

Programmable Controller

FP7 Thermocouple Multi-analog Input Unit / FP7 RTD Input Unit

User's Manual

(MEMO)

Introduction

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

Types of Manual

- There are different types of users manual for the FP7 series, as listed below. Please refer to a relevant manual for the unit and purpose of your use.
- The manuals can be downloaded from our 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 Functions)	WUME-FP7CPUSEC
	FP7 CPU Unit User's Manual (LAN Port Communication)	WUME-FP7LAN
Instructions for Built-in LAN Port	FP7 CPU Unit User's Manual (Ethernet Add-ons)	WUME-FP7CPUETEX
	FP7 CPU Unit User's Manual (EtherNet/IP Communication)	See our web site.
	FP7 Web Server Function Manual	See our web site.
	Instructions for Built-in COM Port	
FP7 Extension (Communication) Cassette (RS-232C and RS485 type)	FP7 series Users Manual (SCU communication)	WUME-FP7COM
FP7 Extension (Communication) Cassette (Ethernet type)	FP7 Series User's Manual (Communication Cassette Ethernet Type)	WUME-FP7CCET
FP7 Extension (Function) Cassette Analog Cassette	FP7 Analog Cassette Users Manual	WUME-FP7FCA
FP7 Digital Input/Output Unit	FP7 Digital Input/Output Unit Users Manual	WUME-FP7DIO
FP7 Analog Input Unit	FP7 Analog Input Unit Users Manual	WUME-FP7AIH
FP7 Analog Output Unit	FP7 Analog Output Unit Users Manual	WUME-FP7AOH
FP7 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 Users Manual	WUME-FP7MXY
FP7 High-speed counter Unit	FP7 High-speed counter Unit Users Manual	WUME-FP7HSC
FP7 Pulse Output Unit	FP7 Pulse Output Unit Users Manual	WUME-FP7PG

Unit name or purpose of use	Manual name	Manual code
FP7 Positioning Unit	FP7 Positioning Unit Users Manual	WUME-FP7POSP
FP7 Serial Communication Unit	FP7 series Users Manual (SCU communication)	WUME-FP7COM
PHLS System	PHLS System Users Manual	WUME-PHLS
Programming software FPWIN GR7	FPWIN GR7 Introduction Guidance	WUME-FPWINGR7

SAFETY PRECAUTIONS

- To prevent accidents or personal injuries, please be sure to comply with the following items.
- Prior to installation, operation, maintenance and check, please read this manual carefully for proper use.
- Before using, please fully understand the knowledge related to the equipment, safety precautions and all other precautions.
- Safety precautions are divided into two levels in this manual: Warning and Caution.

⚠ WARNING Incorrect operation may lead to death or serious injury.

- Take appropriate safety measures to the external circuit of the product to ensure the security of the whole system in case of abnormalities caused by product failure or external.
- Do not use this product in areas with inflammable gases.
Otherwise it may lead to an explosion.
- Do not put this product into a fire.
Otherwise it could cause damage to the battery or other electronic parts.

⚠ CAUTION Incorrect operation may lead to injury or material loss.






- To prevent the excessive exothermic heat or smoke generation of the product, a certain margin is required for guaranteed characteristics and performance ratings of relative products.
- Do not decompose or transform it.
Otherwise it will lead to the excessive exothermic heat or smoke generation of the product.
- Do not touch terminal blocks during power-on.
Otherwise it may result in an electric shock.
- Set an emergency stop and interlock circuit in the external devices.
- Connect wires and connectors reliably.
Otherwise it may lead to the excessive exothermic heat or smoke generation of the product.
- Do not undertake construction (such as connection and disconnection) while the power supply is on.
It could lead to an electric shock.
- If the equipment is used in a manner not specified by the Panasonic, the protection provided by the equipment may be impaired.
- This product has been developed/produced 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.

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

(MEMO)

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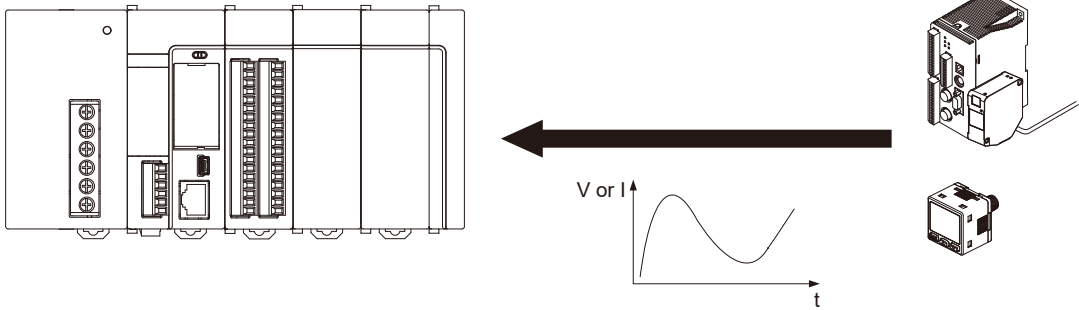
1 Unit Functions and Restrictions

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1.1 Unit Functions and How They Work

1.1 Unit Functions and How They Work

1.1.1 Functions of Unit



- **Analog input control is available in combination with the CPU unit.**
 - Temperature data measured by a thermocouple or resistance temperature detector (RTD) is converted as digital values.
- **Input with simple programs**
 - For input data, digital conversion values are read as input devices (WX).
 - At the time of the thermocouple input or the RTD input, temperatures are read as integer values in units of 0.1 degrees.
- **Ten types of thermocouples and three types of RTDs are supported for each channel.**
 - Ten types of thermocouples (K, J, T, N, R, S, B, E, PLII and WRe5-26) and three types of RTDs (Pt100, JPt100 and Pt1000) can be used. Also, on the thermocouple multi-analog input unit, they can be used in combination with voltage and current inputs.
 - Types of temperature sensors can be changed by the settings of tool software or user programs.
- **Various optional settings**

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

Function	Specifications
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 setting	Offset value (added correction) and gain value (magnification correction) adjustments are made to store processed data in the I/O area.
Scale conversion setting	(Only the voltage and current ranges of the thermocouple multi-analog input unit) This function makes it possible to convert values to an easy-to-use data range. Analog input data acquired in a range between preset minimum and maximum values is scale converted and stored in the I/O area. This function is convenient if used for scale unit conversion.

1.1 Unit Functions and How They Work

Function	Specifications
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 maximum/minimum value hold setting is enabled, and stores the values in provided unit memories for each channel.
Disconnection detection	(Thermocouple multi-analog input unit) Turns ON the disconnection detection flag when input is disconnected or unconnected when selecting the thermocouple or the range of 1-5 V 4-20 mA, and warns of the error state. Also, in case of thermocouple, converts values to digital values in the range (K30000) which are different from those normally converted.
	(RTD input unit) When a line connected to the RTD input terminal is disconnected, converts values to digital values in the range (K30000) which are different from those normally converted, and warns of the error state. (Note 1)

(Note 1) The specifications of the disconnection detection function of the RTD input unit have been changed from the lot manufactured in November 2016 (production lot nos. 161100 or more). For details, refer to "6.7 Disconnection Detection (AFP7RTD8)".

1.1.2 Unit Type and Product Number

Name	Specifications	Product No.
Thermocouple Multi-analog Input Unit	8-ch input Thermocouple input range: K1, K2, J1, J2, T, N, R, S, B, E, PLII, WRe5-26 Voltage input range: -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	AFP7TC8
RTD Input Unit	8-ch input RTD input range: Pt100-1, Pt100-2, JPt100-1, JPt100-2, Pt1000	AFP7RTD8

1.2 Restrictions on Combinations of Units

1.2 Restrictions on Combinations of Units

1.2.1 Restrictions on Power Consumption

The internal current consumption of the unit is as follows. 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 this unit.

