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PROGRAMMABLE CONTROLLERS

FP7 Analog Output Unit

Technical Manual

Before beginning

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Warnings used in this manual

One or more of the following warnings may be used in this documentation:

DANGER



Indicates a hazardous situation which, if not avoided, will result in death or serious injury.

WARNING



Indicates a hazardous situation which, if not avoided, could result in serious or moderate injury.

CAUTION



Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

NOTICE

Indicates a property damage message.

Scope of this manual

This manual covers:

- Unit functions
- Restrictions on unit combinations
- Installation, wiring, and operating instructions
- I/O allocation methods
- Configuration settings
- Time charts
- Conversion characteristics
- Optional settings for offset and gain adjustment, scale conversion, upper and lower limit clipping, etc.
- Troubleshooting information
- An appendix with:
 - Hardware specifications
 - Unit memory addresses
 - Unit dimensions

Please refer to the FP Series Programming Manual or to the online help of Control FPWIN Pro for information on:

- System instructions
- Special internal flags
- Data registers
- System variables
- Memory area tables
- Programming examples

For documentation on other units used with the FP7, please refer to the hardware manual for that unit.

All manuals can be downloaded from the Panasonic Web site (<http://www.panasonic-electric-works.com>).

Safety measures

Operating environment

After installing the unit, make sure to use it within the range of the general specifications:

- Ambient temperature: 0°C to +55°C
- Ambient humidity: 10%–95% RH (at 25°C, non-condensing)
- Pollution degree: 2
- Do not use the unit in the following environments:
 - Direct sunlight
 - Sudden temperature changes causing condensation
 - Inflammable or corrosive gases
 - Excessive airborne dust, metal particles or salts
 - Benzine, paint thinner, alcohol or other organic solvents, or strong alkaline solutions such as ammonia or caustic soda
 - Vibration, shock, or direct drop of water
 - Influence from power transmission lines, high voltage equipment, power cables, power equipment, radio transmitters, or any other equipment that would generate high switching surges. Maintain at least 100mm of space between these devices and the unit.

Static electricity

Before touching the unit or equipment, always touch some grounded metal to discharge any static electricity you may have generated (especially in dry locations). The discharge of static electricity can damage parts and equipment.

Protection of power supply

- Use a twisted power supply wire.
- Insulate the wiring systems to the CPU, input/output devices, and mechanical power apparatus.
- An insulated power supply with an internal protective circuit should be used (FP power supply). The power supply for the CPU is a non-insulated circuit, so if an incorrect voltage is directly applied, the internal circuit may be damaged or destroyed.

- If using a power supply device without an internal protective circuit, always make sure power is supplied to the unit through a protective element such as a fuse.
- Be sure to supply power to a CPU and an expansion unit from the same power supply, and turn the power on and off simultaneously for both.

Power supply sequence

Make sure the power supply of the CPU turns off before the power supply for input and output. If the power supply for input and output is turned off first, the CPU will detect the input fluctuations and may begin an unexpected operation.

Before turning on the power

When turning on the power for the first time, be sure to take the precautions given below.

- During installation, check that there are no scraps of wiring, particularly conductive fragments, adhering to the unit.
- Verify that the power supply wiring, I/O wiring, and power supply voltage are all correct.
- Sufficiently tighten the installation and terminal screws.
- Set the operation mode selector to PROG mode.

Request concerning program storage

To prevent the accidental loss of programs, the user should consider the following measures:

- Backing up programs: To avoid accidentally losing programs, destroying files, or overwriting the contents of a file, use the backup or export functions of Control FPWIN Pro and store the files in a safe place. Additionally, you can print out the entire project documentation.
- Specifying passwords: The password setting is designed to avoid programs being accidentally overwritten. If the password is forgotten, however, it will be impossible to overwrite the program even if you want to. Also, if a password is forcibly bypassed, the program is deleted. Therefore, please note the password in a safe location.

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Chapter 1

Overview

1.1 Features

The analog output unit converts its internal data into analog values to be output to inverters or other analog-driven devices.

- The unit is equipped with six types of output ranges (voltage ranges of -10V to +10V, 0V to +10V, 0V to +5V, and +1V to +5V and current ranges of 0mA to +20mA and +4mA to +20mA).
- The unit has 4 channels to output analog data.
- The conversion speed is 25 μ s/channel.
- Digital values are converted into analog data with up to 16 bits in a resolution range of 1/25000–1/62500.

Optional functions

Name	Description
Analog output in PROG mode	Use this function to specify the operation of the analog output when the PLC is switched from RUN to PROG mode: stop output, hold the current value, or hold a user-defined value.
Offset/gain processing	Offset and gain adjustment can be used to correct offset or scaling errors. The offset and gain adjustments are made to the converted data before it is written to the CPU's output area.
Scale conversion	Use scale conversion to set an easy-to-use analog output range. The digital input values are scaled to values in the specified range between preset minimum and maximum values before they are written to the CPU's output area.
Upper and lower limit clipping	In order to protect connected devices, this function limits the analog output value by clipping the digital input value if it exceeds the specified upper or lower limit.

1.2 Basic operation

The processing of digital input data takes place in three steps:

1. Writing of digital data

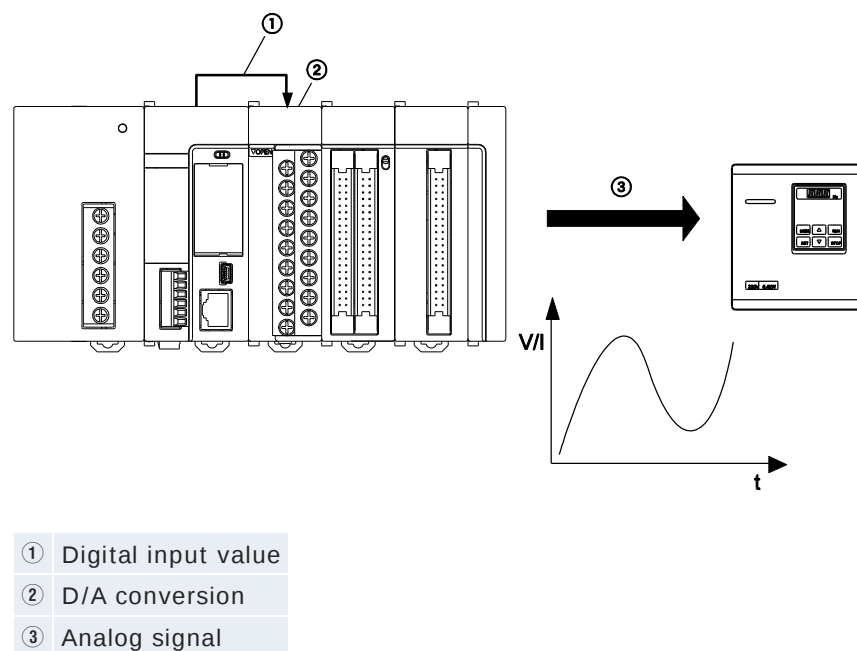
A user program is needed to write the digital input values to the analog unit into the CPU's output area (WY) on a channel-by-channel basis.

2. Digital to analog conversion

The digital input values are converted to analog output values automatically and in sequence.

3. Analog signal output

Analog signals are output to inverters or other analog-driven equipment.



Unit configuration

The unit configuration, which is stored in the unit memory (UM), can be changed via the [Advanced] button in the "I/O map and unit configuration" dialog or by specifying the settings in a user program. The following items can be set:

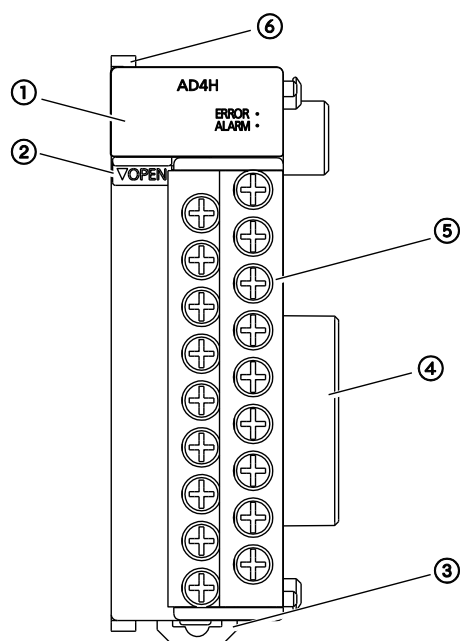
- Analog output in PROG mode
- Offset/gain processing
- Scale conversion
- Upper and lower limit clipping

1.3 Restrictions on unit combination

When designing the system, make sure the total current consumption of all units used together with the analog unit is within the capacity of the power supply. The unit has the following internal current consumption:

Name	Product no.	Current consumption
Analog output unit	AFP7AD4H	≤250mA

1.4 Parts and functions



① Operation status LEDs

Display the current operation mode or the occurrence of an error.

