Panasonic®

Programmable Controller

FP7 Analog Input Unit
User's Manual

[Applicable models]
High-speed and high-accuracy type, 4ch (Product number: AFP7AD4H)
General-purpose type, 8ch (Product number: AFP7AD8)

(MEMO)

Introduction

Thank you for purchasing a Panasonic product. Before you use the product, please carefully read through the user's manual, and understand it in detail to use the product properly.

Types of Manual

- There are different types of user's 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 from the Panasonic website:https://industry.panasonic.com/global/en/downloads/?tab=manual.

Unit name or purpose of use	Manual name	Manual code
FP7 Power Supply Unit	FP7 CPU Unit User's Manual (Hardware)	WUME-FP7CPUH
FP7 CPU Unit	FP7 CPU Unit Command Reference Manual	WUME-FP7CPUPGR
	FP7 CPU Unit User's Manual (Logging Trace Function)	WUME-FP7CPULOG
	FP7 CPU Unit User's Manual (Security Function)	WUME-FP7CPUSEC
Instructions for Built-in LAN Port	FP7 CPU Unit User's Manual (LAN Port Communication)	WUME-FP7LAN
	FP7 CPU Unit User's Manual (Ethernet Expansion Function)	WUME-FP7CPUETEX
	FP7 CPU Unit User's Manual (EtherNet/IP Communication)	WUME-FP7CPUEIP
	Web Server Function Manual	WUME-FP7WEB
Instructions for Built-in COM Port	FP7 Series User's Manual (SCU Communication)	WUME-FP7COM
FP7 Extension Cassette (Communication) (RS-232C / RS485 type)		
FP7 Extension Cassette (Communication) (Ethernet Type)	FP7 Series User's Manual (Communication Cassette Ethernet Type)	WUME-FP7CCET
FP7 Extension (Function) Cassette Analog Cassette	FP7 Analog Cassette User's Manual	WUME-FP7FCA
FP7 Digital Input / Output Unit	FP7 Digital Input / Output Unit User's Manual	WUME-FP7DIO
FP7 Analog Input Unit	FP7 Analog Input Unit User's Manual	WUME-FP7AIH
FP7 Analog Output Unit	FP7 Analog Output Unit User's Manual	WUME-FP7AOH
FP7 Thermocouple Multi-analog Input Unit	FP7 Thermocouple Multi-analog Input Unit FP7 RTD Input Unit User's Manual	WUME-FP7TCRTD
FP7 RTD Input Unit		
FP7 Multi Input / Output Unit	FP7 Multi Input / Output Unit User's Manual	WUME-FP7MXY
FP7 High-speed counter unit	FP7 High-speed Counter Unit User's Manual	WUME-FP7HSC
FP7 Pulse Output Unit	FP7 Pulse Output Unit User's Manual	WUME-FP7PG

Unit name or purpose of use	Manual name	Manual code
FP7 Positioning Unit	FP7 Positioning Unit User's Manual	WUME-FP7POSP
FP7 Serial Communication Unit	FP7 Series User's Manual (SCU Communication)	WUME-FP7COM
FP7 Multi-wire Link Unit	FP7 Multi-wire Link Unit User's Manual	WUME-FP7MW
FP7 Motion Control Unit	FP7 Motion Control Unit User's Manual	WUME-FP7MCEC
PHLS System	PHLS System User's Manual	WUME-PHLS
Programming Software FPWIN GR7	FPWIN GR7 Introduction Guidance	WUME-FPWINGR7

Safety Precautions

- Observe the following precautions to ensure personal safety or to prevent accidents.
- Before performing installation, operation, maintenance, or inspection, read this manual carefully to understand how to use the product correctly.
- Make sure that you fully understand the product, information on safety, and other precautions.
- This manual uses two safety symbols, different levels of safety precautions "Warning" and "Caution", to indicate .

⚠ **WARNING**	Indicates a potentially hazardous situation which, if not handled correctly, could result in death or serious injury of the user.

- Take safety measures outside the 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**	Indicates a potentially hazardous situation which, if not handled correctly, could result in injury to the user or property damage.

- 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.

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Handling Precautions

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

Stop	Indicates an action that is prohibited or a matter that requires caution.
!	Indicates an action that must be taken.
ℹ Info.	Indicates supplemental information.
◻ Note	Indicates details about the subject in question or information useful to remember.

1_2 **Procedure**	Indicates operation procedures.

Table of Contents

1 Unit Functions and Restrictions

1.1 Unit Functions and Operation

1.1.1 Unit Type

■ 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 (AD4H) / 8 channels (AD8)

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.

■ Various optional functions

Functions to process loaded analog input data are provided. User programs can be simplified.

Function	Description
Average processing settings	Averages analog values obtained by sampling and stores them in the I/O area as digital values. It can be selected from No. of averaging times, time average and moving average.
Offset / Gain processing settings	Performs the correction of offset values (addition correct) or gain values (magnification correction), and stores the data after processing in the I/O area.
Scale conversion setting	This function is to scale-convert values to an easy-to-use data range. It converts values to digital values in the specified range (min. value and max. value), and stores the processed data in the I/O area. This function is convenient if used for unit conversion.
Upper / lower limit value comparison setting	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.
Max. / Min. hold setting	This function maintains the maximum and minimum values of acquired data. Holds the maximum and minimum digital conversion values when the max. / min. value hold setting is enabled, and stores the values in provided unit memories for each channel.
Disconnection detection	Turns ON the disconnection detection flag when input is disconnected or unconnected, and warns of the error state.

Function	Description
	For AFP7AD4H: It is detected only when selecting the range of 4 to 20 mA or 1 to 5 V. For AFP7AD8: It is detected only when selecting the range of 4 to 20 mA.
Buffer function	This function stores digital conversion values acquired at a preset cycle into a unit memory. Any of the changes in user program, external digital input or analog input value can be selected as a trigger.

1.1.2 Unit Type

Name	Specifications		Product no.
FP7 Analog Input Unit	Input 4ch	Voltage input range:	AFP7AD4H
	Input 8ch	-10 to +10 V, 0 to +5 V, 1 to +5 V, -100 to +100 mV Current input range: 0 to +20 mA, 4 to +20 mA	AFP7AD8

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).
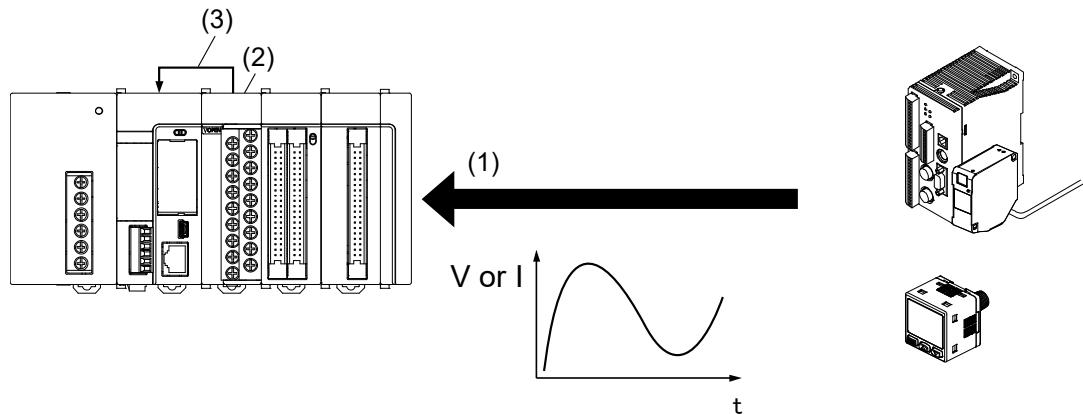
■ Option setting

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
● Max. / Min. hold setting
● Upper / lower limit value comparison setting
● Disconnection detection
● Buffer setting

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 (High-speed and High-accuracy type)	AFP7AD4H	100 mA or less
FP7 Analog Input Unit (General-purpose type)	AFP7AD8	85 mA or less

1.3.2 Applicable Versions of Unit and Software

For using the above units, the following versions of CPU units and software are required.

Name	Product no.	Applicable version		
		CPU unit		FPWIN GR7
		CPS4* CPS3*	CPS2*	
FP7 Analog Input Unit (High-speed and High-accuracy type)	AFP7AD4H	Ver.1.0 or later	Ver.1.0 or later	Ver.1.0 or later
FP7 Analog Input Unit (General-purpose type)	AFP7AD8	Ver.3.1 or later	Ver.1.0 or later	Ver.2.4 or later

(MEMO)

2 Names and Functions of Parts

2.1 Analog Input Unit
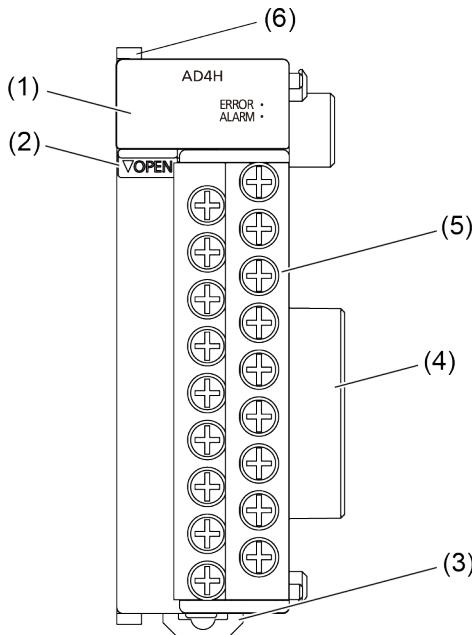
■ **Names and functions of parts**

(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-accuracy units.

(5) Analog input terminal block

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

(6) 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   [fork type terminal diagram]   6 mm or less   [round type terminal diagram]

3.2 mm or more   3.2 mm or more
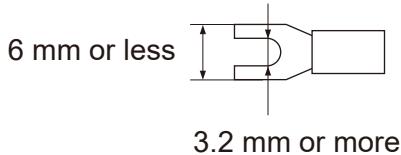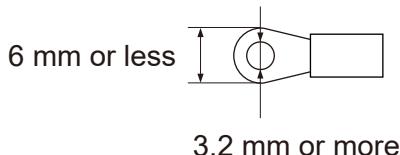
■ Suitable solderless terminals

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 0.6 N·m

■ Connection to the terminal block

Remove the terminal block before beginning the wiring operations.

To remove the terminal block, push downward the release lever located at the top of the terminal block.

Lock button

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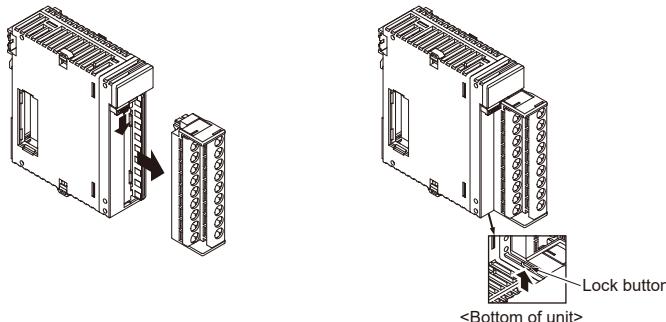
!	● Install the terminal block by inserting it all the way to its original position and pressing the lock button on the bottom of the unit. Then confirm that the terminal block is securely attached and cannot be removed.

3.2 Connecting Analog Input

3.2.1 Precautions When Connecting Analog Input Signal

- 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 have the analog input wiring close to AC wires, power wires, or load line from a device other than PLC. Also, do not bundle it with them.

3.2.2 AFP7AD4H

- For the current input, connect the V and I terminals.
- The trigger input terminal is used when the buffer function is used with an external input signal as a trigger signal. It does not need to be connected when this function is not used.

