1 V or less | -640 |

6.1.5 Voltage Input Range: +1 to +5 V (Resolution: 1/25,600)



Input range: +1 to +5 V

| Analog input value (V) | Digital converted value |
|------------------------|-------------------------|
| +5 | +25600 |
| +4 | +19200 |
| +3 | +12800 |
| +2 | +6400 |
| +1 | 0 |

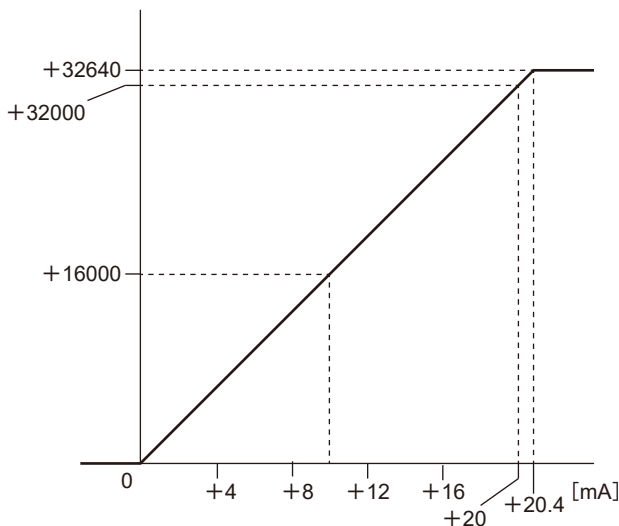
When exceeding the rated range

| Analog input value | Converted value |
|--------------------|-----------------|
| +5.1 V or more | +26240 |
| +0.9 V or less | -640 |

6.2 Current Range

6.2 Current Range

6.2.1 Current Input Range: 0 to +20 mA (Resolution: 1/32,000)



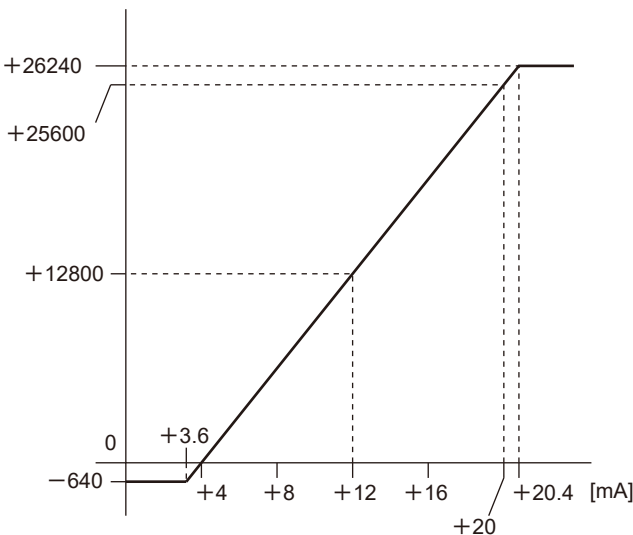
Input range: 0 to +20 mA

| Analog input value (mA) | Digital converted value |
|-------------------------|-------------------------|
| +20 | +32000 |
| +16 | +25600 |
| +12 | +19200 |
| +8 | +12800 |
| +4 | +6400 |
| 0 | 0 |

When exceeding the rated range

| Analog input value | Converted value |
|--------------------|-----------------|
| +20.4 mA or more | +32640 |
| 0 mA or less | 0 |

6.2.2 Current Input Range: +4 to +20 mA (Resolution: 1/25,600)



Input range: +4 to +20 mA

| Analog input value (mA) | Digital converted value |
|-------------------------|-------------------------|
| +20 | +25600 |
| +16 | +19200 |
| +12 | +12800 |
| +8 | +6400 |
| +4 | 0 |

When exceeding the rated range

| Analog input value | Converted value |
|--------------------|-----------------|
| +20.4 mA or more | +26240 |
| +3.6 mA or less | -640 |