Name	Product No.	Consumption current
Thermocouple Multi-analog Input Unit	AFP7TC8	80mA or less
RTD Input Unit	AFP7RTD8	65mA or less

1.2.2 Applicable Versions of Unit and Software

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

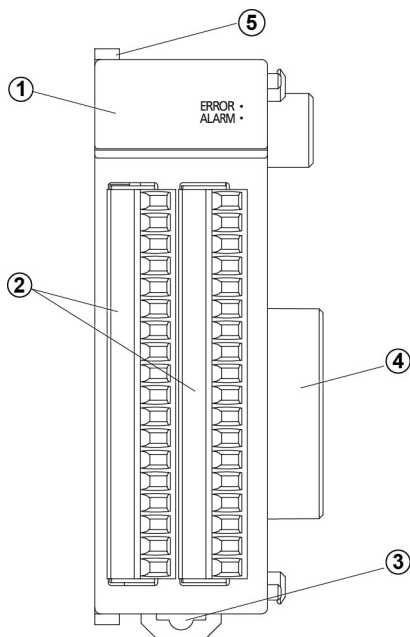
Name	Product No.	Applicable versions		
		CPU unit		FPWINGR7
		CPS4* CPS3*	CPS2*	
Thermocouple Multi-analog Input Unit	AFP7TC8	Ver.2.0 or later	Ver.1.0 or later	Ver.2.2 or later
RTD Input Unit	AFP7RTD8			

2 Names and Functions of Parts

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2.1 Thermocouple Multi-analog Input Unit and RTD Input Unit

2.1 Thermocouple Multi-analog Input Unit and RTD Input Unit



■ Names and Functions of Parts

(1) Operation monitor LED

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

(2) Analog input terminal block

The terminal block is removable. Remove the terminal block before wiring.

(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 highly-functional units.

(5) Fixing hook

This hook is used to secure the unit with another unit.

3 Wiring

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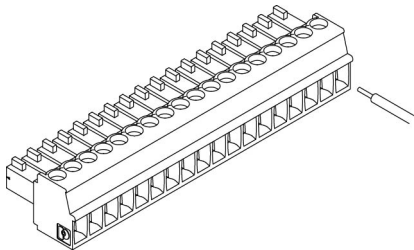
3.1 Wiring of Terminal Block

3.1 Wiring of Terminal Block

3.1.1 Terminal Block, Suitable Wires and Tools

■ Supplied terminal block and suitable wires

A screw-down connection type is used for the terminal block. Use the following suitable wires for the wiring.



Terminal block socket

No. of pins	Phoenix Contact model No.	
	Part number	Product No.
18 pins	MC1,5/18-ST-3,5BK	1840528

Suitable wires (strand wire)

No. of wires	Size	Nominal cross-sectional area
1	AWG#28 to 16	0.08 mm ² to 1.25 mm ²
2	AWG#28 to 20	0.08 mm ² to 0.5 mm ²

Pole terminals with compatible insulation sleeve

If a pole terminal is being used, the following models (made by Phoenix Contact) should be used.

Manufacturer	Cross-sectional area	Size	Phoenix Contact Par No.	
			With insulating sleeve	Without insulating sleeve
Phoenix Contact	0.25 mm ²	AWG#24	AI 0,25-6 BU	A 0,25-7
	0.34 mm ²	AWG#22	AI 0,34-6TQ	A 0,34-7
	0.50 mm ²	AWG#20	AI 0,5-6 WH	A 0,5-6
	0.75 mm ²	AWG#18	AI 0,75-6 GY	A 0,75-6
	1.00 mm ²	AWG#16	-	A 1-6
	0.5 mm ² ×2	AWG#20×2	AI-TWIN 2X 0,5-8 WH	-

Pressure welding tool for pole terminals

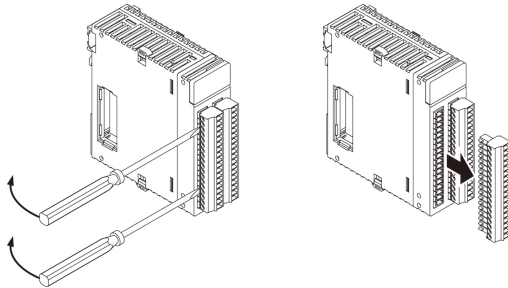
Manufacturer	Phoenix Contact model No.	
	Part number	Product No.
Phoenix Contact	CRIMPFOX 6	1212034

3.1.2 Wiring

■ Wiring method

1 2 Procedure

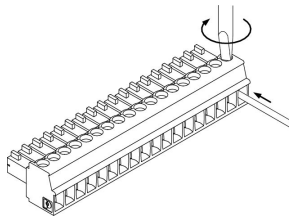
1. Insert a screwdriver between the terminal block and the case, and remove the terminal block.



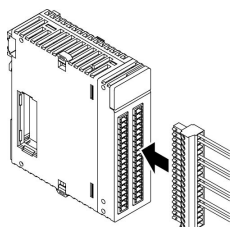
2. Remove a portion of the wire's insulation.



3. Insert the wire into the terminal block until it contacts the back of the block socket, and then tighten the screw clockwise to fix the wire in place.



4. Fit the terminal block into the unit securely.



3.1 Wiring of Terminal Block

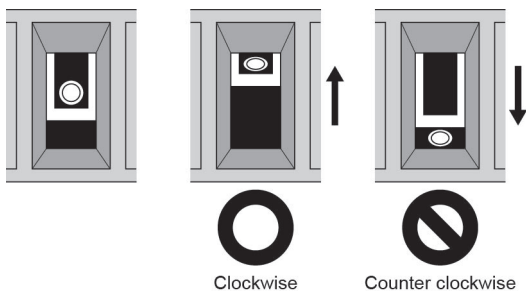
Tightening the terminal block

- When tightening the terminals of the terminal block, use a screwdriver (Phoenix Contact, Product No. 1205037) with a blade size of 0.4 x 2.5 (Part No. SZS 0,4x2,5).
- The tightening torque should be 0.22 to 0.25 N·m.

Precautions on wiring

The following precautions should be observed, to avoid broken or disconnected wires.

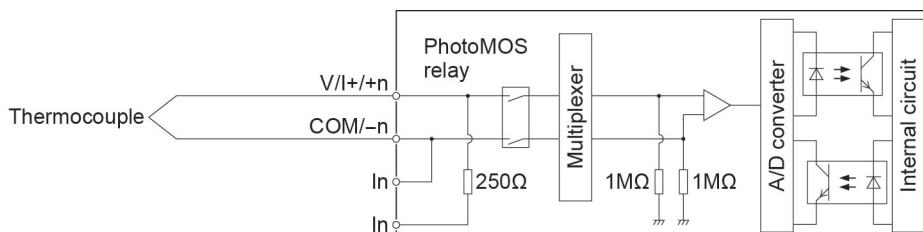
- When removing the wire's insulation, be careful not to scratch the core wire.
- Do not twist the wires to connect them.
- Do not solder the wires to connect them. The solder may break due to vibration.
- After wiring, make sure stress is not applied to the wire.
- In the terminal block socket construction, if the wire is fastened upon counter-clockwise rotation of the screw, the connection is faulty. Disconnect the wire, check the terminal hole, and then re-connect the wire.