■ **Wiring diagram and internal circuit diagram (For voltage input)**
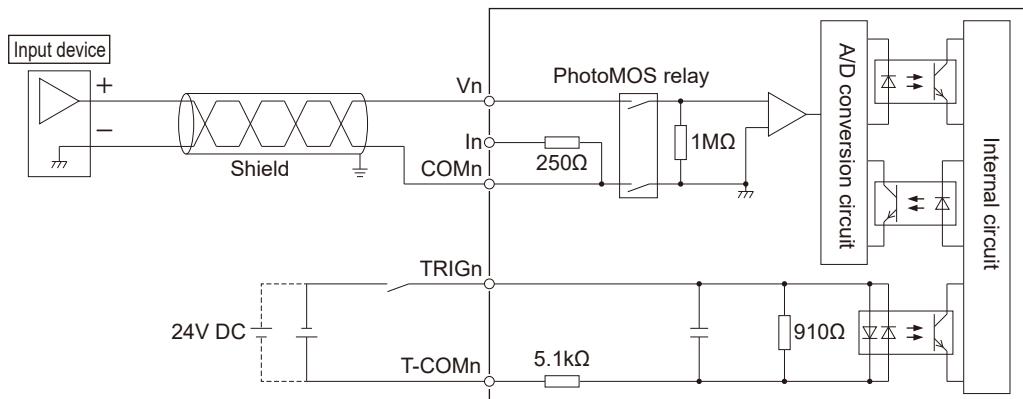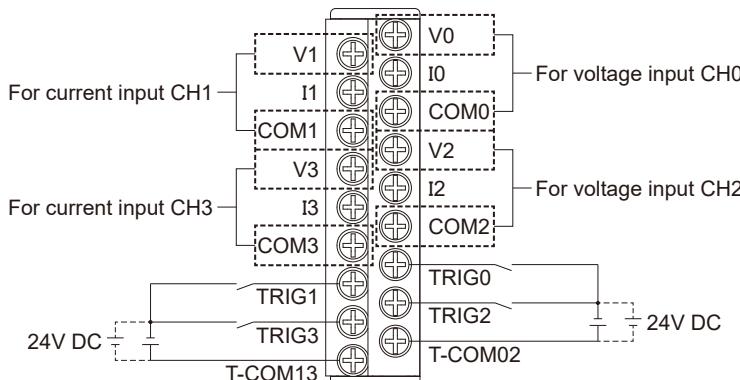
■ **Terminal layout (For voltage input)**

■ **Wiring diagram and internal circuit diagram (For current input)**
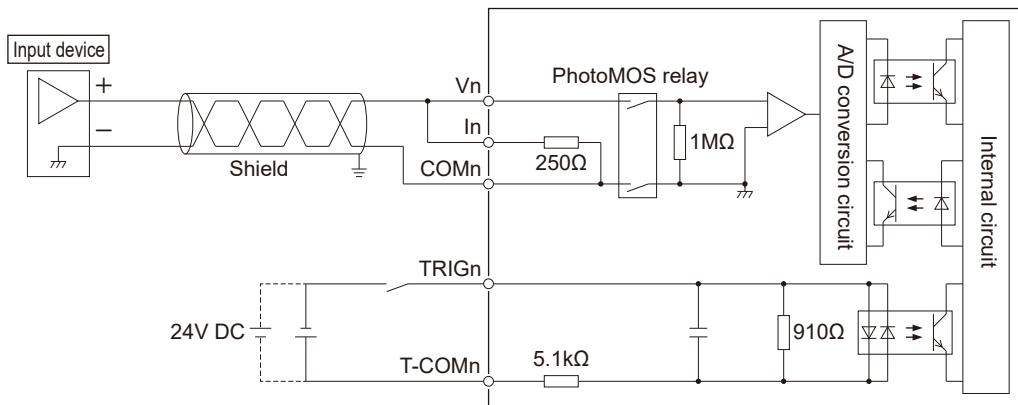
(Note 1)   For the current input, connect the V and I terminals.

■ **Terminal layout (For current input)**
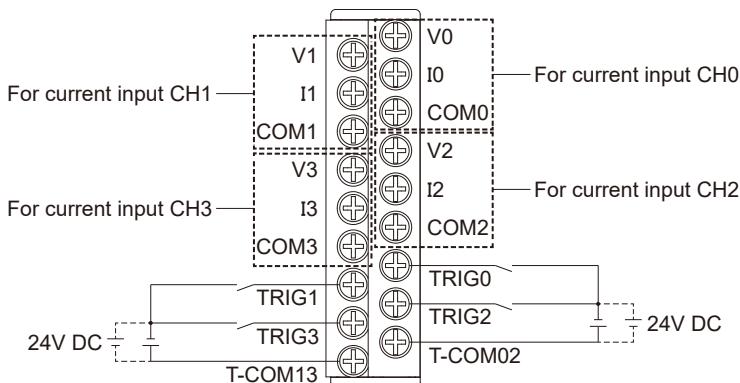
(Note 1)   TRIG0 to TRIG3 of AFP7AD4H indicate input terminal numbers. Note that they do not correspond to the analog inputs "CH0 to CH3".

3.2.3 AFP7AD8

● The voltage input and the current input are switched by the configuration setting.
● The trigger input terminal is used when the buffer function is used with an external input signal as a trigger signal. It does not need to be connected when this function is not used.

■ **Wiring diagram and internal circuit diagram (For voltage input and current input)**
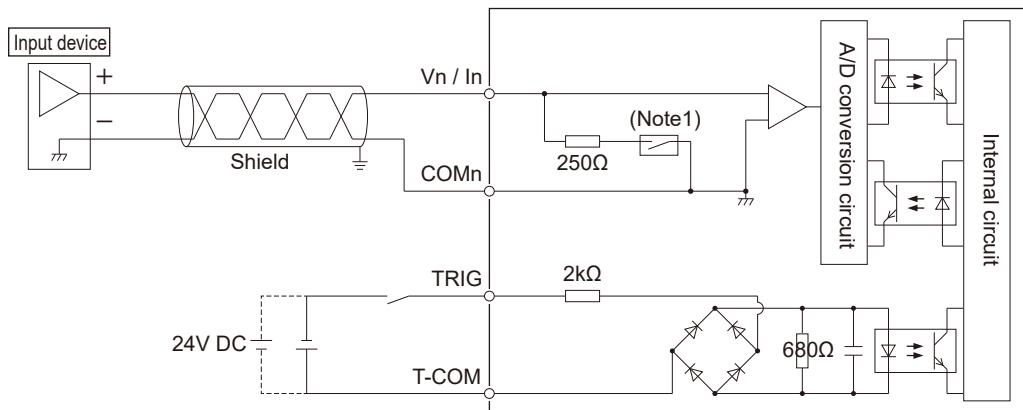
(Note 1)   The connection of the circuit varies according to the configuration setting.

■ **Terminal layout (For voltage input and current input)**
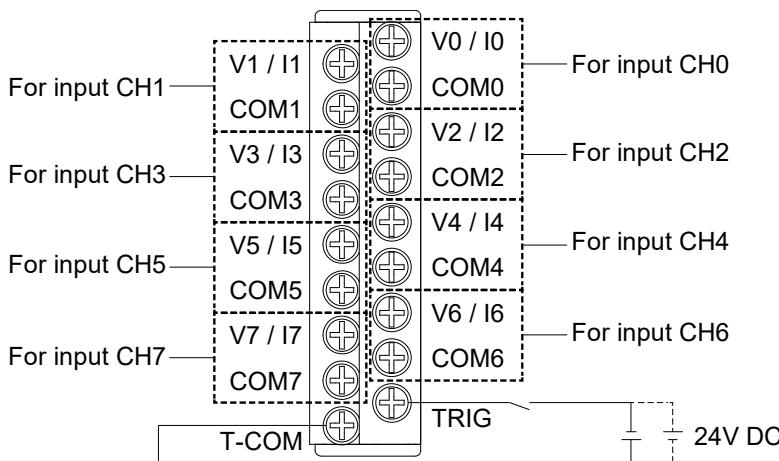
■ **Precautions when setting the voltage range**

A digital conversion value equivalent to an analog input of approx. 2 V is saved in the device (WX) for the channels to which no input is connected.

3.3 Trigger Input Terminal TRIG Specifications

The trigger input terminal is used when the buffer function is used with an external input signal as a trigger signal. It does not need to be connected when this function is not used.

■ **Specifications**

Items		Description	
		AFP7AD4H	AFP7AD8
Insulation system		Optical coupler	
Rated input voltage		24 V DC	
Rated input current		Approx. 4.5 mA (at 24 V)	Approx. 12 mA (at 24 V)
Input impedance		Approx. 5.1 kΩ	Approx. 2 kΩ
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	0.1 ms or less
	ON→OFF	0.2 ms or less	0.1 ms or less
Input points per common		2 point/1 common	1 point/1 common
External connection method		Terminal block connections (M3 terminal screws)	

4 Unit Settings and Data Reading

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

4.1.1 Occupied I/O Area and I/O Allocations

- Input data is allocated to the external input relay areas (WX).
- To the I/O areas of the thermocouple multi analog input unit and RTD input unit, an area to set optional functions and an area to reset errors are allocated.

■ **Input contact**

I/O area No.	Name	Default	Description
WX0	CH0 Analog conversion data	K0	
WX1	CH0 Optional function flag	H0	
WX2	CH1 Analog conversion data	K0	
WX3	CH1 Optional function flag	H0	**Analog conversion data area**
WX4	CH2 Analog conversion data	K0	Digital converted values corresponding to the analog input is stored.
WX5	CH2 Optional function flag	H0	<Voltage range>
WX6	CH3 Analog conversion data	K0	-10 to +10 V: -31,250 to +31,250
WX7	CH3 Optional function flag	H0	0 to +10 V or 0 to +5 V: 0 to +31,250
WX8	CH4 Analog conversion data	K0	+1 to +5 V: 0 to +25,000
WX9	CH4 Optional function flag	H0	<Current range>
WX10	CH5 Analog conversion data	K0	0 to +20 mA: 0 to +31,250
WX11	CH5 Optional function flag	H0	+4 to +20 mA: 0 to +25,000
WX12	CH6 Analog conversion data	K0	**Optional function flag area**
WX13	CH6 Optional function flag	H0	Refer to the table on the "Input contact (Optional functions/Error flag area)".
WX14	CH7 Analog conversion data	K0	
WX15	CH7 Optional function flag	H0	

(Note 1) The I/O numbers in the table indicates offset addresses. The I/O numbers actually allocated are the numbers based on the starting word number allocated to the unit. Example) When the starting word number for the unit is "10", the A/D conversion data of CH0 is WX10 and the error flag is X11F.

(Note 2) It is A/D conversion data within the specified scale range when setting the scale conversion setting.

(Note 3) If the voltage range is set with AFP7AD8, a digital conversion value equivalent to an analog input of approx. 2 V is saved in the device (WX) for the channels to which no input is connected.

■ **Input contact (Optional functions/Error flag area)**

I/O No.								Name	Description
CH0	CH1	CH2	CH3	CH4	CH5	CH6	CH7		
X10	X30	X50	X70	X90	X110	X130	X150	Disconnection detection flag	ON with disconnection detected and OFF with disconnection restored. (Note 3)
X11	X31	X51	X71	X91	X111	X131	X151	Upper limit comparison relay	Turns ON when the value exceeds the set upper limit.

I/O No.								Name	Description
CH0	CH1	CH2	CH3	CH4	CH5	CH6	CH7		
X12	X32	X52	X72	X92	X112	X132	X152	Lower limit comparison relay	Turns OFF when the value drops below the set lower limit.
X13	X33	X53	X73	X93	X113	X133	X153	Upper / lower limit comparison execution flag	Turns ON when the upper limit/ lower limit comparison function is executed.
X14	X34	X54	X74	X94	X114	X134	X154	Not used	Do not use.
X15	X35	X55	X75	X95	X115	X135	X155	Max. / Min. hold execution flag	Turns ON when the max. / min. hold function is executed.
X16 to X17	X36 to X37	X56 to X57	X76 to X77	X96 to X97	X116 to X117	X136 to X137	X156 to X157	Not used	Do not use.
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	X9C to X9E	X11C to X11E	X13C to X13E	X15C to X15E	Not used	Do not use.
X1F	X3F	X5F	X7F	X9F	X11F	X13F	X15F	Error flag	Turns ON when an error occurs

(Note 1)   The I/O numbers in the table indicates offset addresses. The I/O numbers actually allocated are the numbers based on the starting word number allocated to the unit. Example) When the starting word number for the unit is "10", the error flag is X11F.

(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.

(Note 3)   The disconnection detection is valid only when selecting the following ranges.

Unit type	Range
AFP7AD4H	4 to 20 mA
	1 to 5 V
AFP7AD8	4 to 20 mA

■ **Output contact (Optional functions/Error flag area)**

I/O No.								Name	Description
CH0	CH1	CH2	CH3	CH4	CH5	CH6	CH7		
Y0	Y10	Y20	Y30	Y40	Y50	Y60	Y70	Disconnection detection execution relay	ON to execute the disconnection detection function. OFF to turn OFF the disconnection detection flag (Xn0). (Note 3)
Y1	Y11	Y21	Y31	Y41	Y51	Y61	Y71	Not used	Do not use.
Y2	Y12	Y22	Y32	Y42	Y52	Y62	Y72		
Y3	Y13	Y23	Y33	Y43	Y53	Y63	Y73	Upper / 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	Y44	Y54	Y64	Y74	Not used	Do not use.
Y5	Y15	Y25	Y35	Y45	Y55	Y65	Y75	Max. / Min. hold execution relay	ON to execute the max./min. hold function.
Y6	Y16	Y26	Y36	Y46	Y56	Y66	Y76	Not used	Do not use.
Y7	Y17	Y27	Y37	Y47	Y57	Y67	Y77		
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 input relay	When OFF is switched to ON by a user program, buffering will start. This operation is enabled when "Trigger input relay" is selected as a trigger.
YA	-	-	-	-	-	-	-	Buffer data read completion relay	ON for one scan upon completion of reading buffer data from the shared memory with a user program. 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	Y4B to Y4E	Y5B to Y5E	Y6B to Y6E	Y7B to Y7E	Not used	Do not use.
YF	Y1F	Y2F	Y3F	Y4F	Y5F	Y6F	Y7F	Error flag reset relay	Resets an error flag.

(Note 1)   The I/O numbers in the table indicates offset addresses. The I/O numbers actually allocated are the numbers based on the starting word number allocated to the unit. Example) When the starting word number for the unit is "10", the disconnection detection execution relay of CH0 is Y100, and the error flag reset relay is Y10F.

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

(Note 3)   The disconnection detection is valid only when selecting the following ranges.

Unit type	Range
AFP7AD4H	4 to 20 mA
	1 to 5 V
AFP7AD8	4 to 20 mA

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 are determined by the first word number.

4.1.3 Allocations to unit

Take the following procedure to set the first word number.

1 2   **Procedure**

1. Select **Options**>**FP7 Configuration**>**I/O map** in the menu bar.
The "I/O map" dialog box is displayed.

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

3. Select "Analog I/O" and "Analog input unit" in the unit selection field.
The following dialog box shows the case of AFP7AD4H.

Unit selection [Slot No. 1]

Select unit to use | OK

Unit type: Analog I/O

Unit name: Analog 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)

Option

☐ Exclude this unit from the target for verification.

