Panasonic®

PROGRAMMABLE CONTROLLER

FP7 Analog Input Unit
User's Manual

Safety Precautions

Observe the following notices to ensure personal safety or to prevent accidents.
To ensure that you use this product correctly, read this User's Manual thoroughly before use.
Make sure that you fully understand the product and information on safety.
This manual uses two safety flags to indicate different levels of danger.

WARNING

If critical situations that could lead to user's death or serious injury is assumed by mishandling of the product.
-Always take precautions to ensure the overall safety of your system, so that the whole system remains safe in the event of failure of this product or other external factor.
-Do not use this product in areas with inflammable gas. It could lead to an explosion.
-Exposing this product to excessive heat or open flames could cause damage to the lithium battery or other electronic parts.

CAUTION

If critical situations that could lead to user's injury or only property damage is assumed by mishandling of the product.
-To prevent excessive exothermic heat or smoke generation, use this product at the values less than the maximum of the characteristics and performance that are assured in these specifications.
-Do not dismantle or remodel the product. It could cause excessive exothermic heat or smoke generation.
-Do not touch the terminal while turning on electricity. It could lead to an electric shock.
-Use the external devices to function the emergency stop and interlock circuit.
-Connect the wires or connectors securely.
The loose connection could cause excessive exothermic heat or smoke generation.
-Do not allow foreign matters such as liquid, flammable materials, metals to go into the inside of the product. It could cause excessive exothermic heat or smoke generation.
-Do not undertake construction (such as connection and disconnection) while the power supply is on. It could lead to an electric shock.

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Introduction

Thank you for buying a Panasonic product. Before you use the product, please carefully read the installation instructions and the users manual, and understand their contents in detail to use the product properly.

Types of Manual

- There are different types of users manual for the FP7 series, as listed below. Please refer to a relevant manual for the unit and purpose of your use.

- The manuals can be downloaded on our website:
  http://industrial.panasonic.com/ac/e/dl_center/manual/ .

Unit name or purpose of use	Manual name	Manual code
FP7 Power Supply Unit	FP7 CPU Unit Users Manual (Hardware)	WUME-FP7CPUH
FP7 CPU Unit		
Instructions for Built-in COM Port FP7 Extension (Communication) Cassette	FP7 CPU Unit Users Manual (COM Port Communication)	WUME- FP7COM
Instructions for Built-in LAN Port	FP7 CPU Unit Users Manual (LAN Port Communication)	WUME-FP7LAN
FP7 Digital Input/Output Unit	FP7 Digital Input/Output Unit Users Manual	WUME-FP7DIO
FP7 Analog Input Unit	FP7 Analog Input Unit Users Manual	WUME-FP7AIH
FP7 Analog Output Unit	FP7 Analog Output Unit Users Manual	WUME-FP7AOH
FP7 Positioning Unit	FP7 Positioning Unit Users Manual	WUME-FP7POSP
PHLS System	PHLS System Users Manual	WUME-PHLS
Programming Software FPWIN GR7	FPWIN GR7 Introduction Guidance	WUME-FPWINGR7

Table of Contents

1

Unit Functions and Restrictions

1.1 Unit Functions and Operation

■ Features of 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 analog input unit can receive input through a number of channels.
  Analog input units: 4 channels
  Six types of input ranges can be selected to support a variety of connecting equipment.

- The speed of conversion, such as voltage/current range conversion, is as high as 25 μs/channel (non-isolated).

- Converts input analog values into digital data with up to 16 bits in a resolution range of 1/25,000 to 1/62,500.

1.2 Basic Operation of Analog Input Processing

Analog input is processed as explained below.

■ Operation of analog input unit

(1) Receiving analog input
The analog input unit receives analog input data from analog devices, such as laser analog sensors and pressure sensors.

(2) Digital conversion processing
Analog input data received by the unit is converted into digital values in sequence automatically.

(3) Storage of digital values
A user program is used to read converted digital values as data in the input relay area (WX).
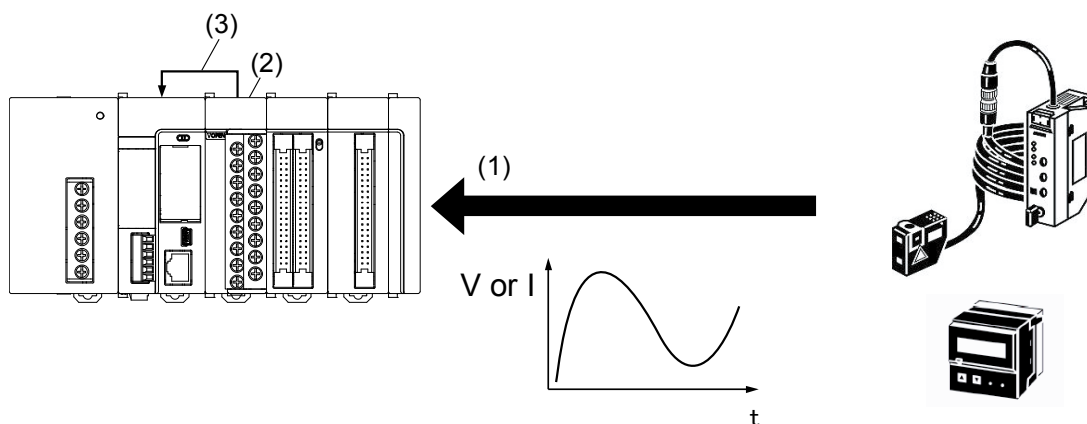
■ Option setting
The following option setting functions are provided for analog input processing. Any of the option setting functions can be set by writing the function to the unit memory (UM) by using the configuration menu of the FPWIN GR7 or a user program.

- Average processing (number of times, time average, and moving average)

- Scale conversion

- Offset/Gain processing

- Holding Max./Min.

- Comparison for upper and lower limits

- Disconnection detection

- Buffering

1.3 Restrictions on Units Combination

1.3.1 Restriction by Power Consumption

The unit has the following internal current consumption. Make sure that the total current consumption is within the capacity of the power supply with consideration of all other units used in combination with the analog input unit.

Name	Product no.	Current consumption
FP7 analog input unit	AFP7AD4H	100 mA or less

2

Names and Functions of Parts

2.1 Analog Input Unit
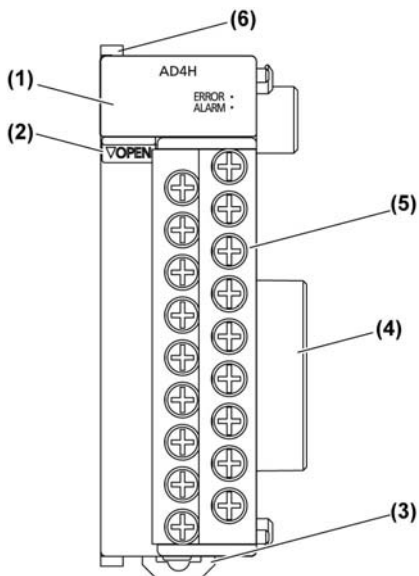
■ Names and functions of parts

(1) Operation monitor LEDs

LED name	LED color	Contents
-	Blue	Lit when the CPU unit is turned ON.
ERROR	Red	Lit if the configuration settings are beyond the allowable range or A/D conversion is not possible.
ALARM	Red	Lit if the hardware has an error.

(2) Terminal block release lever

To remove the analog input terminal block, push the release lever downward.

(3) DIN rail attachment lever

This lever is used to fix the unit to the DIN rail.

(4) Unit Connector

Connects to other I/O units and high-function units.

(5) Analog input terminal block

The terminal block is removable. Remove the terminal block before wiring.
Solderless terminals for M3 can be used.

(8) Fixing hook

Used to secure the unit with another unit.

3
Wiring

3.1 Wiring of Terminal Block

■ Suitable solderless terminals/wires

M3 terminal screws are used for the terminal. The following suitable solderless terminals are recommended for the wiring to the terminals

●Fork type terminal   ●Round type terminal

6 mm or less   6 mm or less

3.2 mm or more   3.2 mm or more
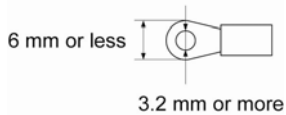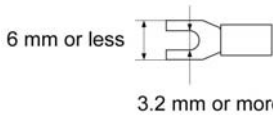
• Suitable solderless terminals

Manufacturer	Shape	Part no.	Suitable wires
J.S.T. Mfg Co., Ltd.	Round type	1.25-MS3	0.25 to 1.65 mm^2
	Fork type	1.25-B3A	
	Round type	2-MS3	1.04 to 2.63 mm^2
	Fork type	2-N3A	

• Suitable wires

Suitable wires	Tightening torque
AWG22 to 14 (0.3 mm^2 to 2.0 mm^2)	0.5 to 0.6N ·m

■ Connection to the terminal block

Remove the terminal block before beginning the wiring operations.
To remove the terminal block, push the release lever located at the top of the terminal block downward.

Lock button

<Bottom of unit>
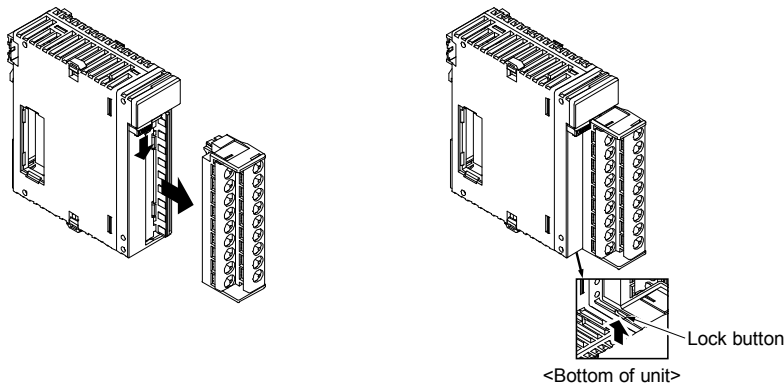
 ◆ **NOTE**

Install the terminal block by inserting it all the way to its original position and pressing the lock button on the bottom of the unit. Then confirm that the terminal block is securely attached and cannot be removed.

3.2 Connecting Analog Input

3.2.1 Voltage Input (-10 to +10, 0 to +10, 0 to +5, and +1 to +5 V)

■ **Wiring diagram and internal circuit diagram**
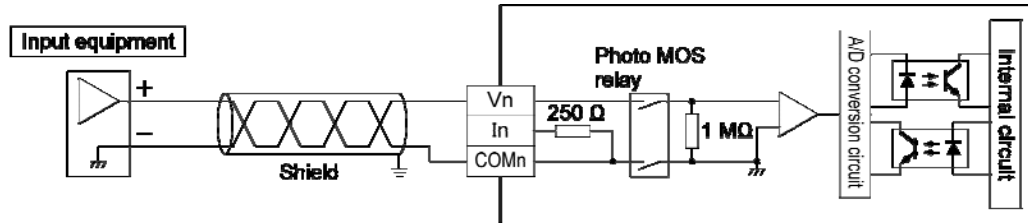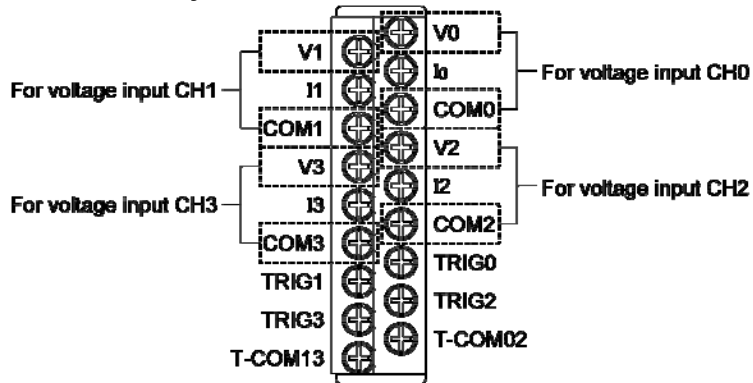
■ **Terminal layout**

3.2.2   Current Input (0 to +20, +4 to +20 mA)

■ **Wiring diagram and internal circuit diagram**

In the case of current input, connect the Vn and In terminals.
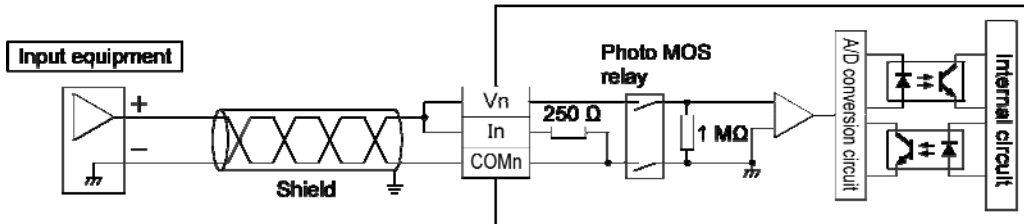
■ **Terminal layout**
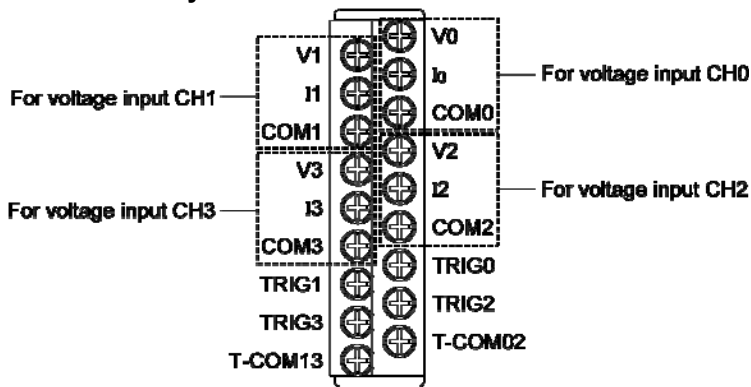
☞ ◆ **NOTES**

- **Use double-core twisted-pair shielded wires. It is recommended to ground them. However, depending on the conditions of the external noise, it may be better not to ground the shielding.**

- **Do not place the analog input wiring close to AC lines, high-tension lines, or load lines other than PLC wires or bundle the analog input and other wires together.**

3.3 Connecting Trigger Input Terminal TRIG

The trigger input terminal is used when the buffer function is used with an external input signal as a trigger signal. This terminal needs not be connected if these functions are not used.

■ Description

Items		Description
Insulation system		Optical coupler
Rated input voltage		24 V DC
Rated input current		Approx. 4.5 mA (at 24 V)
Input impedance		Approx. 5.1kΩ
Operating voltage range		21.6 to 26.4 V DC
Min. ON voltage/Min. ON current		19.2 V/3.5 mA
Max. OFF voltage/Max. OFF current		5 V/1.5 mA
Response time	OFF→ON	0.2 ms or less
	ON→OFF	0.2 ms or less
Input points per common		2 point/1 common
External connection method		Terminal block connections (M3 terminal screws)

■ Internal circuit diagram
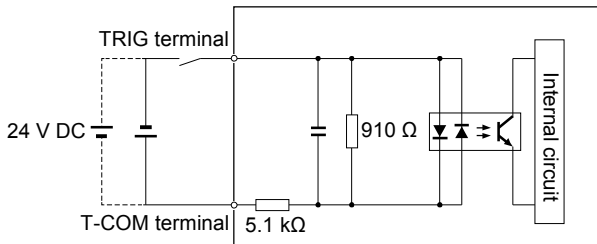
■ Terminal layout
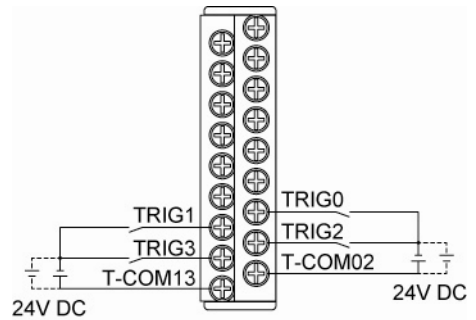
4

Unit Settings and data Reading

4.1 Confirming the I/O Number Allocations and First Word Number

4.1.1 Occupied I/O Area and I/O Allocations

In the FP7, analog input data is allocated to the external input relay area and processed.
An analog input signal into a single channel is handled by 16 X-contact points.
The following table shows the I/O allocation of analog input data.