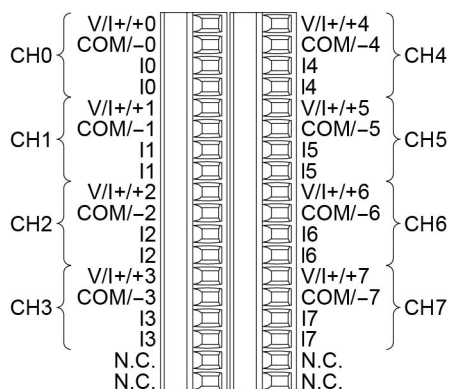
3.2 Connection of Thermocouple Multi-analog Input Unit

3.2.1 For Thermocouple Input

■ Wiring Diagram and Internal Circuit Diagram



■ Terminal layout



(Note 1) Do not connect anything to N.C terminals.

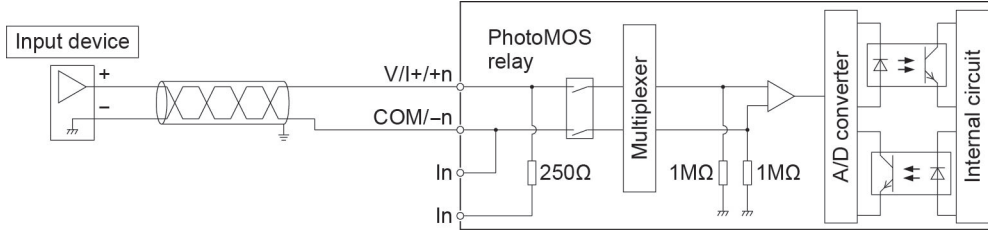
Note

- Connect wires in accordance with the polarity of the thermocouple. Also, when extending the signal line of the thermocouple, use the compensating lead wire for the used thermocouple. It is recommended to ground the unit using the shielded compensating lead wire.
- 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.

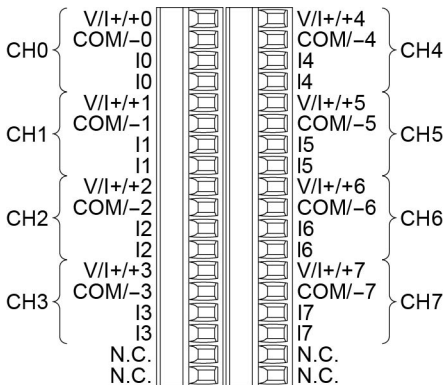
3.2 Connection of Thermocouple Multi-analog Input Unit

3.2.2 For Voltage Input

Wiring Diagram and Internal Circuit Diagram



Terminal layout



(Note 1) Do not connect anything to N.C terminals.

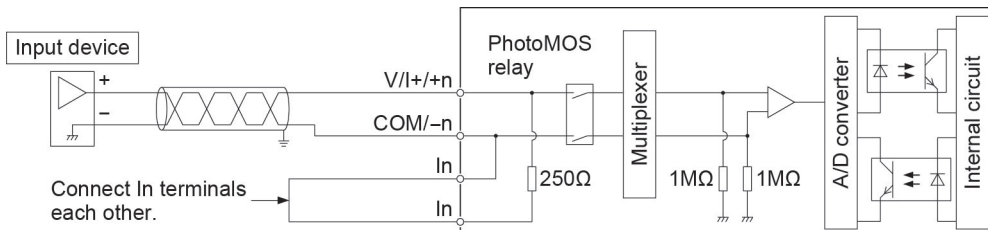
Note

- 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.

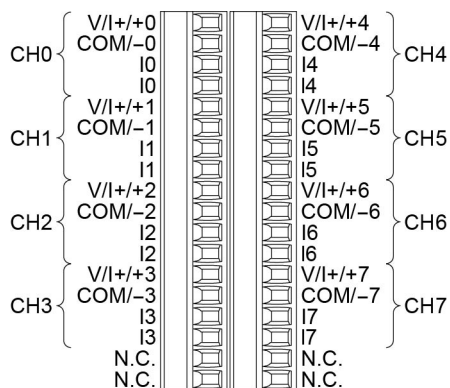
3.2.3 For Current Input

Wiring Diagram and Internal Circuit Diagram

In case of the current input, connect In terminals each other.



■ Terminal layout



(Note 1) Do not connect anything to N.C terminals.

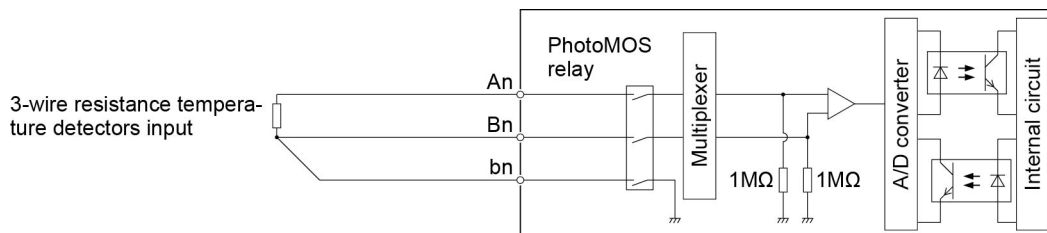
Note

- 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.

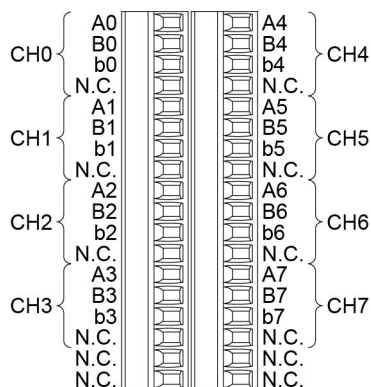
3.3 Connection of RTD Input Unit

3.3 Connection of RTD Input Unit

■ Wiring Diagram and Internal Circuit Diagram



■ Terminal layout



(Note 1) Do not connect anything to N.C terminals.

■ Note

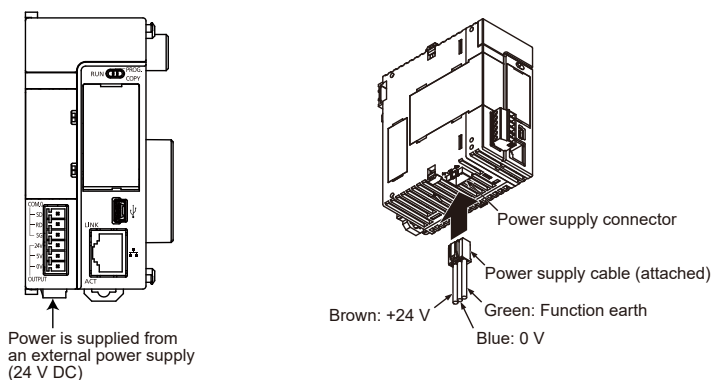
- For copper wires for wiring, use thick wires having insulation performance of JISC3307 and JISC3401 or equivalents to prevent a large increase in the electric resistance. It is recommended to ground the unit using the shielded compensating lead wire.
- Do not have the analog input wiring close to AC wires, power wires, or load line from a device other than PLC. Also, do not bundle it with them.

3.4 Connection of CPU Unit Function Earth

For using the TC Multi-analog Input Unit (AFP7TC8) or RTD Input Unit (AFP7RTD8), ground the function earth of the CPU unit.