☐ Exclude this unit from the target for I/O refresh.
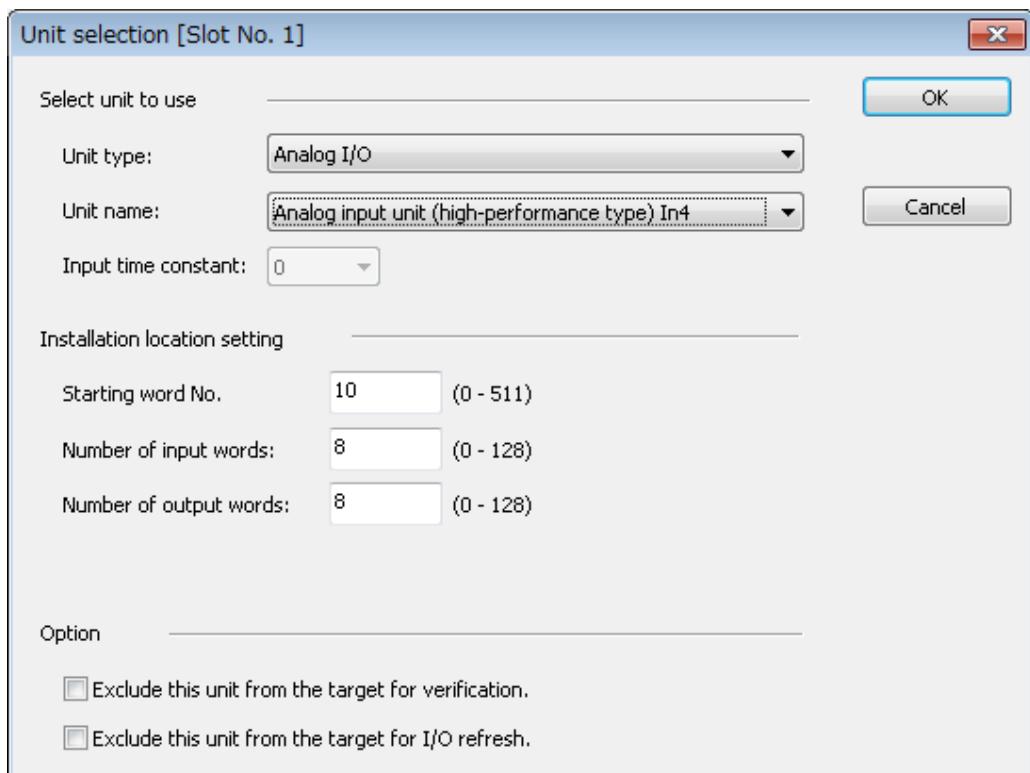
4. Press the [OK] button.
The first word number specified is set.

4.2 Configuration 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.

4.2.2 Setting Method

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

1 2   **Procedure**

1. Select **Options**>**FP7 Configuration**>**I/O map** in the menu bar.
The "I/O map" dialog box is displayed.

2. Select the slot where the analog input unit is registered and press the [Advanced] button.
The "Analog unit settings" dialog box is displayed.

3. Select a setting to be set from the left pain, and set desired items.
The following explanation shows the case of CH0 setting. Displayed items vary depending on the unit types and selected items.
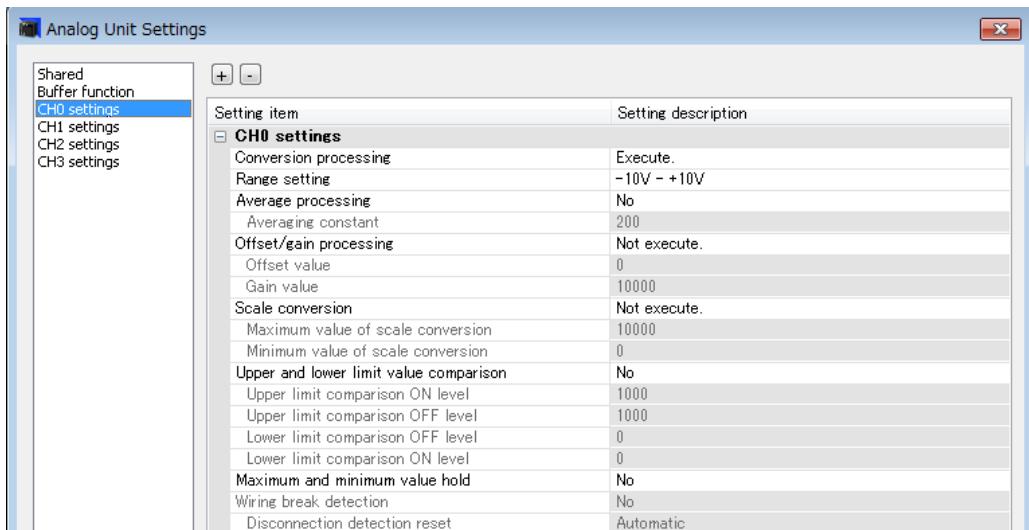
4. Press the [OK] button.
The set value will become effective when the set value is downloaded together with a corresponding program as a project.

Settings (AFP7AD4H)

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 +5V +1 to +5V 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
	Upper / lower limit comparison	Not execute / Execute	Not execute
	Max. / Min. hold	Not execute / Execute	Not execute
	Disconnection detection	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 (non-isolated): 200 to 60,000 [ms] Moving: 2 to 2,000 [times]	200
	Offset value	-3,000 to +3,000	0
	Gain value	+9,000 to +11,000	+10,000
	Maximum value of scale conversion	-30,000 to +30,000	+10,000
	Minimum value of scale conversion	-30,000 to +30,000	0
	Upper limit comparison ON level	-31,250 to +31,250	0

Group	Setting item	Settings	Default
	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

Settings (AFP7AD8)

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
	Input level trigger CH	Unused / CH0 / CH1 / CH2 / CH3 / CH4 / CH5 / CH6 / CH7	Not used
	No. of buffer data items	1 to 8,000	1000
	No. of data items before triggering	0 to 7,999	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 +5V +1 to +5V 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
	Upper / lower limit comparison	Not execute / Execute	Not execute
	Max. / Min. hold	Not execute / Execute	Not execute
	Disconnection detection	Not execute / Execute	Not execute
	Disconnection detection reset	Auto / Manual	Auto
	Averaging constant	Times: 2 to 60,000 [times] Time: 1 to 1500 [ms] Moving: 2 to 2,000 [times]	200
	Offset value	-3,000 to +3,000	0
	Gain value	+9,000 to +11,000	+10,000
	Maximum value of scale conversion	-30,000 to +30,000	+10,000

Group	Setting item	Settings	Default
	Minimum value of scale conversion	-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

4.2.3 Unit Setting and Conversion Processing Time

Conversion time varies with the configuration setting conditions.

■ **Isolation setting and conversion processing time**

Unit Type	Setting	Conversion time	Description
AFP7AD4H	Non-isolated	25 µs/ch	● The speed of A/D conversion processing will become faster if "non-isolation" is set.
	Isolated	5 ms/ch	● The photo-MOS relays in the internal circuit are always ON at the time of non-isolation and the commons will be shared. ● When "isolation" is set, each channel is isolated by switching the photo-MOS relays of the internal circuit at the time of conversion.
AFP7AD8	Non-isolated	25 µs/ch	The areas between channels are always isolated. The setting by the configuration is not available.

■ **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 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. 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.
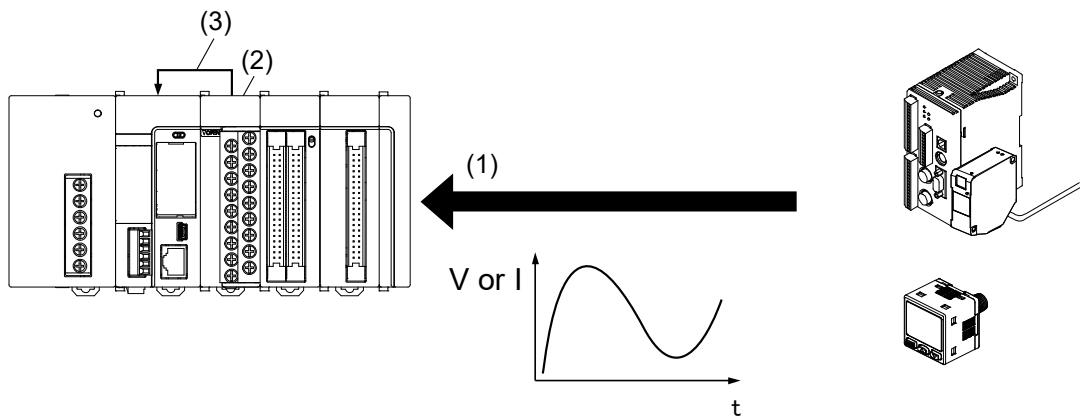
■ Program to Acquire Converted Digital Values

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

Transferring the digital data in analog input areas WX10, WX12, WX14, and WX16 to data registers ranging from DT100 to DT103.
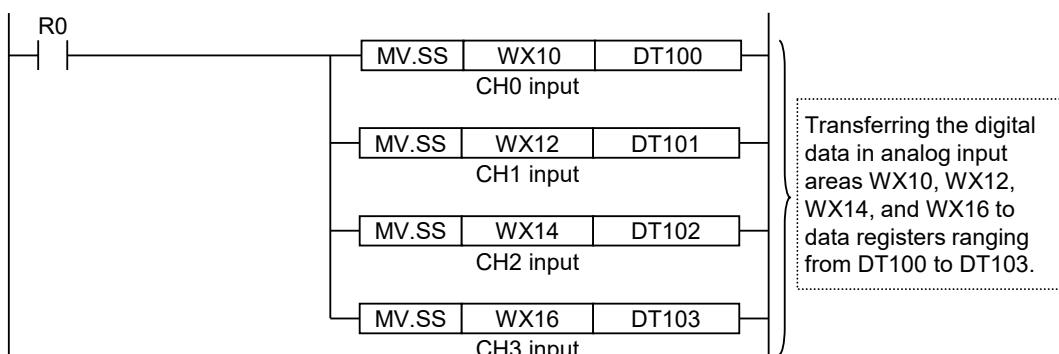
4.4 Data Acquisition Timing

■ 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 conversion	ch1 conversion
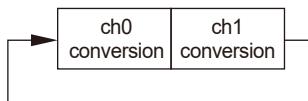
■ Data acquisition timing of CPU unit

● 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
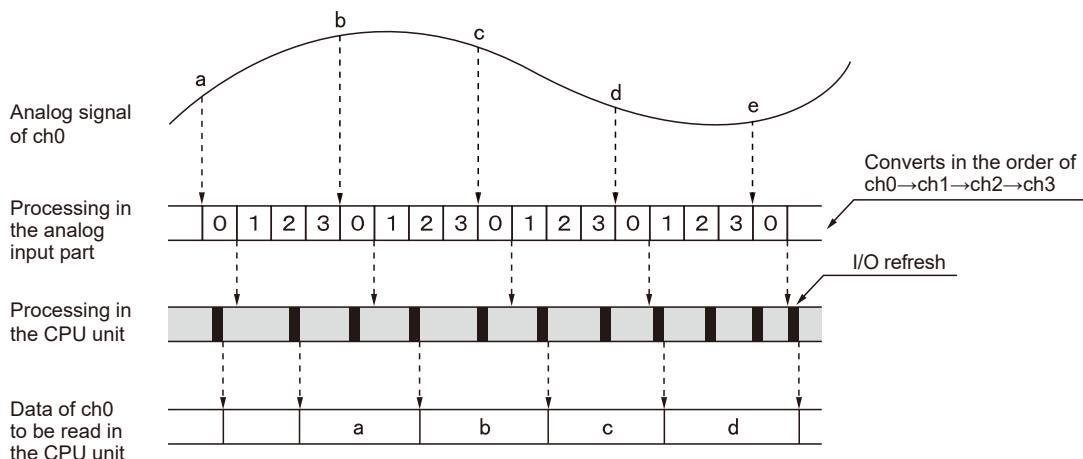
Example of 1-channel conversion
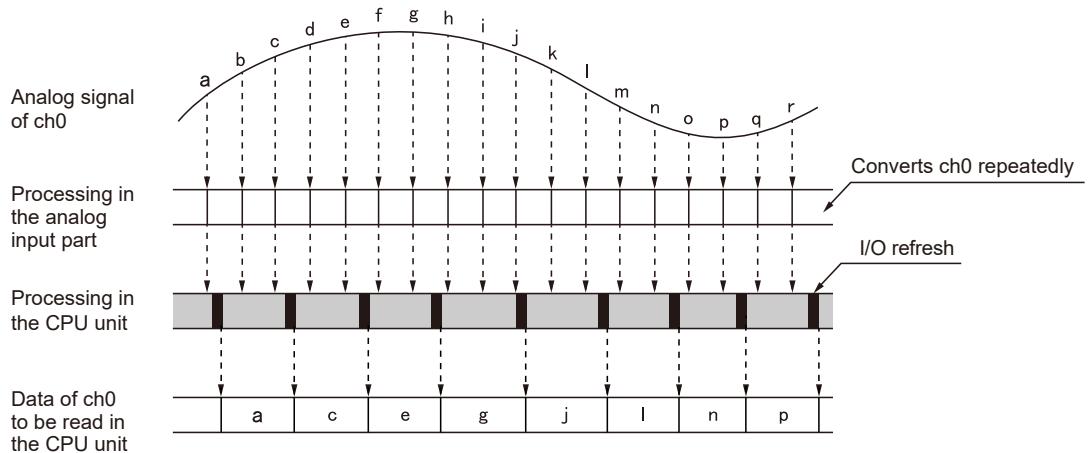
(MEMO)