LED	Color	Description
–	Blue	Lights when the CPU power is on.
ERROR	Red	Lights when the configuration settings are beyond the allowable range.
ALARM	Red	Lights when a hardware error occurs.

② Terminal block release lever – By lowering this lever, the terminal block can be removed from the unit without disconnecting the wiring. After installation, push in the lock button at the bottom of the unit to lock in the terminal block.

- ③ DIN rail attachment lever – Fixes the unit to the DIN rail.
- ④ Unit connector – Connects the unit to the internal circuit of I/O units and intelligent units.
- ⑤ Analog output terminal block – Remove the terminal block to facilitate wiring. Crimp terminals for M3 can be used.
- ⑥ Fixing hook – Used to fix expansion units.

Chapter 2

Wiring

2.1 Wiring the terminal block

Suitable wire

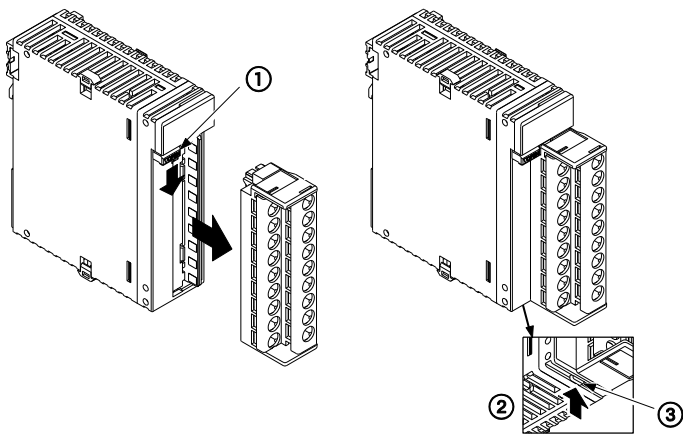
Size	Cross-sectional area [mm ²]	Tightening torque [Nm]
AWG22-14	0.3-2.0	0.5-0.6

Wiring method

Remove the terminal block to facilitate wiring.

Procedure

1. Push down release lever
2. Pull off terminal block



- | | |
|---|------------------------------|
| ① | Terminal block release lever |
| ② | Bottom of unit |
| ③ | Lock button |

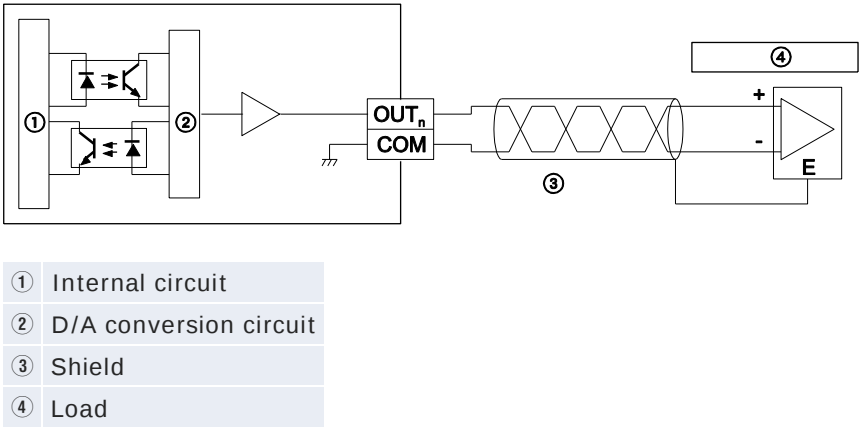
Note

To reattach the terminal block, insert it all the way to its original position and press the lock button on the bottom of the unit. Then confirm that the terminal block is securely attached and cannot be removed.

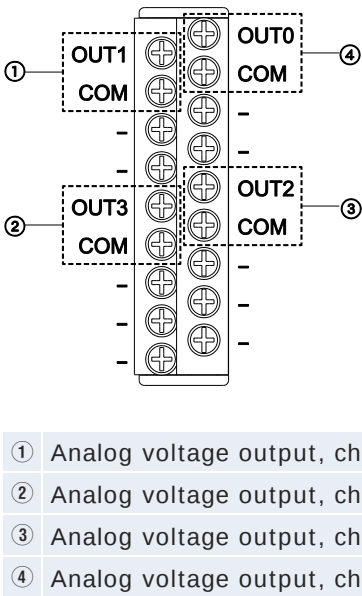
2.1.1 Voltage output

Output range: -10V to +10V, 0V to +10V, 0V to +5V, +1V to +5V

Wiring and internal circuit diagram



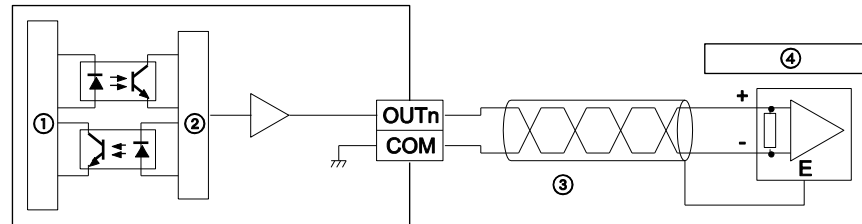
Terminal layout



2.1.2 Current output

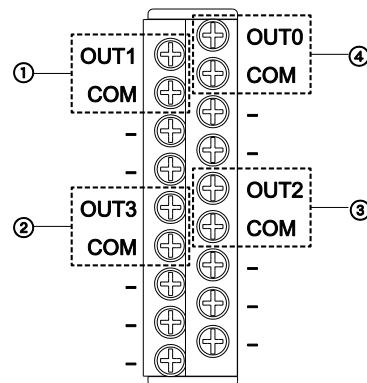
Output range: 0mA to +20mA, +4mA to +20mA

Wiring and internal circuit diagram



①	Input circuit
②	D/A conversion circuit
③	Shield
④	Load

Terminal layout



①	Analog current output, channel 1
②	Analog current output, channel 3
③	Analog current output, channel 2
④	Analog current output, channel 0

Note

- Use double-core twisted-pair shielded wires.
- Ground the shielding of the shielded wire on the load side. However, depending on the conditions of the external noise, it may be better to ground the shielding externally or not to ground the shielding.
- Do not place the analog output wires close to power lines or load lines other than PLC wires, and do not bundle them with other wires.
- The NC terminals of the output terminal block are unused. Do not use these terminals to connect wires because some of the terminals are connected internally.

Chapter 3

I/O allocation

3.1 General

Each unit attached to the CPU must be configured in an I/O map which is registered in the CPU. The current I/O map can be displayed in the "I/O map and unit configuration" dialog. It shows the slot numbers and starting word numbers of the CPU and its expansion units. I/O addresses are allocated based on the starting word number.

To display the current I/O map and starting word number of a unit in Control FPWIN Pro, proceed as follows:

Procedure

1. Open project
2. Double-click "PLC" in the navigator
3. Double-click "I/O map and unit configuration"
4. Double-click the desired slot number

Reference

Please refer to the CPU Hardware User's Manual for details on entering and uploading I/O maps.

3.1.1 Digital values and control flags

Before D/A conversion, the digital input values to the analog unit are written to the CPU's output area (WY). Control flags are also allocated to the CPU's outputs.

The I/O addresses in the table show offset addresses. I/O addresses actually allocated are based on the first word number allocated to the unit.

Example: If the first word number is 10, the address number for the digital input value on channel 0 will be WY10.

Address								Name
Channel 0		Channel 1		Channel 2		Channel 3		
WY0	Y0–YF	WY2	Y20–Y2F	WY4	Y40–Y4F	WY6	Y60–Y6F	Digital input value (16 bits) ¹⁾
WY1	Y10	WY3	Y30	WY5	Y50	WY7	Y70	Clipping control flag ²⁾
	Y10–Y1F		Y31–Y3F		Y51–Y5F		Y71–Y7F	Not used

¹⁾ Digital input value

Memory area for digital values before conversion into the analog output values. If scale conversion has been set, the corresponding scaled values are stored here.