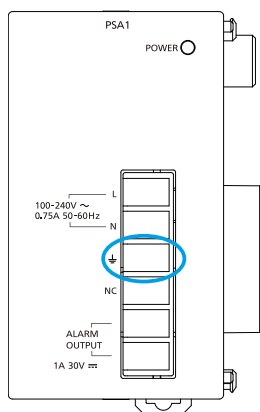
■ When using the CPU unit while supplying 24 V DC power

- The function earth wire of the power supply cable should be grounded.



■ When using the power supply unit

- The function earth terminal of the power supply unit should be grounded.



i Info.

- For details of the grounding method, refer to "4.2 Wiring the Power Supply" of *FP7 CPU Unit User's Manual (Hardware)*.

(MEMO)

4 Unit Settings and Data Reading

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

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

4.1.1 Occupied I/O Area and I/O Allocation

- 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 number	Name	Default	Description
WX0	CH0 Analog conversion data	K0	<p>Analog conversion data area Digital conversion values corresponding to analog input are stored as 16-bit signed integer data. Stored values vary by ranges. When optional average processing, scale conversion, offset/gain processing has been set, data after the processing is stored.</p> <p>Optional function flag area Refer to the next page.</p>
WX1	CH0 Optional function flag	H0	
WX2	CH1 Analog conversion data	K0	
WX3	CH1 Optional function flag	H0	
WX4	CH2 Analog conversion data	K0	
WX5	CH2 Optional function flag	H0	
WX6	CH3 Analog conversion data	K0	
WX7	CH3 Optional function flag	H0	
WX8	CH4 Analog conversion data	K0	
WX9	CH4 Optional function flag	H0	
WX10	CH5 Analog conversion data	K0	
WX11	CH5 Optional function flag	H0	
WX12	CH6 Analog conversion data	K0	
WX13	CH6 Optional function flag	H0	
WX14	CH7 Analog conversion data	K0	
WX15	CH7 Optional function flag	H0	

(Note 1) The I/O numbers in the table indicate 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.

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

■ 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 2)(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.
X14	X34	X54	X74	X99	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 X1E	X36 to X3E	X56 to X5E	X76 to X7E	X96 to X9E	X116 to X11E	X136 to X13E	X156 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 indicate 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, the disconnection detection execution relay of CH0 is Y100, and the error flag reset relay is Y10F.

(Note 2) For the Thermocouple Multi-analog Input Unit, the disconnection detection function is valid in the case of the following range; "Thermocouple, voltage: 1-5 V and current: 4-20 mA".

(Note 3) On the RTD input unit (AFP7RTD8), the disconnection detection execution relay and the disconnection detection flag cannot be used. Disconnection is detected by a digital value (K30000) different from normally converted values within the range.

■ Output flag

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 2)(Note 3)}	ON to execute the disconnection detection function. OFF to turn OFF the disconnection detection flag (Xn0).
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	ON to execute the function to compare the upper and lower limits.

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

I/O number								Name	Description
CH0	CH1	CH2	CH3	CH4	CH5	CH6	CH7		
								Comparison execution relay	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 to YE	Y16 to Y1E	Y26 to Y2E	Y36 to Y3E	Y46 to Y4E	Y56 to Y5E	Y66 to Y6E	Y76 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 indicate 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, the disconnection detection execution relay of CH0 is Y100, and the error flag reset relay is Y10F.

(Note 2) For the Thermocouple Multi-analog Input Unit, the disconnection detection function is valid in the case of the following range; "Thermocouple, voltage: 1-5 V and current: 4-20 mA".

(Note 3) On the RTD input unit (AFP7RTD8), the disconnection detection execution relay and the disconnection detection flag cannot be used. Disconnection is detected by a digital value (K30000) different from normally converted values within the range.

4.1.2 Confirming Allocation of I/O Numbers

- The I/O numbers and base word numbers are necessary when creating programs. Always check to see if the numbers match the design.
- The I/O numbers allocated to the analog input unit are determined by the starting word numbers.

■ Allocation method

Take the following procedure to set the starting word number.

1 2 Procedure

1. Select **Options>FP7 Configuration>I/O map** in the menu bar.
The "I/O map setting" dialog box will be displayed.
2. Double-click a desired slot.
The "Unit selection" dialog box is displayed.
3. Select "Analog I/O" for Unit type and select the unit used, and press the [OK] button.

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

Unit selection [Slot No. 1]

Select unit to use _____

Unit type: Analog I/O

Unit name: -

Input time constant: _____

Installation location setting: _____

Starting word No. 10 (0 - 511)

Number of input words: 0 (0 - 128)

Number of output words: 0 (0 - 128)

Option _____

Exclude this unit from the target for verification.

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

OK

Cancel

The selected unit is now registered in the I/O map.

Slot No.	Product No.	Unit used	Head	Input	Outp...	Veri...	Refresh	Time ...	Consum...
<input type="checkbox"/>	0	AFP7CPS41E	FP7 CPU unit	0	10	10	Valid	Valid	200mA
<input checked="" type="checkbox"/>	1	AFP7TC8	Thermocouple multi a	10	16	8	Valid	Valid	80mA
<input type="checkbox"/>	2	AFP7RTD8	RTD input unit	26	16	8	Valid	Valid	65mA

4.2 Configuration Settings

4.2 Configuration Settings

4.2.1 Unit Configuration

The settings for the unit such as input range, channels to be converted and optional functions are specified in the configuration menu of tool software.

■ Setting method

The following procedure describes the process when the thermocouple multi-analog input unit or RTD input unit has been already allocated in the I/O map.

1 2 Procedure

1. Select **Options>FP7 Configuration** in the menu bar.
2. Select "I/O Map" in the field.
3. Select the slot where the unit has been registered, and press the [Advanced] button.
" Thermocouple multi-analog input unit or RTD input unit setting" dialog box is displayed.
4. Select items according to the conditions used.
Select optional settings as necessary.
5. Click the [OK] button.
The set values will be effective when they are downloaded with programs as a project.

Settings

Group	Setting item	Settings	Default
Basic setting item (Common)	Power frequency	60Hz/50Hz	60 Hz
	Conversion time ^(Note 1)	25ms/5ms	25 ms
Basic setting item (for each channel)	Conversion processing	Execute/Not execute	Execute
	Range setting (TC unit)	Thermocouple K1 (-100.0 to 600.0°C) K2 (-200.0 to 1370.0°C) ^(Note 2) J1 (-100.0 to 400.0°C) J2 (-200.0 to 1200.0°C) ^(Note 2) T (-270.0 to 400.0°C) N (-270.0 to 1300.0°C) R (0.0 to 1760.0°C) S (0.0 to 1760.0°C) B (0.0 to 1820.0°C) E (-270.0 to 1000.0°C) PLII (0.0 to 1390.0°C) WRe5-26 (0.0 to 2315.0°C)	-10 to +10 V
		Voltage	

4.2 Configuration Settings

Group	Setting item	Settings	Default
		-100 to +100 mV	
	Current	0 to +20 mA +4 to +20 mA	
	Range setting (RTD unit)	Pt100-1 (-100.0 to 200.0°C) Pt100-2 (-200.0 to 650.0°C) JPt100-1 (-100.0 to 200.0°C) JPt100-2 (-200.0 to 650.0°C) Pt1000 (-100.0 to 100.0°C)	Pt100-1 (-100.0 to 200.0°C)
Option Setting (for each 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 ^(Note 3)	Not execute/Execute	Not execute
	Comparison for Upper and Lower Limits	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	No. of times: 2 to 60000 [times]	8
		Time: 200 to 60000 [ms]	200
		Moving: 3 to 64 [times]	8
	Offset value	-3000 to +3000	0
	Gain value	+9000 to +11000	+10000
	Maximum value of scale conversion ^(Note 3)	-30000 to +30000	+10000
	Minimum value of scale conversion ^(Note 3)	-30000 to +30000	0
	Upper limit comparison ON level	-31250 to +31250	+1000
	Upper limit comparison OFF level	-31250 to +31250	+1000
Lower limit comparison ON level	-31250 to +31250	0	
Lower limit comparison OFF level	-31250 to +31250	0	

(Note 1) Conversion time can be set only when selecting the thermocouple multi-analog input unit.