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)
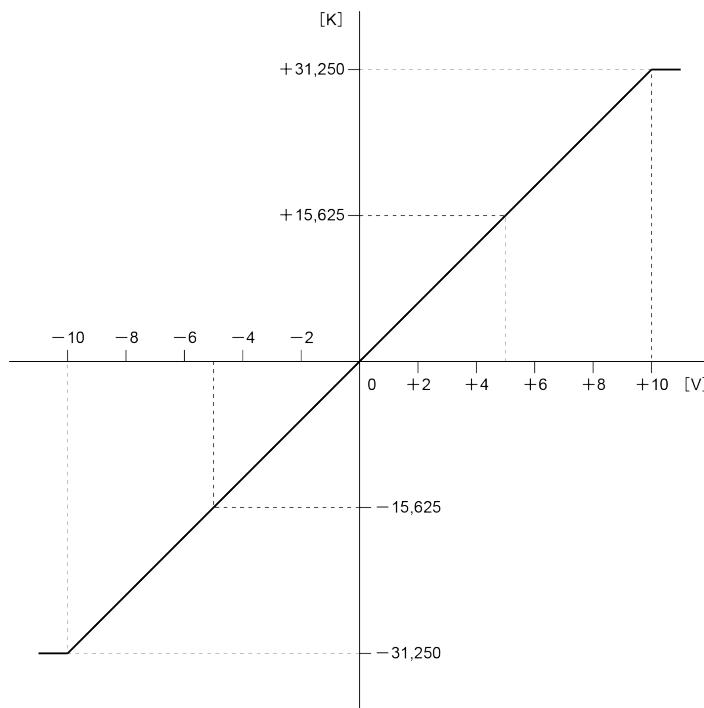
Input range: -10 to +10V

Analog input value (V)	Digital converted 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)
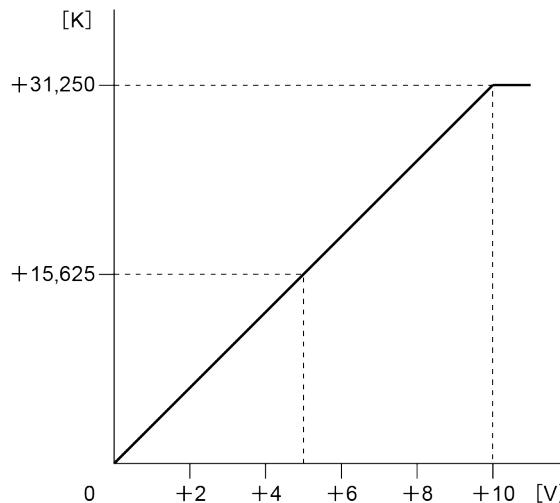
Input range: 0 to +10V

Analog input value (V)	Digital converted 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 +5V (0.16 mV, 1/31,250)
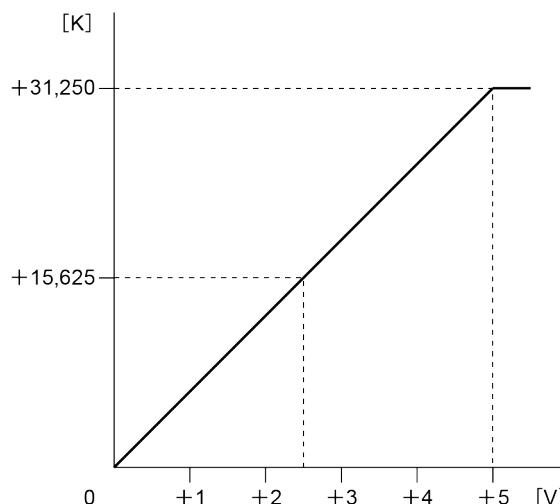
Input range: 0 to 5 V

Analog input value (V)	Digital converted 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)
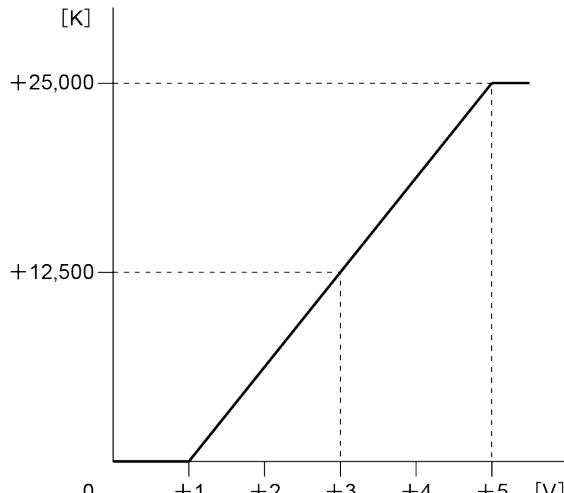
Input range: 1 to 5 V

Analog input value (V)	Digital converted 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 (0.64 µA, 1/31,250)
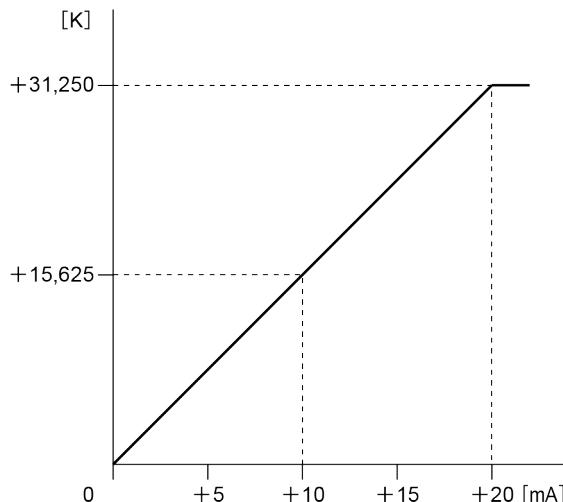
Input range: 0 to +20 mA

Analog input value (mA)	Digital converted 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 (0.64 µA, 1/25,000)
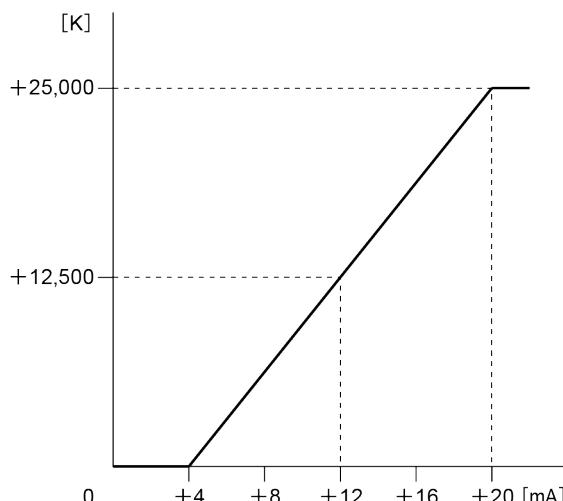
Input range: +4 to +20 mA

Analog input value (mA)	Digital converted 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

(MEMO)

6 Option Settings

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 averaging setting is set to "Number of averaging times", 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 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 for the number of averaging times set as averaging setting

  Output: Number of averaging times value

■ Processing during the number of averaging times

Averaging setting example: "Number of averaging times" is set to 5 for the number of sampling times.
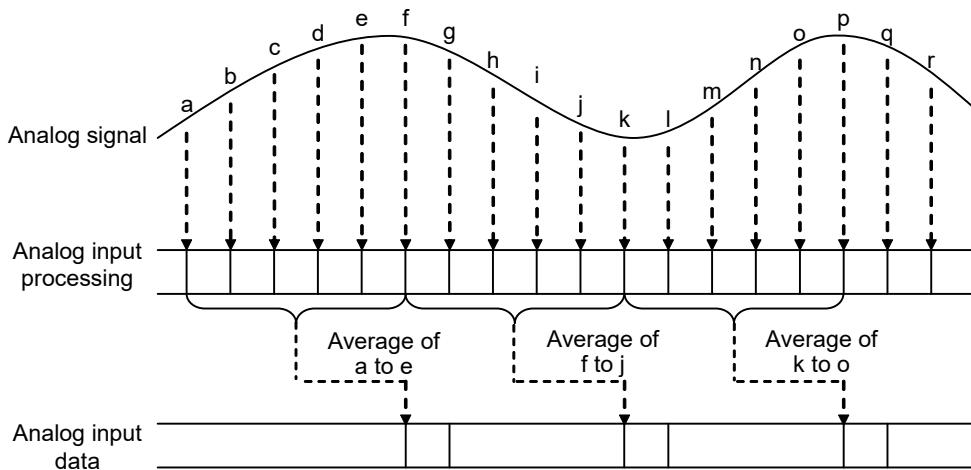
■ Configuration

Name		Default	Setting range and description
Function setting	Average processing settings	Not execute	Select the "Number of averaging times".
	Averaging constant	U200	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 the averaging setting is set to "Time 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.
- Obtain the time average to be processed from the following input.

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

  Output: Time average value

■ Configuration

Name		Default	Setting range and description
Function setting	Average processing settings	Not execute	Select "Time average".
	Averaging constant	U200	Time (non-isolated): 1 to 1,500 [ms] Time (isolated): 200 to 60,000 [ms] (For AD4H only) (Specified with an unsigned integer)

■ Processing during time average

Average setting example: "Time average" is set to an averaging time of 5 ms.
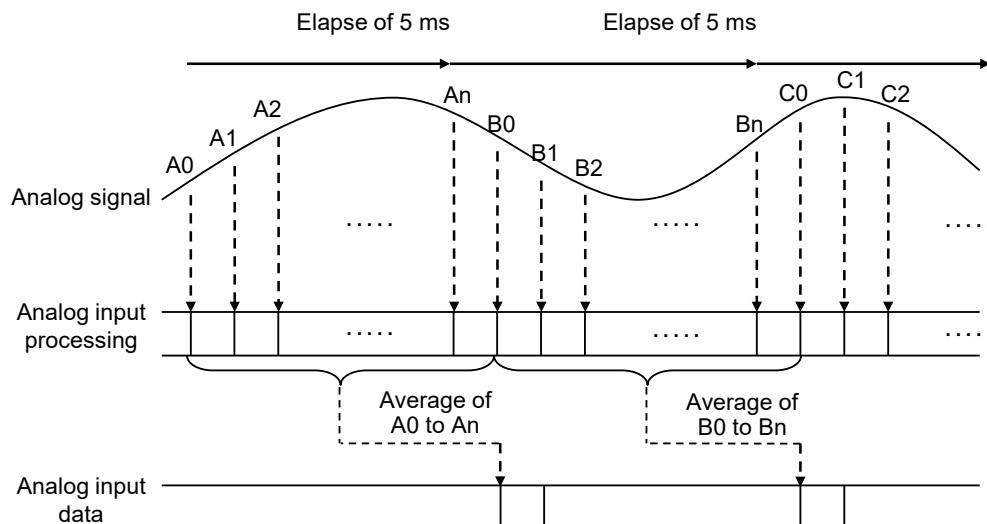
6.1.3 Moving Average

■ **Overview of functions**

● Analog input data sampled by the unit is averaged and stored as digital values.
● If the averaging setting is set to "Moving average", analog input data acquired will be processed to find a moving average and stored as digital values when the number of analog input data items reaches the set number of moving average times.
● Obtain output (moving average value) 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: "Moving average" is set to 15 for the number of averaging times.
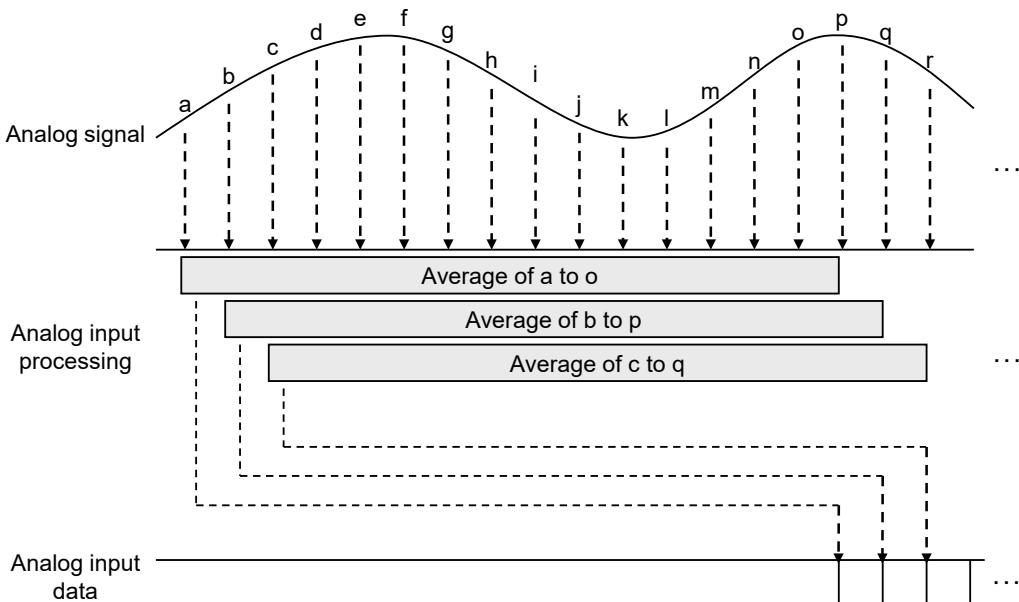
■ **Configuration**

Name		Default	Setting range and description
Function setting	Average processing settings	Not execute	Select "Moving average"
	Averaging constant	U200	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.
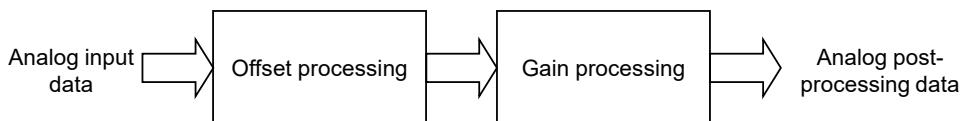
● Offset value settings are used as a function (zero-point adjustment) to make offset error adjustments between load devices.