Voltage range	Current range	Digital input value
-10 to +10V	–	-31250 to +31250
0 to +10V or 0 to 5V	–	0 to +31250
+1 to +5V	–	0 to +25000
–	0 to +20mA	0 to +31250
–	+4 to +20mA	0 to +25000

²⁾ Clipping control flag

TRUE to execute the upper and lower limit clipping function.

FALSE to turn the upper limit clipping flag (Xn1) and the lower limit clipping flag (Xn2) to FALSE.

3.1.2 Status flags

Status flags are allocated to the CPU's input area (WX).

The I/O addresses in the table show offset addresses. I/O addresses actually allocated are based on the first word number allocated to the unit.

Example: If the first word number is 10, the address number for the error flag on channel 0 will be X100.

Address								Name
Channel 0		Channel 1		Channel 2		Channel 3		
WX0	X0	WX1	X10	WX2	X20	WX3	X30	Error flag ¹⁾
	X1		X11		X21		X31	Upper limit clipping flag ²⁾
	X2		X12		X22		X32	Lower limit clipping flag ³⁾
	X3–XF		X13–X1F		X23–X3F		X33–X3F	Not used

¹⁾ Error flag

TRUE when an error has occurred.

²⁾ Upper limit clipping flag

TRUE when the digital input value exceeds the upper limit clipping value, provided that the clipping function is active.

³⁾ Lower limit clipping flag

TRUE when the digital input value drops below the lower limit clipping value, provided that the clipping function is active.

Chapter 4

Operation

4.1 Writing of analog output data

The processing of digital input data takes place in three steps:

1. Writing of digital data

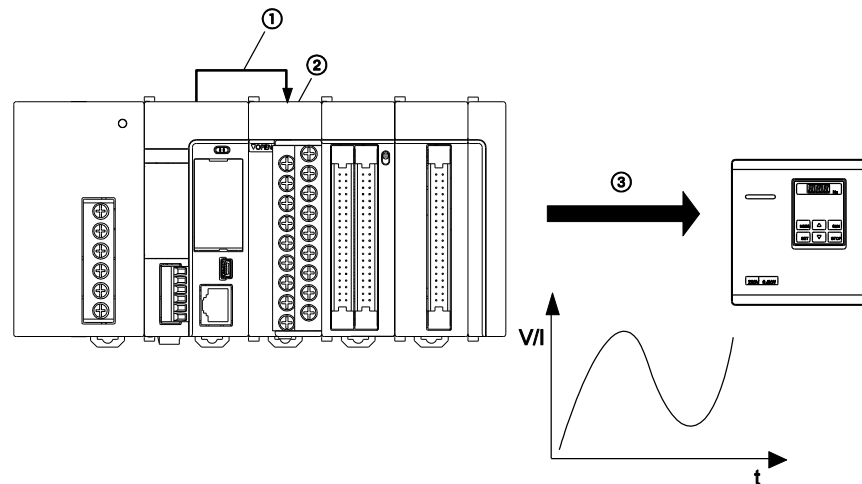
A user program is needed to write the digital input values to the analog unit into the CPU's output area (WY) on a channel-by-channel basis.

2. Digital to analog conversion

The digital input values are converted to analog output values automatically and in sequence.

3. Analog signal output

Analog signals are output to inverters or other analog-driven equipment.



①	Digital input value
②	D/A conversion
③	Analog signal

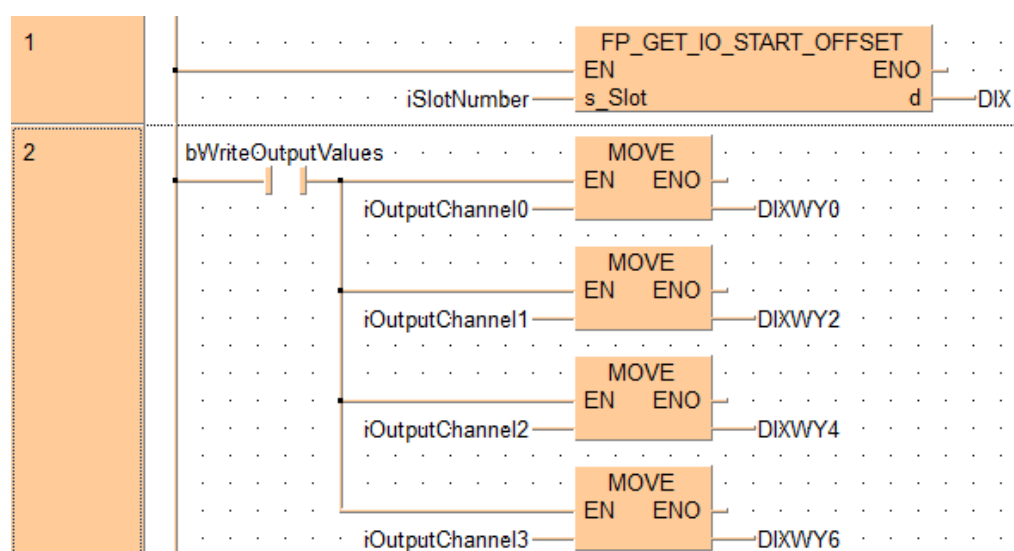
Sample program

The digital input values to the analog output unit are stored by channel in four different variables. They will be written to the CPU's memory areas DIXWY0, DIXWY2, DIXWY4, and DIXWY6.

POU Header

	Class	Identifier	Type	Initial
0	VAR_CONSTANT	iSlotNumber	INT	0
1	VAR	bWriteOutputValues	BOOL	FALSE
2	VAR	iOutputChannel0	INT	0
3	VAR	iOutputChannel1	INT	0
4	VAR	iOutputChannel2	INT	0
5	VAR	iOutputChannel3	INT	0

LD Body



4.2 Conversion time

Conversion time varies with the selected configuration settings.

Conversion processing

To speed up conversion, disable "Conversion processing" for all unused channels.

Example

- Conversion processing is enabled for 4 channels:

Order of conversion: channel 0→channel 1→channel 2→channel 3→channel 0→channel 1→channel 2→channel 3→....

$$1 \text{ cycle} = 4 \text{ channels} \times 25\mu\text{s} = 100\mu\text{s}$$

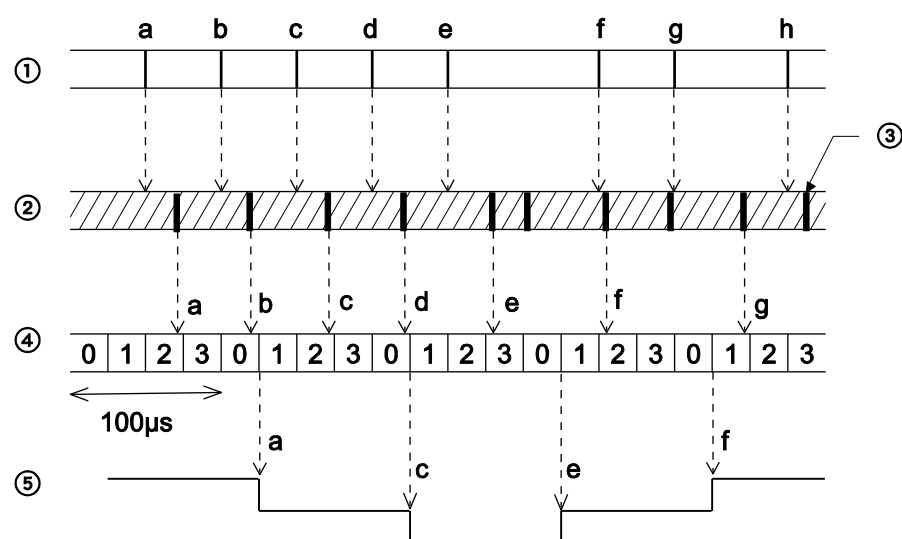
- Conversion processing is enabled for 2 channels:

Order of conversion: channel 0→channel 1→channel 0→channel 1→...

$$1 \text{ cycle} = 2 \text{ channels} \times 25\mu\text{s} = 50\mu\text{s} \text{ (The conversion time for the disabled channels 2 and 3 is saved.)}$$

Time chart of D/A conversion

The digital input values are written to the CPU's output area at the CPU's I/O refresh time. D/A conversion in the analog unit and the CPU's processing cycles are not synchronized. Therefore, the latest digital input value from the CPU will only be processed by the analog unit after D/A conversion has been completed.