(Note 2) For the Thermocouple Multi-analog Input Unit of Ver. 1.0, the K2 range is -200.0 to 1000.0°C, and J2 range is -200.0 to 750.0°C.

(Note 3) Scale conversion can be set only when selecting voltage or current range in the thermocouple multi-analog input unit.

4.2 Configuration Settings

4.2.2 Unit Setting and Conversion Processing Time

Conversion time varies with the configuration setting conditions.

■ Unit's conversion process cycle time

- The unit's conversion time is determined by the number of channels that the conversion process is executed.
- For the thermocouple multi-analog input unit, a conversion time per channel can be selected.

Normal mode (When conversion time is 25 ms/ch)		High-speed mode (When conversion time is 5 ms/ch) ^(Note 2)	
No. of executed channels ^(Note 1)	Conversion time + Processing time	No. of executed channels ^(Note 1)	Conversion time + Processing time
1	25 ms +25 ms	1	5 ms +5 ms
2	50 ms +25 ms	2	10 ms +5 ms
3	75 ms +25 ms	3	15 ms +5 ms
4	100 ms +25 ms	4	20 ms +5 ms
5	125 ms +25 ms	5	25 ms +5 ms
6	150 ms +25 ms	6	30 ms +5 ms
7	175 ms +25 ms	7	35 ms +5 ms
8	200 ms +25 ms	8	40 ms +5 ms

(Note 1) Channels to execute the conversion processing are set in the unit memories (UM00080/UM00090/UM000A0/UM000B0/UM000C0/UM000D0/UM000E0/UM000F0).

(Note 2) Conversion time can be set only when selecting the thermocouple multi-analog input unit. It is set in the unit memory (UM00071).

■ Normal mode and High-speed mode

- In the normal mode (conversion time: 25 ms/c), a process is available to reduce the effects of commercial frequency (50Hz/60Hz) noises by a digital filter. In the high-speed mode (conversion time: 5 ms/ch), this process is not available.
- When there are effects of commercial frequency (50Hz/60Hz) noises, it is recommended to use the normal mode.

■ 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 two channels (with CH2 to CH7 excluded)

Conversion is executed in the order of ch0→ch1→ch0→ch1→ch0→ch1→ch0→ch1..., and the conversion time for CH2 to CH7, which are excluded, is saved.

4.3 Reading Analog Input Data

4.3.1 Reading Analog Input Data

■ Basic operation of analog input processing

(1) Receiving analog input

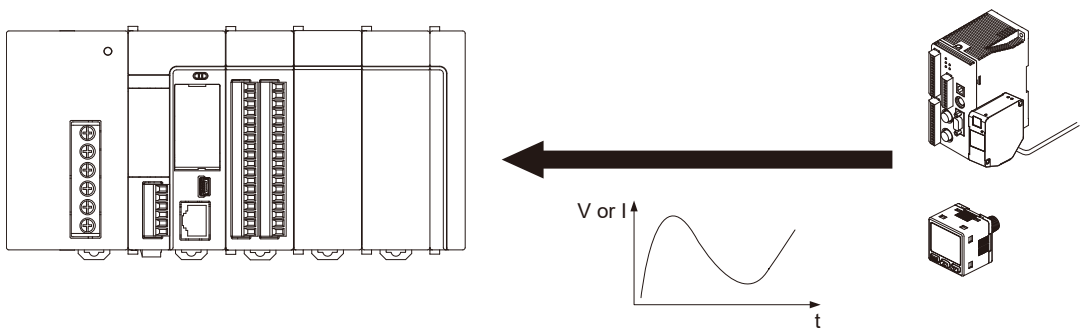
The input part of the unit receives analog input data from the thermocouple, RTD or external devices.

(2) Digital conversion processing

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

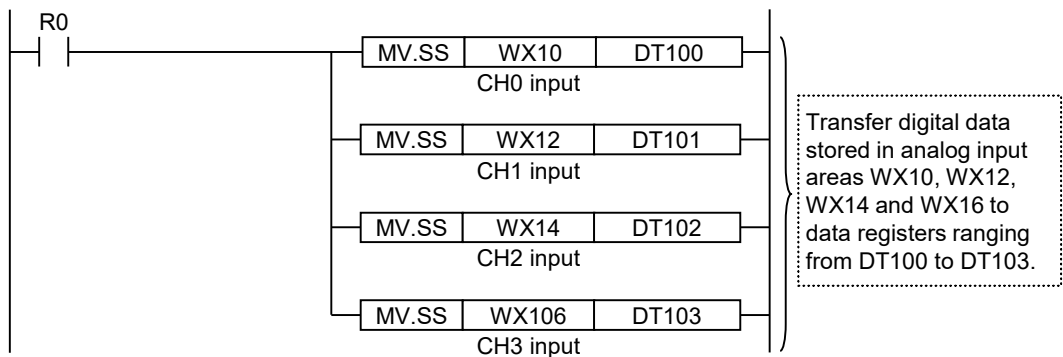
(3) Storage of digital values

A user program is used to read converted digital values as data in the unit 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."



4.4 Data Acquisition Timing

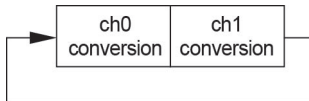
4.4 Data Acquisition Timing

■ Input conversion processing time of the 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

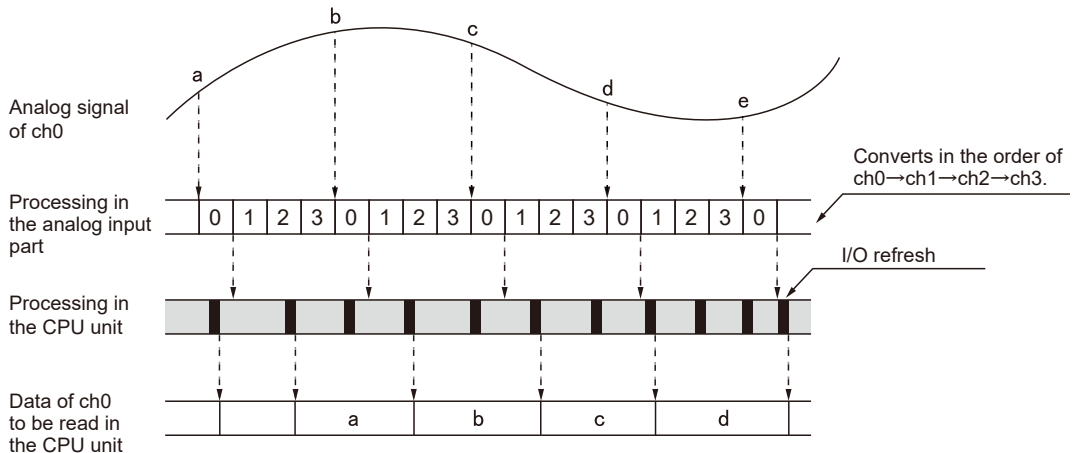
Converted in the order of ch0→ch1→ch0→ch1→...