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.
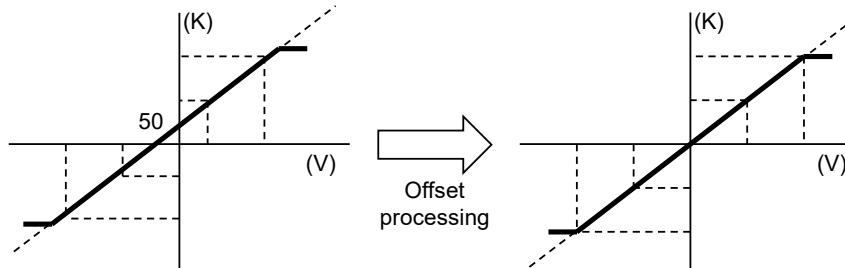
● Gain value settings are used as a function to adjust delicate scale errors between load devices. The gain value slope can be changed in a range of x0.9 to x1.1.
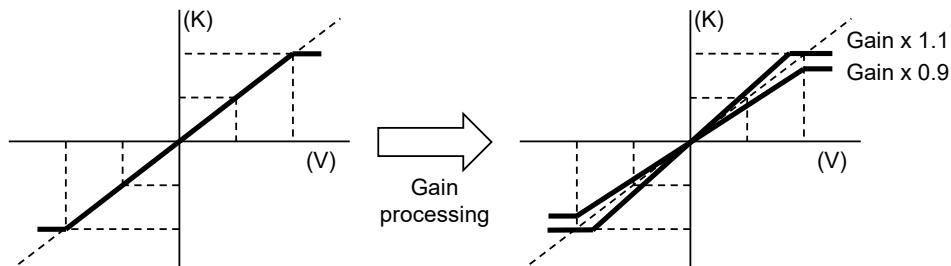
● Offset / Gain processing is executed on a channel-by-channel basis.

■ **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		U10000	Set a gain value at the time of using the offset processing function.

Name	Default	Setting range and description
		Setting range: +9,000 to +11,000 (0.9x to 1.1x: Specified with a signed integer)

i Info.

- 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 is to scale-convert values to an easy-to-use data range. Converts values to digital values in the specified range (min. value and max. value), and stores the processed data in the I/O area. This function is convenient if used for 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.
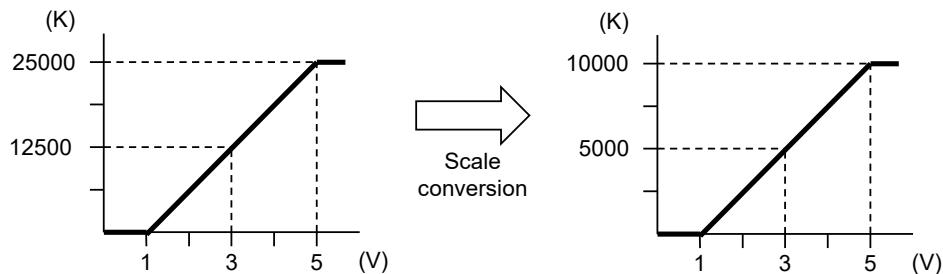
■ **Configuration**

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)

(Note 1)   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 Upper / Lower Limit Comparison

■ 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 comparison ON level.

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

● The function will be disabled with the comparison execution relay (Y) turned ON if the configuration-upper / lower limit comparison setting is not executed.
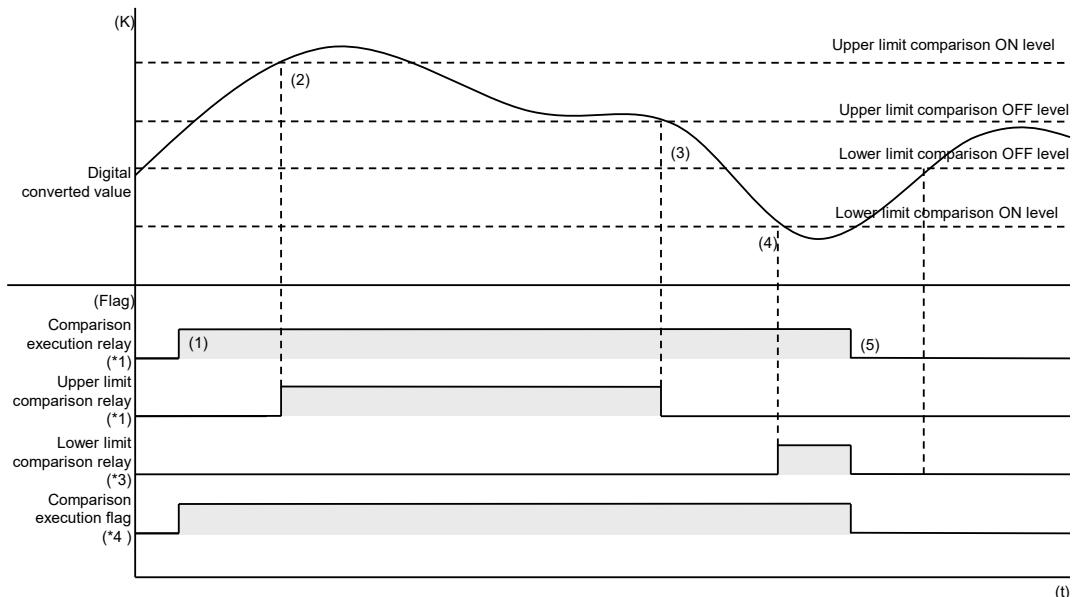
(1)	The upper / lower limit comparison function will be executed when the user program turns ON the comparison execution relay.
(2)	The upper limit comparison relay will turn ON if the upper limit comparison ON level or an upper level is detected.
(3)	The upper limit comparison relay will turn OFF if 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	CH4	CH5	CH6	CH7
*1 Comparison execution relay	Y103	Y113	Y123	Y133	Y143	Y153	Y163	Y173
*2 Upper limit comparison relay	X111	X131	X151	X171	X191	X211	X231	X251
*3 Lower limit comparison relay	X112	X132	X152	X172	X192	X212	X232	X252
*4 Comparison execution flag	X113	X133	X153	X173	X193	X213	X233	X253

■ Configuration

Name		Default	Setting range and description
Function setting	Upper / 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 1)   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.

6.4 Upper / Lower Limit Comparison

```
   R0                                          Y103
   ┤├──────( DF )─────────────────────< SET >──┐  ┐ (CH0): Controls upper
                                 (CH0): Upper/Lower │  │ and lower limit
                                 limit comparison   │  │ comparison function
                                 execution relay    │  │ R0 ON:
                                                    │  ├   Comparison execution
   R1                                          Y103 │  │ R1 ON:
   ┤├──────( DF )─────────────────────< RST >──┘  │   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 stored in the unit memories will be held even if the hold execution relay is turned OFF.
● The maximum and minimum values stored in the unit memories will be held even if the unit is set into PROG. mode.
● The maximum and minimum values are held on a channel-by-channel basis.
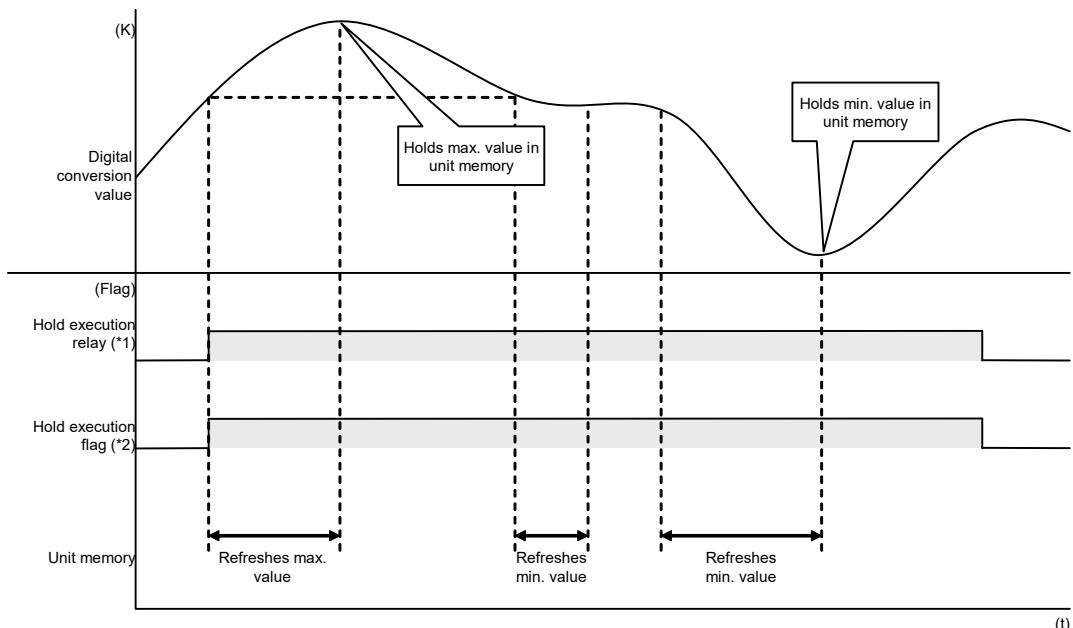
■ **Hold data storage area**

Unit memory no. (Hex)	Name	Default	Setting range and description
UM 00180 UM 00181 UM 00182 UM 00183 UM 00184 UM 00185 UM 00186	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)

Unit memory no. (Hex)	Name	Default	Setting range and description
UM 00187			
UM 00188 UM 00189 UM 0018A UM 0018B UM 0018C UM 0018D UM 0018E UM 0018F	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 1)   The unit memory numbers in the above table are listed for CH0 to CH7 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	CH4	CH5	CH6	CH7
*1 Hold execution relay	Y105	Y115	Y125	Y135	Y145	Y155	Y165	Y175
*2 Hold execution flag	X115	X135	X155	X175	X195	X215	X235	X255

■ **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.

```
   R0                                          Y105
 ──┤├──( DF )────────────────────────< SET >──┐ ┐ (CH0): Controls upper
                                                │ │ and lower limit
                              Max./Min. value   │ ┤ comparison function.
                              hold execution    │ │ ON: Execute
                              relay             │ │ OFF: Don't execute
   R1                                          Y105┘
 ──┤├──( DF )────────────────────────< RST >──┘

                              Max./Min. value
                              hold execution
                              relay