■ **Input contact**

I/O number								Name	Description
CH0		CH1		CH2		CH3			
WX0	X0 to XF	WX2	X20 to X2F	WX4	X40 to X4F	WX6	X60 to X6F	A/D conversion data (16 bits)	Digital converted values corresponding to the analog input is stored. <Voltage range> -10 to +10 V: -31,250 to +31,250 0 to +10 V or 0 to +5 V: 0 to +31,250 +1 to +5 V: 0 to +25,000 <Current range> 0 to +20 mA: 0 to +31,250 +4 to +20 mA: 0 to +25,000 * A/D conversion data within the set scale applies if scale conversion is set.
WX1	X10	WX3	X30	WX5	X50	WX7	X70	Disconnection detection flag	ON with disconnection detected and OFF with disconnection restored (valid for 1 to 5 V and 4 to 20 mA ranges only)
	X11		X31		X51		X71	Upper limit comparison relay	Turns ON when the value exceeds the set upper limit.
	X12		X32		X52		X72	Lower limit comparison relay	Turns ON when the value drops below the set lower limit.
	X13		X33		X53		X73	Upper limit/Lower limit comparison execution flag	ON when the upper limit/lower limit comparison function is executed.
	X14		X34		X54		X74	Not used	Do not use.
	X15		X35		X55		X75	Max./Min. hold execution flag	ON when the max./min. hold function is executed.
	X16		X36		X56		X76	Not used	Do not use.
	X17		X37		X57		X77		
	X18		—		—		—	Buffer function execution flag	ON when the buffer function is executed.
	X19		—		—		—	Buffering flag	ON when buffering starts after the trigger is accepted. OFF when the number of buffer data items is reached.
	X1A		—		—		—	Buffering completion flag	ON when the shared memory has become accessible after completion of buffering OFF on completion of buffer data reading.
	X1B		—		—		—	Data before triggering enable flag	ON when the number of buffer data items before triggering has reached the set value. OFF on completion of buffer data reading.

X1C to X1E	X3C to X3E	X5C to X5E	X7C to X7E	Not used	Do not use.
X1F	X3F	X5F	X7F	Error flag	Turns ON if an error occurs.

(Note 1) The I/O numbers in the tables above show offset addresses. I/O numbers actually allocated are based on the first word number allocated to the unit. (Example) If the first word number is 10, the D/A conversion data on CH0 and the error flag will be WX10 and X11F, respectively.

(Note 2): The conditions of the buffer function (i.e., the buffer function execution flag, buffering flag, buffering completion flag, and data enable flag before triggering) are allocated to the input contacts for CH0.

■ Output contact

I/O number				Name	Description
CH0	CH1	CH2	CH3		
Y0	Y10	Y20	Y30	Disconnection detection execution relay	ON to execute the disconnection detection function. OFF to turn OFF the disconnection detection flag (Xn0). (valid for 1 to 5 V and 4 to 20 mA ranges only)
Y1	Y11	Y21	Y31	Not used	Do not use.
Y2	Y12	Y22	Y32		
Y3	Y13	Y23	Y33	Upper limit/Lower limit comparison execution relay	ON to execute the function to compare the upper and lower limits. OFF to turn OFF the upper limit comparison relay (Xn1) and lower limit comparison relay (Xn2).
Y4	Y14	Y24	Y34	Not used	Do not use.
Y5	Y15	Y25	Y35	Max./Min. hold execution relay	ON when the max./min. hold function is executed.
Y6	Y16	Y26	Y36	Not used	Do not use.
Y7	Y17	Y27	Y37		
Y8	—	—	—	Buffer execution relay	When the buffer function is enabled, trigger acceptance will be permitted with the buffer execution relay turned ON. The internal state transition will be initialized with the buffer execution relay turned OFF.
Y9	—	—	—	Buffer trigger relay	If "Trigger relay" is set in trigger setting, triggering will start with the trigger relay turned ON.
YA	—	—	—	Buffer data Read completion relay	ON upon completion of reading buffer data from the shared memory. Goes to the state of trigger acceptance permitted after clearing the buffer memory.
YB to YE	Y1B to Y1E	Y2B to Y2E	Y3B to Y3E	Not used	Do not use.
YF	Y1F	Y2F	Y3F	Error flag reset relay	Reset the error flag.

(WY0 spans CH0, WY1 spans CH1, WY2 spans CH2, WY3 spans CH3)

(Note 1) The I/O numbers in the tables above show offset addresses. I/O numbers actually allocated are based on the first word number allocated to the unit. (Example) If the first word number is 10, the disconnection detection execution relay on CH0 and the error flag reset relay will be Y100 and X10F, respectively.

(Note 2) The operation of the buffer function (consisting of the buffer execution relay, buffer trigger relay, and buffer data read completion relay) is specified by the output contacts for CH0.

4.1.2 Confirming the I/O Number Allocations

- I/O numbers and base word numbers are always necessary when writing programs. Always check to see if the numbers match the design.

- I/O numbers allocated to the analog input unit are determined by the first word number.

■ Allocations to unit

Take the following procedure to set the first word number.

◆ **PROCEDURE**

1. **Select "Options" → "FP7 Configuration" from the menu bar.**

2. **Select "I/O Map" from the field.**

3. **Double-click the target slot where the operating unit is to be inserted.**

4. **Select "Analog I/O" and "Input Unit" in the unit selection field.**

```
Unit selection [Slot No. 1]                                    [ X ]

  Select unit to use ─────────────────────────       [   OK   ]

     Unit type:        Analog I/O                 ▼   [ Insert ]

     Unit name:        Input unit (high-performance type) In4  ▼   [ Cancel ]

     Input time constant: 0    ▼

  Installation location setting ─────────────

     Starting word No.       10      (0 - 511)

     Number of input words:  8       (0 - 128)

     Number of output words: 8       (0 - 128)

     ☐ Automatically shift the starting word number for subsequent slots.

  Option ─────────────────────────────────

     ☐ Exclude this unit from the target for verification.

     ☐ Exclude this unit from the target for I/O refresh.
```

5. **Press the [OK] button.**

   The first word number specified is set.

4.2 Option settings

4.2.1 Configuration of Analog Input unit

Use the FPWIN GR7 configuration menu to make analog input unit settings, such as input range and isolation/non-isolation settings.

■ Setting method

The following steps are described on the condition that the analog input unit has been already allocated on the I/O map.

◆ PROCEDURE

1. **Select "Options" → "FP7 Configuration" from the menu bar.**

2. **Select "I/O Map" from the field**

3. **Select the slot where the analog input unit is registered and press the [Advanced] button.**

    The "Analog unit settings" dialog box is displayed.
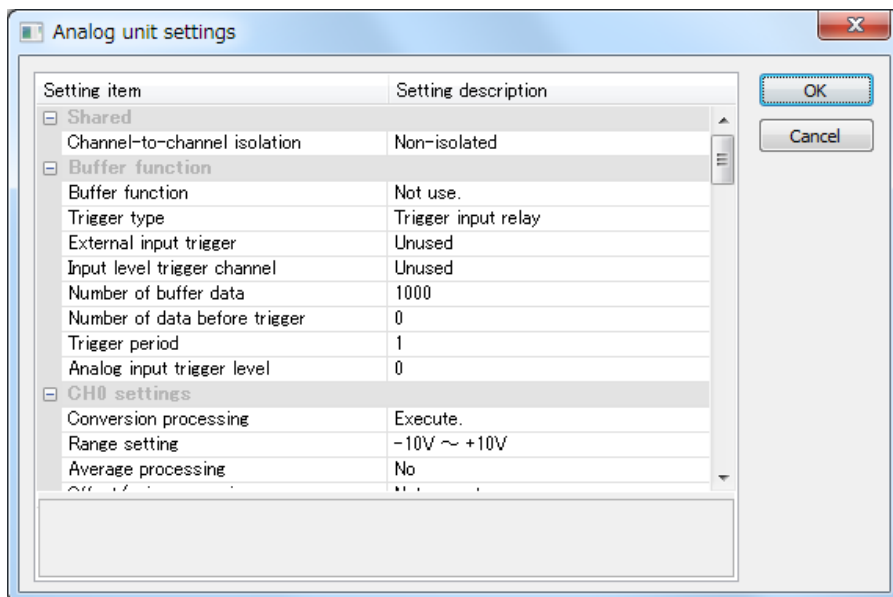
4. **Select the isolation, conversion process skip, and input range settings.**

    Select option setting as required.

5. **Press the [OK] button.**

    The set value will become effective when the set value is downloaded together with a corresponding program as a project.

■ **Settings**

Group	Setting item	Settings	Default
Basic setting items (common to all channels)	Isolation between channels	Non-isolated/Isolated	Non-isolated
	Buffer function	Not use/Use	Not use
	Trigger type	Trigger input relay/rise of external input trigger/fall of external input trigger/rising time of analog input level/falling time of analog input level	Trigger input relay
	External input trigger	Unused/TRIG0/TRIG1/TRIG2/TRIG3	Not used
	Input level trigger CH	Unused/CH0/CH1/CH2/CH3	Not used
	No. of buffer data items	1 to 10,000	1000
	No. of data items before triggering	0 to 9,999	0
	Trigger cycle	1 to 30,000	1
	Analog input trigger level	-31,250 to +31,250	0
Basic setting items (per channel)	Conversion processing	Execute/Not execute	Execute
	Range setting	-10 to +10 V 0 to +10 V 0 to +5 V +1 to +5 V 0 to +20 mA +4 to +20 mA	-10 to +10 V
Option setting items (per channel)	Average processing settings	Not execute/No. of averaging times/time average/moving average	Not execute
	Offset/Gain processing	Not execute/Execute	Not execute
	Scale conversion	Not execute/Execute	Not execute
	Comparison settings for upper and lower limits	Not execute/Execute	Not execute
	Max./Min.	Not execute/Execute	Not execute
	Disconnection detection settings	Not execute/Execute	Not execute
	Disconnection detection reset	Auto/Manual	Auto
	Averaging constant	Times: 2 to 60,000 [times] Time (non-isolated): 1 to 1,500 [ms] Time (isolated): 200 to 60,000 [ms] Moviing average: 2 to 2,000 [times]	200
	Offset value	-3,000 to +3,000	0
	Gain value	+9,000 to +11,000	+10,000
	Scale conversion max. value	-30,000 to +30,000	10,000
	Scale conversion min. value	-30,000 to +30,000	0
	Upper limit comparison ON level	-31,250 to +31,250	0
	Upper limit comparison OFF level	-31,250 to +31,250	0
	Lower limit comparison ON level	-31,250 to +31,250	0
	Lower limit comparison OFF level	-31,250 to +31,250	0

4.2.2 Unit Setting and Conversion Processing Time

Conversion time varies with the configuration setting conditions.

■ Isolation setting and conversion processing time

• Isolated: 5 ms/ch • Non-isolated: 25 μs/ch
• The speed of A/D conversion processing will become faster if non-isolation is set. Each channel is isolated by switching the respective photo-MOS relays of the channels at the time of conversion. The photo-MOS relays are always turned ON at the time of non-isolation and the commons will be shared.

■ Conversion processing execution/non-execution setting and conversion processing time

Select the execution or non-execution of the conversion processing of analog input on a channel-by-channel basis. This can save the conversion time for channels that do not execute conversion processing.

Example) Conversion time for four channels

Converted in the order of ch0→ch1→ch2→ch3→ch0→ch1→ch2→ch3→.... (1 cycle = 100 μs at the time of non-isolation)

Example) Conversion time for two channels (with CH2 and CH3 excluded).

Conversion is executed in the order of ch0→ch1→ch0→ch1→ch0→ch1→ch0→ch1→... and the conversion time for CH2 and CH3, which are excluded, is saved. (1 cycle = 50 μs at the time of non-isolation)

4.3 Reading Analog Input Data

4.3.1 Reading Analog Input Data

■ Basic Operation of Analog Input Processing

(1) Receiving analog input

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

(2) Digital conversion processing

Analog input data received by the unit is converted into digital values in sequence automatically in the unit. The converted digital value varies with the setting of the range.

(3) Storage of digital values

A user program is used to read converted digital values as data in the input relay area (WX). The specified area number varies depending on the installation position of the unit.
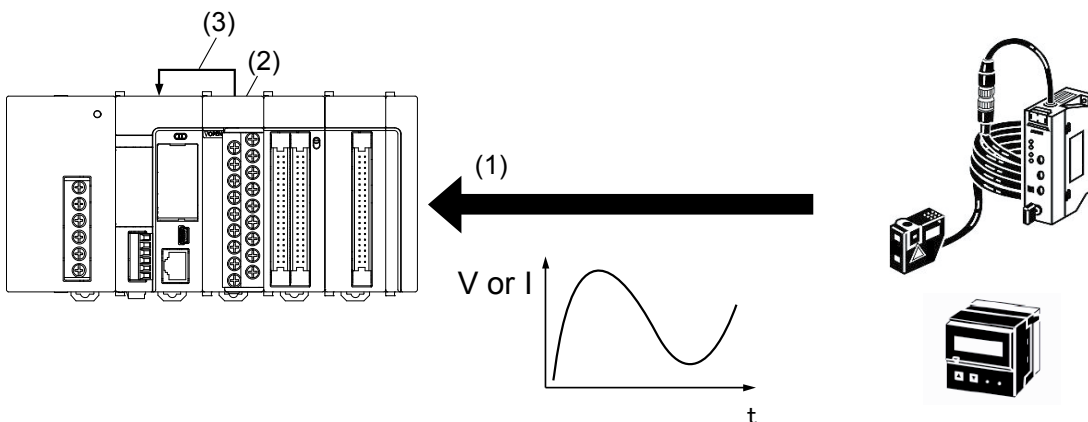
■ Program to Acquire Converted Digital Values

Reading the values in digital conversion value storage areas WX10, WX12, WX14, and WX16 to any a reas of data registers ranging from DT100 to DT103.

4.4 Data Acquisition Timing

■ Input conversion processing time of analog input unit

Conversion processing time varies with the range and the number of channels in use. The conversion execution/non-execution channel function can save the conversion time for channels that do not execute conversion processing.