①	Digital input value, channel 0 of CPU
②	CPU processing cycles
③	I/O refresh
④	Conversion processing
⑤	Analog signal, channel 0 of analog output unit

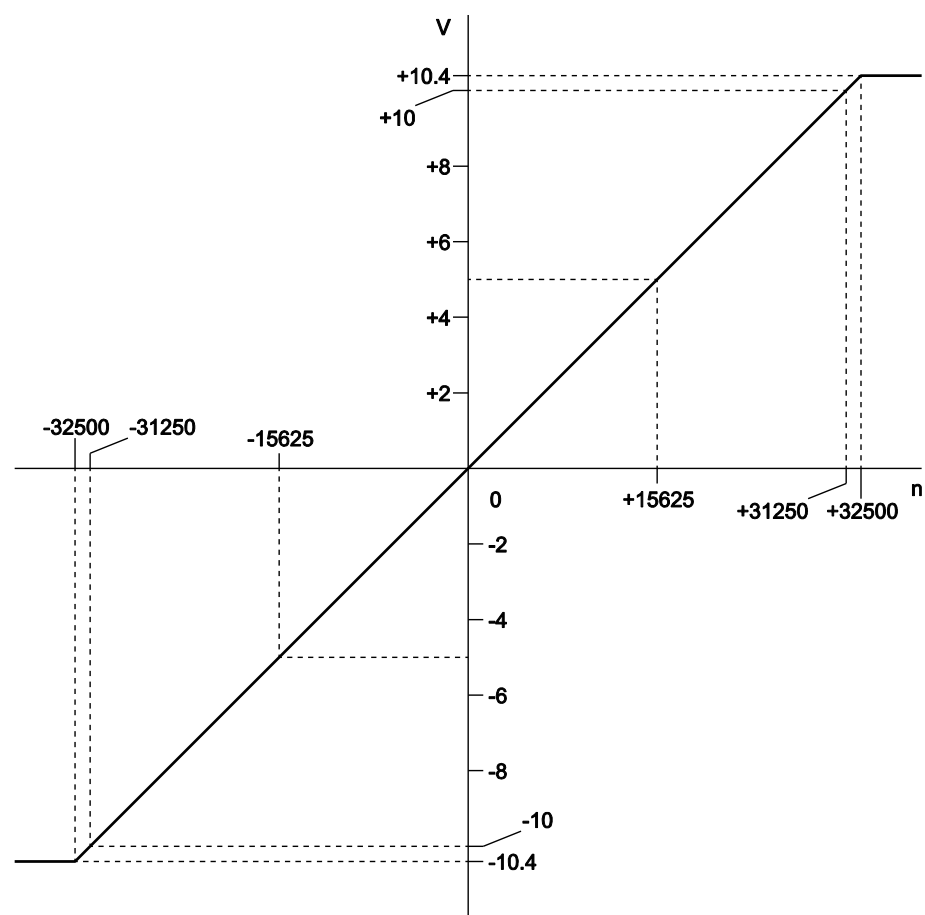
Chapter 5

Conversion characteristics

5.1 Voltage range

5.1.1 -10 to +10V (0.32mV, 1/62500)

Output range: -10 to +10V



Digital input value n	Analog output value (V)
+31250	+10
+25000	+8
+18750	+6
+12500	+4
+6250	+2
0	0
-6250	-2
-12500	-4
-18750	-6

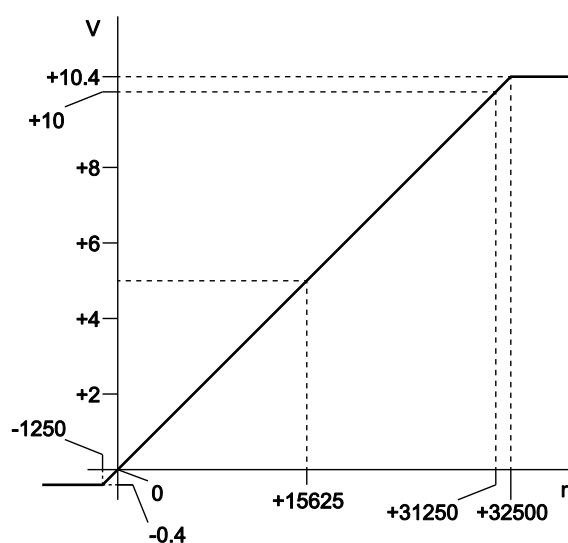
Digital input value n	Analog output value (V)
-25000	-8
-31250	-10

When exceeding the rated range

Digital input value	Analog output value (V)
$\geq +32500$	+10.4
≤ -32500	-10.4

5.1.2 0 to +10V (0.32mV, 1/31250)

Output range: 0 to +10V



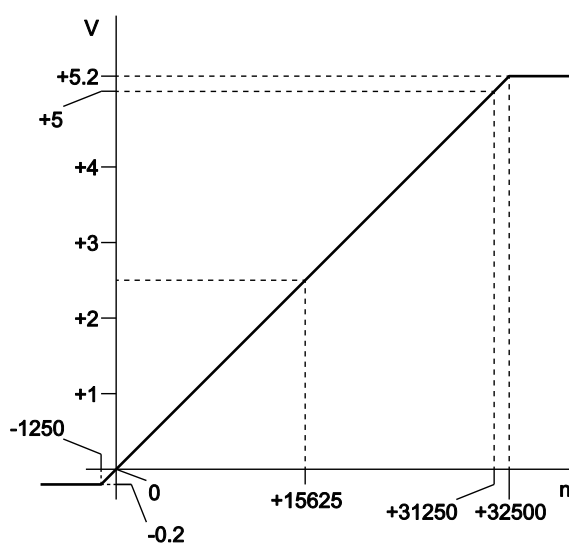
Digital input value n	Analog output value (V)
+31250	+10
+25000	+8
+18750	+6
+12500	+4
+6250	+2
0	0

When exceeding the rated range

Digital input value	Analog output value (V)
$\geq +32500$	+10.4
≤ -1250	-0.4

5.1.3 0 to +5V (0.16mV, 1/31250)

Output range: 0 to +5V



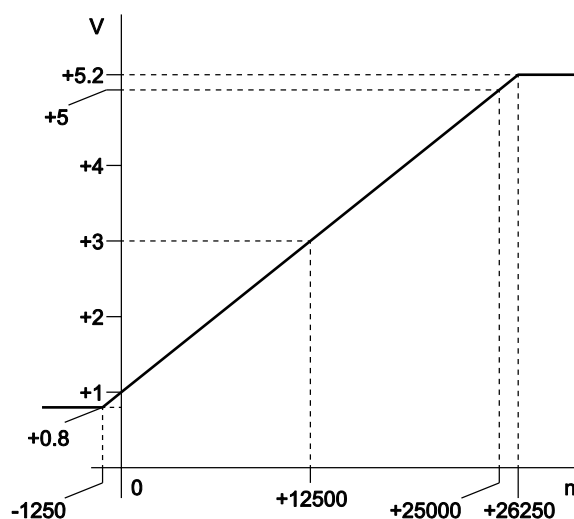
Digital input value n	Analog output value (V)
+ 31250	+ 5
+ 25000	+ 4
+ 18750	+ 3
+ 12500	+ 2
+ 6250	+ 1
0	0

When exceeding the rated range

Digital input value	Analog output value (V)
$\geq +32500$	+ 5.2
≤ -1250	- 0.2

5.1.4 1 to +5V (0.16mV, 1/25000)

Output range: 0 to +5V



Digital input value n	Analog output value (V)
+25000	+5
+18750	+4
+12500	+3
+6250	+2
0	+1

