## PROGRAMMABLE CONTROLLER FPOR Analog I/O Unit User's Manual

[Applicable Models]<br>- FPOR Analog Input Unit (Model No. AFPORAD4/AFPORAD8)<br>- FPOR Analog Output Unit (Model No. AFPORDA4)<br>- FPOR Analog I/O Unit (Model No. AFPORA21/AFPORA42)

## Safety Precautions

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

## WARNING

## If critical situations that could lead to user's death or serious injury is assumed by mishandling of the product.

-Always take precautions to ensure the overall safety of your system, so that the whole system remains safe in the event of failure of this product or other external factor.
-Do not use this product in areas with inflammable gas. It could lead to an explosion. -Exposing this product to excessive heat or open flames could cause damage to the lithium battery or other electronic parts.

## CAUTION

## If critical situations that could lead to user's injury or only property damage is assumed by mishandling of the product.

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

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## Introduction

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

## Types of Manual

- There are different types of users manual for the FPOR series, as listed below. Please refer to a relevant manual for the unit and purpose of your use.
- The manuals can be downloaded on our website:
https://industrial.panasonic.com/ac/e/dl center/manual/

| Unit name or purpose of use | Manual name | Manual code |
| :---: | :---: | :---: |
| FPOR Control Unit | FPOR User's Manual | ARCT1F475E |
| FPOR Expansion I/O Unit |  |  |
| FPE Control Unit | FPE User's Manual | ARCT1F333E |
| FPOH Control Unit | FPOH User's Manual (Basic) | WUME-FPOHBAS |
| FPOR Analog Input Unit | FPOR Analog I/O Unit User's Manual | WUME-FPORAIO |
| FPOR Analog Output Unit |  |  |
| FPOR Analog I/O Unit |  |  |
| Programming | FP-series Programming Manual | ARCT1F313E |
| Programming Software FPWIN GR | FPWIN GR Operation Guide (Non-free) | ARCT1F332E |

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## Unit Functions and Restrictions

### 1.1 Unit Functions and How They Work

### 1.1.1 Functions of Unit

Attaching these units to FPOR Control Unit enables analog I/O control.

- It is selectable from five types of units in accordance with the intended use.
- Compatibility mode with conventional models is prepared.
-The compatibility mode which enables smooth transition from conventional Analog I/O Units (FP0-A80, FP0-A04V, FP0-A04I, FP0-A21) is prepared.
- 14-bit processing mode is added.
- The high-resolution 14-bit mode (1/16000) is added to the both input and output. Also, ranges for each channel can be specified by user programs.


### 1.1.2 Unit Type

| Name | Specifications | Product number |
| :--- | :--- | :--- |
| FPOR Analog Input unit | 4-ch input | AFPORAD4 |
|  | 8-ch input | AFPORAD8 |
| FPOR Analog Output Unit | 4-ch output | AFPORDA4 |
| FPOR Analog I/O Unit | 2-ch Input, 1-ch output | AFP0RA21 |
|  | 4-ch Input, 2-ch output | AFPORA42 |

### 1.1.3 Restrictions on Units Combination

Up to three units can be connected with the control unit including other FP0/FPOR Expansion I/O Unit and intelligent unit.

## Names and Functions of Parts

### 2.1 Analog Input Unit (FP0R-AD4/AD8)

### 2.1.1 Names and Functions of Parts



Names and Functions of Parts

| No. | Name | Description |
| :---: | :--- | :--- |
| (1) | Mode setting <br> switch | - Used for selecting the input range, the number of input channels and whether <br> to use the averaging processing or not. <br> U Used for selecting the operation mode (12-bit mode or 14-bit mode compatible <br> with the conventional product FPO-A80). |
| (2) | Innut terminal <br> for CH0-CH3 | Used for connecting the analog input device. |
| (3) | Input terminal <br> for CH4-CH7 | Used for connecting the analog input device. |
| (4) | Expansion <br> connector | Used for connecting the expansion unit with the internal circuit of the Control Unit. |
| (5) | DIN rail installing <br> groove | It can be installed to a 35-mm-wide DIN rail. |
| (6) | DIN hook | The unit can be installed to the DIN rail through one-touch operation. <br> This hook is also used for installing the unit to the Slim Type Mounting Plate <br> (AFP0803). |
| (7) | Expansion hook | Used for securing expansion units. |