● Example of 2-channel conversion

Converted in the order of ch0→ch1→ch0→ch1→....

```
┌──────────┬──────────┐
│   ch0    │   ch1    │
│conversion│conversion│
└──────────┴──────────┘
```
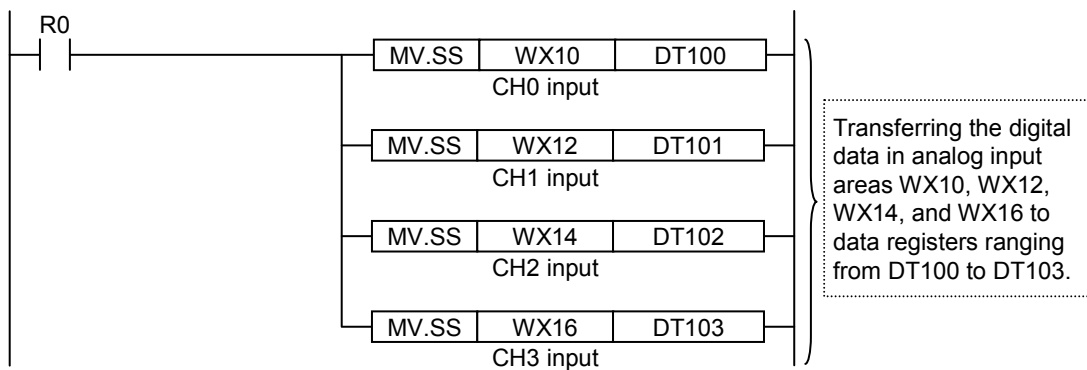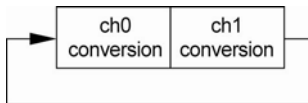
■ Data acquisition timing of CPU unit

• Digital values converted by the analog input unit are input into the CPU unit at the I/O refreshing timing of the CPU unit.

• The conversion processing of the analog input unit is not synchronized with the I/O refreshing timing of the CPU unit. Therefore, the latest data is input into the operation memory of the CPU unit when the CPU unit implements I/O refreshing.

• Example of 4-channel conversion
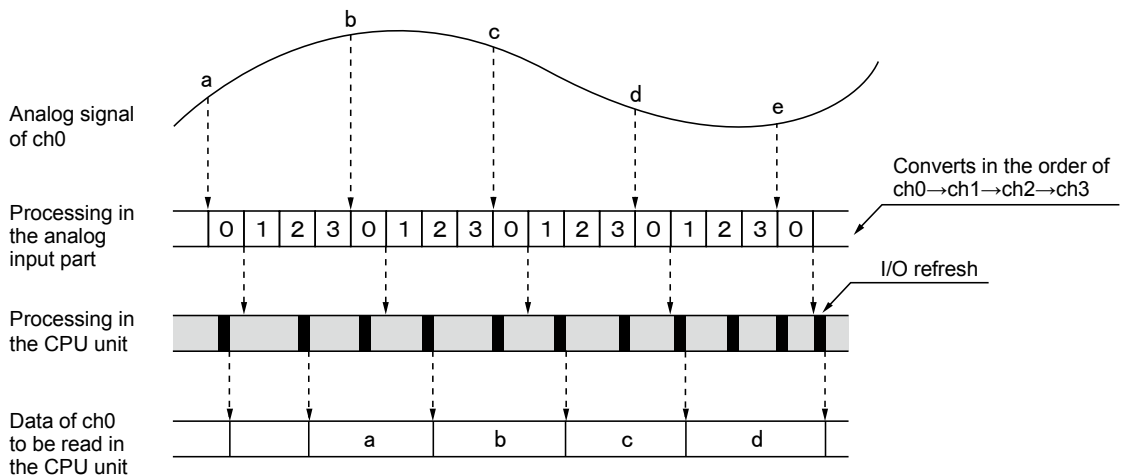
- Example of 1-channel conversion

Analog signal
of ch0

a b c d e f g h i j k l m n o p q r

Processing in
the analog
input part

Converts ch0 repeatedly

I/O refresh

Processing in
the CPU unit

Data of ch0
to be read in
the CPU unit

| a | c | e | g | j | l | n | p |
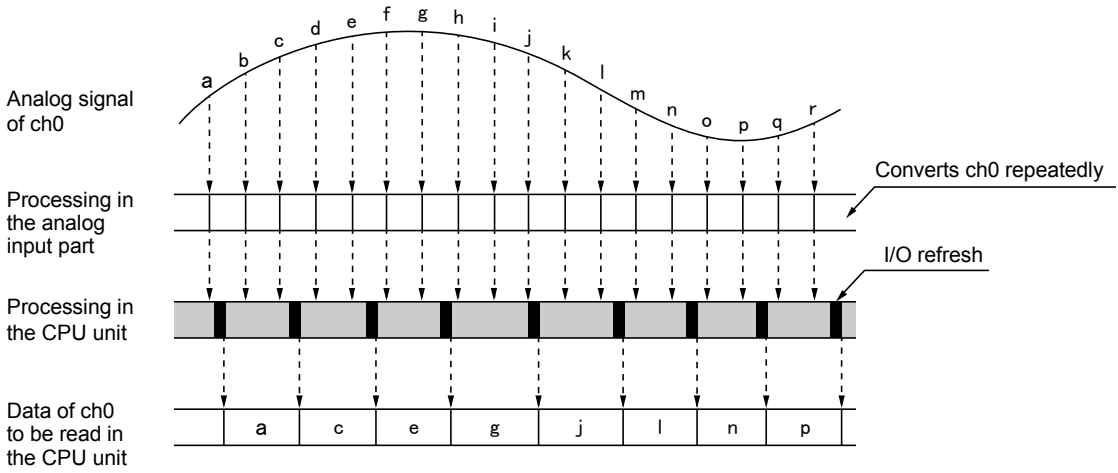
5

Conversion Characteristics of Analog Input Unit

5.1 Voltage Range

5.1.1 Voltage Input Range: -10 to +10 V (0.32 mV, 1/62,500)
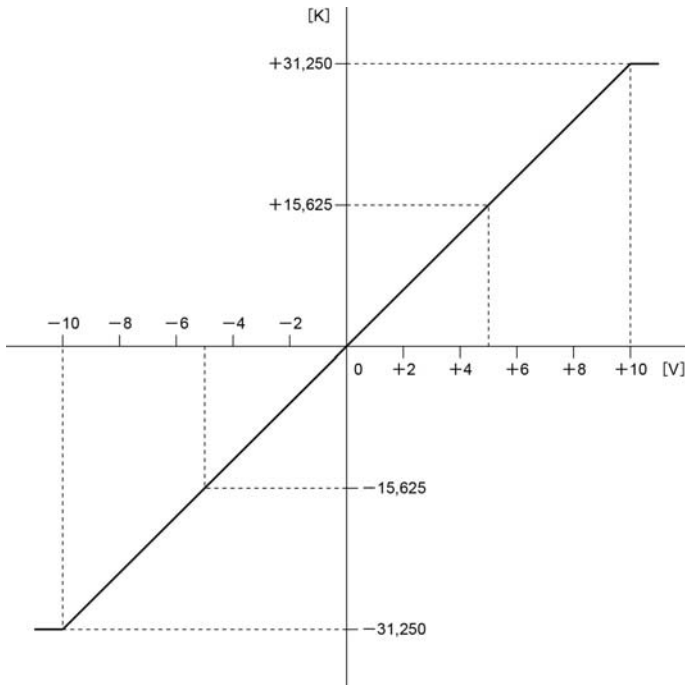
Input range: -10 to +10 V

Analog input value (V)	Digital conveted value (K)
+10	+31,250
+8	+25,000
+6	+18,750
+4	+12,500
+2	+6,250
0	0
-2	-6,250
-4	-12,500
-6	-18,750
-8	-25,000
-10	-31,250

When exceeding the rated range

Analog input value	Converted value
+10 V or more	+31,250
-10V or less	-31,250

5.1.2   Voltage Input Range: 0 to +10 V (0.32 mV, 1/31,250)
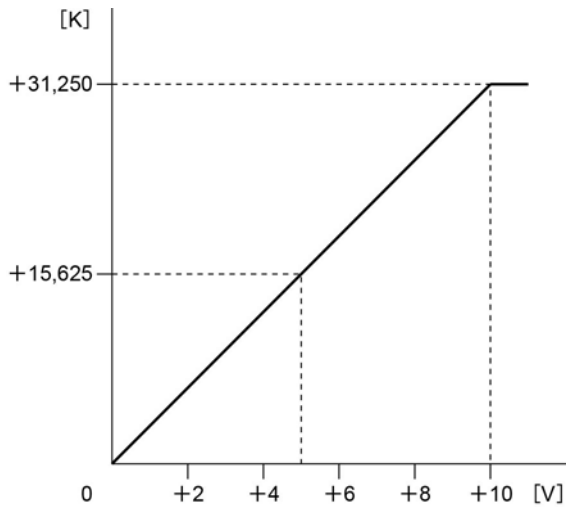
Input range: 0 to +10 V

Analog input value (V)	Digital conveted value (K)
+10	+31,250
+8	+25,000
+6	+18,750
+4	+12,500
+2	+6,250
0	0

When exceeding the rated range

Analog input value	Converted value
+10 V or more	+31,250
0 V or less	0

5.1.3   Voltage Input Range: 0 to +5 V (0.16 mV, 1/31,250)
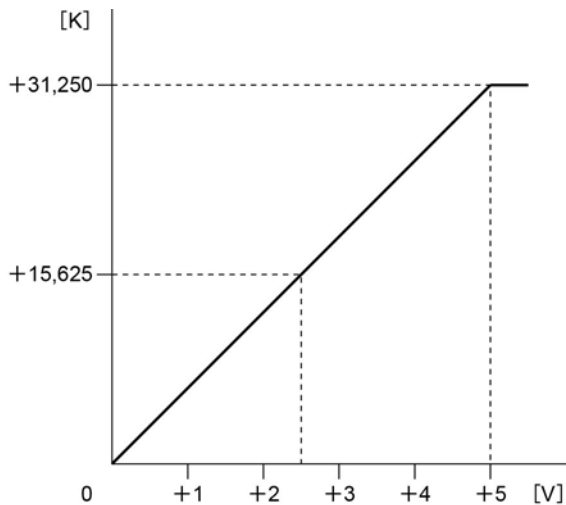
Input range: 0 to +5 V

Analog input value (V)	Digital conveted value (K)
+5	+31,250
+4	+25,000
+3	+18,750
+2	+12,500
+1	+6,250
0	0

When exceeding the rated range

Analog input value	Converted value
+5 V or more	+31,250
0 V or less	0

5.1.4 Voltage input range: 1 to 5 V (0.16 mV, 1/25,000)
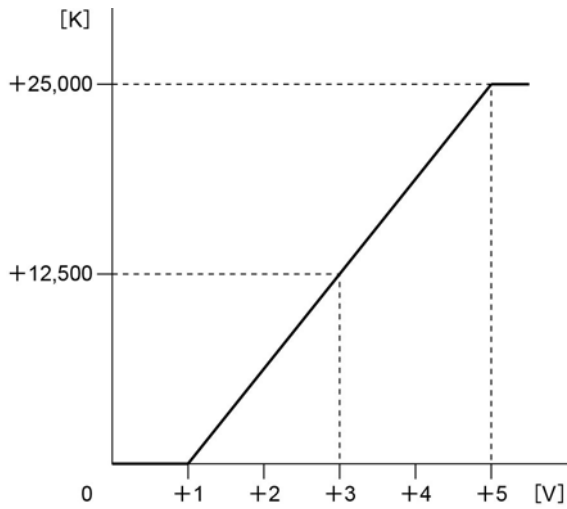
Input range: 1 to 5 V

Analog input value (V)	Digital conveted value (K)
5	25,000
4	18,750
3	12,500
2	6,250
1	0

When exceeding the rated range

Analog input value	Converted value
5 V or more	25,000
1 V or less	0

5.2 Current Range

5.2.1 Current Input Range: 0 to +20 mA (0.64µA, 1/31,250)
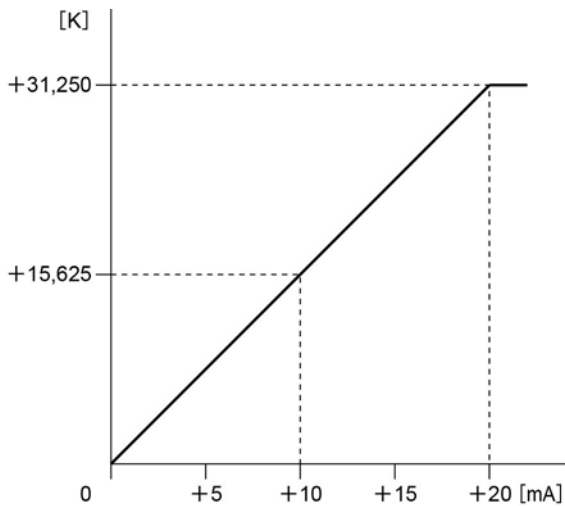
Input range: 0 to +20 mA

Analog input value (mA)	Digital conveted value (K)
+20	+31,250
+16	+25,000
+12	+18,750
+8	+12,500
+4	+6,250
0	0

When exceeding the rated range

Analog input value	Converted value
+20 mA or more	+31,250
0 mA or less	0

5.2.2 Current Input Range: +4 to +20 mA (0.64µA, 1/25,000)
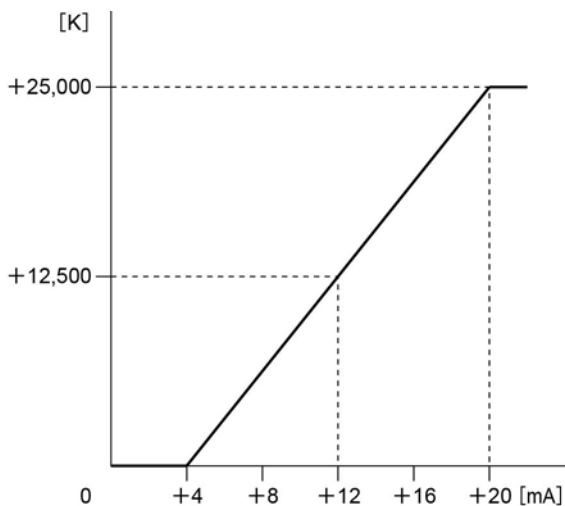
Input range: +4 to +20 mA

Analog input value (mA)	Digital conveted value (K)
+20	+25,000
+16	+18,750
+12	+12,500
+8	+6,250
+4	0

When exceeding the rated range

Analog input value	Converted value
+20 mA or more	+25,000
+4 mA or less	0

6

Optional Settings for Analog Input

6.1 Average Processing Settings

6.1.1 Number of Averaging Times

■ Overview of functions

- Analog input data sampled by the unit is averaged and stored as digital values.

- If the number of averaging times is set, analog input data items acquired will be stored as digital values when the number of analog input data items reaches the set number of averaging times.

- If the number of data items acquired is less than the number of averaging times, the acquired data will be stored in the I/O area.

- Obtain the number of averaging times to be processed from the following input.

    Input: The sum of analog input data items for the number of averaging times
    Output: Number of averaging times value

■ Processing during the number of averaging times
Averaging setting example: The number of averaging times is set to 5.

■ Configuration

Name		Default	Setting range and description
Function setting	Average processing settings	Not execute	Select "the number of averaging times."
	Averaging constant	K200	Number: 2 to 60,000 [times] (specified with an unsigned integer)

6.1.2   Time Average

■ Overview of functions

- Analog input data sampled by the unit is averaged and stored as digital values.

- If time average is set, analog input data items acquired will be stored as digital values when the acquisition period of the analog input data items reaches the set averaging time.

- Obtain the time average to be processed from the following input.