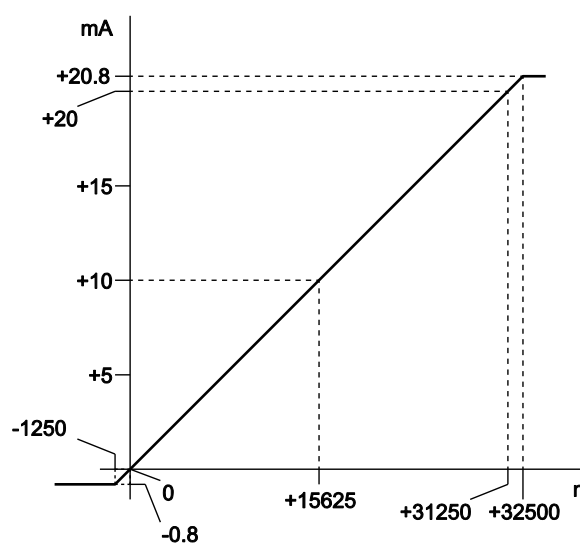
When exceeding the rated range

Digital input value	Analog output value (V)
$\geq +26250$	+5.2
≤ -1250	0.8

5.2 Current range

5.2.1 0 to +20mA (0.64 μ A, 1/31250)

Output range: 0 to +20mA



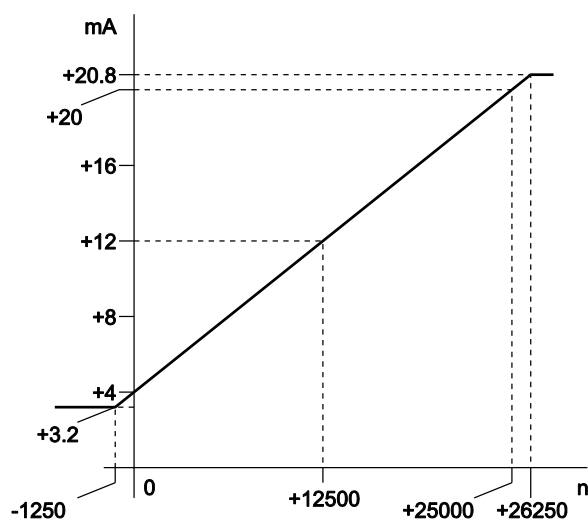
Digital input value n	Analog output value (mA)
+ 31250	+ 20
+ 25000	+ 16
+ 18750	+ 12
+ 12500	+ 8
+ 6250	+ 4
0	0

When exceeding the rated range

Digital input value	Analog output value (mA)
$\geq +32500$	+ 20.8mA
≤ -1250	-0.8mA

5.2.2 +4 to +20mA (0.64μA, 1/25000)

Output range: +4 to +20mA



Digital input value n	Analog output value (mA)
+25000	+16
+18750	+12
+12500	+8
+6250	+4
0	0

When exceeding the rated range

Digital input value	Analog output value (mA)
$\geq +26250$	+20.8mA
≤ -1250	+3.2mA

Chapter 6

Unit configuration

6.1 Advanced settings

After the unit has been entered in the I/O map, it can be configured in Control FPGWIN Pro.

Procedure

1. Open project
2. Double-click "PLC" in the navigator
3. Double-click "I/O map and unit configuration"
4. Double-click the desired slot number
5. [Advanced]
6. Make the desired settings
7. [OK]

The settings will become effective when the project is downloaded to the PLC.

6.2 List of advanced configuration settings

Group	Item name	Data	Default setting
Channel 0– Channel 3 (settings per channel)	Analog output processing	Disable/Enable	Enable
	Range setting	-10...+10V/0...+10V/ 0...+5V/+1...+5V/ 0...+20mA/+4...+20mA	-10...+10V
	Analog output in PROG mode	Stop output/Hold current value/Hold user-defined value	Stop output
	Digital input value in PROG mode	-10...+10V: -32500 to +32500 0...+10V/0...+5V/0...+20mA: 0 to +32500 +1...+5V/+4...+20mA: 0 to +25000	0
	Offset/gain processing	Disable/Enable	Disable
	Offset value	-3000 to +3000	0

Group	Item name	Data	Default setting
	Gain value	+9000 to +11000	10000
	Scale conversion	Disable/Enable	Disable
	Upper limit of scale	-30000 to +30000	10000
	Lower limit of scale	-30000 to +30000	0
	Upper and lower limit clipping	Disable/Enable	Disable
	Upper limit clipping value	-32500 to +32500	0
	Lower limit clipping value	-32500 to +32500	0

6.3 Analog output in PROG mode

Use this function to specify the operation of the analog output when the PLC is switched from RUN to PROG mode: stop output, hold the current value, or hold a user-defined value. Settings are made on a channel-by-channel basis.

Configuration

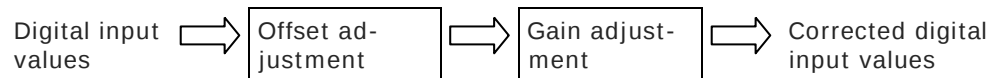
Name	Default	Setting range
Analog output in PROG mode	Stop output	Stop output/Hold current value/Hold user-defined value
Digital input value in PROG mode	0	To apply the setting, "Hold user-defined value" must be set for "Analog output in PROG mode". Set a digital value corresponding to the analog output value. Setting range: -10...+10V: -32500 to +32500 0...+10V/0...+5V/0...+20mA: 0 to +32500 +1...+5V/+4...+20mA: 0 to +25000 (specified with a signed integer)

Note

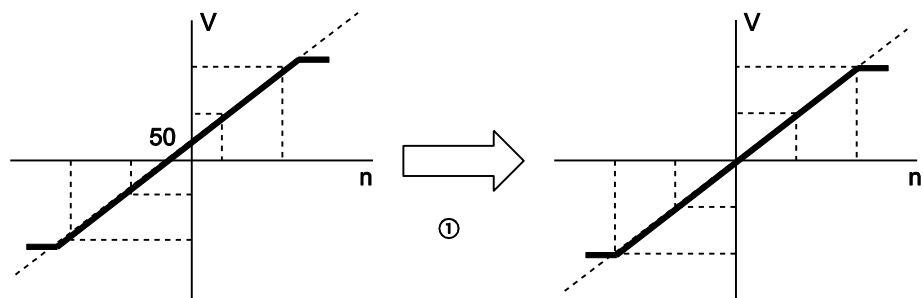
- If "Hold user-defined value" has been set, the digital value varies depending on the range setting.
- If "Stop output" has been set, the output will turn to FALSE (0V or 0mA) when the PLC is switched to PROG mode.
- The output will turn to FALSE (0V or 0mA) if an error occurs.

6.4 Offset/gain processing

Offset and gain adjustment can be used to correct offset or scaling errors. The offset and gain adjustments are made to the converted data before it is written to the CPU's output area.

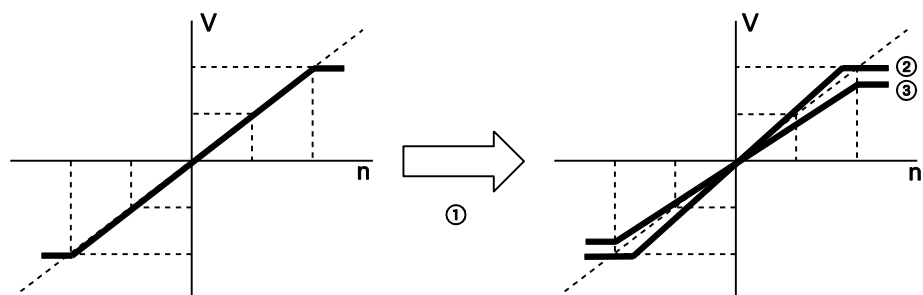


- The offset adjustment (zero-point adjustment) is used to remove the offset error between different components. If the analog output value is 50V for a digital input value of $n=0$, select an offset value of -50 to correct the analog output value to 0V.



① Offset adjustment

- The gain value settings are used as a function to adjust small scale errors between different components. The gain value slope can be changed in a range of $0.9x-1.1x$.



① Gain adjustment
② Gain 1.1x
③ Gain 0.9x

- Offset and gain processing is executed on a channel-by-channel basis.