### 2.1.2 Setting of Mode Switch



Setting of the mode switch

| Item | No. | Settings |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
| Resolution and FP0-A21compatible 12-bit mode input range | 1 | OFF | ON | OFF | ON |
|  | 2 | OFF | OFF | ON | ON |
|  |  | FP0-A80compatible 12-bit mode 0 to $5 \mathrm{~V} / 0$ to 20 mA (Note 1) | FP0-A80compatible 12-bit mode $-10 \text { to }+10 \mathrm{~V}$ | $\begin{aligned} & \text { FP0-A80- } \\ & \text { compatible } \\ & \text { 12-bit mode } \\ & -100 \text { to }+100 \mathrm{mV} \\ & \text { (Note } 2 \text { ) } \end{aligned}$ | 14-bit mode (Note 3) |
| The number of converted CH | 3 | OFF | ON | OFF | ON |
|  | 4 | OFF | OFF | ON | ON |
|  |  | $\begin{aligned} & 2 \mathrm{ch} \\ & (\mathrm{CH}-\mathrm{CH} 1) \end{aligned}$ | $\begin{aligned} & \text { 4ch } \\ & \text { (CHO-CH3) } \end{aligned}$ | $\begin{aligned} & \text { 6ch } \\ & \text { (CHO-CH5) } \end{aligned}$ | $\begin{aligned} & 8 \mathrm{ch} \\ & \text { (CHO-CH7) } \end{aligned}$ |
| Input averaging | 5 | OFF: Averaging Not performed, ON: Averaging Performed |  |  |  |

(Note 1): When the both switch No. 1 and No. 2 are OFF, the voltage/current is switched by the connection method.
(Note 2): This has been implemented in version 1.2 or later. In version 1.1 or earlier, this is reserved for the system (not available).
(Note 3): In the 14-bit mode, the input range is set by writing into the operation memory WY with a user program.
(Note 4): All the switches are set to OFF at the factory.
(Note 5): The switch settings will be valid when the power is turned ON from OFF. The settings will not change if the operation power supply is switched when it is ON.

### 2.2 Analog Output Unit (FPOR-DA4)

### 2.2.1 Names and Functions of Parts



## Names and Functions of Parts

| No. | Name | Description |
| :---: | :---: | :---: |
| (1) | Mode setting switch | - Used for selecting the output range and the output method (voltage/current). <br> - Used for selecting the operation mode (12-bit mode or 14-bit mode compatible with the conventional product FPO-A04V/A04I). |
| (2) | Voltage output terminal for $\mathrm{CH} 0-\mathrm{CH} 3$ | - Used for connecting the analog output device. <br> - The voltage and current vary according to the settings of the mode switch. They can be selected for each channel. |
| (3) | Current output terminal for $\mathrm{CH} 0-\mathrm{CH} 3$ |  |
| (4) | Power connector | 24 V DC is supplied from an external power supply.For connection, use the power supply cable (AFP0581) that comes with the Unit. |
| (5) | Expansion connector | Used for connecting the expansion unit with the internal circuit of the Control Unit. |
| (6) | DIN rail installing groove | It can be installed to a $35-\mathrm{mm}$-wide DIN rail. |
| (7) | DIN hook | The unit can be installed to the DIN rail through one-touch operation. This hook is also used for installing the unit to the Slim Type Mounting Plate (AFP0803). |
| (8) | Expansion hook | Used for securing expansion units. |

### 2.2.2 Setting of Mode Switch



Setting of the mode switch

| Item | No. | Settings |  |
| :--- | :--- | :--- | :--- |
| Resolution | 1 | $\mathrm{OFF}:$ FP0-A04V/A04I compatible 12-bit mode, ON: 14-bit mode (Note 1) |  |
| Output switch | 2 | $\mathrm{CH0}$ |  |
|  | 3 | CH 1 | OFF:Voltage output |
|  | 4 | $\mathrm{CH}:$ Current output (Note 2) |  |
|  | 5 | CH 3 |  |