    Input: The sum of analog input data items for the number of averaging time
    Output: Time average value

■ Processing during time average
Average setting example: Example of an averaging time of 5 ms
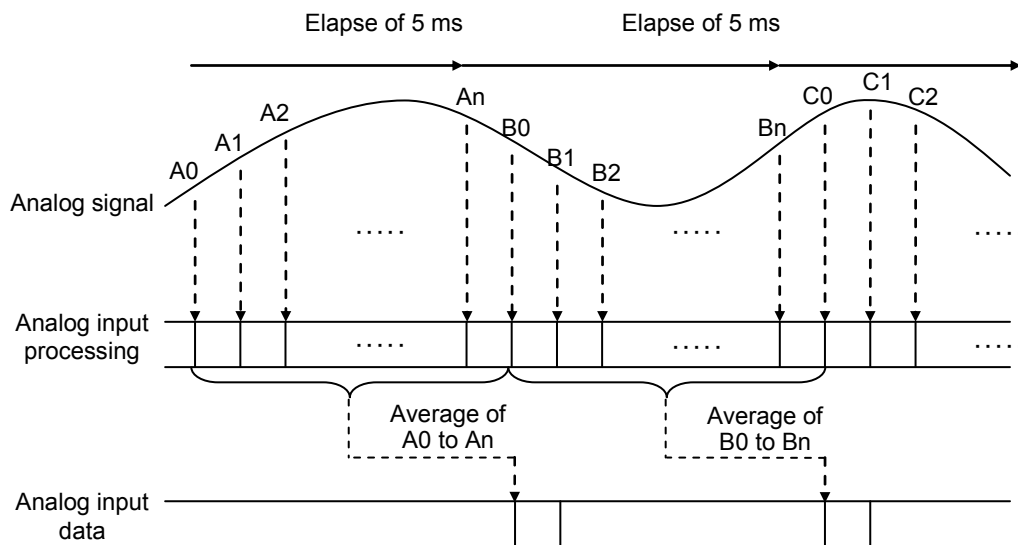
■ Configuration

Name		Default	Setting range and description
Function setting	Average processing settings	Not execute	Select "time average."
	Averaging constant	K200	Time (non-isolated): 1 to 1,500 [ms]
			Time (isolated): 200 to 60,000 [ms]
			(Specified with an unsigned integer)

6.1.3 Moving Average

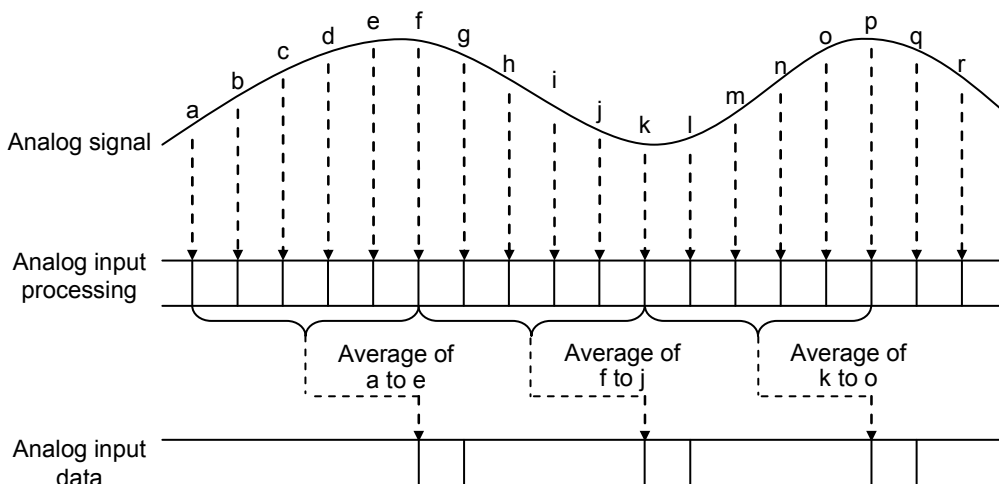### ■ Overview of functions

- Analog input data sampled by the unit is averaged and stored as digital values.

- If moving average is set, analog input data items acquired will be stored as digital values when the number of analog input data items reaches the set number of moving average times.

- Obtain the number of averaging times to be processed 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

Averaging setting example: The number of averaging times is set to 15.
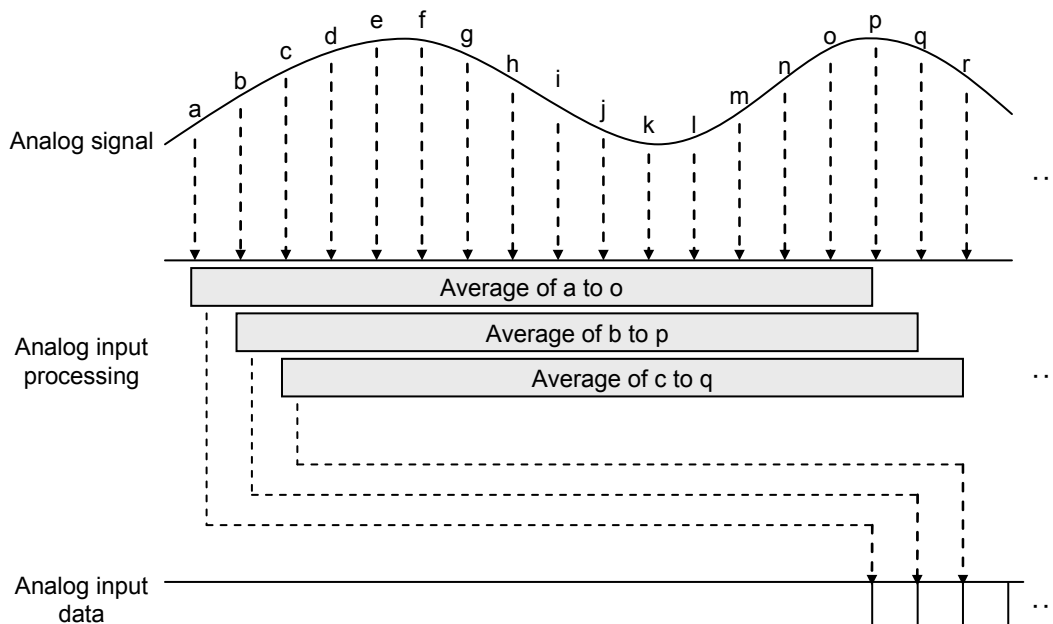
■ Configuration

Name		Default	Setting range and description
Function setting	Average processing settings	Not execute	Select "moving average."
	Averaging constant	K200	Number: 2 to 2,000 [times] (specified with an unsigned integer)

6.2 Offset/Gain processing

■ Overview of Functions

- Offset value (added correction) and gain value (magnification correction) adjustments are made to store processed data in the I/O area.
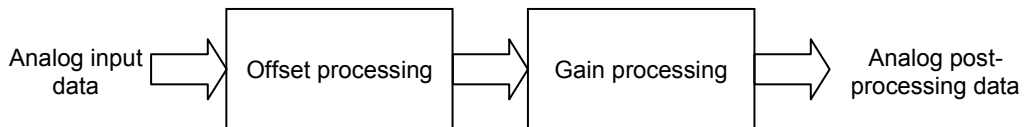
- Offset value settings are used as a function (zero-point adjustment) to make offset error adjustments between load devices. If the analog conversion value is K50 when the analog input value is 0 V, the analog conversion data is corrected to 0 V based on K-50 as an offset value.
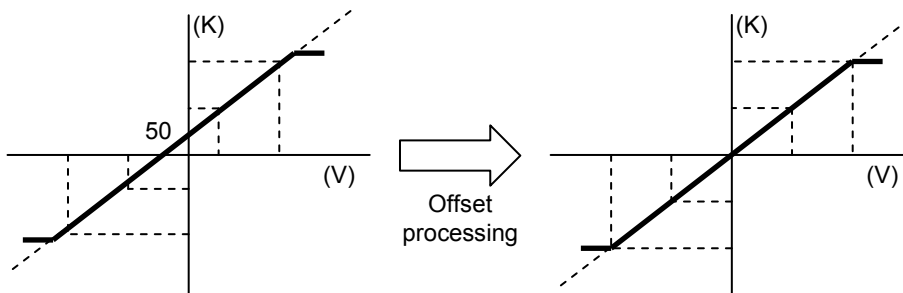
- Gain value settings are used as a function to adjust delicate scale errors between load devices. The gain value slope can be changed in a range of x0.9 to x1.1.
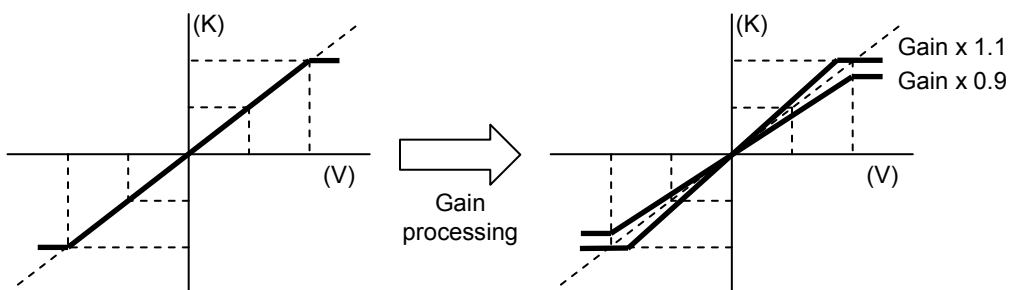
- Offset/Gain processing is executed on a channel-by-channel basis.

■ **Configuration**

Name		Default	Setting range and description
Function setting	Offset/Gain processing	Not execute	Select "Execute."
Offset value		K0	Set an offset value at the time of using the offset processing function.
			Setting range: -3,000 to +3,000 (specified with a signed integer)
Gain value		K10,000	Set an gain value at the time of using the gain processing function.
			Setting range: +9,000 to 1+1,000 (0.9x to 1.1x: Specified with a signed integer)

NOTE

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

6.3 Scale Conversion

■ Overview of functions

- This function makes it possible to set an easy-to-use analog output range. Analog input data acquired in a range between preset minimum and maximum values is scale converted and stored in the I/O area. This function is convenient if used for scale unit conversion.

- Scale conversion is executed on a channel-by-channel basis.

- Conversion values read from the analog input unit include fractions. Therefore, convert the values to easy-to-handle figures if needed.
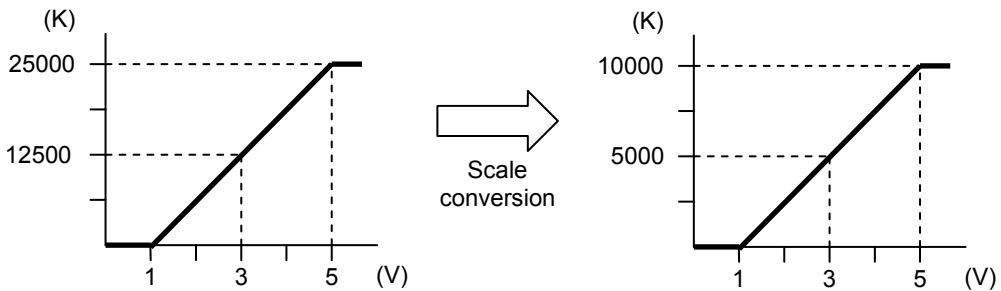
■ Configuration

Name		Default	Setting range and description
Function setting	Scale conversion	Not execute	Select "Execute."
Minimum value of scale conversion		K0	Set the minimum value at the time of using the scale conversion function.
			Setting range: -30,000 to +30,000 (specified with a signed integer)
Maximum value of scale conversion		K10,000	Set the maximum value at the time of using the scale conversion function.
			Setting range: -30,000 to +30,000 (specified with a signed integer)

* If data outside the minimum or maximum scale is input, scale conversion will be disabled and the minimum or maximum scale value will be stored as a conversion value.

6.4 Comparison for Upper and Lower Limits

■ Overview of Functions

This function compares acquired data with the upper limit and lower limit and turns ON the upper limit relay or lower limit relay if the acquired data exceeds the upper limit value or lower limit value.

- Comparison for upper and lower limits is executed on a channel-by-channel basis.

- The upper limit relay will turn ON if the digital conversion value is larger than the upper limit.

- The lower limit relay will turn ON if the digital conversion value is smaller than the lower limit.

- The function will be disabled with the comparison execution relay (Y) turned ON if the configuration-upper/lower limit comparison setting is not executed.
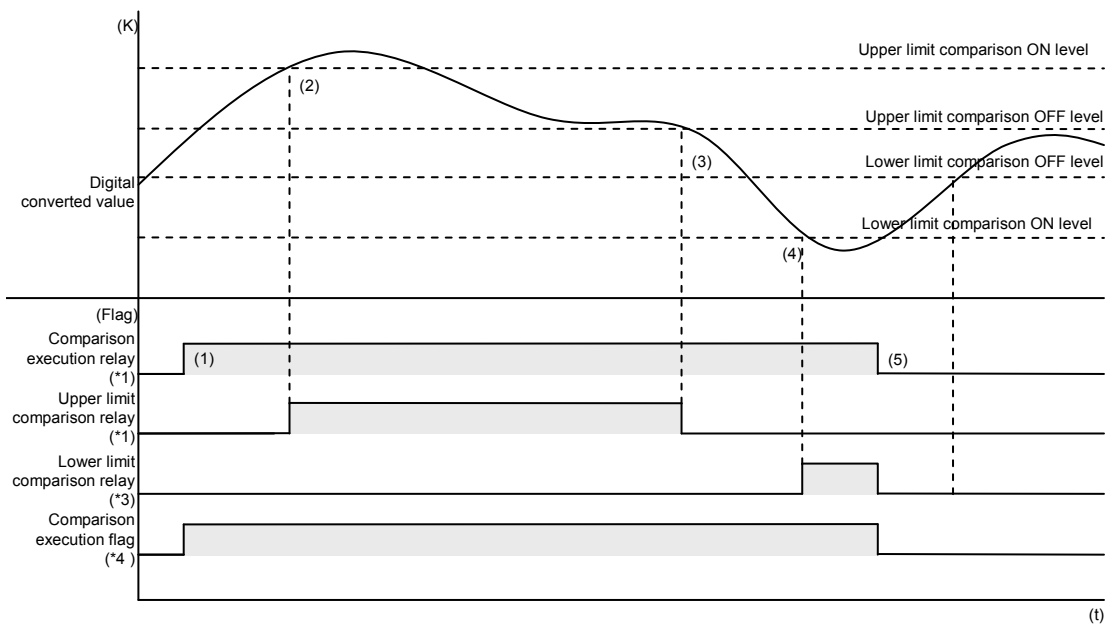
(1) The upper/lower limit comparison function will be executed when the user program turns ON the comparison execution relay.

(2) The upper limit comparison relay will turn ON if the upper limit comparison ON level or an upper level is detected

(3) The upper limit comparison relay will turn OFF if the upper limit comparison OFF level or a lower level is detected.

(4) The lower limit comparison relay will turn ON if the lower limit comparison ON level or a lower level is detected.

(5) The upper/lower limit comparison relay and comparison execution flag will be forcibly turned OFF if the comparison execution relay is turned OFF.

■ I/O Allocation

The I/O numbers in the timing chart and program are shown on the condition that the first word number of the unit is 10. Actual I/O numbers allocated to the analog input unit are determined by the first word number.