Configuration

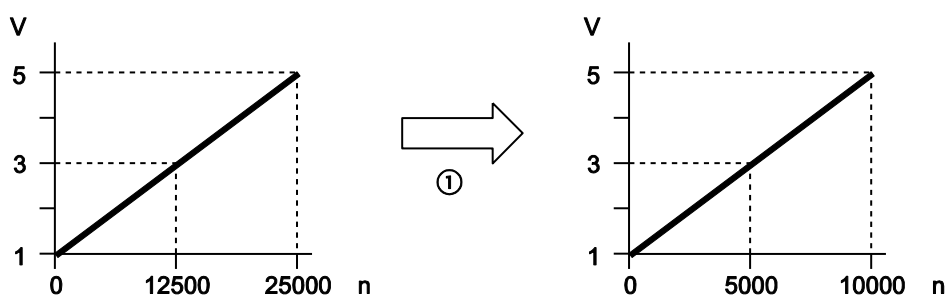
Name	Default	Setting range
Offset/gain processing	Disable	Select "Enable"
Offset value	0	To apply the setting, "Offset/gain processing" must be enabled. Setting range: -3000 to +3000 (specified with a signed integer)
Gain value	10000	To apply the setting, "Offset/gain processing" must be enabled. Setting range: +9000 to +11000 corresponding to a gain factor of 0.9x–1.1x (specified with a signed integer)

Note

The offset adjustment is applied to the unscaled value.

6.5 Scale conversion

Use scale conversion to set an easy-to-use data range. The digital input values are scaled to values in the specified range between preset minimum and maximum values before they are written to the CPU's output area. This function is convenient if used for unit conversion.



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

Configuration

Name	Default	Setting range
Scale conversion	Disable	Select "Enable"
Upper limit of scale	10000	To apply the setting, "Scale conversion" must be enabled.
Lower limit of scale	0	Setting range: -30000 to +30000 (specified with a signed integer)

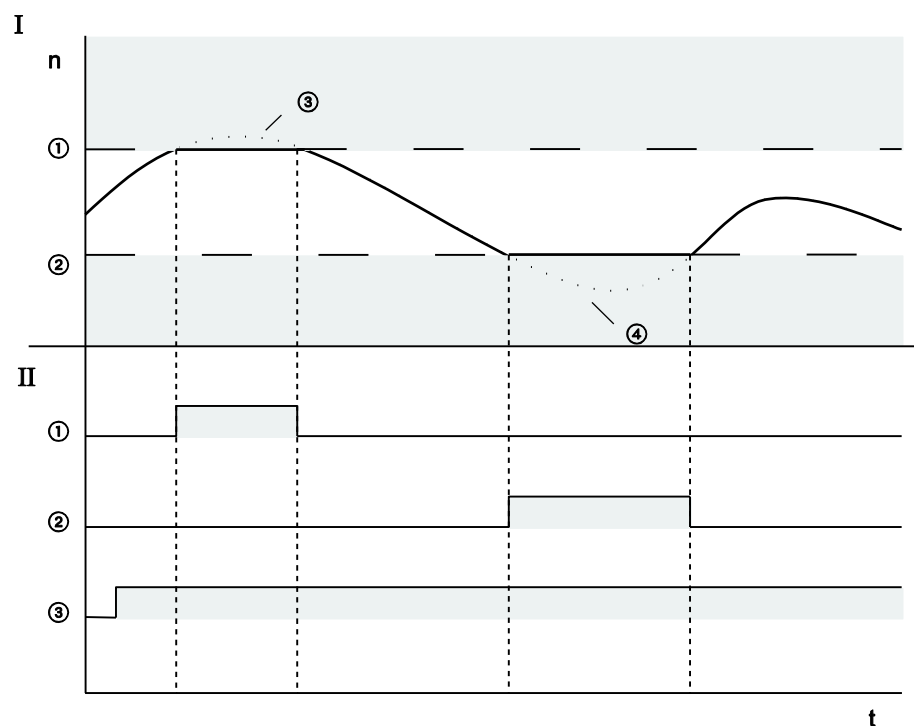
Note

- If the lower limit of scale is larger than the upper limit of scale, an error will occur and the function will be disabled.
- If values outside the allowable range are set, an error will occur and the function will be disabled.
- If data outside the lower or upper limit are acquired, scale conversion will be disabled and the lower or upper limit value will be written to the CPU's output area.

6.6 Upper and lower limit clipping

In order to protect connected devices, this function limits the analog output value by clipping the digital input value if it exceeds the specified upper or lower limit.

- Upper and lower limit clipping settings are made on a channel-by-channel basis.
- The upper limit clipping flag will turn to TRUE if the digital input value is larger than the upper limit.
- The lower limit clipping flag will turn to TRUE if the digital input value is smaller than the lower limit.
- To use the function, you must enable "Upper and lower limit clipping" in the "Analog unit settings" dialog and turn the clipping control flag to TRUE.



n	Digital input value
I	Limit values
①	Upper limit clipping value
②	Lower limit clipping value
③	Digital input value > Upper limit clipping value
④	Digital input value < Lower limit clipping value
II	Control and status flags
⑦	Upper limit clipping flag
⑧	Lower limit clipping flag
⑨	Clipping control flag

For I/O addresses of control and status flags, see p. 17.

Configuration

Name	Default	Setting range
Upper limit clipping value	0	Set the upper limit of the digital input value. Setting range: -32500 to +32500 (specified with a signed integer)
Lower limit clipping value	0	Set the lower limit of the digital input value. Setting range: -32500 to +32500 (specified with a signed integer)

Note

Upper and lower limit clipping is applied to the unscaled value.

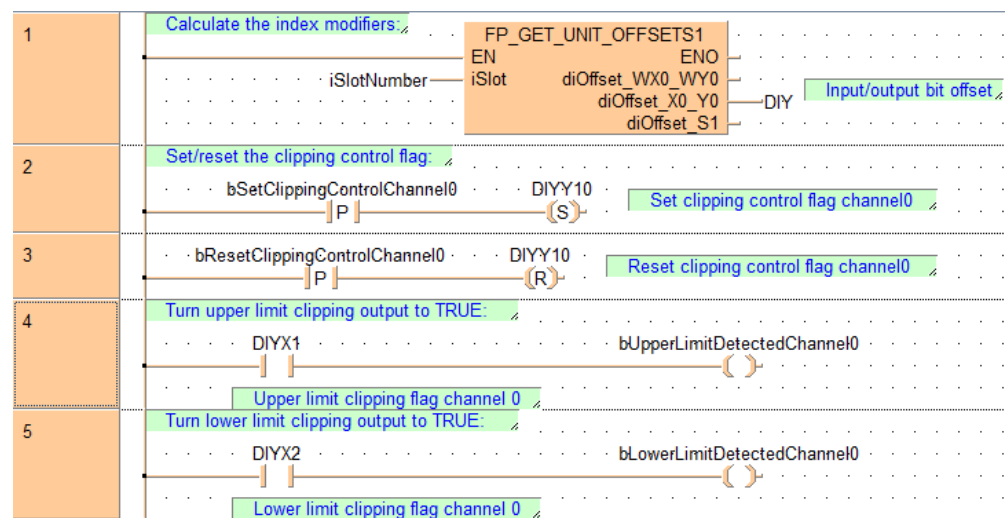
Sample program

The clipping function is activated on channel 0 of the analog output unit, and the desired output turns to TRUE when the specified upper or lower limit is detected. The output is specified using the function block FP_GET_UNIT_OFFSETS1. Please refer to the Control FPWIN Pro online help for detailed information.

POU Header

	Class	Identifier	Type	Initial
0	VAR_CONSTANT	iSlotNumber	INT	0
1	VAR	bSetClippingControlChannel0	BOOL	FALSE
2	VAR	bResetClippingControlChannel0	BOOL	FALSE
3	VAR	bUpperLimitDetectedChannel0	BOOL	FALSE
4	VAR	bLowerLimitDetectedChannel0	BOOL	FALSE

LD Body



When bSetClippingControlChannel0 turns to TRUE, the limit alarm function on channel 0 is activated. When bResetClippingControlChannel0 turns to TRUE, the function is deactivated.

bUpperLimitDetectedChannel0 turns to TRUE when the upper limit is reached. bLowerLimitDetectedChannel0 turns to TRUE when the lower limit is reached.

6.7 Configuration by program

With the analog unit it is possible to make configuration settings by user program. Please refer to the appendix for the bit settings of each parameter (see p. 42).