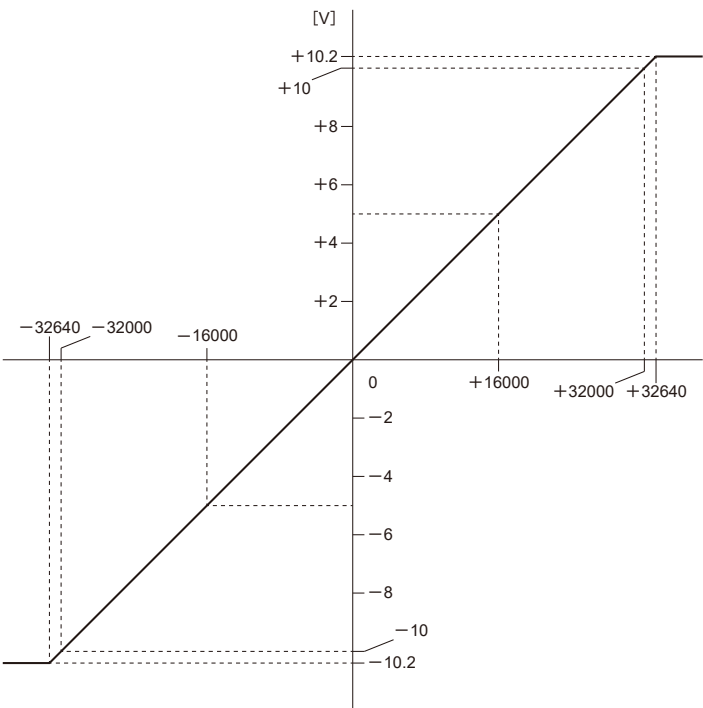
7 Conversion Characteristics of Analog Output

| | |
|--|-----|
| 7.1 Voltage Range | 7-2 |
| 7.1.1 Voltage Output Range: -10 to +10 V (Resolution: 1/64,000)..... | 7-2 |
| 7.1.2 Voltage Output Range: 0 to +10 V (Resolution: 1/32,000)..... | 7-3 |
| 7.1.3 Voltage Output Range: -5 to +5 V (Resolution: 1/64,000)..... | 7-3 |
| 7.1.4 Voltage Output Range: 0 to +5 V (Resolution: 1/32,000)..... | 7-4 |
| 7.1.5 Voltage Output Range: +1 to +5 V (Resolution: 1/25,600)..... | 7-4 |
| 7.2 Current Range | 7-6 |
| 7.2.1 Current Output Range: 0 to +20 mA (Resolution: 1/32,000)..... | 7-6 |
| 7.2.2 Current Output Range: +4 to +20 mA (Resolution: 1/25,600)..... | 7-6 |

7.1 Voltage Range

7.1 Voltage Range

7.1.1 Voltage Output Range: -10 to +10 V (Resolution: 1/64,000)



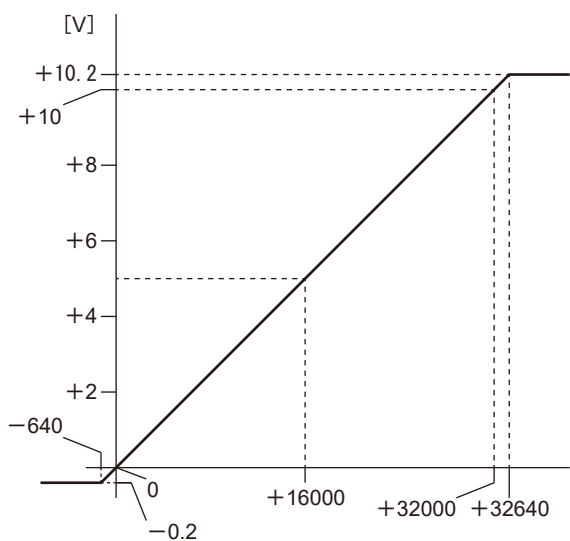
Output range: -10 to +10 V

| Digital input value | Analog output value (V) |
|---------------------|-------------------------|
| +32000 | +10 |
| +25600 | +8 |
| +19200 | +6 |
| +12800 | +4 |
| +6400 | +2 |
| 0 | 0 |
| -6400 | -2 |
| -12800 | -4 |
| -19200 | -6 |
| -25600 | -8 |
| -32000 | -10 |

When exceeding the rated range

| Digital input value | Analog output value |
|---------------------|---------------------|
| +32,640 or more | +10.2 V |
| -32,640 or less | -10.2 V |