	CH0	CH1	CH2	CH3
*1 Comparison execution relay	Y103	Y113	Y123	Y133
*2 Upper limit comparison relay	X111	X131	X151	X171
*3 Lower limit comparison relay	X112	X132	X152	X172
*4 Comparison execution flag	X113	X133	X153	X173

■ Configuration

Name		Default	Setting range and description
Function setting	Upper limit / Lower limit comparison	Not execute	Select the desired function to be used.
Upper/Lower limit comparison Upper limit comparison ON level		K0	Set the upper limit to turn ON the output flag at the time of using the upper/lower limit comparison function. Setting range: -31,250 to +31,250 (specified with a signed integer)
Upper/Lower limit comparison Upper limit comparison OFF level		K0	Set the upper limit to turn OFF the output flag at the time of using the upper/lower limit comparison function. Setting range: -31,250 to +31,250 (specified with a signed integer)
Upper/Lower limit comparison Lower limit comparison OFF level		K0	Set the lower limit to turn OFF the output flag at the time of using the upper/lower limit comparison function. Setting range: -31,250 to +31,250 (specified with a signed integer)
Upper/Lower limit comparison Lower limit comparison ON level		K0	Set the lower limit to turn ON the output flag at the time of using the upper/lower limit comparison function. Setting range: -31,250 to +31,250 (specified with a signed integer)

(Note) Make the following level settings for upper/lower limit comparison.
Lower limit comparison ON level ≤ Lower limit comparison OFF level < Upper limit comparison OFF level ≤ Upper limit comparison ON level

■ **Sample Program**

The digital conversion value on ch0 of the analog input unit is read to detect the upper limit and lower limit, and the desired output is turned ON with the upper or lower limit detected.

```
  R0                                              Y103
  ├─┤ ├──────( DF )────────────────────────< SET >─┐
                                                    │   (CH0): Controls upper
                               (CH0): Upper/Lower   │   and lower limit
                               limit comparison     │   comparison function
                               execution relay      │   R0 ON:
  R1                                            Y103 │      Comparison execution
  ├─┤ ├──────( DF )────────────────────────< RST >─┘   R1 ON:
                                                          Turns OFF comparison
                               (CH0): Upper/Lower         execution relay.
                               limit comparison
                               execution relay

  X113        X111                                  Y200
  ├─┤ ├───────┤ ├───────────────────────────────────( )─┐  (CH0): Turns ON Y200
                                                         ├  when the value exceeds
  Comparison  Upper limit                               ┘  the upper limit.
  execution   comparison
  flag        relay
  X113        X112                                  Y201
  ├─┤ ├───────┤ ├───────────────────────────────────( )─┐  (CH0): Turns ON Y201
                                                         ├  when the value drops
  Comparison  Lower limit                               ┘  below the lower limit.
  execution   comparison
  flag        relay
```
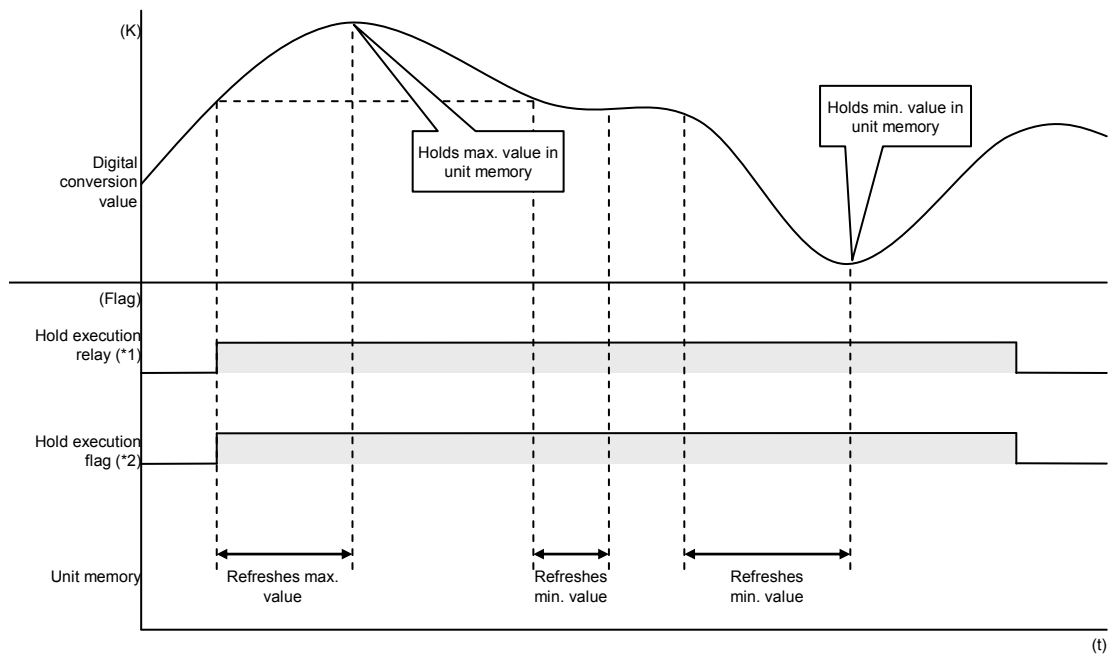
6.5 Holding Max./Min. Values

■ Overview of Functions

This function maintains the maximum and minimum values of acquired data. When the maximum and minimum value hold settings are valid, the maximum and minimum digital conversion values will be maintained and stored in the following unit memories.

- If the function has not been enabled with the configuration settings, the function will not work with the hold execution relay turned ON.

- When the hold execution relay is turned ON, the values at that time will be preset as maximum and minimum values in the unit memories.

- The maximum and minimum values will be stored in the unit memories even if the hold execution relay is turned OFF or the unit is set into PROG. mode.

- The maximum and minimum values are held on a channel-by-channel basis.

■ **Hold data storage area**

Unit memory number (Hex)	Name	Default	Setting range and description
UM 00180 UM 00181 UM 00182 UM 00183	Holding max. value	K0	The acquired maximum value will be held when the maximum and minimum value holding function is used. Setting range: -31,250 to 31,250 (specified with a signed integer)
UM 00188 UM 00189 UM 0018A UM 0018B	Holding min. value	K0	The acquired minimum value will be held when the maximum and minimum value holding function is used. Setting range: -31,250 to 31,250 (specified with a signed integer)

(Note) The unit memory numbers in the above table are listed for CH0, CH1, CH2, and CH3 in numerical order.

■ **I/O allocation**

The I/O numbers in the timing chart and program are shown on the condition that the first word number of the unit is 10. Actual I/O numbers allocated to the analog input unit are determined by the first word number.

	CH0	CH1	CH2	CH3
*1 Hold execution relay	Y105	Y115	Y125	Y135
*2 Hold execution flag	X115	X135	X155	X175

■ **Configuration**

Name		Default	Setting range and description
Function setting	Holding max./min. values	Not execute	Select "Execute."
Holding min. value		K0	Holding min. value (-31,250 to +31,250)
Holding max. value		K0	Holding max. value (-31,250 to +31,250)

■ Sample Program

The analog data on ch0 of the analog input unit is read, and the data holding the maximum and minimum values will be read at the desired data register.
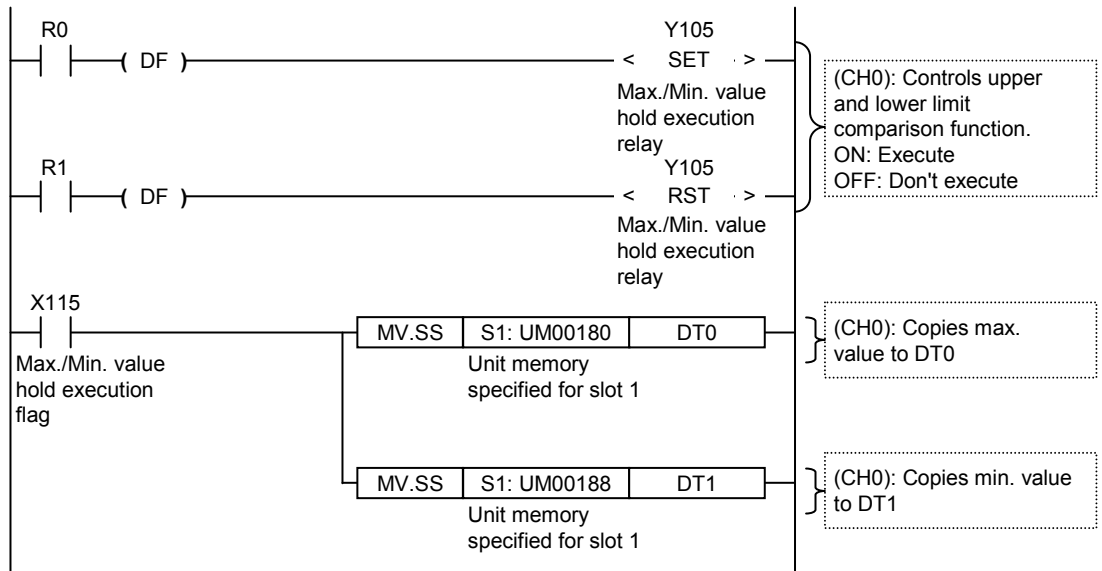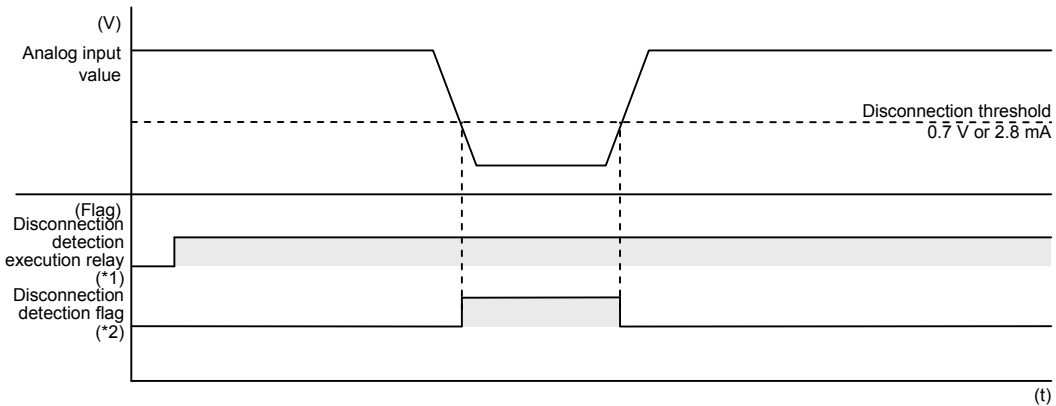
6.6 Disconnection detection

■ **Overview of Functions**

The disconnection detection flag is turned ON and the error indicator will be lit if the result of input does not reach a certain value while a voltage input range of +1 to +5 V or input current range of +4 to +20 mA is set.

Voltage input range of +1 to +5 V set: 0.7 V or less; Current input range of +4 to +20 mA set: 2.8 mA max.

- If the input exceeds the above value while the disconnection detection execution relay is turned ON, the disconnection detection flag will be turned OFF automatically, provided that the auto setting has been made.

- If the manual reset setting is made, the disconnection detection flag will be turned OFF by using a user program and turning OFF the disconnection detection execution relay.

- If the configuration-disconnection detection setting has not been made, the function will be disabled with the disconnection detection execution relay turned ON.

■ **Action with the detection disconnection reset setting set to auto**

■ **Action with the detection disconnection reset setting set to manual**
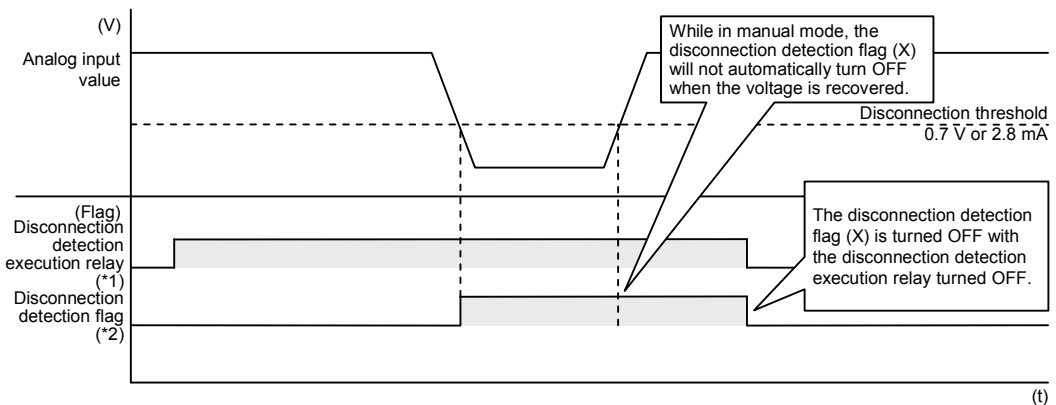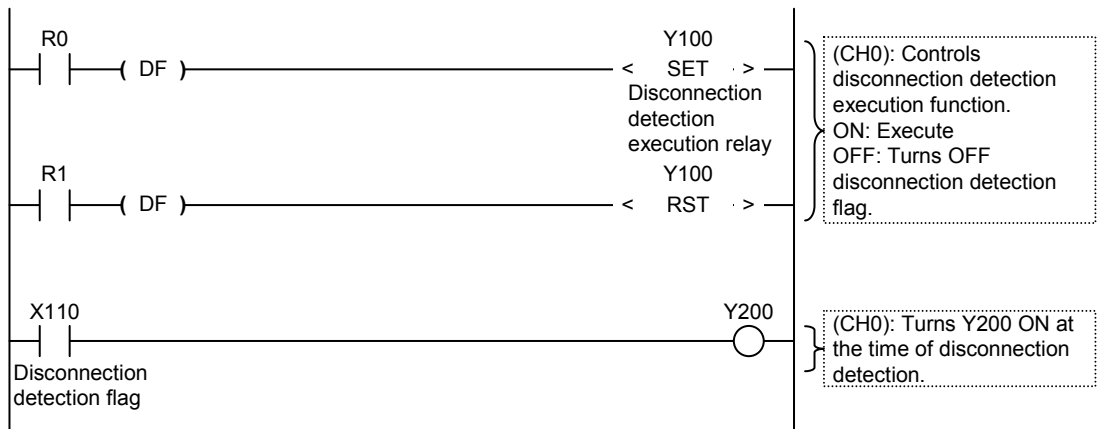
■ I/O allocation

The I/O numbers in the timing chart and program are shown on the condition that the first word number of the unit is 10. Actual I/O numbers allocated to the analog input unit are determined by the first word number.

	CH0	CH1	CH2	CH3
*1 Disconnection detection execution relay	Y100	Y110	Y120	Y130
*2 Disconnection detection flag	X110	X130	X150	X170

■ Configuration

Name		Default	Setting range and description
Function setting	Disconnection detection	Not execute	Select "Execute."
	Disconnection detection reset	Auto	Select "Auto."