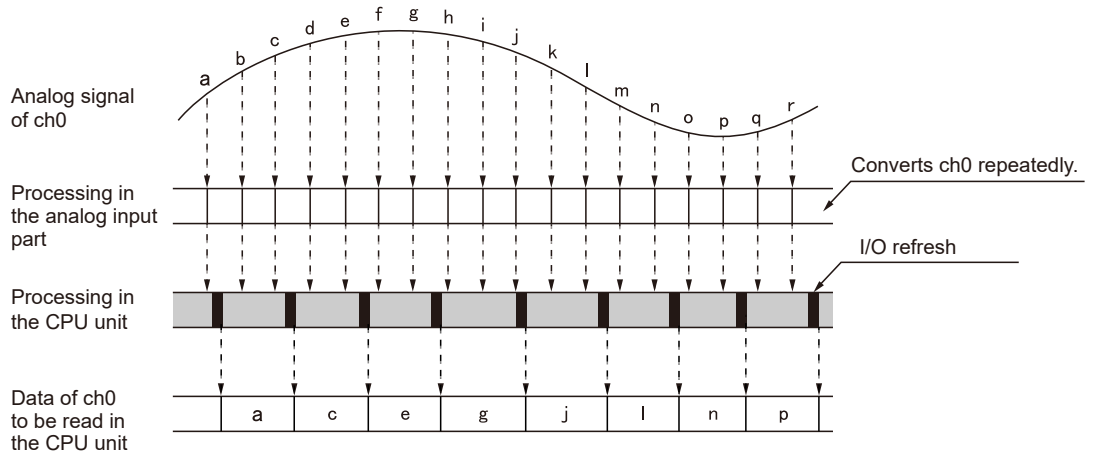
■ Data acquisition timing of CPU unit

- 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

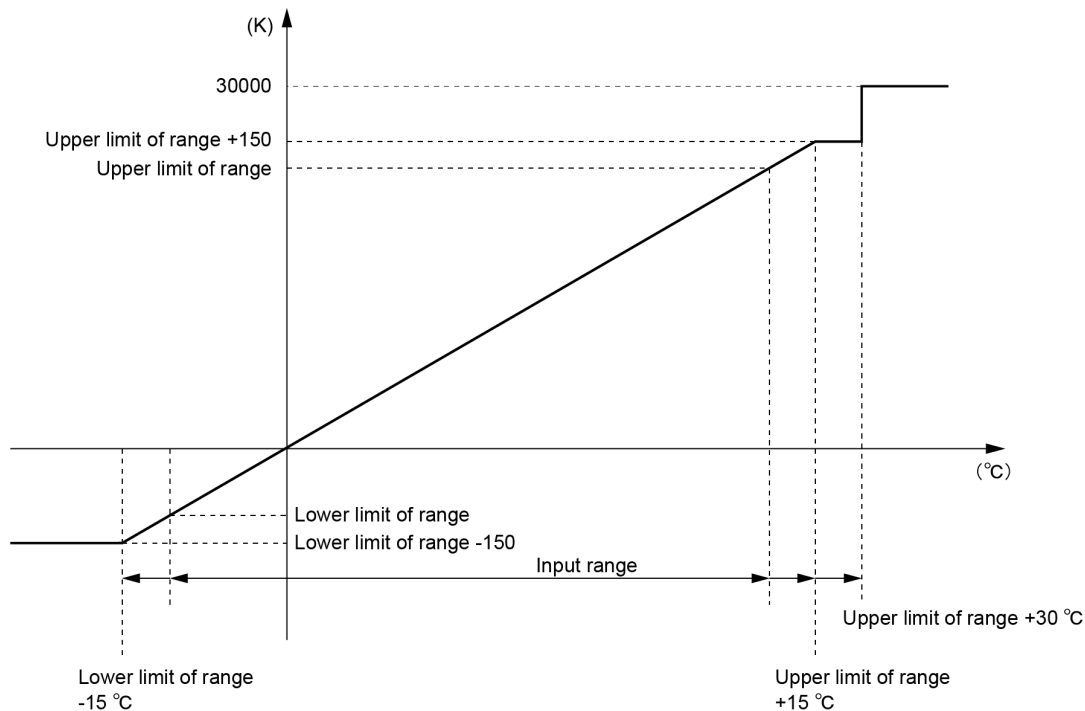
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5.1 Input Conversion Characteristics (AFP7TC8)

5.1 Input Conversion Characteristics (AFP7TC8)

5.1.1 Thermocouple Input Range

■ Conversion characteristics graph



■ When exceeding the rated range

- Up to the lower limit -15°C and the upper limit $+15^{\circ}\text{C}$ of the range, reference values for which the conversion accuracy is not assured are indicated.
- When exceeding the upper limit of the range $+30^{\circ}\text{C}$, converted values are "30000".

Range	Input value	Converted value	Remarks
K1 (Thermocouple type K)	-115°C or less	-1150	
	$+615^{\circ}\text{C}$ or more	+6150	
K2 (Thermocouple type K)	-215°C or less	-2150	
	$+1385^{\circ}\text{C}$ or more	+13850	For the unit Ver. 1.0, the upper limit of the range is $+1000^{\circ}\text{C}$.
J1 (Thermocouple type J)	-115°C or less	-1150	
	$+415^{\circ}\text{C}$ or more	+4150	
J2 (Thermocouple type J)	-215°C or less	-2150	

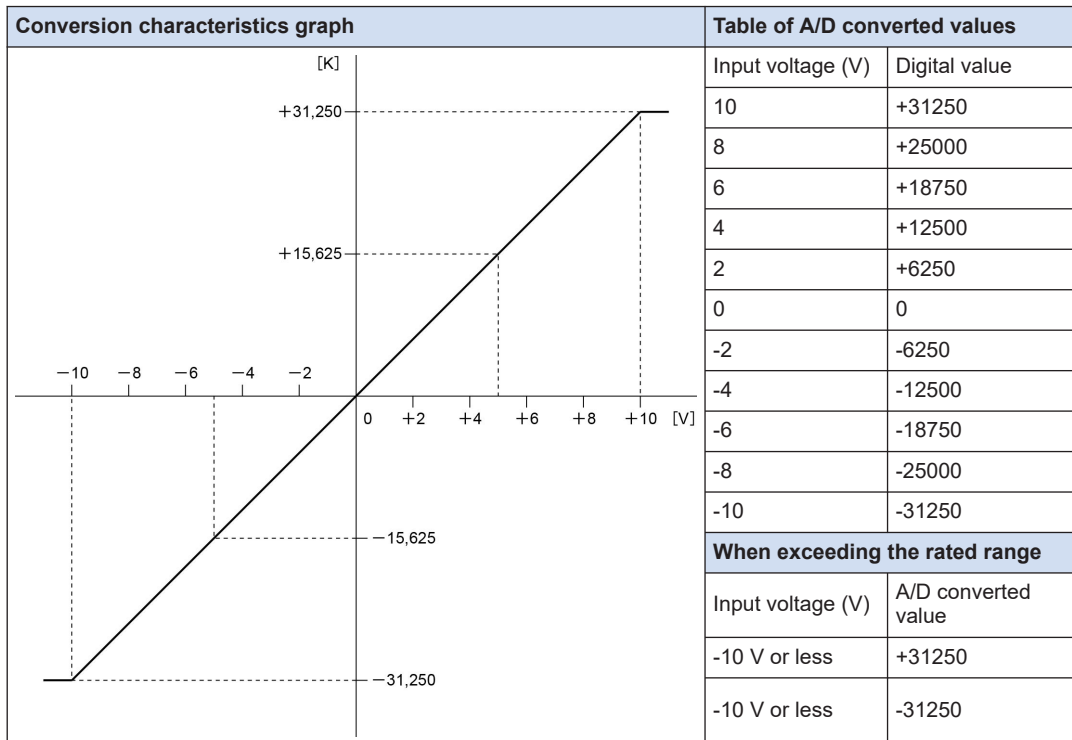
5.1 Input Conversion Characteristics (AFP7TC8)