7.1.2 Voltage Output Range: 0 to +10 V (Resolution: 1/32,000)



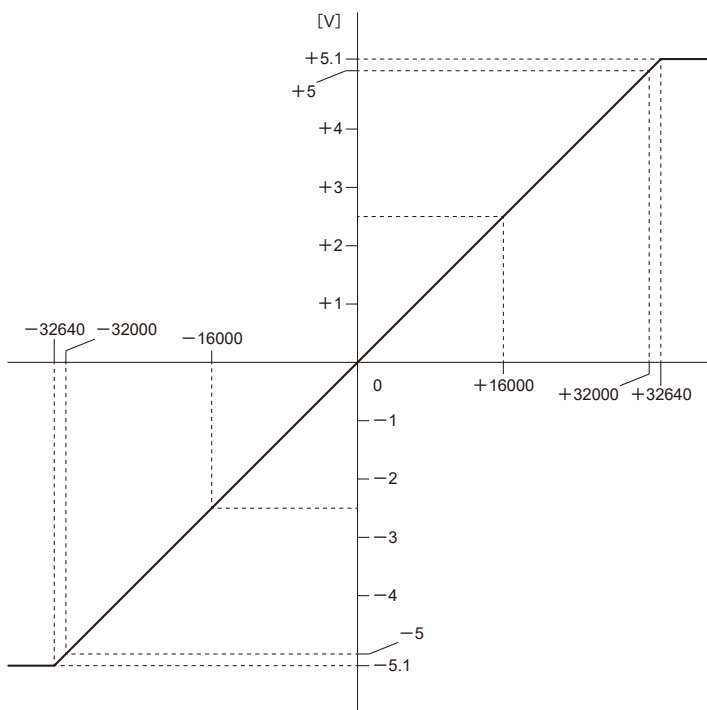
Output range: 0 to +10 V

| Digital input value | Analog output value (V) |
|---------------------|-------------------------|
| +32000 | +10 |
| +25600 | +8 |
| +19200 | +6 |
| +12800 | +4 |
| +6400 | +2 |
| 0 | 0 |

When exceeding the rated range

| Digital input value | Analog output value |
|---------------------|---------------------|
| +32640 or more | +10.2 V |
| -640 or less | -0.2 V |

7.1.3 Voltage Output Range: -5 to +5 V (Resolution: 1/64,000)



Output range: -5 to +5 V

| Digital input value | Analog output value (V) |
|---------------------|-------------------------|
| +32000 | +5 |
| +25600 | +4 |
| +19200 | +3 |
| +12800 | +2 |
| +6400 | +1 |
| 0 | 0 |
| -6400 | -1 |
| -12800 | -2 |
| -19200 | -3 |
| -25600 | -4 |
| -32000 | -5 |

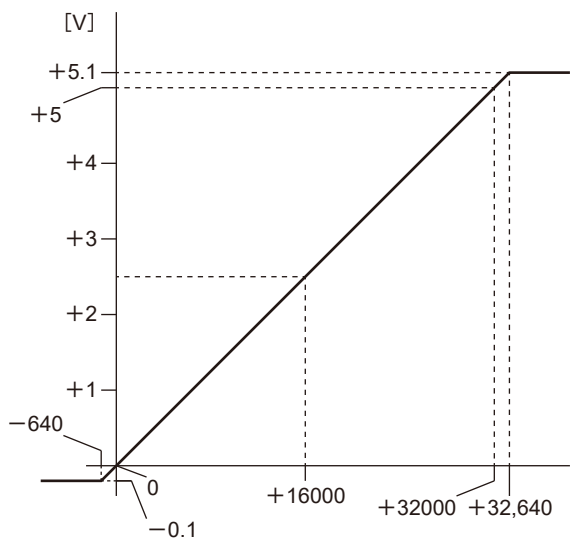
When exceeding the rated range

| Digital input value | Analog output value |
|---------------------|---------------------|
| +32640 or more | +5.1 V |

7.1 Voltage Range

| Digital input value | Analog output value |
|---------------------|---------------------|
| -32640 or less | -5.1 V |