(Note 1): In the 14-bit mode, the output range is set by writing into the operation memory WY with a user program.
(Note 2): For the both FPO-A04V/A04I compatibility 12 -bit mode and 14 -bit mode, the output can be selected for each channel.
(Note 3): All the switches are set to OFF at the factory.
(Note 4): The switch settings will be valid when the power is turned ON from OFF. The settings will not change if the operation power supply is switched when it is ON.

- In the FPO-A04V/A04I compatibility 12-bit mode, the voltage output range is -10 to +10 V , and the current output range is $\mathbf{4}$ to $\mathbf{2 0} \mathrm{mA}$.


### 2.3 Analog I/O Unit (FP0R-A21/A42)

### 2.3.1 Names and Functions of Parts



## Names and Functions of Parts

| No. | Name | Description |
| :---: | :--- | :--- |
| (1) | Mode setting <br> switch | - Used for selecting the input and output ranges, the output method <br> (voltage/current), and whether to perform the input averaing processing or not. <br> - Used for selecting the operation mode (12-bit mode or 14-bit mode compatible <br> with the conventional product FPO-A21). |
| (2) | I/O terminal <br> Input for CH0- <br> CH1 <br> Output for CH0 | - Used for connecting the analog input device or analog output device. <br> - The voltage and current vary according to the settings of the mode switch. <br> They can be selected for each channel. |
| (3) | I/O terminal <br> Input for CH2- <br> CH3 <br> Output for CH1 | The supply 24 V DC from an external power supply. For connection, use the <br> power supply cable (AFPO581) that comes with the Unit. |
| (4) | Power connector |  |
| (5) | Expansion <br> connector | Used for connecting the expansion unit with the internal circuit of the Control Unit. |
| (6) | DIN rail installing <br> groove | It can be installed to a 35-mm-wide DIN rail. |
| (7) | DIN hook | The unit can be installed to the DIN rail through one-touch operation. <br> This hook is also used for installing the unit to the Slim Type Mounting Plate <br> (AFP0803). |
| (8) | Expansion hook | Used for securing expansion units. |

### 2.3.2 Setting of Mode Switch



Setting of the mode switch

| Item | No. | Settings |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
| I/O resolution and FP0-A21compatible 12-bit mode input range | 1 | OFF | ON | OFF | ON |
|  | 2 | OFF | OFF | ON | ON |
|  |  | FPO-A21compatible 12-bit mode 0 to $5 \mathrm{~V} / 0$ to 20 mA (Note 1) | FP0-A21compatible 12-bit mode -10 to +10 V | Reserved for system (Not settable) | 14-bit mode (Note 2) |
| FPO-A21compatible 12-bit mode output range (Note 3) | 3 | OFF | ON | OFF | ON |
|  | 4 | OFF | OFF | ON | ON |
|  |  | FP0-A21compatible 12-bit mode 0 to 20 mA | Reserved for system (Not settable) | FP0-A21compatible 12-bit mode -10 to +10 V | Reserved for system (Not settable) |
| 14-bit mode output switch (Note 4) | 3 | OFF | ON | OFF | ON |
|  | 4 | OFF | OFF | ON | ON |
|  |  | CH0 Voltage output <br> CH1 Voltage output | CHO Current output <br> CH1 Voltage output | CH0 Voltage output CH1 Current output | CH0 Current output CH1 Current output |
| Input averaging | 5 | OFF: Averaging Not performed, ON: Averaging Performed |  |  |  |

(Note 1): When the both switch No. 1 and No. 2 are OFF, the input voltage/current is switched by the connection method.
(Note 2): In the 14-bit mode, the input and ouput ranges are set by writing into the operation memory WY with a user program.
(Note 3): The setting of "FPO-A21 compatibility 12-bit mode output switch" of the switches No. 3 and No. 4 is valid when the switch No. 2 is off.
(Note 4): The setting of "14-bit mode output switch" of the switches No. 3 and No. 4 is valid when the both switch No. 1 and No. 2 are on. Switching CH 1 is available only for A42 type.
(Note 5): All the switches are set to OFF at the factory.
(Note 6): The switch settings will be valid when the power is turned ON from OFF. The settings will not change if the operation power supply is switched when it is ON.