■ Sample Program


```
  R0                                          Y100
  ─┤ ├──( DF )──────────────────────────<   SET   >─      (CH0): Controls
                                       Disconnection        disconnection detection
                                       detection            execution function.
                                       execution relay      ON: Execute
  R1                                          Y100          OFF: Turns OFF
  ─┤ ├──( DF )──────────────────────────<   RST   >─        disconnection detection
                                                            flag.


  X110                                        Y200
  ─┤ ├──────────────────────────────────────( )──          (CH0): Turns Y200 ON at
  Disconnection                                              the time of disconnection
  detection flag                                             detection.
```
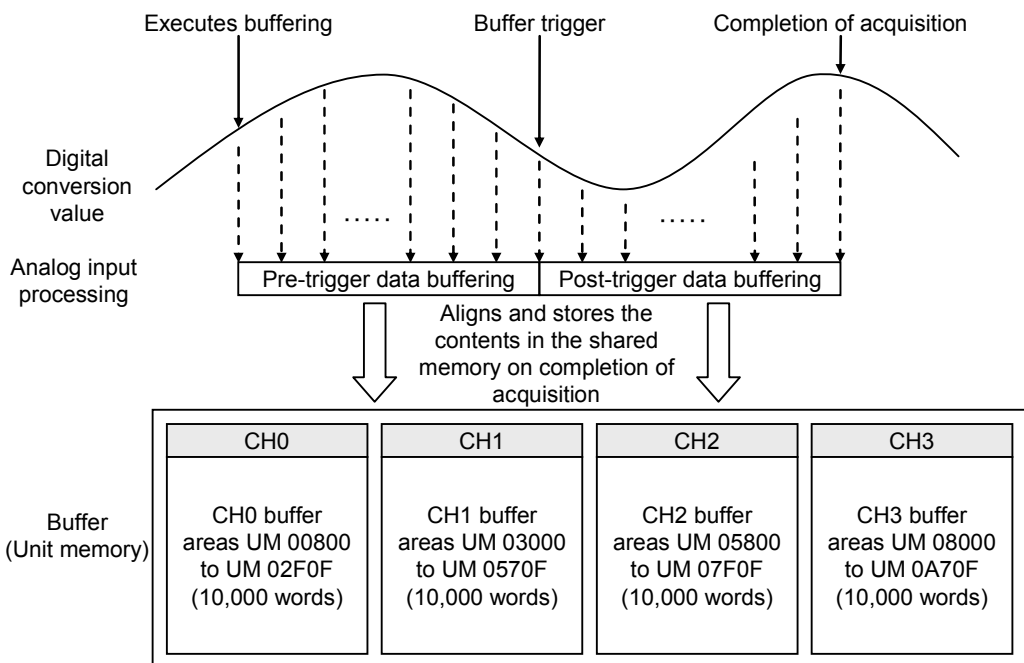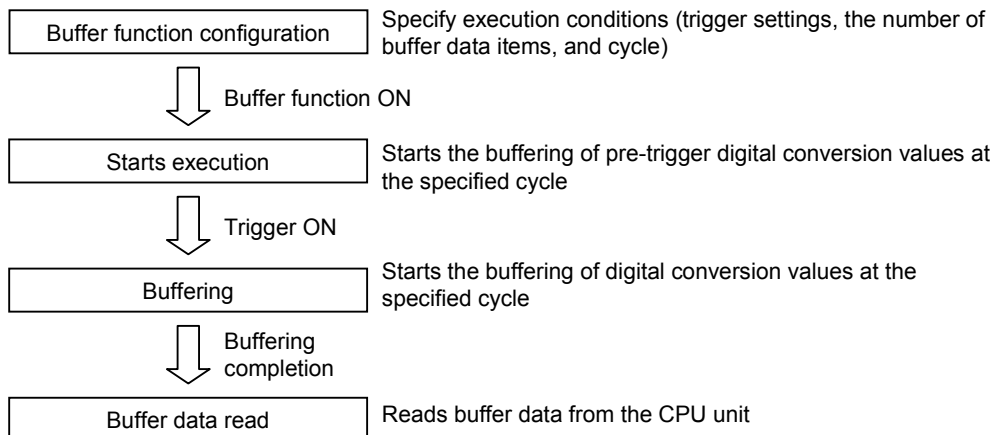
> **☞ ◆ NOTE**
>
> Not executed unless a voltage input range of +1 to +5 V or current input range of +4 to +20 mA is set.

6.7 Buffer Settings

6.7.1 Overview of Buffer Function

This function stores digital conversion values acquired at a preset cycle into a unit memory. If a trigger is input while the buffer function is executed (with the buffer execution relay turned ON), digital conversion values for a specified number of data items will be stored in the buffer memory (unit memory) at a specified cycle.


- If the configuration-disconnection detection setting has not been set to "not execute", the function will be disabled even if the buffer execution relay is turned ON.

■ **Configuration**

| Name	Default	Setting range and description
Buffer function Execution/Non-execution settings	Not use	Select "Use" for the buffer function.
Trigger setting	H0	Select a trigger signal to start buffering when the buffer function is used.
No. of buffer data items	K1,000	Set the number of data items (words) to be stored in the buffer. Setting range: 1 to +10,000 * The number of buffer data items is the total sum of data items including the number of data items before triggering
No. of data items before triggering	K0	Set the number of data items (words) before triggering. Setting range: 0 to +9,999 * Set the number of data items before triggering to a value smaller than the number of buffer data items.
Trigger cycle	K1	Set the cycle enabling trigger input. The trigger period is obtained from the following formula. At the time of isolation: Set value x Enabled number of channels x 5 [ms] At the time of non-isolation: Set value x Enabled number of channels x 0.025 [ms]
Input level trigger	K0	If "Input level" is selected for the trigger type, set an input level to enable triggering. Setting range: -31,250 to +31,250

■ **Sample program**

Select the trigger input relay for the trigger setting, set the trigger cycle to 1, the number of data items before triggering to 1,000, and the number of buffer data items to 10,000. After completion of buffering, acquire analog data in the desired data area.
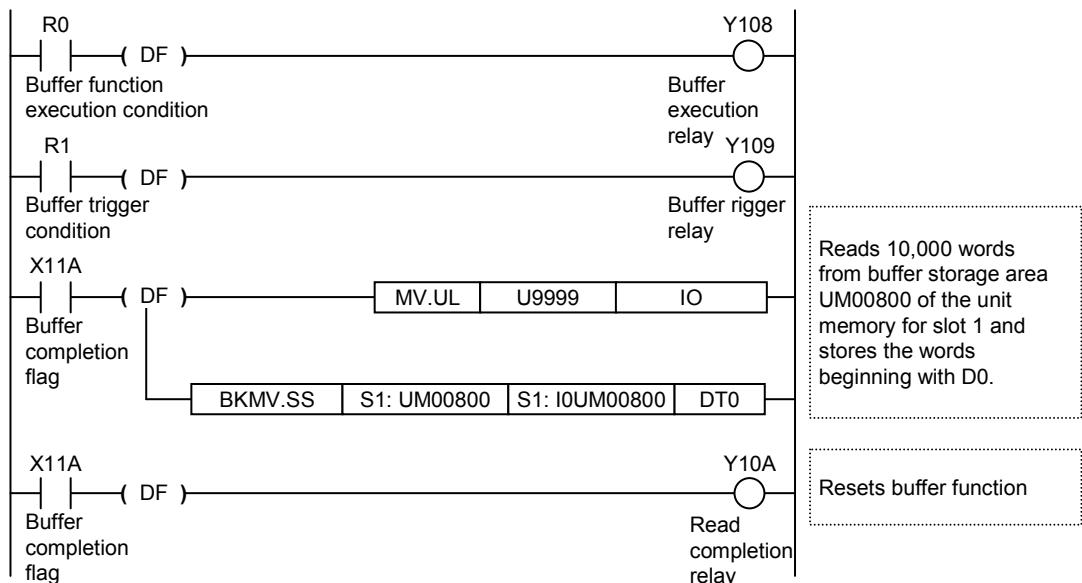
6.7.2 Buffering by Trigger Output Relay

■ Buffering by trigger output relay (YXXX)

The following sequence shows the operation of starting buffer processing with the trigger relay (YXXX) turned ON by a user program.
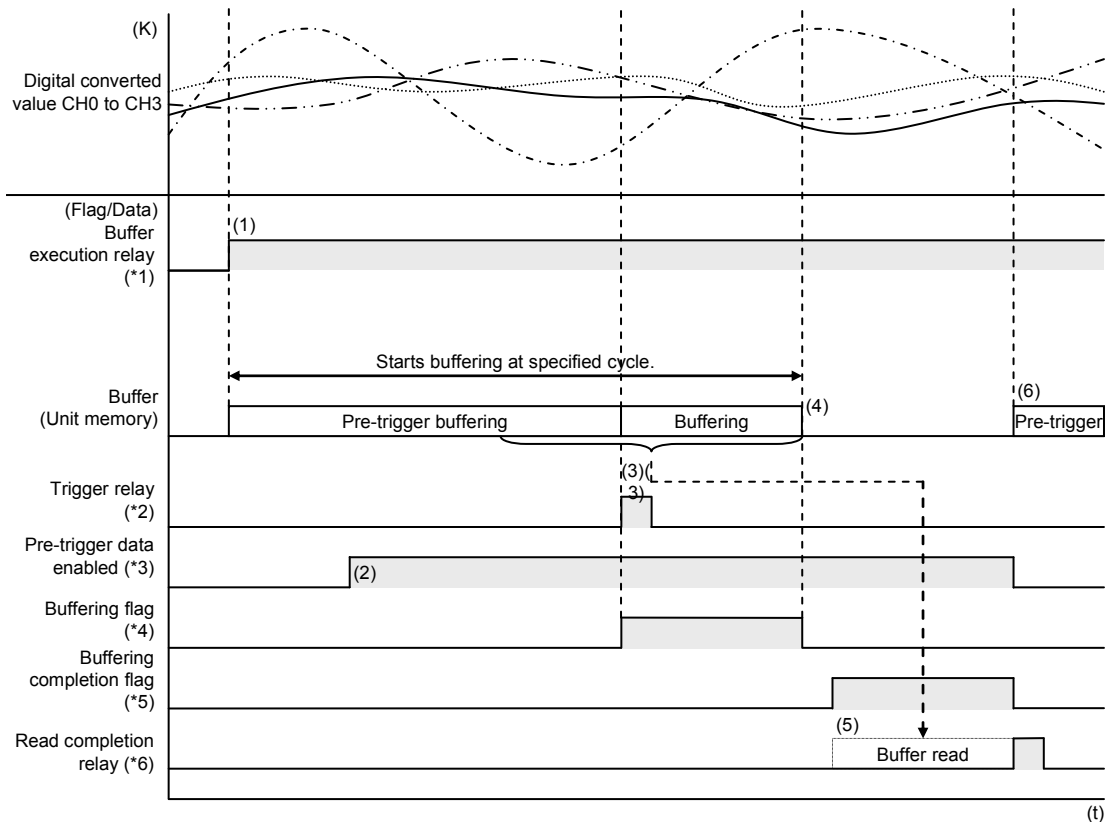
(1) Pre-trigger buffering will start when the user program turns ON the buffer execution relay.

(2) The pre-trigger data enabled flag is turned ON when the number of pre-trigger data items is reached.

(3) Buffering starts with the trigger relay turned ON. The user program turns ON the trigger relay. Buffering will continue until the set number of buffer data items is reached after the trigger relay is turned ON.

(4) Buffering is completed with the number of buffer data items obtained.

(5) The user program reads the buffering data and turns ON the read completion relay.

(6) The unit waits for the next trigger and repeat the sequence from pre-trigger buffering.

■ I/O Allocation

The I/O numbers in the timing chart and program are shown on the condition that the first word number of the unit is 10. Actual I/O numbers allocated to the analog input unit are determined by the first word number. The buffer function is allocated to I/O on CH0. CH1 to CH3 all operate simultaneously with the I/O on CH0.

|	CH0 to CH3
*1 Buffer execution relay	Y108
*2 Trigger relay	Y109
*3 Pre-trigger data enabled	X11B
*4 Buffering flag	X119
*5 Buffering completion flag	X11A
*6 Read completion relay	Y10A

◆ NOTES

- **Trigger input will be prohibited with the buffer execution relay turned ON after trigger input. Input, if any, will be ignored.**

- **It is possible to start buffering with the trigger input even if the number of pre-trigger data items has not reached a specified number. (The area where pre-trigger data is not acquired is 0).**

6.7.3   Buffering by External Input Trigger

■ Using external input as trigger

The following sequence shows the operation of buffer processing with input into the external trigger input terminal of the unit.
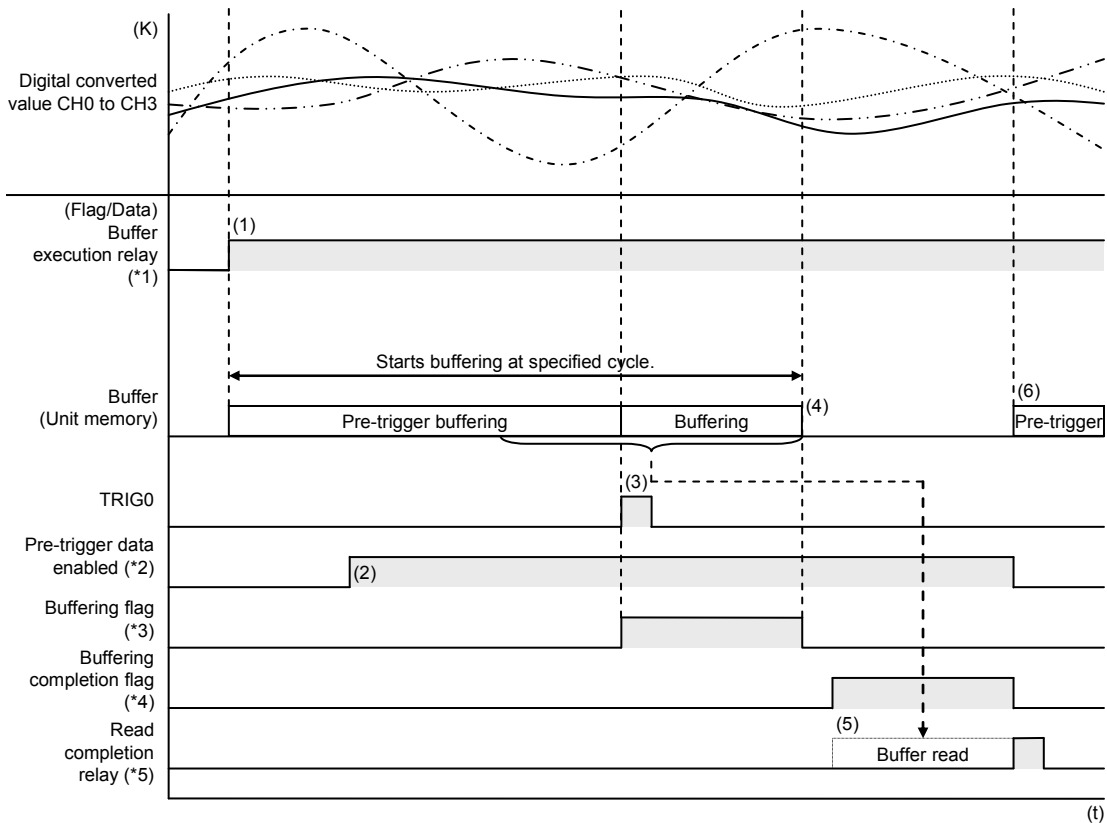
(1) Pre-trigger buffering will start when the user program turns ON the buffer execution relay.

(2) The pre-trigger data enabled flag is turned ON when the number of pre-trigger data items is reached.

(3) Starts buffering with the rising of TRIG0. Buffering will continue until the preset number of buffer data items is reached from the rising of TRIG0.

(4) Buffering is completed with the number of buffer data items obtained.

(5) The user program reads the buffering data and turns ON the read completion relay.

(6) The unit waits for the next trigger and repeat the sequence from pre-trigger buffering.