To change the configuration, make the desired bit settings in the unit memory of the corresponding parameter and write "16#55AA" to unit memory UM00028.

After the configuration has been updated, unit memory UM00028 will be set to 0.

Sample program (AFP7AD4H)

Make the following settings by user program:

Analog output processing, channel 0–1: Enable

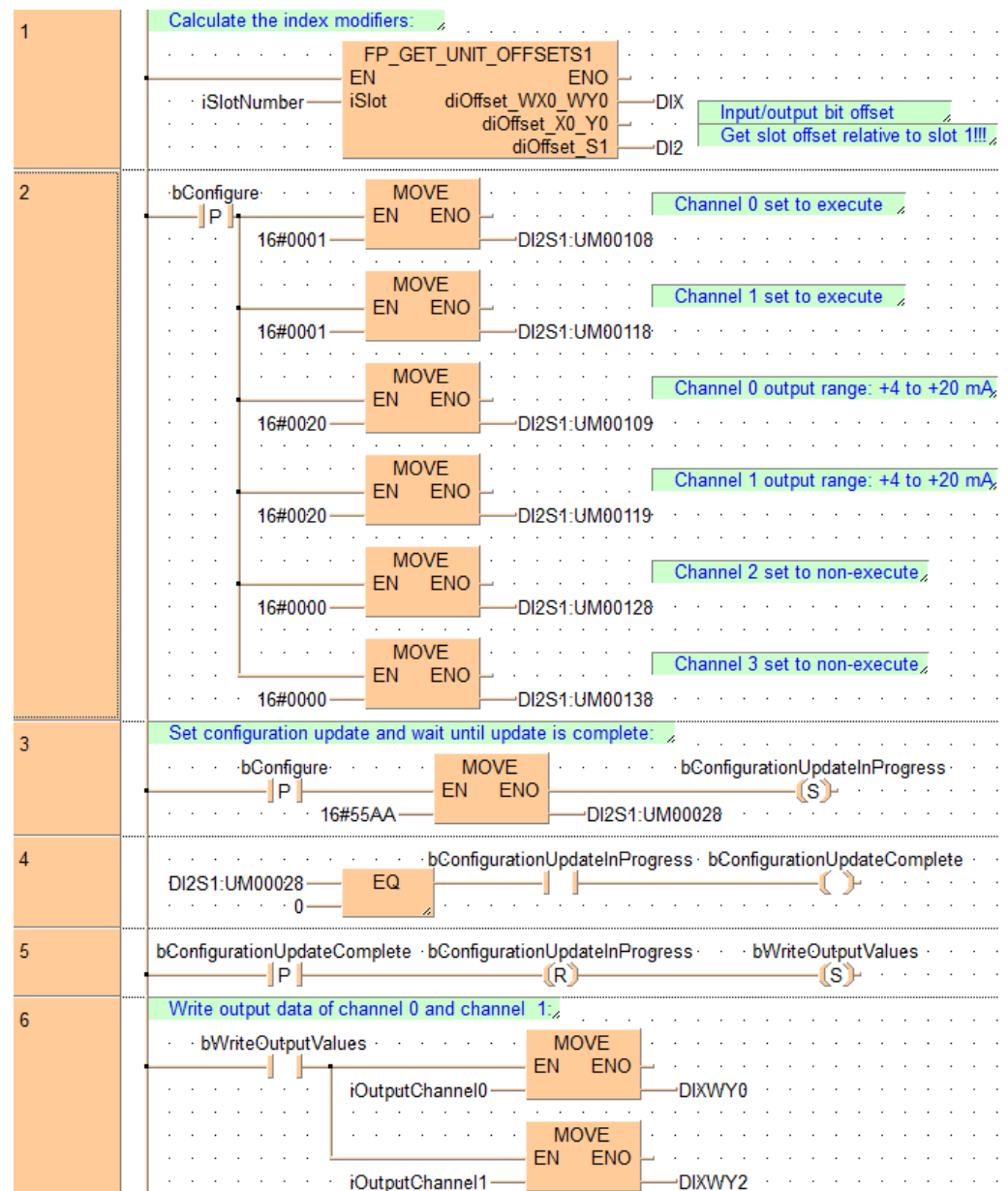
Analog output processing, channel 2–3: Disable

Range setting: 4–20mA

POU Header

	Class	Identifier	Type	Initial
0	VAR_CONSTANT	iSlotNumber	INT	0
1	VAR	bConfigure	BOOL	FALSE
2	VAR	bConfigurationUpdateInProgress	BOOL	FALSE
3	VAR	bConfigurationUpdateComplete	BOOL	FALSE
4	VAR	bWriteOutputValues	BOOL	FALSE
5	VAR	iOutputChannel0	INT	0
6	VAR	iOutputChannel1	INT	0

LD Body



When `bConfigure` turns to TRUE and 16#55AA is written to unit memory UM00028, the configuration is updated. When the update is complete, 0 is written to UM00028 and writing of the output data starts.

Chapter 7

Troubleshooting

7.1 Unstable analog output value

If the analog output value is unstable, check the following:

- Check if the shielded wire of the input device is grounded.

However, depending on the conditions of the external noise, it may be better not to ground the shielding.

- Review the program again.

7.2 Analog output value does not change

If the analog output value remains unchanged, check the following:

- Check that the unit is in RUN mode.
- Check that I/O allocations are correct.
- Check the connections of the terminal block.
- Check that the impedance of the input device is 500Ω or below if a current output range has been set.
- Check that the output is not short-circuited.
- Check that the digital input value is within the range.
- Check the configuration settings.

Chapter 8

Specifications

8.1 General specifications

Item	Description	
Ambient temperature	0–+55°C	
Storage temperature	-40–+70°C	
Ambient humidity	10%–95% RH (at 25°C, non-condensing)	
Storage humidity	10%–95% RH (at 25°C, non-condensing)	
Breakdown voltage Cutoff current: 5mA (factory setting)	Input terminals/Output terminals ↔ Power supply terminal/Function earth of CPU	500V AC for 1min
	Between analog output channels	200V AC for 1min
Insulation resistance (measured with a 500V DC megger)	Input terminals/Output terminals ↔ Power supply terminal/Function earth of CPU	100MΩ
Vibration resistance ¹⁾	5–8.4Hz, amplitude of 3.5mm 8.4–150Hz, constant acceleration of 9.8m/s ² 10min on 3 axes (in X, Y, and Z direction), 10 sweeps (1 octave/min)	
Shock resistance ¹⁾	≥147m/s ² , 3 times on 3 axes (in X, Y, and Z direction)	
Noise immunity (Power supply terminal)	1000Vp-p, with pulse widths 50ns and 1μs (based on in-house measurements)	
Operation conditions	Free from corrosive gases and excessive dust	
Conformity to CE Directives	EMC: EN 61131-2	
Overvoltage category	II	
Pollution degree	2	

¹⁾ Based on JIS B 3502 and IEC 61131-2.

8.2 Performance specifications

Item		Description
Outputs		4 channels
Output range (Resolution)	Voltage	-10 to +10 V DC (1/62500) 0 to -10 V DC (1/31250) 0 to +5 V DC (1/31250) +1 to +5 V DC (1/25000) ¹⁾
	Current	0 to +20mA (1/31250) +4 to +20mA (1/25000) ²⁾
Conversion time	Voltage output	25μs/channel
	Current output	
Total accuracy		Max. ±0.1% F.S. at +25°C Max. ±0.3% F.S. at 0°C to +55°C
Output impedance (Voltage output)		Max. 0.5Ω
Max. output current (Voltage output)		10mA

Item		Description
Allowable load resistance (Current output)		Max. 500Ω
Insulation method		Input terminals ↔ Internal circuit • Optical coupler • Insulated DC-DC converter Between channels: non-insulated
Channel deactivation		Unused channels may be disabled to speed up conversion
Upper and lower limit clipping		Setting range. -32500 to +32500
Scale conversion		Setting range: -30000 to +30000
Offset/gain processing	Offset value	Setting range: -3000 to +3000
	Gain value	Setting range: -9000 to +11000 (90%–110%)
Analog output in PROG mode		Setting range: -31250 to +31250

¹⁾ Full scale (F.S.) for accuracy specifications is 0 to +5V.

²⁾ Full scale (F.S.) for accuracy specifications is 0 to +20mA.