## Wiring

### 3.1 Analog Input Unit (FP0R-AD4/AD8)

### 3.1.1 Terminal Layout Diagrams


(Note 1): For inputting a current signal, connect the V terminal and I terminal externally.
(Note 2):Two COM terminals are connected internally.

### 3.1.2 Wiring of Analog Input Unit

Voltage input
(Note 1): Two COM terminals are connected internally.
(Note 2): Two cables or less must be inserted to COM terminal as above (two channel once combined).
(Note 3): Recommend using the twisted and shielded communication cables for analog lines and grounding the end of shield.

### 3.2 Analog Output Unit (FPOR-DA4)

### 3.2.1 Terminal Layout Diagrams

| Appearance | Pin No. | Name | Function |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
| $\begin{gathered} {\left[\begin{array}{c} \mathrm{V} 0 \\ \text { COM } \end{array}\right.} \\ {\left[\begin{array}{c} \mathrm{V} 1 \\ \mathrm{COM} \\ {\left[\begin{array}{c} \mathrm{V} 2 \\ \mathrm{COM} \end{array}\right.} \\ {\left[\begin{array}{c} \mathrm{V} 3 \\ \mathrm{COM} \\ \mathrm{NC} \end{array}\right.} \end{array} .\right.} \end{gathered}$ | 1 | V0 | Analog output | CHO | Voltage signal output |
|  | 2 | COM |  | --- | Output common |
|  | 3 | VI |  | CH1 | Voltage signal output |
|  | 4 | COM |  | --- | Output common |
|  | 5 | V2 |  | CH2 | Voltage signal output |
|  | 6 | COM |  | --- | Output common |
|  | 7 | V3 |  | CH3 | Voltage signal output |
|  | 8 | COM |  | --- | Output common |
|  | 9 | NC | Unused |  |  |
|  |  |  |  |  |  |
| 0 | Pin No. | Name | Function |  |  |
| COM | 1 | 10 | Analog output | CHO | Current signal output |
| $\Gamma^{11}$ | 2 | COM |  | --- | Output common |
| COM | 3 | 11 |  | CH1 | Current signal output |
|  | 4 | COM |  | --- | Output common |
|  | 5 | 12 |  | CH2 | Current signal output |
|  | 6 | COM |  | --- | Output common |
|  | 7 | 13 |  | CH3 | Current signal output |
|  | 8 | COM |  | --- | Output common |
|  | 9 | NC | Unused |  |  |

(Note): All COM terminals are connected within the unit.

### 3.2.2 Wiring of Analog Output Unit

## ■ When the voltage output



## ■ When current output


(Note):All COM terminals of the voltage output terminal block and current output terminal block are connected internally.

### 3.3 Analog I/O Unit (FP0R-A21/A42)

### 3.3.1 Terminal Layout Diagrams

| Appearance |  | Pin No. | Name |  | Function |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | 1 | IN | V0 | Analog input | CH0 | Voltage signal input |
|  |  | 2 | IN | 10 |  | CH0 | Current signal input |
|  |  | 3 | IN | COM |  | --- | Input common |
|  |  | 4 | IN | VI |  | CH1 | Voltage signal input |
|  |  | 5 | IN | 11 |  | CH1 | Current signal input |
|  |  | 6 | FG |  | For shield connection of analog signal cable |  |  |
|  | - | 7 | OUT | V0 | Analog output | CH0 | Voltage signal output |
|  |  | 8 | OUT | 10 |  | CHO | Current signal output |
|  |  | 9 | OUT | COM |  | --- | Output common |
|  | 二 | Pin No. | Name |  | Function |  |  |
|  |  | 1 | IN | Vo | Analog input | CH 2 | Voltage signal input |
|  |  | 2 | IN | 10 |  | CH2 | Current signal input |
|  |  | 3 | IN | COM |  | --- | Input common |
|  |  | 4 | IN | VI |  | CH3 | Voltage signal input |
|  |  | 5 | IN | 11 |  | CH3 | Current signal input |
|  |  | 6 | FG |  | For shield connection of analog signal cable |  |  |
|  |  | 7 | OUT | V1 | Analog output | CH1 | Voltage signal output |
|  |  | 8 | OUT | 11 |  | CH 1 | Current signal output |
|  |  | 9 | OUT | COM |  | --- | Output common |