■ **I/O Allocation**

The I/O numbers in the timing chart and program are shown on the condition that the first word number of the unit is 10. Actual I/O numbers allocated to the analog input unit are determined by the first word number. The buffer function is allocated to I/O on CH0. CH1 to CH3 all operate simultaneously with the I/O on CH0.

|	**CH0 to CH3**
*1 Buffer execution relay	Y108
*2 Pre-trigger data enabled	X11B
*3 Buffering flag	X119
*4 Buffering completion flag	X11A
*5 Read completion relay	Y10A

◆ **NOTES**

- **Trigger input will be prohibited with the buffer execution relay turned ON after trigger input. Input, if any, will be ignored.**

- **It is possible to start buffering with the trigger input even if the number of pre-trigger data items has not reached a specified number. (The area where pre-trigger data is not acquired is 0).**

- **TRIG0 to TRIG3 for external input trigger selection show input terminals. Keep in mind that none of them supports CH0 to CH3.**

- **The buffer function will not be executed if "Not use" is selected with the external input trigger even if "External input trigger" is selected as "Trigger type" in the configuration menu of the FPWIN GR7.**

6.7.4 Buffering Triggered by Value Change in Analog Input

■ Buffering by change in trigger input

The following sequence shows the operation of starting buffer processing with the detection of a rise or fall of the digital converted value on a specified analog input channel. The example below shows a case where the level of analog input CH0 rises.
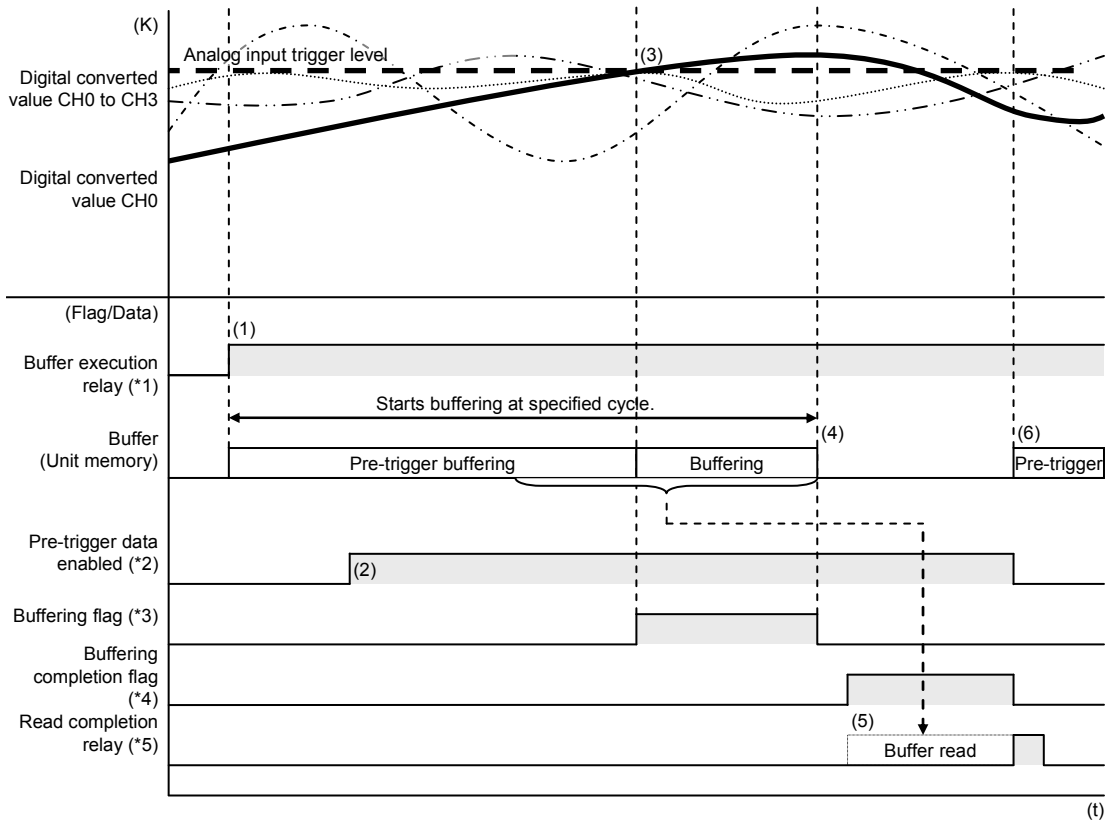
(1) Pre-trigger buffering will start when the user program turns ON the buffer execution relay.

(2) The pre-trigger data enabled flag is turned ON when the number of pre-trigger data items is reached.

(3) Buffering will start because the preset digital conversion value on CH0 has risen above the trigger level. Buffering will continue until the set number of buffer data items is reached after the rise of the trigger level.

(4) Buffering is completed with the number of buffer data items obtained.

(5) The user program reads the buffering data and turns ON the read completion relay.

(6) The unit waits for the next trigger and repeat the sequence from pre-trigger buffering.

■ **I/O allocation**

The I/O numbers in the timing chart and program are shown on the condition that the first word number of the unit is 10. Actual I/O numbers allocated to the analog input unit are determined by the first word number. The buffer function is allocated to I/O on CH0. CH1 to CH3 all operate simultaneously with the I/O on CH0.

	CH0 to CH3
*1 Buffer execution relay	Y108
*2 Pre-trigger data enabled	X11B
*3 Buffering flag	X119
*4 Buffering completion flag	X11A
*5 Read completion relay	Y10A

◆ **NOTES**

- **Trigger input will be prohibited with the buffer execution relay turned ON after trigger input. Input, if any, will be ignored.**

- **If analog input is selected, buffering will start at the rise (or fall) timing of the digital conversion value on the corresponding channel from a specified value if analog input is selected. If the value exceeds a threshold value from the beginning, buffering will start at the moment the value exceeds the threshold value again after the value once falls below (or rises above) the set value.**

- **Keep in mind that the analog input trigger will generate timing that disables trigger detection depending on the buffer cycle setting.**

- **It is possible to start buffering with the trigger input even if the number of pre-trigger data items has not reached a specified number. (The area where pre-trigger data is not acquired is 0).**

- **The buffer function will not be executed if "Not use" is selected for the selection of an external input trigger or the selection of input level trigger channel.**

- **The buffer function will not be executed if "Not use" is selected for the input trigger channel even if "Analog input level" is selected as "Trigger type" in the configuration menu of the FPWIN GR7.**

6.8 Configuration by Programming

■ **Overview of functions**

- The FP7 analog input unit makes it possible to overwrite configuration information by programming.

- The configuration information is refreshed by writing "55AA" to unit memory UM 00028 after the value is stored in the unit memory where a desired parameter is set.

- The value of unit memory UM 00028 will be set to 0 when the configuration information is refreshed.

■ **Sample program**

Between channels: Isolated; Input range: 4 to 20 mA with CH0 and CH1 set as execution channels and CH2 and CH3 set as non-execution channels.
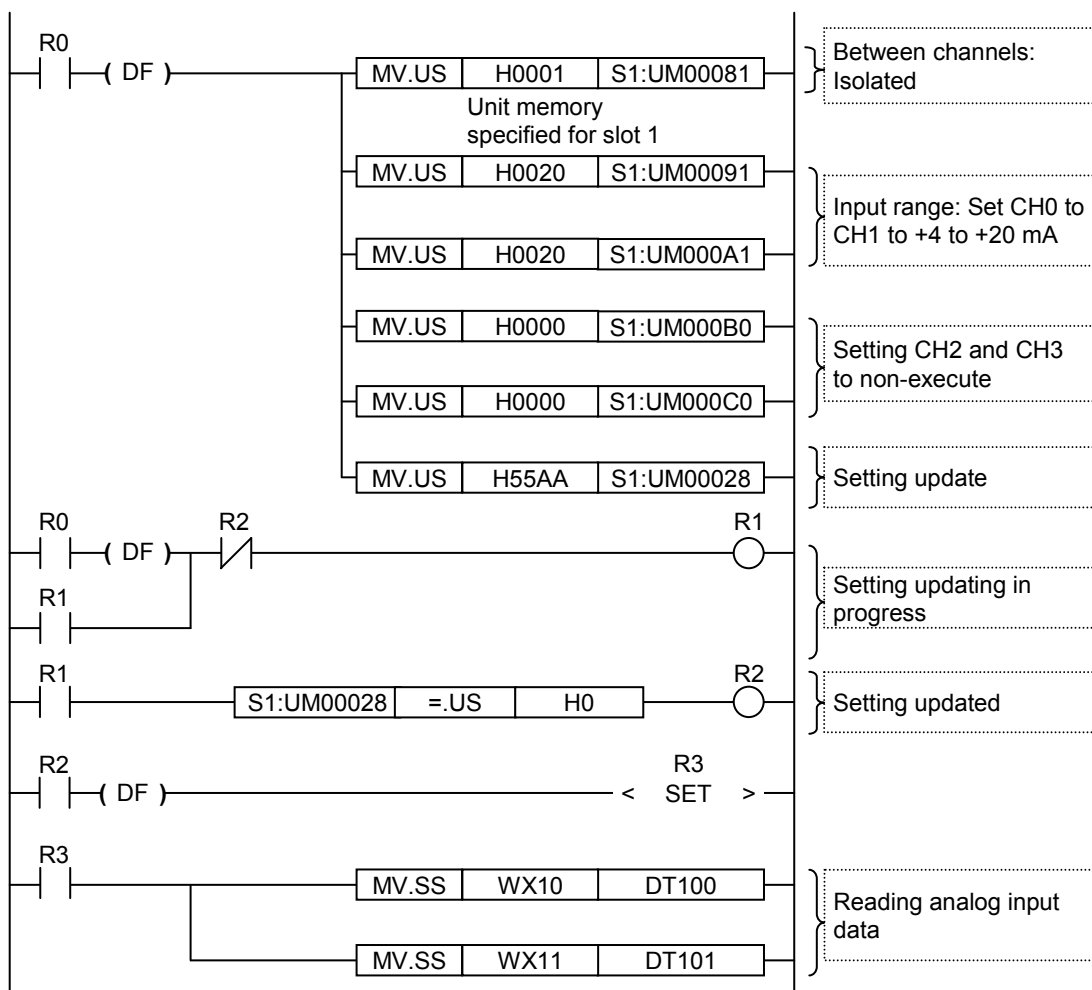
7

What to Do If an Error Occurs

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

7.1.1   Failure in Reading Analog Input Data

- Check again that I/O allocations are correct.

- Check again the connections of the terminal block.

- Check again the configuration settings.

7.1.2   Unstable Analog Input Conversion Value

- Used a twisted pair shield wire and check that the wire is properly shielded.

- Check that the analog input wiring is not placed close to AC lines or high-tension lines or bundled with the lines.

- 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.

7.1.3   No Proper Conversion Values Obtained with Current Input

- Check again the connections of the terminal block.

- Check again the connections of the output equipment.

8
Specifications

8.1 Specifications

■ General Specifications

Items	Description	
Operating ambient temperature	0°C to 55°C	
Storage ambient temperature	-40°C to 70°C	
Operating ambient humidity	10% to 95% (RH) with no condensation (at 25°C)	
Storage ambient humidity	10% to 95% (RH) with no condensation (at 25°C)	
Breakdown voltage (Note)	Between I/O terminals and power supply terminals of CPU unit/function earth	500 V AC for 1 minute
	Between analog input terminal channels	200 V AC for 1 minute
Insulation resistance	Between I/O terminals and power supply terminals of CPU unit/function earth	100 MΩ (Test voltage: 500 V DC)
Vibration resistance	Conforming to JIS B 3502 and IEC 61131-2 5 to 8.4 Hz, 3.5-mm-wide single amplitude 8.4 to 150 Hz, acceleration 9.8 m/s^2 10-time sweeping in X, Y, and Z directions (1 octave/min.)	
Shock resistance	Conforming to JIS B 3502 and IEC 61131-2 147 m/s^2 or more., 3 times each in X, Y, and Z directions	
Noise resistance	1,000 V DC (p-p) with pulse width of 50 ns/1 μs (by using a noise simulator) (Applied to the power supply of the CPU unit)	
Environment	Free from corrosive gases and excessive dust.	
EU Directive applicable standard	EMC Directive: EN61131-2	
Overvoltage category	Category II or lower	
Pollution degree	Pollution degree 2 or lower	

(Note) Cutoff current: 5 mA (Factory default setting)

■ Performance Specifications

Items		Description
No. of input points		4 channels
Input range (resolution)	Voltage	-10 to +10 V DC (Resolution: 1/62,500) 0 to +10 V DC (Resolution: 1/31,250) 0 to +5 V DC (Resolution: 1/31,250) +1 to +5 V DC (Resolution: 1/25,000) (see note 3)
	Current	0 to +20 mA (Resolution: 1/31,250) +4 to +20 mA (Resolution: 1/25,000) (see note 3)
Conversion speed		25 µs/Ch (non-isolation); 5 ms/Ch (isolation)
Total accuracy		±0.05% F.S. max. (at +25°C) and ±0.1% F.S. max. (at 0°C to +55°C)
Input impedance		Voltage input: Approximately 1MΩ; current input: Approximately 250Ω
Absolute max. input		Voltage input: -15 to +15 V; current input: -30 to +30 mA
Insulation system		Between input terminals and internal circuit: Photocoupler and isolated DC/DC converter Between channels: Photo-MOS relay
Execution/Non-execution channel settings		Possible to make non-converted channel settings.
Input range selection		Possible to make settings on a channel-by-channel basis
Average processing settings	Number of averaging times	Setting range of 2 to 60,000 times
	Time average	Time setting range of 1 to 1,500 ms (non-isolated) and 200 to 60,000 ms (isolated)
	Moving average	Setting range of 2 to 2,000 times
Offset/Gain processing		A desired value within the digital output range can be set for the offset value. Setting range: -3,000 to +3,000
		A desired value within the digital output range can be set for the offset value. Setting range: 9,000 to +11,000 (90% to 110%)
Scale conversion settings		A desired value within the digital input range can be set for the offset value. Setting range: -30,000 to +30,000
Comparison settings for upper and lower limits		Output if the value is outside the preset upper and lower limits
Holding max./min. values		Holding max./min. values sampled
Disconnection detection		Disconnection detection is possible at the time of setting ranges of +1 to +5 V and +4 to +20 mA Possible to select auto or manual resetting.
Buffer function		The buffering of up to 10,000 words is possible on each channel. Sampling is performed with a change in desired input, external input, or analog input as a trigger.

(Note 1) Set any of the following functions in the configuration menu of the tool software or a user program: Input range, selection of isolation and non-isolation, conversion execution/non-execution channel, averaging processing, offset/gain, scaling processing, upper/lower limit comparison, holding max./min. value, and disconnection detection.

(Note 2) If not all channels are used, the conversion speed can be saved by setting non-execution channels with the function of setting the conversion execution/non-execution channels used.

(Note 3) The full scale (F.S.) on the accuracy of an analog voltage input range from +1 to +5 V and that of an analog current input range from +4 to +20 mA are 0 to +5 V and 0 to +20 mA, respectively.

8.2 I/O Allocation

■ Input contact

I/O number						Name	Description
CH0		CH1		CH2		CH3			
WX0	X0 to XF	WX2	X20 to X2F	WX4	X40 to X4F	WX6	X60 to X6F	A/D conversion data (16 bits)	Digital convertedvalues corresponding to the analog input is stored. <Voltage range> -10 to +10 V: -31,250 to +31,250 0 to +10 V or 0 to 5 V: 0 to +31,250 +1 to +5 V: 0 to +25,000 <Current range> 0 to +20 mA: 0 to +31,250 +4 to +20 mA: 0 to +25,000
WX1	X10	WX3	X30	WX5	X50	WX7	X70	Disconnection detection flag	ON with disconnection detected and OFF with disconnection restored (valid for 1 to 5 V and 4 to 20 mA ranges only)
	X11		X31		X51		X71	Upper limit comparison relay	Turns ON when the value exceeds the set upper limit.
	X12		X32		X52		X72	Lower limit comparison relay	Turns ON when the value drops below the set lower limit.
	X13		X33		X53		X73	Upper limit/Lower limit comparison execution flag	ON when the function for comparing upper and lower limits is executed.
	X14		X34		X54		X74	Not used	Do not use.
	X15		X35		X55		X75	Max./Min. hold execution flag	ON when the max./min. hold function is executed.
	X16		X36		X56		X76	Not used	Do not use.
	X17		X37		X57		X77		
	X18		---		---		---	Buffer function execution flag	ON when the buffer function is executed.
	X19		---		---		---	Buffering flag	ON when buffering starts after the trigger is accepted. OFF when the number of buffer data items is reached.
	X1A		---		---		---	Buffering completion flag	ON when the shared memory has become accessible after completion of buffering OFF on completion of buffer data reading.
	X1B		---		---		---	Data before triggering enable flag	ON when the number of buffer data items before triggering has reached the set value. OFF on completion of buffer data reading.
	X1C to X1E		X3C to X3E		X5C to X5E		X7C to X7E	Not used	Do not use.
	X1F		X3F		X5F		X7F	Error flag	Turns on if an error occurs.