   X115                     ┌──────┬───────────┬─────┐
 ──┤├────────────────────────│MV.SS │S1: UM00180│ DT0 │── ┐ (CH0): Copies max. value
                            └──────┴───────────┴─────┘   ┘ to DT0
 Max./Min. value                   Unit memory
 hold execution                    specified for slot 1
 flag
                            ┌──────┬───────────┬─────┐
 └───────────────────────────│MV.SS │S1: UM00188│ DT1 │── ┐ (CH0): Copies min. value
                            └──────┴───────────┴─────┘   ┘ to DT1
                                   Unit memory
                                   specified for slot 1
```

6.6 Disconnection Detection

■ Overview of functions

Turns ON the disconnection detection flag when input is disconnected or unconnected, and warns of the error state.

Unit type	Range	Detection level
AFP7AD4H	4 to 20 mA	2.8 mA or less
	1 to 5 V	0.7 V or less
AFP7AD8	4 to 20 mA	2.8 mA or less

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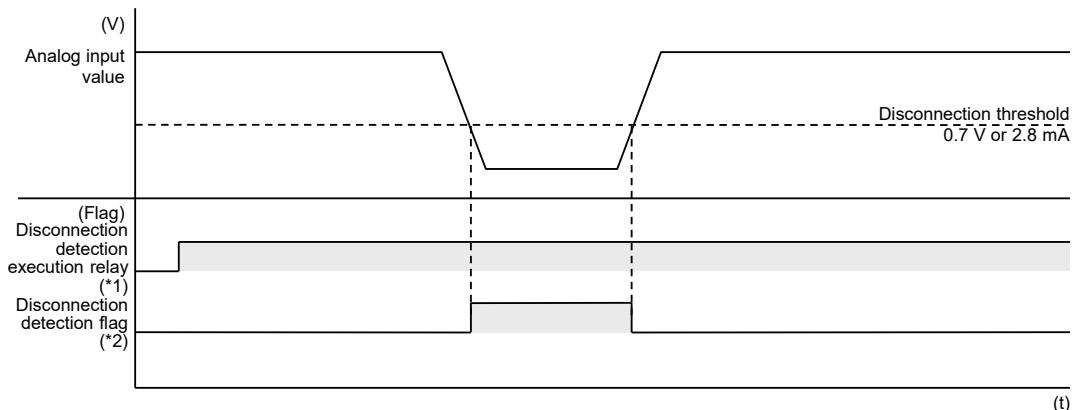
■ **Action with the detection disconnection reset setting set to manual**
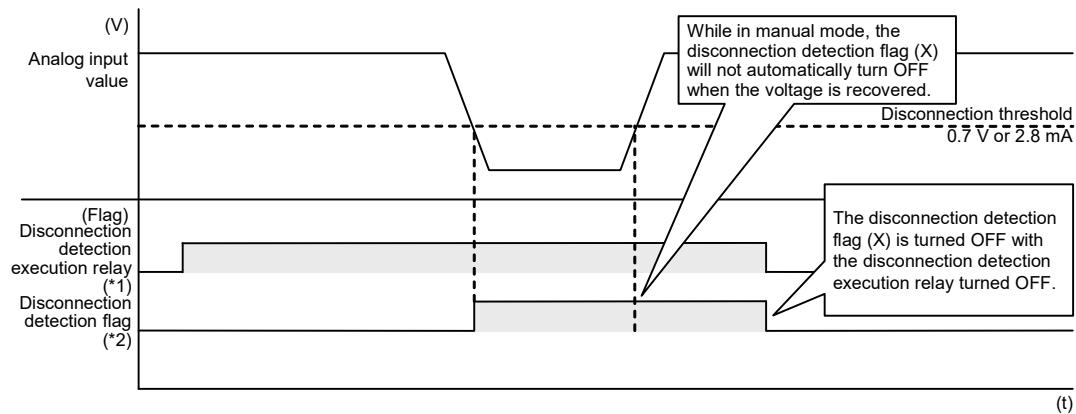
■ **I/O allocation**

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	CH4	CH5	CH6	CH7
*1 Disconnection detection execution relay	Y100	Y110	Y120	Y130	Y140	Y150	Y160	Y170
*2 Disconnection detection flag	X110	X130	X150	X170	X190	X210	X230	X250

■ **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		(CH0): Controls
DF				< SET >		disconnection detection
				Disconnection		execution function.
				detection		ON: Execute
				execution relay		OFF: Turns OFF
R1				Y100		disconnection detection
DF				< RST >		flag.

(CH0): Controls
disconnection detection
execution function.
ON: Execute
OFF: Turns OFF
disconnection detection
flag.

X110 — Y200 — (CH0): Turns Y200 ON at the time of disconnection detection.

Disconnection
detection flag
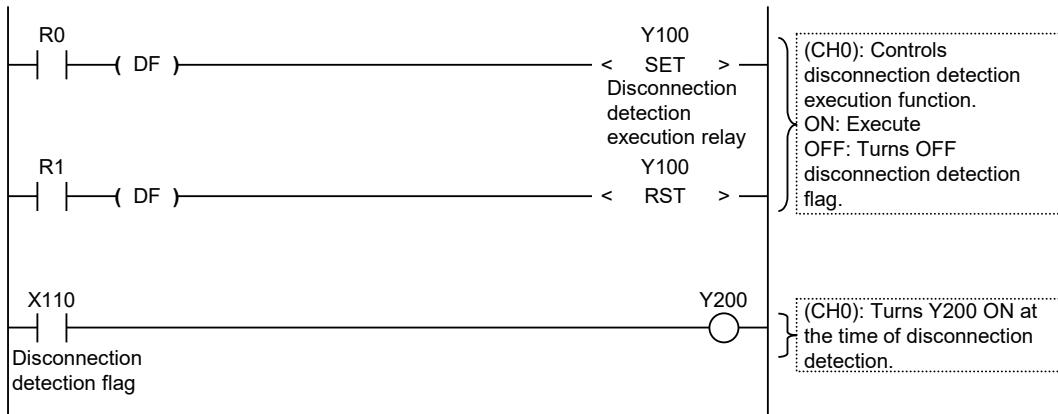
ℹ Info.

● The disconnection detection function operates as shown in the following table. Check the range that is used.

Unit type	Range	Disconnection detection function
AFP7AD4H	1 to 5 V or 4 to 20 mA	Valid
	Other numbers	Invalid
AFP7AD8	4 to 20 mA	Valid
	Other numbers	Invalid

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.

| Buffer function configuration | Specify execution conditions (trigger settings, the number of buffer data items, and cycle) |

↓ Buffer function ON

| Starts execution | Starts the buffering of pre-trigger digital conversion values at the specified cycle |

↓ Trigger ON

| Buffering | Starts the buffering of digital conversion values at the specified cycle |

↓ Buffering completion

| Buffer data read | Reads buffer data from the CPU unit |

Executes buffering   Buffer trigger   Completion of acquisition

Digital conversion value

Analog input processing

Pre-trigger data buffering | Post-trigger data buffering

Aligns and stores the contents in the shared memory on completion of acquisition

Buffer (Unit memory)

| CH0 | CH1 | CH2 | CH3 |
| CH0 buffer areas | CH1 buffer areas | CH2 buffer areas | CH3 buffer areas |

ℹ️ Info.

- If the configuration-buffer function setting has 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 (Note 1)	Not use	Select "Use" for the buffer function.
Trigger setting(Note 2)	H0	Select a trigger signal to start buffering when the buffer function is used.
No. of buffer data items	U1000	Set the number of data items (words) to be stored in the buffer. Setting range: 1 to 10000 (AFP7AD4H), 1 to 8000 (AFP7AD8) * 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	U0	Set the number of data items (words) before triggering. Setting range: 1 to 9999 (AFP7AD4H), 1 to 7999 (AFP7AD8) * Set the number of data items before triggering to a value smaller than the number of buffer data items.
Trigger cycle	U1	Set the cycle enabling trigger input. The trigger cycle is obtained from the following formula. For AFP7AD8, only the non-isolated setting is available. At the time of isolation: Set value (1 to 30000) × Enabled number of channels × 5 [ms] At the time of non-isolation: Set value (1 to 30000) × Enabled number of channels × 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

(Note 1)   The name displayed by the tool software is "Buffer function".

(Note 2)   The name displayed by the tool software is "Trigger type".

■ 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.

```
R0                                          Y108
├──┤ ├──( DF )──────────────────────< SET >──
Buffer function                        Buffer execution
execution condition                    relay

R1                                          Y109
├──┤ ├──( DF )──────────────────────────( )──
Buffer trigger                         Trigger input
condition                              relay

X11A
├──┤ ├──( DF )──┬──────────[ MV.UL │ U9999 │ I0 ]
Buffer          │
completion      │
flag            └──[ BKMV.SS │ S1:UM00800 │ S1:I0UM00800 │ DT0 ]