Range	Input value	Converted value	Remarks
	+1215°C or more	+12150	For the unit Ver. 1.0, the upper limit of the range is +750°C.
Thermocouple type T	-285°C or less	-2850	
	+415°C or more	+4150	
Thermocouple type N	-285°C or less	-2850	
	+1315°C or more	+13150	
Thermocouple type R	-15°C or less	-150	
	+1775°C or more	+17750	
Thermocouple type S	-15°C or less	-150	
	+1775°C or more	+17750	
Thermocouple type B	-15°C or less	-150	
	+1835°C or more	+18350	
Thermocouple type E	-285°C or less	-2850	
	+1015°C or more	+10150	
Thermocouple type PLII	-15°C or less	-150	
	+1405°C or more	+14050	
Thermocouple type WRe5-26	-15°C or less	-150	
	+2330°C or more	+23300	
Disconnection	-	+30000	

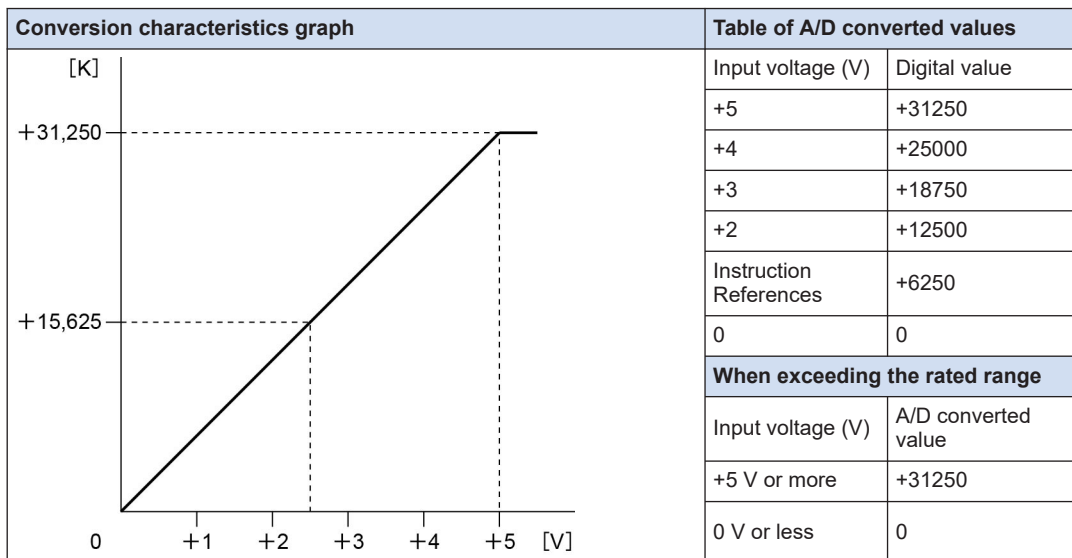
5.1 Input Conversion Characteristics (AFP7TC8)

5.1.2 Voltage Input Range

■ -10 V to +10 V DC input (0.32 mV, 1/62500)

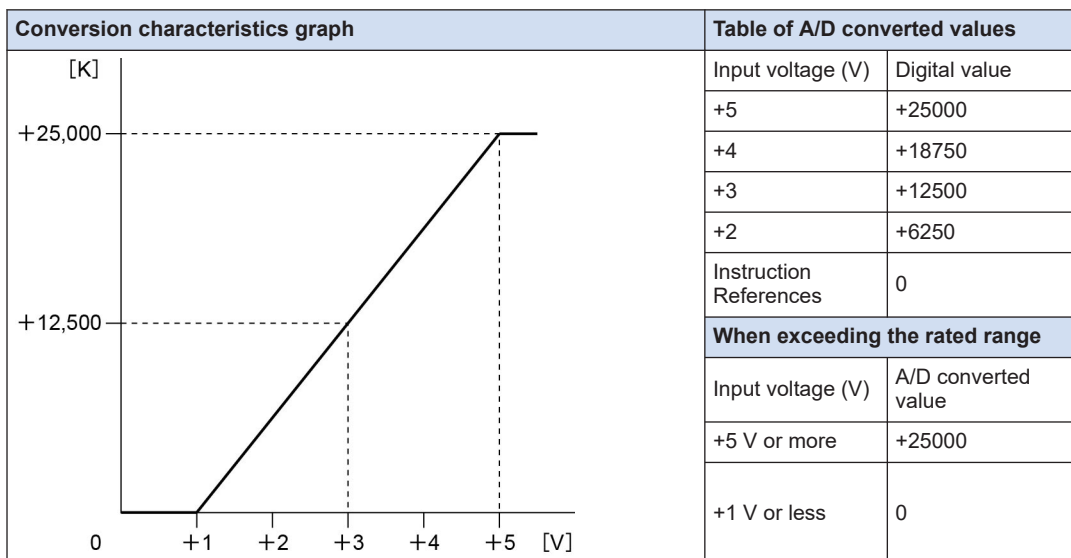


■ 0 V to 5 V DC input (0.16mV, 1/31250)

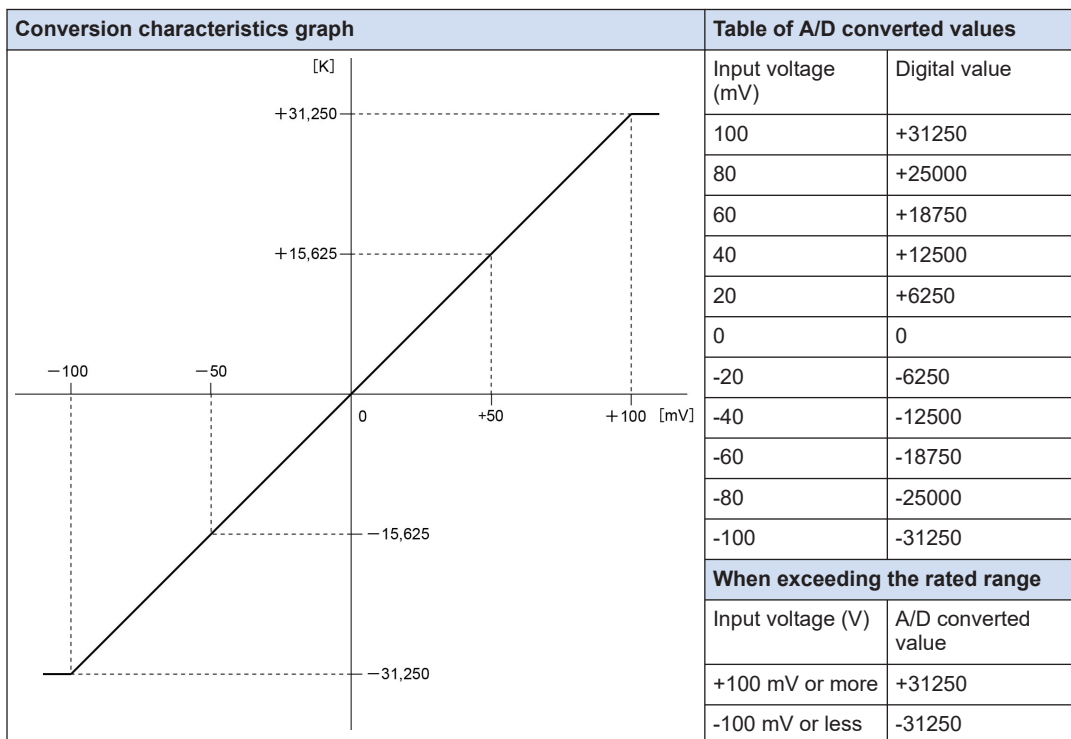


5.1 Input Conversion Characteristics (AFP7TC8)

■ 1 V to 5 V DC input (0.16mV, 1/25000)