7.1.4 Voltage Output Range: 0 to +5 V (Resolution: 1/32,000)



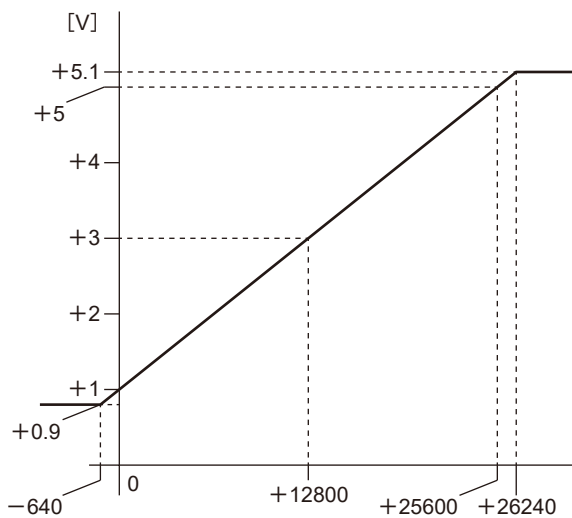
Output range: 0 to +5 V

| Digital input value (K) | Analog output value (V) |
|-------------------------|-------------------------|
| +32000 | +5 |
| +25600 | +4 |
| +19200 | +3 |
| +12800 | +2 |
| +6400 | +1 |
| 0 | 0 |

When exceeding the rated range

| Digital input value | Analog output value |
|---------------------|---------------------|
| +32640 or more | +5.1 V |
| -640 or less | -0.1 V |

7.1.5 Voltage Output Range: +1 to +5 V (Resolution: 1/25,600)



Output range: +1 to +5 V

| Digital input value (K) | Analog output value (V) |
|-------------------------|-------------------------|
| +25600 | +5 |
| +19200 | +4 |
| +12800 | +3 |
| +6400 | +2 |
| 0 | +1 |

When exceeding the rated range

| Digital input value | Analog output value |
|---------------------|---------------------|
| +26,240 or more | Output at +5.1 V |

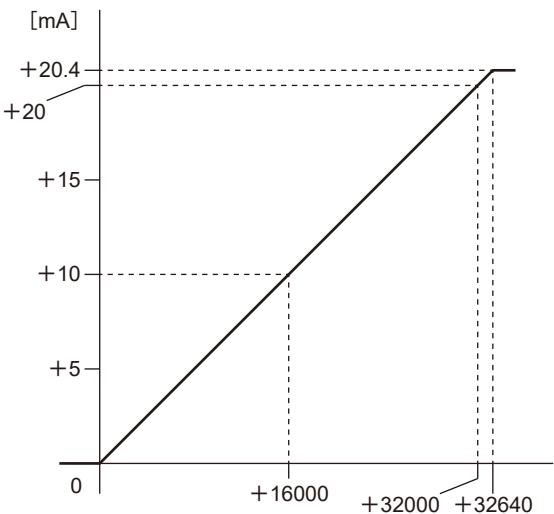
7.1 Voltage Range

| Digital input value | Analog output value |
|---------------------|---------------------|
| -640 or less | Output at +0.9 V |

7.2 Current Range

7.2 Current Range

7.2.1 Current Output Range: 0 to +20 mA (Resolution: 1/32,000)



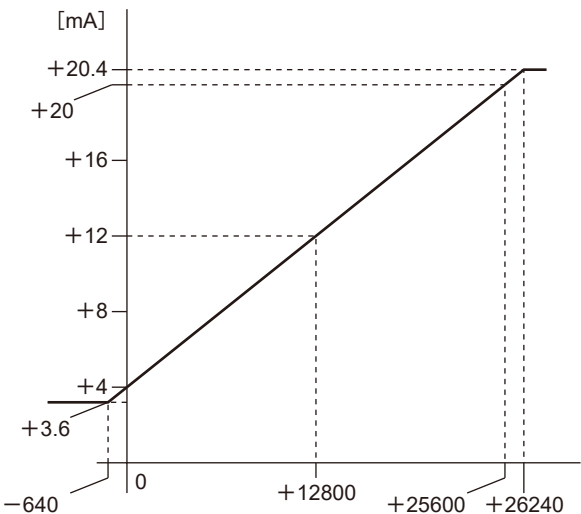
Output range: 0 to +20 mA

| Digital input value | Analog output value (mA) |
|---------------------|--------------------------|
| +32000 | +20 |
| +25600 | +16 |
| +19200 | +12 |
| +12800 | +8 |
| +6400 | +4 |
| 0 | 0 |

When exceeding the rated range

| Digital input value | Analog output value |
|---------------------|---------------------|
| +32,640 or more | +20.4 mA |
| -0 or less | 0 mA |

7.2.2 Current Output Range: +4 to +20 mA (Resolution: 1/25,600)



Output range: +4 to +20 mA

| Digital input value (K) | Analog output value (mA) |
|-------------------------|--------------------------|
| +25600 | +20 |
| +19200 | +16 |
| +12800 | +12 |
| +6400 | +8 |
| 0 | +4 |