X11A                                        Y10A
├──┤ ├──( DF )──────────────────────────( )──
Buffer                                 Read
completion                             completion
flag                                   relay
```

> Reads 10,000 words from buffer storage area UM00800 of the unit memory for slot 1 and stores the words beginning with DT0.

> Resets the buffer function.

6.7.2 Buffering by Trigger Input Relay

■ Buffering by trigger input relay (YXXX)

The following sequence shows the operation of starting buffer processing with the trigger input 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 will start when the user program turns ON the trigger input relay (YXXX). Buffering will continue until the set number of buffer data items is reached after the trigger input relay is turned ON.
(4)	Buffering will be completed when the set number of buffer data items is reached.
(5)	The user program reads the buffering data and turns ON the read completion relay.
(6)	he 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 CH7 all operate simultaneously with the I/O on CH0.

|	CH0 to CH7
*1 Buffer execution relay	Y108
*2 Trigger input relay	Y109
*3 Pre-trigger data enabled	X11B
*4 Buffering flag	X119
*5 Buffering completion flag	X11A
*6 Read completion relay	Y10A

ℹ️ Info.

- When buffering is started by a trigger, the buffering flag (X119) turns ON. Trigger input is disabled while the buffering flag (X119) remains ON.
- 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.
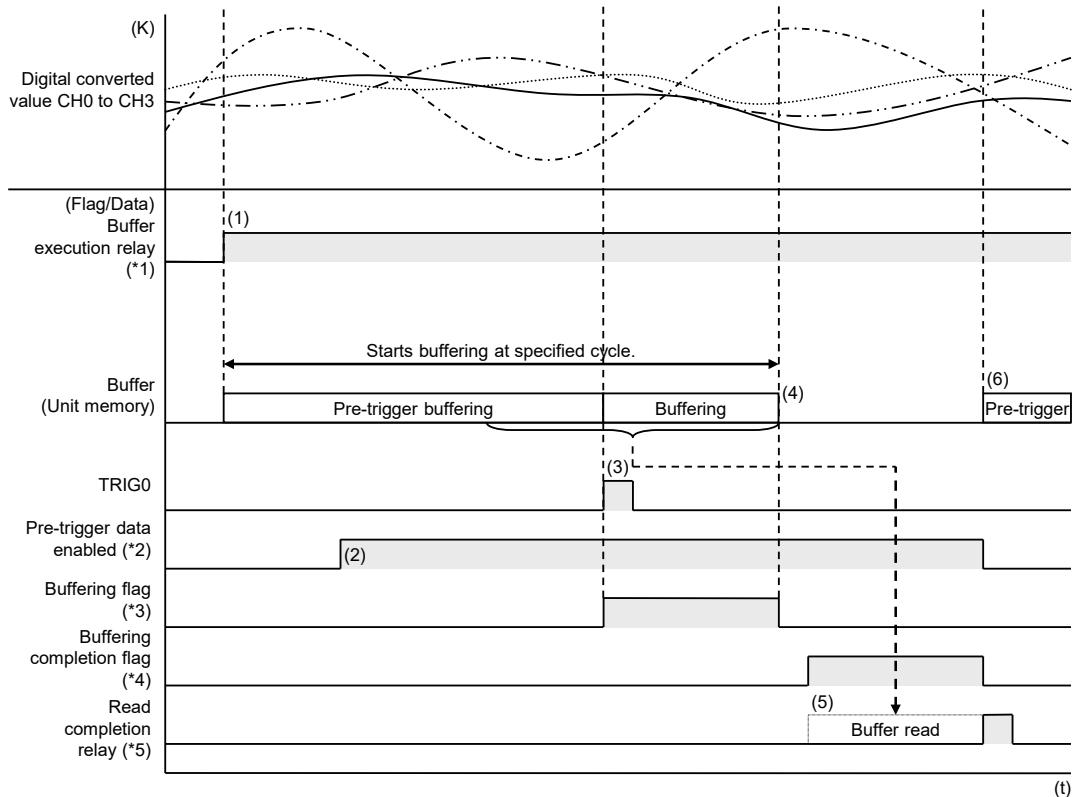
(1)	Pre-trigger buffering will start when the user program turns ON the buffer execution relay.
(2)	The pre-trigger data enabled flag is turned ON when the number of pre-trigger data items is reached.
(3)	Starts buffering with the rising of TRIG0. Buffering will continue until the preset number of buffer data items is reached from the rising of TRIG0.
(4)	Buffering will be completed when the set number of buffer data items is reached.
(5)	The user program reads the buffering data and turns ON the read completion relay.
(6)	he 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 CH7 all operate simultaneously with the I/O on CH0.

|	CH0 to CH7
*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

> ● When buffering is started by a trigger, the buffering flag (X119) turns ON. Trigger input is disabled while the buffering flag (X119) remains ON.
> ● 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 terminal numbers. 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 will be completed when the set number of buffer data items is reached.
(5)	The user program reads the buffering data and turns ON the read completion relay.
(6)	he 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 CH7 all operate simultaneously with the I/O on CH0.

	CH0 to CH7
*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

- When buffering is started by a trigger, the buffering flag (X119) turns ON. Trigger input is disabled while the buffering flag (X119) remains ON.
- 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 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 Using User Programs

■ **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.
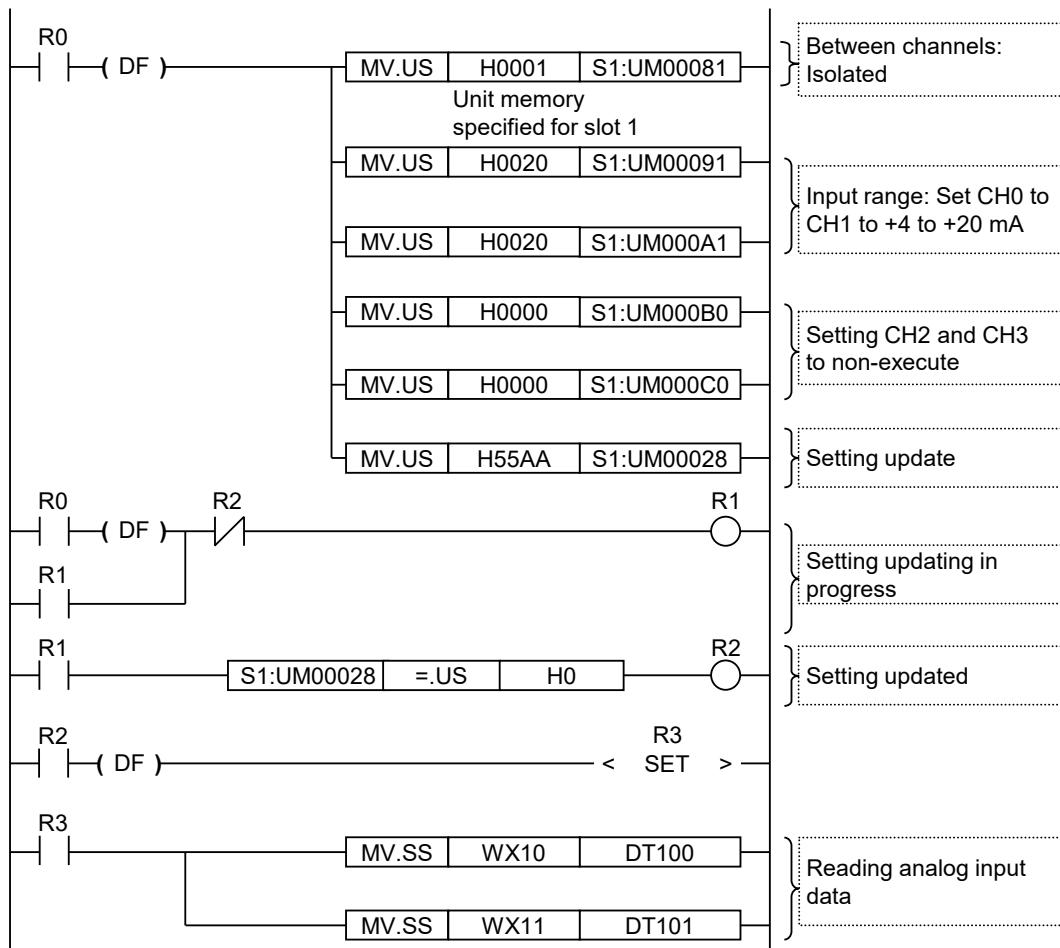
7 What to Do If an Error Occurs

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

7.1.1 Failure in Reading Analog Input Data

■ **Situation**

There is a failure in reading analog input data.

■ **Solution**

1. Check again that I/O allocations are correct.

2. Check again the connections of the terminal block.

3. Check again the configuration settings.

7.1.2 Unstable Analog Input Conversion Value

■ **Situation**

The analog input conversion 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.

7.1.3 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 Specifications

8.1 Specifications

8.1.1 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	Between I/O terminals and power supply terminals of CPU unit/ function earth(Note 1)	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
Vibration resistance	Conforming to JISB3502 and IEC61131-2 5 to 8.4 Hz, 3.5-mm 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 JISB3502 and IEC61131-2 147 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.	
Overvoltage category	Category II	
Pollution degree	Pollution degree: 2	

(Note 1)   Not applicable to AFP7AD8.

8.1.2 Performance Specifications (AFP7AD4H)

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) (Note 3)
	Current	0 to +20 mA (Resolution: 1/31,250)

Items		Description
		+4 to +20 mA (Resolution: 1/25,000) (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 1 MΩ; current input: Approximately 250 Ω
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 gain 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 scale conversion setting 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
Max. / Min. hold		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. (Detection level is 0.7 V or less and 2.8 mA or less.) 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, disconnection detection, and buffer.

(Note 2) 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.

Items		Description
No. of input points		8 channels
Input range (resolution)	Voltage (Note 4)	-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) (Note 3)
	Current	0 to +20 mA (Resolution: 1/31,250) +4 to +20 mA (Resolution: 1/25,000) (Note 3)
Conversion speed		25 µs/Ch (non-isolated)
Total accuracy		±0.1% F.S. max. (at +25°C) and ±0.3% F.S. max. (at 0°C to +55°C)
Input impedance		Voltage input: Approximately 1 MΩ; current input: Approximately 250 Ω
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: Non-isolated
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
	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 gain 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 scale conversion setting 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
Max. / Min. hold		Holding max. / min. values sampled
Disconnection detection		Disconnection detection is possible at the time of setting range of 4 to 20 mA.(Detection level is 2.8 mA or less.) Possible to select auto or manual resetting.
Buffer function		The buffering of up to 8,000 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, conversion execution / non-execution channel, averaging processing, offset / gain, scaling processing, upper / lower limit comparison, holding max. / min. value, disconnection detection, and buffer.

(Note 2)   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.

(Note 4)   If the voltage range is set with AFP7AD8, a digital conversion value equivalent to an analog input of approx. 2 V is saved in the device (WX) for the channels to which no input is connected.

8.2 I/O Allocation

■ Input contact

I/O area No.	Name	Default	Description
WX0	CH0 Analog conversion data	K0	
WX1	CH0 Optional function flag	H0	
WX2	CH1 Analog conversion data	K0	
WX3	CH1 Optional function flag	H0	**Analog conversion data area**
WX4	CH2 Analog conversion data	K0	Digital converted values corresponding to the analog input is stored.
WX5	CH2 Optional function flag	H0	<Voltage range>
WX6	CH3 Analog conversion data	K0	-10 to +10 V: -31,250 to +31,250
WX7	CH3 Optional function flag	H0	0 to +10 V or 0 to +5 V: 0 to +31,250
WX8	CH4 Analog conversion data	K0	+1 to +5 V: 0 to +25,000
WX9	CH4 Optional function flag	H0	<Current range>
WX10	CH5 Analog conversion data	K0	0 to +20 mA: 0 to +31,250
WX11	CH5 Optional function flag	H0	+4 to +20 mA: 0 to +25,000
WX12	CH6 Analog conversion data	K0	**Optional function flag area**
WX13	CH6 Optional function flag	H0	Refer to the table on the "Input contact (Optional functions/Error flag area)".
WX14	CH7 Analog conversion data	K0	
WX15	CH7 Optional function flag	H0	

(Note 1) The I/O numbers in the table indicates offset addresses. The I/O numbers actually allocated are the numbers based on the starting word number allocated to the unit.

Example) When the starting word number for the unit is "10", the A/D conversion data of CH0 is WX10 and the error flag is X11F.

(Note 2) It is A/D conversion data within the specified scale range when setting the scale conversion setting.

(Note 3) If the voltage range is set with AFP7AD8, a digital conversion value equivalent to an analog input of approx. 2 V is saved in the device (WX) for the channels to which no input is connected.

■ Input contact (Optional functions/Error flag area)

I/O number								Name	Description
CH0	CH1	CH2	CH3	CH4	CH5	CH6	CH7		
X10	X30	X50	X70	X90	X110	X130	X150	Disconnection detection flag (Note 3)	ON with disconnection detected and OFF with disconnection restored.
X11	X31	X51	X71	X91	X111	X131	X151	Upper limit comparison relay	Turns ON when the value exceeds the set upper limit.
X12	X32	X52	X72	X92	X112	X132	X152	Lower limit comparison relay	Turns OFF when the value drops below the set lower limit.
X13	X33	X53	X73	X93	X113	X133	X153	Upper / lower limit comparison execution flag	Turns ON when the upper limit/ lower limit comparison function is executed.

I/O number								Name	Description
CH0	CH1	CH2	CH3	CH4	CH5	CH6	CH7		
X14	X34	X54	X74	X94	X114	X134	X154	Not used	Do not use.
X15	X35	X55	X75	X95	X115	X135	X155	Max. / Min. hold execution flag	Turns ON when the max. / min. hold function is executed.
X16 to X17	X36 to X37	X56 to X57	X76 to X77	X96 to X97	X116 to X117	X136 to X137	X156 to X157	Not used	Do not use.
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	X9C to X9E	X11C to X11E	X13C to X13E	X15C to X15E	Not used	Do not use.
X1F	X3F	X5F	X7F	X9F	X11F	X13F	X15F	Error flag	Turns ON when an error occurs.

(Note 1)   The I/O numbers in the table indicates offset addresses. The I/O numbers actually allocated are the numbers based on the starting word number allocated to the unit.

Example) When the starting word number for the unit is "10", the error flag is X11F.

(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.

(Note 3)   The disconnection detection is valid only when selecting the following ranges.

Unit type	Range
AFP7AD4H	1 to 5 V or 4 to 20 mA
AFP7AD8	4 to 20 mA

■ Output contact (Optional functions/Error flag area)

I/O number								Name	Description
CH0	CH1	CH2	CH3	CH4	CH5	CH6	CH7		
Y0	Y10	Y20	Y30	Y40	Y50	Y60	Y70	Disconnection detection execution relay (Note 3)	ON to execute the disconnection detection function. OFF to turn OFF the disconnection detection flag (Xn0). (Valid only for 1 to 5 V or 4 to 20 mA range)
Y1	Y11	Y21	Y31	Y41	Y51	Y61	Y71	Not used	Do not use.
Y2	Y12	Y22	Y32	Y42	Y52	Y62	Y72		
Y3	Y13	Y23	Y33	Y43	Y53	Y63	Y73	Upper / 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	Y44	Y54	Y64	Y74	Not used	Do not use.
Y5	Y15	Y25	Y35	Y45	Y55	Y65	Y75	Max. / Min. hold execution relay	ON to execute the max./min. hold function.
Y6	Y16	Y26	Y36	Y46	Y56	Y66	Y76	Not used	Do not use.
Y7	Y17	Y27	Y37	Y47	Y57	Y67	Y77		
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 input relay	When OFF is switched to ON by a user program, buffering will start. This operation is enabled when "Trigger input relay" is selected as a trigger.
YA	-	-	-	-	-	-	-	Buffer data read completion relay	ON for one scan upon completion of reading buffer data from the shared memory with a user program. 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	Y4B to Y4E	Y5B to Y5E	Y6B to Y6E	Y7B to Y7E	Not used	Do not use.
YF	Y1F	Y2F	Y3F	Y4F	Y5F	Y6F	Y7F	Error flag reset relay	Resets an error flag.

(Note 1)   The I/O numbers in the table indicates offset addresses. The I/O numbers actually allocated are the numbers based on the starting word number allocated to the unit.

Example) When the starting word number for the unit is "10", the disconnection detection execution relay of CH0 is Y100, and the error flag reset relay is Y10F.

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

(Note 3)   The disconnection detection is valid only when selecting the following ranges.

Unit type	Range
AFP7AD4H	1 to 5 V or 4 to 20 mA
AFP7AD8	4 to 20 mA

8.3 List of Unit Memories

These are operation memories for accessing the "monitor area" and "configuration area" of the unit. When the mode of the CPU unit changes from PROG. to RUN, the configuration information set by the tool software will be stored. For performing the configuration by user programs, refer to "6.8 Configuration Using User Programs".

■ Allocation of unit memories (CH0 to CH3)

Setting monitoring item		Unit memory no. (Hex)			
		CH0	CH1	CH2	CH3
Configuration update		UM 00028			
Isolation between channels		UM 00081 (AFP7AD4H only)			
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 Offset / Gain processing Scale conversion	UM 00092	UM 000A2	UM 000B2	UM 000C2
Function setting 2	Upper / lower limit comparison Holding max. / min. values Disconnection detection Disconnection detection reset	UM 00093	UM 000A3	UM 000B3	UM 000C3
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 / 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

Setting monitoring item		Unit memory no. (Hex)			
		CH0	CH1	CH2	CH3
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	Refer to "P.8-18".			

■ **Allocation of unit memories (CH4 to CH7)**

Setting monitoring item		Unit memory no. (Hex)			
		CH4	CH5	CH6	CH7
Unit memory update		UM 00028			
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 000D0	UM 000E0	UM 000F0	UM 00100
Range setting		UM 000D1	UM 000E1	UM 000F1	UM 00101
Function setting 1	Average processing settings Offset / Gain processing Scale conversion	UM 000D2	UM 000E2	UM 000F2	UM 00102
Function setting 2	Upper / lower limit comparison Holding max. / min. values Disconnection detection Disconnection detection reset	UM 000D3	UM 000E3	UM 000F3	UM 00103
Averaging constant		UM 000D4	UM 000E4	UM 000F4	UM 00104
Offset value		UM 000D5	UM 000E5	UM 000F5	UM 00105
Gain value		UM 000D6	UM 000E6	UM 000F6	UM 00106
Scale conversion	Max. value	UM 000D7	UM 000E7	UM 000F7	UM 00107
	Min. Value	UM 000D8	UM 000E8	UM 000F8	UM 00108
Upper / lower limit comparison	Upper limit comparison ON level	UM 000D9	UM 000E9	UM 000F9	UM 00109
	Upper limit comparison OFF level	UM 000DA	UM 000EA	UM 000FA	UM 0010A