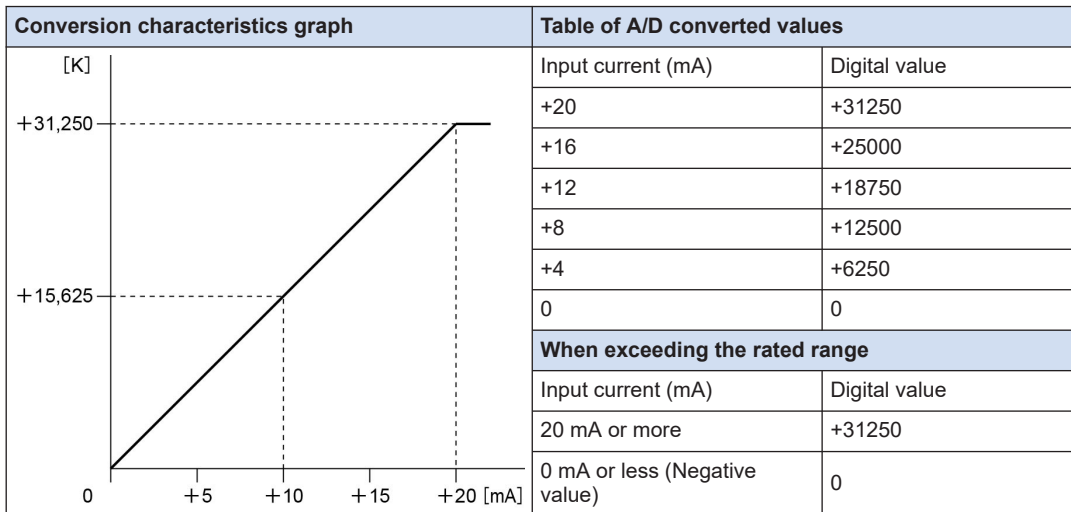
■ -100 mV to +100 mV DC input (3.2 μ V, 1/62500)



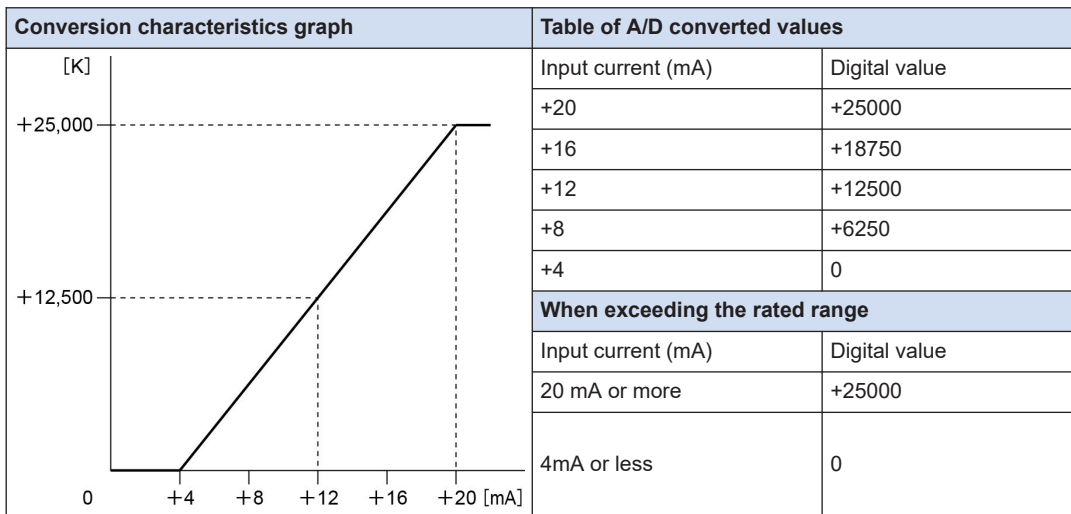
5.1 Input Conversion Characteristics (AFP7TC8)

5.1.3 Current Input Range

■ 0 mA to 20 mA DC input (0.64 □A, 1/31250)



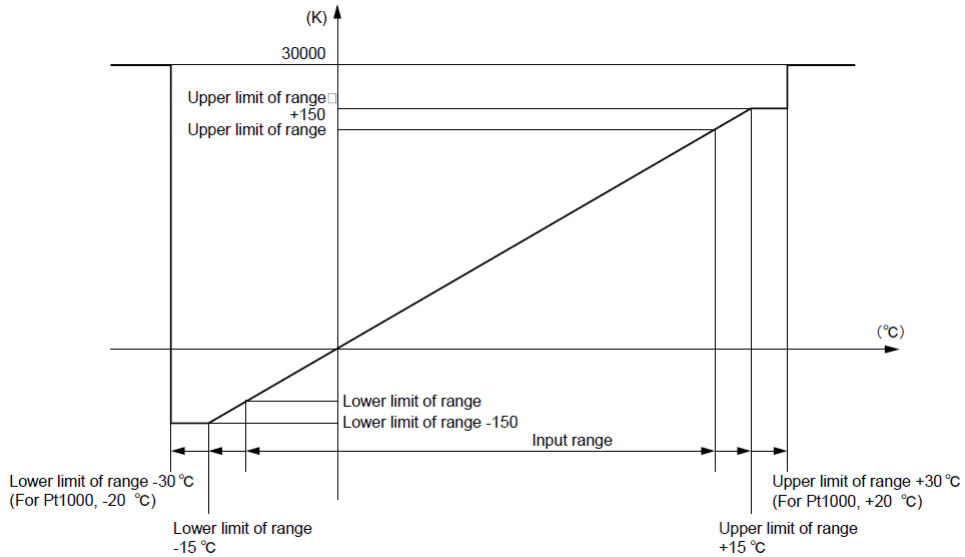
■ 4 mA to 20 mA DC input (0.64 □A, 1/25000)



5.2 Input Conversion Characteristics (AFP7RTD8)

5.2.1 RTD Input Range

■ Conversion characteristics graph



■ When exceeding the rated range

- Up to the lower limit -15 °C and the upper limit +15 °C of the range, reference values which the conversion accuracy is not assured are indicated.
- When the lower limit of the range is -30 °C or less, or when the upper limit is +30 °C or more, the converted values are "30000". (For Pt1000, the lower limit of the range is -20 °C or less, and the upper limit is +20 °C or more.)

Range	Input value	Converted value
Pt100 Range1 JPt100 Range1	-130°C or less	+30000
	-130°C ~ -115°C	-1150
	+215°C ~ +230°C	+2150
	+230°C or more	+30000
Pt100 Range2 JPt100 Range2	-230°C or less	+30000
	-230°C ~ -215°C	-2150
	+665°C ~ +680°C	+6650
	+680°C or more	+30000
Pt1000	-120°C or less	+30000
	-120°C ~ -115°C	-1150
	+115°C ~ +120°C	+1150
	+120°C or more	+30000

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