When exceeding the rated range

| Digital input value | Analog output value |
|---------------------|---------------------|
| +26,240 or more | +20.4 mA |
| -640 or less | + 3.6 mA |

8 What to Do If an Error Occurs

- 8.1 What to Do If an Error Occurs (Analog Input).....8-2
 - 8.1.1 Failure in Reading Analog Input Data 8-2
 - 8.1.2 Unstable Analog Input Values 8-2
 - 8.1.3 No Proper Conversion Values Obtained with Current Input..... 8-2
- 8.2 What to Do If an Error Occurs (Analog Output)8-3
 - 8.2.1 Unstable Analog Output Value 8-3
 - 8.2.2 Unchanged Analog Output Value 8-3

8.1 What to Do If an Error Occurs (Analog Input)

8.1 What to Do If an Error Occurs (Analog Input)

8.1.1 Failure in Reading Analog Input Data

■ Situation

There is a failure in reading analog input data.

■ Solution

1. Check again that I/O mapping allocations are correct.
2. Check again the connections of the terminal block.
3. Check again the parameter settings.

8.1.2 Unstable Analog Input Values

■ Situation

The analog input value is not stable.

■ Solution

1. Check that a twisted pair shield wire is used and that the wire is properly shielded.
2. Check that the analog input wiring is not placed close to AC lines or high-tension lines or bundled with the lines.
3. Check that there are no power lines, high-tension lines, high-capacity relays, or noise-generating equipment, such as inverters, close to the analog input unit.
4. Check that the voltage or current for the range setting is set correctly.

8.1.3 No Proper Conversion Values Obtained with Current Input

■ Situation

Proper conversion values cannot be obtained with current input.

■ Solution

1. Check again the connections of the terminal block.
2. Check again the connections of the output equipment.
3. Check that the range setting is the current mode.

8.2 What to Do If an Error Occurs (Analog Output)

8.2.1 Unstable Analog Output Value

■ Situation

The analog output value is not stable.

■ Solution

1. Check if the shielded wire of the input device is grounded.
However, depending on the conditions of the external noise, it may be better not to ground the shielding.
2. Review the program again.

8.2.2 Unchanged Analog Output Value

■ Situation

The analog output value remains unchanged.

■ Solution

1. Check that the unit is in the RUN mode.
2. Check again that I/O allocations are correct.
3. Check again the connections of the terminal block.
4. Check that the impedance of the input device is 500 Ω or below if the current output range is set.
5. Check that the output is not short-circuited.
6. Check that the digital input value is within the range.
7. Check the parameter settings.

(MEMO)

Appendix Warranty / Cautions for Proper Use

| | |
|-------------------------------|-------|
| Warranty | App-2 |
| Warranty Period | App-2 |
| Warranty Scope | App-2 |
| Cautions for Proper Use | App-3 |

Warranty

Warranty Period

The warranty period of the Product shall be 12 months from the ex-factory date or 18 months from the date of manufacturing unless otherwise specified between both parties.

Warranty Scope

Panasonic warrants the replacement of the defected parts of the Product or repair of them when the defects of the Product occur during the Warranty Period, and when the defects are under Panasonic responsibility. This Warranty only covers the Product itself and does not cover any damage to your company and the third party incurred by the Product, such as damage that is induced by an object machined or produced using the Product or by the defects of the Product. This Warranty shall be exempted in the following cases,

1. Defects resulting from misuse and/or repair or modification by the customer.
2. Defects resulting from drop of the Product or damage during transportation.
3. Defects resulting from improper usage of the Product beyond the Specifications.
4. Defects resulting from fire, earthquake, lightening, flood, damage from salt, abnormal voltage or other Act of God, or other disaster.
5. Defects resulting from the intrusion of foreign material to the Product, such as water, oil or metallic particles.
6. Parts exceeding their standard lifetime specified in this document.
7. The machines are not assembled in accordance with the instructions or precautions noted in this specification.
8. When the machine does not match the Product assembled in the machine.
9. When the machine condition is not caused by Panasonic reasons.
10. Defects that Panasonic could not foresee at the time of delivery of the Product.