(Note 1) The I/O numbers in the tables above show offset addresses. Actual I/O numbers allocated to the analog input unit are determined by the first word number. (Example) If the first word number is 10, the A/D conversion data on CH0 and the error flag will be WX10 and X11F, respectively.

(Note 2): The conditions of the buffer function (i.e., the buffer function execution flag, buffering flag, buffering completion flag, and data enable flag before triggering) are allocated to the input contacts for CH0.

■ **Output contact**

I/O number				Name	Description
CH0	CH1	CH2	CH3		
Y0	Y10	Y20	Y30	Disconnection detection execution relay	ON to execute the disconnection detection function. OFF to turn OFF the disconnection detection flag (Xn0). (valid for 1 to 5 V and 4 to 20 mA ranges only)
Y1	Y11	Y21	Y31	Not used	Do not use.
Y2	Y12	Y22	Y32		
Y3	Y13	Y23	Y33	Upper limit/Lower limit comparison execution relay	ON to execute the function to compare the upper and lower limits. OFF to turn OFF the upper limit comparison relay (Xn1) and lower limit comparison relay (Xn2).
Y4	Y14	Y24	Y34	Not used	Do not use.
Y5	Y15	Y25	Y35	Max./Min. hold execution relay	ON when the max./min. hold function is executed.
Y6	Y16	Y26	Y36	Not used	Do not use.
Y7	Y17	Y27	Y37		
Y8	---	---	---	Buffer execution relay	When the buffer function is enabled, trigger acceptance will be permitted with the buffer execution relay turned ON. The internal state transition will be initialized with the buffer execution relay turned OFF.
Y9	---	---	---	Buffer trigger relay	If "Trigger relay" is set, triggering will start with the trigger relay turned ON.
YA	---	---	---	Buffer data Read completion relay	ON upon completion of reading buffer data from the shared memory. Goes to the state of trigger acceptance permitted after clearing the buffer memory.
YB to YE	Y1B to Y1E	Y2B to Y2E	Y3B to Y3E	Not used	Do not use.
YF	Y1F	Y2F	Y3F	Error flag reset relay	Reset the error flag.

(Note: the leftmost column groups are labeled WY0, WY1, WY2, WY3 for CH0, CH1, CH2, CH3 respectively.)

(Note 1) The I/O numbers in the tables above show offset addresses. Actual I/O numbers allocated to the analog input unit are determined by the first word number. (Example) If the first word number is 10, the disconnection detection execution relay on CH0 and the error flag reset relay will be Y100 and X10F, respectively.

(Note 2) The operation of the buffer function (consisting of the buffer execution relay, buffer trigger relay, and buffer data read completion relay) is specified by the output contacts for CH0.

8.3 List of Unit Memories

8.3.1 List of Unit Memory Number

There is no need to set unit memory values, because unit memory values will be written automatically if they are set in the configuration menu of the FPWIN GR7 tool software. In the case of making program settings, specify the desired unit memory numbers and write the corresponding values.

■ **Setting monitoring items and allocation of unit memory numbers**

Setting monitoring item		Unit memory no.			
		CH0	CH1	CH2	CH3
Isolation between channels		UM 00081			
Buffer function	Execution/Non-execution settings	UM 00088			
	Trigger type	UM 00089			
	No. of buffer data items	UM 0008A			
	No. of data items before triggering	UM 0008B			
	Trigger cycle	UM 0008C			
	Analog input trigger level	UM 0008D			
Conversion processing		UM 00090	UM 000A0	UM 000B0	UM 000C0
Range setting		UM 00091	UM 000A1	UM 000B1	UM 000C1
Function setting 1	Average processing settings	UM 00092	UM 000A2	UM 000B2	UM 000C2
	Offset/Gain processing				
	Scale conversion				
Function setting 2	Comparison of upper and lower limits	UM 00093	UM 000A3	UM 000B3	UM 000C3
	Holding max./min. values				
	Disconnection detection				
	Disconnection detection reset				
Averaging constant		UM 00094	UM 000A4	UM 000B4	UM 000C4
Offset value		UM 00095	UM 000A5	UM 000B5	UM 000C5
Gain value		UM 00096	UM 000A6	UM 000B6	UM 000C6
Scale conversion	Max. value	UM 00097	UM 000A7	UM 000B7	UM 000C7
	Min. Value	UM 00098	UM 000A8	UM 000B8	UM 000C8
Upper limit / Lower limit comparison	Upper limit comparison ON level	UM 00099	UM 000A9	UM 000B9	UM 000C9
	Upper limit comparison OFF level	UM 0009A	UM 000AA	UM 000BA	UM 000CA
	Lower limit comparison OFF level	UM 0009B	UM 000AB	UM 000BB	UM 000CB
	Lower limit comparison ON level	UM 0009C	UM 000AC	UM 000BC	UM 000CC
Max./Min. value hold monitor area	Holding max. value	UM 00180	UM 00181	UM 00182	UM 00183
	Holding min. value	UM 00188	UM 00189	UM 0018A	UM 0018B
Buffer function	Hold data storage area	UM 00800 to UM 02F0F	UM 03000 to UM 0570F	UM 05800 to UM 07F0F	UM 08000 to UM 0A70F

8.4 List of Detailed Specifications of Unit Memories

■ **Common to All Channels**

Unit memory number (Hex)	Name	Default	Setting range and description		
UM 00081	Isolation between channels	H0	Select the insulation or non-insulation between analog input channels. H0: Non-isolated H1: Isolated		
UM 00088	Buffer function Execution/Non-execution settings	H0	Select the use of the buffer function. H0: Not use H1: Use		
UM 00089	Buffer function Trigger settings	H0	Select a trigger signal to start buffering when the buffer function is used.		
			Bit	Name	Description
			3-0	Trigger type	H0 Trigger input relay H1 Rise of external input trigger H2 Fall of external input trigger input H4 Rising time of analog input level H8 Falling time of analog input level
			7-4	External input trigger	H0 Unused H1 TRG0 H2 TRG1 H4 TRG2 H8 TRG3
			11-8	Input level trigger CH	H0 Unused H1 CH0 H2 CH1 H4 CH2 H8 CH3
			15-10	Not used	
UM 0008A	Buffer function No. of buffer data items	K1,000	Set the number of data items (words) to be stored in the buffer. Setting range: +1 to +10,000		
UM 0008B	Buffer function No. of pre-trigger data items	K0	Set the number of data items (words) out of the number of buffer data items before triggering. Setting range: 0 to +9,999		
UM 0008C	Buffer function Trigger cycle	K1	Set the cycle enabling trigger input. The trigger cycle is obtained from the following formula. Isolated: Set value × No. of enabled channels × 5 [ms] Non-isolated: Set value × No. of enabled channels × 0.025 [ms]		
UM 0008D	Buffer function Analog input Trigger level	K0	If "Analog input level" is selected for the trigger type, set an input level to enable triggering. Setting range: -31,250 to +31,250		

■ **Individual setting area per channel**

Unit memory number (Hex)	Name	Default	Setting range and description			
UM 00090 UM 000A0 UM 000B0 UM 000C0	Conversion processing Execution/Non-execution	H1	Select the conversion function to be used. H0: Not execute H1: Execute			
UM 00091 UM 000A1 UM 000B1 UM 000C1	Range setting	H1	Select the input range. H1: Voltage input -10 to +10 V H2: Voltage input 0 to +10 V H4: Voltage input 0 to +5 V H8: Voltage input +1 to+ 5 V H10: Current input 0 to +20 mA H20: Current input +4 to +20 mA			
UM 00092 UM 000A2 UM 000B2 UM 000C2	Function setting 1 Average processing settings Offset processing/ Gain processing Scale conversion	H0	Select the desired function to be used.			
			Bit	Name	Settings	
			3-0	Average processing	H0 Not execute H1 No. of averaging times H2 Time average H4 Moving average	
			7-4	Offset/Gain processing	H0 Not execute H1 Execute	
			11-8	Scale conversion	H0 Not execute H1 Execute	
			15-10	Not used		
UM 00093 UM 000A3 UM 000B3 UM 000C3	Function setting 2 Comparison of upper and lower limits Holding max./min. values Disconnection detection Disconnection detection reset	H0	Select the desired function to be used.			
			Bit	Name	Settings	
			3-0	Upper limit / Lower limit comparison	H0 Not execute H1 Execute	
			7-4	Max./Min. values hold	H0 Not execute H1 Execute	
			11-8	Disconnection detection	H0 Not execute H1 Execute	
			15-10	Disconnection detection reset	H0 Auto (Auto reset for reconnection) H1 Manual	

(Note) The unit memory numbers in the above table are listed for CH0, CH1, CH2, and CH3 in numerical order.

■ **Individual setting area per channel**

Unit memory number (Hex)	Name	Default	Setting range and description		
UM 00094 UM 000A4 UM 000B4 UM 000C4	Averaging constant	K200	Set constants for average processing.		
			Function used	Settings	
			Number of averaging times	No. of averaging times	2 to 60,000 [times]
			Average time	Non-isolated Isolated	1 to 1,500 [ms] 200 to 60,000 [ms]
			Moving average	No. of moving average	2 to 2,000 [times]
UM 00095 UM 000A5 UM 000B5 UM 000C5	Offset value	K0	Set an offset value at the time of using the offset processing function. Setting range: -3,000 to +3,000 (specified with a signed integer)		
UM 00096 UM 000A6 UM 000B6 UM 000C6	Gain value	K10,000	Set an offset value at the time of using the offset processing function. Setting range: +9,000 to +11,000 (0.9x to 1.1x: Specified with a signed integer)		
UM 00097 UM 000A7 UM 000B7 UM 000C7	Scale conversion Max. value	K10,000	Set the maximum value at the time of using the scale conversion function. Setting range: -30,000 to +30,000 (specified with a signed integer)		
UM 00098 UM 000A8 UM 000B8 UM 000C8	Scale conversion Min. value	K0	Set the minimum value at the time of using the scale conversion function. Setting range: -30,000 to +30,000 (specified with a signed integer)		
UM 00099 UM 000A9 UM 000B9 UM 000C9	Upper limit comparison ON level	K0	Set the upper limit to turn ON the output flag at the time of using the upper/lower limit comparison function. Setting range: -31,250 to +31,250 (specified with a signed integer)		
UM 0009A UM 000AA UM 000BA UM 000CA	Upper limit comparison OFF level	K0	Set the upper limit to turn OFF the output flag at the time of using the upper/lower limit comparison function. Setting range: -31,250 to +31,250 (specified with a signed integer)		
UM 0009B UM 000AB UM 000BB UM 000CB	Lower limit comparison OFF level	K0	Set the lower limit to turn OFF the output flag at the time of using the upper/lower limit comparison function. Setting range: -31,250 to +31,250 (specified with a signed integer)		
UM 0009C UM 000AC UM 000BC UM 000CC	Lower limit comparison ON level	K0	Set the lower limit to turn ON the output flag at the time of using the upper/lower limit comparison function. Setting range: -31,250 to +31,250 (specified with a signed integer)		

(Note) The unit memory numbers in the above table are listed for CH0, CH1, CH2, and CH3 in numerical order.

■ Individual monitor area per channel

Unit memory number (Hex)	Name	Default	Setting range and description
UM 00180 UM 00181 UM 00182 UM 00183	Holding max. value	K0	The acquired maximum value will be held when the maximum and minimum value holding function is used. Setting range: -31,250 to +31,250 (specified with a signed integer)
UM 00188 UM 00189 UM 0018A UM 0018B	Holding min. value	K0	The acquired minimum value will be held when the maximum and minimum value holding function is used. Setting range: -31,250 to +31,250 (specified with a signed integer)

(Note) The unit memory numbers in the above table are listed for CH0, CH1, CH2, and CH3 in numerical order.

■ Buffer data storage area per channel

Unit memory number (Hex)	Name	Default	Setting range and description
UM 00800 to UM 02F0F	CH0 Buffer area	K0	
UM 03000 to UM 0570F	CH1 Buffer area	K0	Stores buffer data when the buffer function is used. 10,000 words per channel Setting range: -31,250 to +31,250 (specified with a signed integer)
UM 05800 to UM 02F0F	CH2 Buffer area	K0	
UM 08000 to UM 0A70F	CH3 Buffer area	K0	

8.5 Dimensions
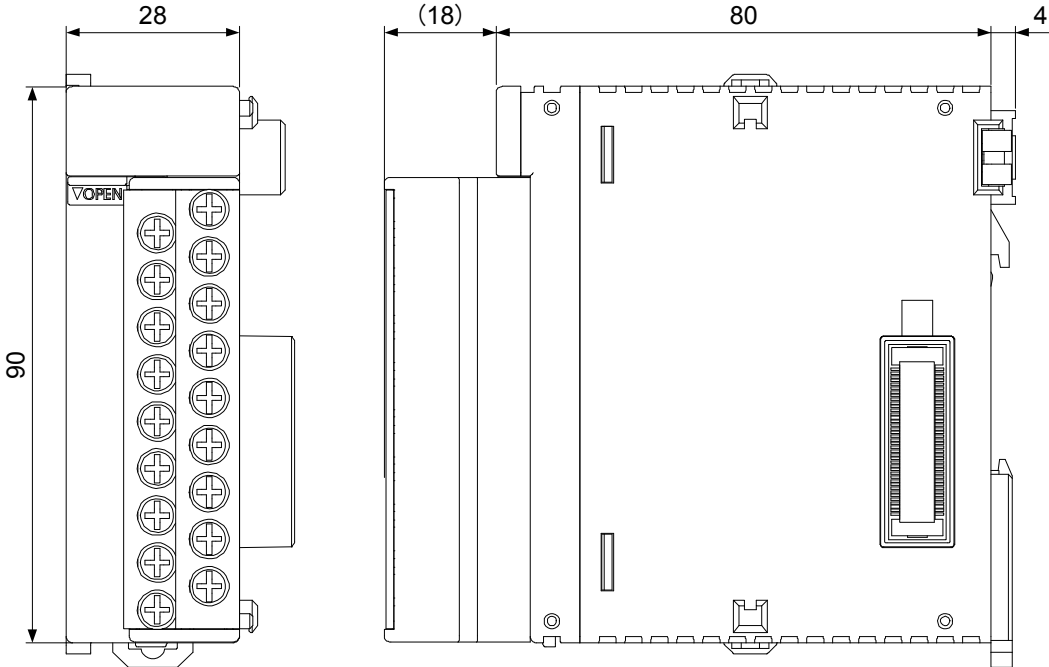
Record of changes

Manual No.	Date	Record of Changes
WUME-FP7AIH-01	Mar.2013	First Edition