Note

The unit configuration, which is stored in the unit memory (UM), can be changed via the [Advanced] button in the "I/O map and unit configuration" dialog or by specifying the settings in a user program.

See p. 36.

8.3 I/O allocation

8.3.1 Digital values and control flags

Before D/A conversion, the digital input values to the analog unit are written to the CPU's output area (WY). Control flags are also allocated to the CPU's outputs.

The I/O addresses in the table show offset addresses. I/O addresses actually allocated are based on the first word number allocated to the unit.

Example: If the first word number is 10, the address number for the digital input value on channel 0 will be WY10.

Address								Name
Channel 0		Channel 1		Channel 2		Channel 3		
WY0	Y0–YF	WY2	Y20–Y2F	WY4	Y40–Y4F	WY6	Y60–Y6F	Digital input value (16 bits) ¹⁾
WY1	Y10	WY3	Y30	WY5	Y50	WY7	Y70	Clipping control flag ²⁾
	Y10–Y1F		Y31–Y3F		Y51–Y5F		Y71–Y7F	Not used

1) Digital input value

Memory area for digital values before conversion into the analog output values. If scale conversion has been set, the corresponding scaled values are stored here.

Voltage range	Current range	Digital input value
-10 to +10V	–	-31250 to +31250
0 to +10V or 0 to 5V	–	0 to +31250
+1 to +5V	–	0 to +25000
–	0 to +20mA	0 to +31250
–	+4 to +20mA	0 to +25000

2) Clipping control flag

TRUE to execute the upper and lower limit clipping function.

FALSE to turn the upper limit clipping flag (Xn1) and the lower limit clipping flag (Xn2) to FALSE.

8.3.2 Status flags

Status flags are allocated to the CPU's input area (WX).

The I/O addresses in the table show offset addresses. I/O addresses actually allocated are based on the first word number allocated to the unit.

Example: If the first word number is 10, the address number for the error flag on channel 0 will be X100.

Address								Name
Channel 0		Channel 1		Channel 2		Channel 3		
WX0	X0	WX1	X10	WX2	X20	WX3	X30	Error flag ¹⁾
	X1		X11		X21		X31	Upper limit clipping flag ²⁾
	X2		X12		X22		X32	Lower limit clipping flag ³⁾
	X3–XF		X13–X1F		X23–X3F		X33–X3F	Not used

1) Error flag

TRUE when an error has occurred.

2) Upper limit clipping flag

TRUE when the digital input value exceeds the upper limit clipping value, provided that the clipping function is active.

3) Lower limit clipping flag

TRUE when the digital input value drops below the lower limit clipping value, provided that the clipping function is active.

8.4 Unit memory addresses

8.4.1 Allocation of unit memory addresses

There is no need to set unit memory values, because unit memory values will be written automatically if they are set in the "Analog unit settings" dialog of Control FPCWIN Pro. To change parameters by user program, write the desired value to the parameter's unit memory address. See p. 36.

Setting item		Unit memory address			
		Channel 0	Channel 1	Channel 2	Channel 3
Analog output processing		UM00108	UM00118	UM00128	UM00138
Range setting		UM00109	UM00119	UM00129	UM00139
Function setting	Offset/gain processing	UM0010A	UM0011A	UM0012A	UM0013A
	Scale conversion				
	Upper and lower limit clipping				
	Analog output in PROG mode				
Offset value		UM0010B	UM0011B	UM0012B	UM0013B
Gain value		UM0010C	UM0011C	UM0012C	UM0013C
Scale conversion	Upper limit of scale	UM0010D	UM0011D	UM0012D	UM0013D
	Lower limit of scale	UM0010E	UM0011E	UM0012E	UM0013E
Upper and lower limit clipping	Upper limit clipping value	UM0010F	UM0011F	UM0012F	UM0013F
	Lower limit clipping value	UM00110	UM00120	UM00130	UM00140
Digital input value in PROG mode		UM00111	UM00121	UM00131	UM00141

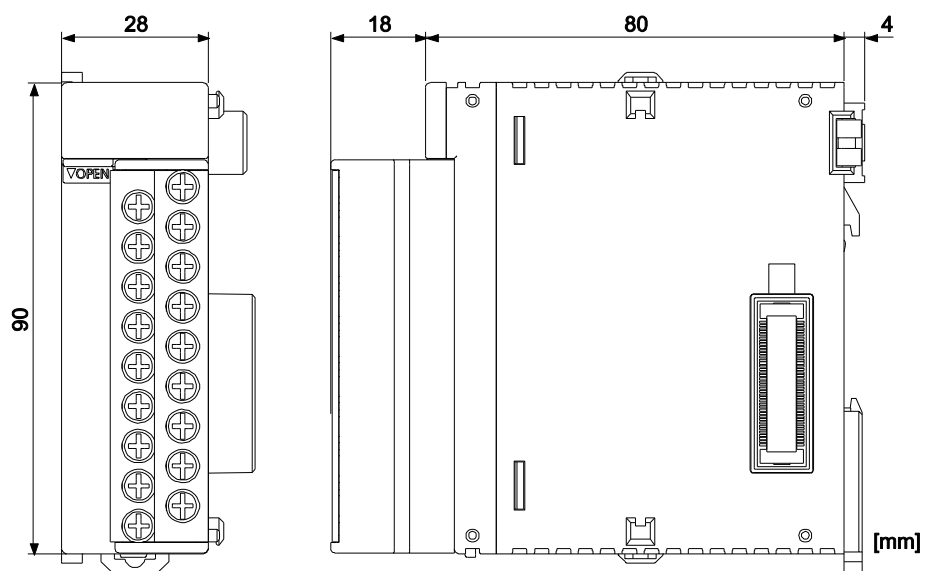
8.5 Bit settings in unit memory areas

Individual settings (settings per channel)

The unit memory addresses are listed in ascending order for the supported channels (e.g. first unit memory address applies to channel 0, second to channel 1 etc.).

Unit memory address	Name	Default	Setting range	
UM00108 UM00118 UM00128 UM00138	Analog output processing	16#1	16#0: Disable 16#1: Enable	
UM00109 UM00119 UM00129 UM00139	Range setting	16#1	16#1: Voltage output -10 to +10V 16#2: Voltage output 0 to +10V 16#4: Voltage output 0 to +5V 16#8: Voltage output +1 to +5V 16#10: Current output 0 to +20mA 16#20: Current output +4 to +20mA	
UM0010A UM0011A UM0012A UM0013A	Analog output in PROG mode	16#0	Bit 0-3	16#0: Stop output (output FALSE) 16#1: Hold current value 16#2: Hold user-defined value
	Offset/gain processing	16#0	Bit 4-7	16#0: Disable 16#1: Enable
	Scale conversion	16#0	Bit 8-11	16#0: Disable 16#1: Enable
	Upper and lower limit clipping	16#0	Bit 12-15	16#0: Disable 16#1: Enable
UM0010B UM0011B UM0012B UM0013B	Offset value	0	To apply the setting, "Offset/gain processing" must be enabled. Setting range: -3000 to +3000 (specified with a signed integer)	
UM0010C UM0011C UM0012C UM0013C	Gain value	10000	To apply the setting, "Offset/gain processing" must be enabled. Setting range: +9000 to +11000: 0.9x to 1.1x (specified with a signed integer)	
UM0010D UM0011D UM0012D UM0013D	Scale conversion max. value	10000	To apply the setting, "Scale conversion" must be enabled. Setting range: -30000 to +30000 (specified with a signed integer)	
UM0010E UM0011E UM0012E UM0013E	Scale conversion min. value	0	To apply the setting, "Scale conversion" must be enabled. Setting range: -30000 to +30000 (specified with a signed integer)	
UM0010F UM0011F UM0012F UM0013F	Upper limit clipping value	0	To apply the setting, "Limit alarm" must be enabled. Setting range: -32500 to +32500 (specified with a signed integer)	
UM00100 UM00120 UM00130 UM00140	Lower limit clipping value	0		
UM 00111 UM 00121 UM 00131 UM 00141	Digital input value in PROG mode	0	Setting range: -10...+10V: -32500 to +32500 0...+10V/0...+5V/0...+20mA: 0 to +32500 +1...+5V/+4...+20mA: 0 to +25000 (specified with a signed integer)	

8.6 Dimensions



Record of changes

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