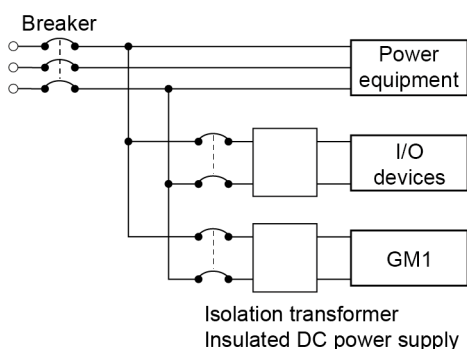
Cautions for Proper Use

■ Selection of a power supply

- Use a low noise power supply.
- The inherent noise resistance is sufficient for the noise superimposed on the power wires, however, the noise can be attenuated further by using the isolation transformer / insulated power supply.

■ Isolation of power supply systems

- Wiring to the units, I/O devices, and other power devices should have separate wiring systems.

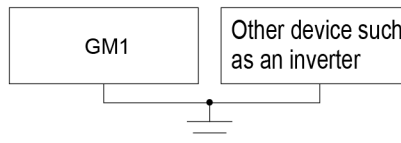
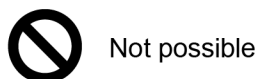
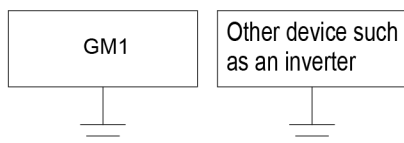


■ Power supply sequence

- Start the GM1 controller only after I/O devices and power devices are energized.
In case of stopping the operation of the GM1 controller, have the I/O devices or power devices turned OFF after the GM1 controller has stopped operating.

■ Grounding

- The grounding connection should have a resistance of 100 Ω or less.
- The point of grounding should be as close to the GM1 controller as possible. The ground wire should be as short as possible.
- Sharing the ground with another device may have an adverse effect. Therefore, be sure that grounding is dedicated.



Conversely, depending on your environment, grounding may cause a problem. Do not ground the function earth when grounding a plus (+) terminal of the power.

Cautions for Proper Use

■ Wiring

- Turn OFF the power supply when carry out wiring or connecting the GM1 controller to expansion units.
- Noise resistance measures such as attaching a noise filter, a surge absorber or a ferrite core may be necessary in some cases, depending on the usage environment.

■ Installation of an interlock circuit

- When controlling conflicting operations such as the motor rotation in clockwise or counter-clockwise direction, provide an interlock circuit external to the GM1 controller.

■ Installation of an emergency stop circuit

- Provide an emergency stop circuit external to the GM1 controller to turn OFF the power supply of the output device.

■ Installation environment

Do not use it in the following environments.

- Direct sunlight
- Sudden temperature changes causing condensation.
- Inflammable or corrosive gas.
- Excessive airborne dust, metal particles or saline matter.
- Benzine, paint thinner, alcohol or other organic solvents or strong alkaline solutions such as ammonia or caustic soda.
- Direct vibration, shock or direct drop of water.
- Influence from power transmission lines, high voltage equipment, power cables, power equipment, radio transmitters, or any other equipment that would generate high switching surges. (100 mm or more)

■ Handling instructions

- Before touching the unit, always touch a grounded piece of metal in order to discharge static electricity.
- Always rid yourself of any static electricity before handling this product.
- Do not connect a unit other than our GM1 series to the side connector on the unit.
- Use copper wires with a temperature rating of 90°C or higher.

Record of Changes

| Date | Manual No. | Record of changes |
|---------------|----------------|---|
| August 2021 | WUME-GM1AIO-01 | 1st edition |
| April 2022 | WUME-GM1AIO-02 | 2nd edition <ul style="list-style-type: none">• Changed the Company name |
| June 2022 | WUME-GM1AIO-03 | 3rd edition <ul style="list-style-type: none">• Clerical corrections |
| August 2023 | WUME-GM1AIO-04 | 4th edition <ul style="list-style-type: none">• Clerical corrections |
| November 2023 | WUME-GM1AIO-05 | 5th edition <ul style="list-style-type: none">• Clerical corrections |
| August 2024 | WUME-GM1AIO-06 | 6th edition <ul style="list-style-type: none">• Consolidation of wiring information and specifications into the Reference Manual Hardware |

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Please contact

**Industrial Device Business Division,
Panasonic Industry Co., Ltd.**

7-1-1 Morofuku, Daito City, Osaka, 574-0044, Japan
industrial.panasonic.com/ac/e/

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