	Lower limit comparison OFF level	UM 000DB	UM 000EB	UM 000FB	UM 0010B
	Lower limit comparison ON level	UM 000DC	UM 000EC	UM 000FC	UM 0010C

Setting monitoring item		Unit memory no. (Hex)			
		CH4	CH5	CH6	CH7
Max. / Min.value hold monitor area	Holding max. value	UM 00184	UM 00185	UM 00186	UM 00187
	Holding min. value	UM 0018C	UM 0018D	UM 0018E	UM 0018F
Buffer function	Hold data storage area	Refer to "P.8-18".			

Info.

● Unit memories (UM) include the areas used in the system. Do not write data with user programs in the areas other than the configuration area.

Unit memory no.	Application	Unit memory no.	Application
UM00000 to UM0007F	Reserved area for the system (UM00028 can be set.)	UM00180 to UM0018F	Monitor area (Read only)
UM00080 to UM0010F	Configuration area	UM00190 to UM007FF	Reserved area for the system
UM00110 to UM0017F	Reserved area for the system	UM00800 to UM0FFFF	Buffer storage area (Read only)

8.4 List of Detailed Specifications of Unit Memories

■ **Common to All Channels**

Unit memory no. (Hex)	Name	Default	Setting range and description
UM 00028	Unit memory update	H0	This is used to rewrite configuration information using a user program. If the constant "55AA" is written to the unit memory UM 00028 after transferring a desired parameter to a unit memory, the settings will be updated. The value of unit memory UM 00028 will be set to "0" when the configuration information is refreshed.
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 setting (AFP7AD4H)	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 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
15-12	Not used	-	
UM 00089	Buffer function Trigger setting (AFP7AD8)	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	

Unit memory no. (Hex)	Name	Default	Setting range and description		
			bit	Name	Description
					H1: Rise of external input trigger
					H2: Fall of external input trigger
					H4: Rising time of analog input level
					H8: Falling time of analog input level
			7-4	Not used	-
			11-8	Input level trigger CH	H0: CH0 H1: CH1 H2: CH2 H3: CH3 H4: CH4 H5: CH5 H6: CH6 H7: CH7
			15-12	Not used	-
UM 0008A	Buffer function No. of buffer data items	U1000	Set the number of data items (words) to be stored in the buffer. Setting range: +1 to +10,000 (AFP7AD4H), +1 to +8,000 (AFP7AD8)		
UM 0008B	Buffer function No. of data items before triggering	U0	Set the number of data items (words) before triggering. Setting range: 0 to +9,999 (AFP7AD4H), 0 to +7,999 (AFP7AD8)		
UM 0008C	Buffer function Trigger cycle	U1	Set the cycle enabling trigger input. The trigger cycle is obtained from the following formula. For AFP7AD8, only the non-isolated setting is available. Isolated: Set value (1 to 30,000) × No. of enabled channels × 5 [ms] Non-isolated: Set value (1 to 30,000) × 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 no. (Hex)	Name	Default	Setting range and description
UM 00090 UM 000A0 UM 000B0 UM 000C0 UM 000D0	Conversion processing Execution/Non-execution	H1	Select the conversion function to be used. H0: Not execute H1: Execute

Unit memory no. (Hex)	Name	Default	Setting range and description		
UM 000E0 UM 000F0 UM 00100					
UM 00091 UM 000A1 UM 000B1 UM 000C1 UM 000D1 UM 000E1 UM 000F1 UM 00101	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 +5V H8: Voltage input +1 to+ 5 V H10: Current output 0 to +20 mA H20: Current input +4 to +20 mA		
UM 00092 UM 000A2 UM 000B2 UM 000C2 UM 000D2 UM 000E2 UM 000F2 UM 00102	Function setting 1 Average processing settings Offset / Gain processing Scale conversion	H0	Select the desired function to be used.		
			bit	Name	Settings
			3-0	Average processing settings	H0: Not execute H1: No. of averaging times H2: Time average H3: Moving average
			7-4	Offset / Gain processing	H0: Not execute H1: Execute
			11-8	Scale conversion	H0: Not execute H1: Execute
			15-12	Not used	-
UM 00093 UM 000A3 UM 000B3 UM 000C3 UM 000D3 UM 000E3 UM 000F3 UM 00103	Function setting 2 Upper / lower limit comparison Holding max. / min. values Disconnection detection Disconnection detection reset	H0	Select the desired function to be used.		
			bit	Name	Settings
			3-0	Upper / lower limit comparison	H0: Not execute H1: Execute
			7-4	Holding max. / min. values	H0: Not execute H1: Execute
			11-8	Disconnection detection	H0: Not execute H1: Execute
			15-12	Disconnection detection reset	H0: Auto (Auto reset for reconnection) H1: Manual

(Note 1)   The unit memory numbers in the above table are listed for CH0 to CH7 in numerical order.

■ **Individual setting area per channel**

Unit memory no. (Hex)	Name	Default	Setting range and description
UM 00094	Averaging constant	U200	Set constants for average processing.

Unit memory no. (Hex)	Name	Default	Setting range and description		
UM 000A4 UM 000B4 UM 000C4 UM 000D4 UM 000E4 UM 000F4 UM 00104			**Function used**	**Settings**	
			Number of averaging times	Times: 2 to 60,000 [times]	
			Time average	Non-isolated: 1 to 1,500 [ms] Isolated: 200 to 60,000 [ms]	
			Moving average	No. of moving average: 2 to 2000 [times]	
UM 00095 UM 000A5 UM 000B5 UM 000C5 UM 000D5 UM 000E5 UM 000F5 UM 00105	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 UM 000D6 UM 000E6 UM 000F6 UM 00106	Gain value	U10000	Set a gain 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 UM 000D7 UM 000E7 UM 000F7 UM 00107	Maximum value of scale conversion	K10000	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 UM 000D8 UM 000E8 UM 000F8 UM 00108	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)		
UM 00099 UM 000A9 UM 000B9 UM 000C9 UM 000D9	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)		

Unit memory no. (Hex)	Name	Default	Setting range and description
UM 000E9 UM 000F9 UM 00109			
UM 0009A UM 000AA UM 000BA UM 000CA UM 000DA UM 000EA UM 000FA UM 0010A	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 UM 000DB UM 000EB UM 000FB UM 0010B	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 UM 000DC UM 000EC UM 000FC UM 0010C	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 1)   The unit memory numbers in the above table are listed for CH0 to CH7 in numerical order.

■ Individual monitor area per channel

Unit memory no. (Hex)	Name	Default	Setting range and description
UM 00180 UM 00181 UM 00182 UM 00183 UM 00184 UM 00185 UM 00186 UM 00187	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	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)

Unit memory no. (Hex)	Name	Default	Setting range and description
UM 0018B UM 0018C UM 0018D UM 0018E UM 0018F			

(Note 1)　The unit memory numbers in the above table are listed for CH0 to CH7 in numerical order.

■ Buffer data storage area per channel (AFP7AD4H)

Unit memory no. (Hex)	Name	Default	Setting range and description
UM 00800 to UM 02F0F	CH0 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 03000 to UM 0570F	CH1 Buffer area	K0	
UM 05800 to UM 07F0F	CH2 Buffer area	K0	
UM 08000 to UM 0A70F	CH3 Buffer area	K0	

### ■ Buffer data storage area per channel (AFP7AD8)

Unit memory no. (Hex)	Name	Default	Setting range and description
UM 00400 to UM 0233F	CH0 Buffer area	K0	Stores buffer data when the buffer function is used. 8,000 words per channel Setting range: -31,250 to +31,250 (specified with a signed integer)
UM 02340 to UM 0427F	CH1 Buffer area	K0	
UM 04280 to UM 061BF	CH2 Buffer area	K0	
UM 061C0 to UM 080FF	CH3 Buffer area	K0	
UM 08100 to UM 0A03F	CH4 Buffer area	K0	
UM 0A040 to UM 0BF7F	CH5 Buffer area	K0	
UM 0BF80	CH6	K0	

Unit memory no. (Hex)	Name	Default	Setting range and description
to UM 0DEBF	Buffer area		
UM 0DEC0 to UM 0FDFF	CH7 Buffer area	K0	

8.5 Dimensions
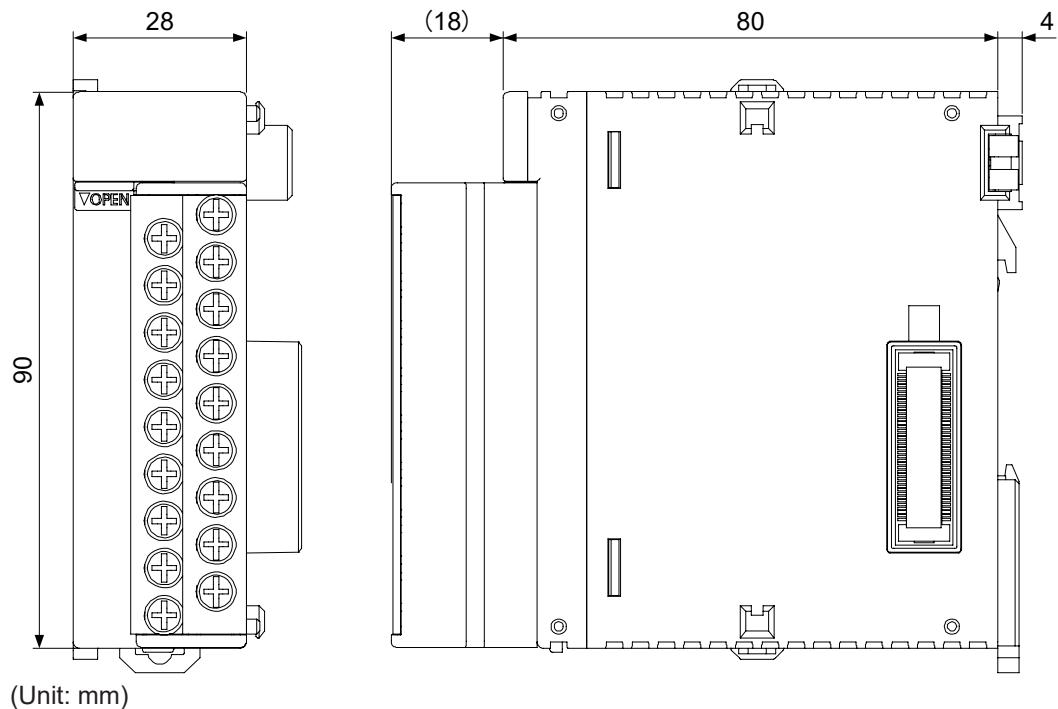
(Unit: mm)

Record of Changes

Date	Manual No.	Record of Changes
December 2012	WUME-FP7AIH-01	1st Edition
February 2013	WUME-FP7AIH-02	2nd Edition ● Corrected errors.
June 2014	WUME-FP7AIH-03	3rd Edition ● Added new model (AFP7AD8) ● Corrected errors.
April 2016	WUME-FP7AIH-04	4th Edition ● Corrected errors. Correction on the disconnection detection function for the AFP7AD8 (Sections 1.1, 4.1, 6.6, 8.1, and 8.2) Correction on the insulation system between channels for the AFP7AD8 (Sections 4.2 and 8.1) Other error corrections
June 2018	WUME-FP7AIH-05	5th Edition ● Corrected errors.
May 2021	WUME-FP7AIH-06	6th Edition ● Changed the manual format.
December 2022	WUME-FP7AIH-07	7th Edition ● Specification change
April 2024	WUME-FP7AIH-08	8th Edition ● Change in Corporate name

Order Placement Recommendations and Considerations

The Products and Specifications listed in this document are subject to change (including specifications, manufacturing facility and discontinuing the Products) as occasioned by the improvements of Products. Consequently, when you place orders for these Products, Panasonic Industry Co., Ltd. asks you to contact one of our customer service representatives and check that the details listed in the document are commensurate with the most up-to-date information.

[Safety precautions]
Panasonic Industry Co., Ltd. is consistently striving to improve quality and reliability. However, the fact remains that electrical components and devices generally cause failures at a given statistical probability. Furthermore, their durability varies with use environments or use conditions. In this respect, check for actual electrical components and devices under actual conditions before use. Continued usage in a state of degraded condition may cause the deteriorated insulation. Thus, it may result in abnormal heat, smoke or fire. Carry out safety design and periodic maintenance including redundancy design, design for fire spread prevention, and design for malfunction prevention so that no accidents resulting in injury or death, fire accidents, or social damage will be caused as a result of failure of the Products or ending life of the Products.

The Products are designed and manufactured for the industrial indoor environment use. Make sure standards, laws and regulations in case the Products are incorporated to machinery, system, apparatus, and so forth. With regard to the mentioned above, confirm the conformity of the Products by yourself.

Do not use the Products for the application which breakdown or malfunction of Products may cause damage to the body or property.
i) usage intended to protect the body and ensure security of life
ii) application which the performance degradation or quality problems, such as breakdown, of the Products may directly result in damage to the body or property
It is not allowed the use of Products by incorporating into machinery and systems indicated below because the conformity, performance, and quality of Products are not guaranteed under such usage.
i) transport machinery (cars, trains, boats and ships, etc.)
ii) control equipment for transportation
iii) disaster-prevention equipment / security equipment
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v) nuclear control system
vi) aircraft equipment, aerospace equipment, and submarine repeater
vii) burning appliances
viii) military devices
ix) medical devices (except for general controls)
x) machinery and systems which especially require the high level of reliability and safety

[Acceptance inspection]
In connection with the Products you have purchased from us or with the Products delivered to your premises, please perform an acceptance inspection with all due speed and, in connection with the handling of our Products both before and during the acceptance inspection, please give full consideration to the control and preservation of our Products.

[Warranty period]
Unless otherwise stipulated by both parties, the warranty period of our Products is three years after the purchase by you or after their delivery to the location specified by you. The consumable items such as battery, relay, filter and other supplemental materials are excluded from the warranty.

[Scope of warranty]
In the event that Panasonic Industry Co., Ltd. confirms any failures or defects of the Products by reasons solely attributable to Panasonic Industry Co., Ltd. during the warranty period, Panasonic Industry Co., Ltd. shall supply the replacements of the Products, parts or replace and/or repair the defective portion by free of charge at the location where the Products were purchased or delivered to your premises as soon as possible.
However, the following failures and defects are not covered by warranty and we are not responsible for such failures and defects.
(1) When the failure or defect was caused by a specification, standard, handling method, etc. which was specified by you.
(2) When the failure or defect was caused after purchase or delivery to your premises by an alteration in construction, performance, specification, etc. which did not involve us.
(3) When the failure or defect was caused by a phenomenon that could not be predicted by the technology at purchasing or contracted time.
(4) When the use of our Products deviated from the scope of the conditions and environment set forth in the instruction manual and specifications.
(5) When, after our Products were incorporated into your products or equipment for use, damage resulted which could have been avoided if your products or equipment had been equipped with the functions, construction, etc. the provision of which is accepted practice in the industry.
(6) When the failure or defect was caused by a natural disaster or other force majeure.
(7) When the equipment is damaged due to corrosion caused by corrosive gases etc. in the surroundings.

The above terms and conditions shall not cover any induced damages by the failure or defects of the Products, and not cover your production items which are produced or fabricated by using the Products. In any case, our responsibility for compensation is limited to the amount paid for the Products.

[Scope of service]
The cost of delivered Products does not include the cost of dispatching an engineer, etc.
In case any such service is needed, contact our sales representative.

Panasonic Industry Co., Ltd.

(MEMO)

February, 2025

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