(Note 1):For inputting a current signal to the analog input part, connect the V terminal and I terminal externally. (Note 2): All COM terminals are connected within the unit.

### 3.3.2 Wiring of Analog I/O Unit

- Analog input
Voltage input
(Note 1):In the above figure, the input ( $\mathrm{CHO} / \mathrm{CH} 1$ ) and output CH 0 are described as representative examples.
The input ( $\mathrm{CH} 2 / \mathrm{CH} 3$ ) and output CH 1 of A 42 type also have the same terminal layouts.
(Note 2): All COM terminals are connected within the unit.


### 3.4 Common Precautions

### 3.4.1 Wiring of Analog I/O Unit

## Wiring diagram

## Voltage input

Analog device


## Current input


*1: For the current input, short-circuit the V and I terminals.

## Voltage output



## Current output



## - Precautions on Wiring

- Use double-core twisted-pair shielded wires. It is recommended to ground the shielding. 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 $A C$ wires, power wires, or load wires.
- Do not have the analog output wiring close to AC wires, power wires, or load wires.
- Compatible cable (twisted wire)

| Size | Nominal cross section area |
| :--- | :--- |
| AWG\#28-16 | $0.08 \mathrm{~mm}^{2}-1.25 \mathrm{~mm}^{2}$ |

## - Special tools

| Manufacturer | Serial number (model number) |
| :--- | :--- |
| Phoenix Contact Co. | SZS0.4×2.5(1205037) |

### 3.4.2 Wiring of Power Cable (FPOR-DA4 / FPOR-A21 / FPOR-A42)

The power needs to be supplied to the analog output unit (FPOR-DA4) and analog I/O unit (FP0R-A21/FP0R-A42) for operation.


Green: Function earth
Blue:- $\quad 24 \mathrm{~V}$ DC
Brown:+

## ■ Precautions on Wiring

- It is connected using the cable (Part number:AFP0581) supplied with the unit.
- The input voltage range of the power supply for operating the unit is 20.4 to 28.8 VDC.
- Use the power supply of SELV (Safety Extra-Low Voltage) and LIM (Limited Energy Circuit).
- In order to avoid influence of noise, the function earth terminal must be grounded.


## 4

## Creating Programs

### 4.1 I/O Allocation

### 4.1.1 I/O Allocation

- For analog input data and analog output data, input relays (WX) and output relays (WY) are read and written to the control unit.
- I/O numbers do not need to be set as I/O allocation is performed automatically.
- I/O numbers vary according to installation positions.
- The allocated contents vary according to the type of units and mode. For details, refer to the chapters 4.2 to 4.4.


| Type of unit | Allocation content | I/O number |  |  |
| :---: | :---: | :---: | :---: | :---: |
|  |  | Expansion unit 1 | Expansion unit 2 | Expansion unit 3 |
| FPOR <br> Analog input unit AFPORAD4 (Note 1) AFPORAD8 | Input $\mathrm{CHO} / \mathrm{CH} 2 / \mathrm{CH} 4 / \mathrm{CH} 6$ | $\begin{aligned} & \text { WX2 } \\ & (X 20 \sim X 2 F) \end{aligned}$ | $\begin{aligned} & \text { WX4 } \\ & (X 40 \sim \text { X4F) } \end{aligned}$ | $\begin{aligned} & \text { WX6 } \\ & \text { (X60~X6F) } \end{aligned}$ |
|  | Input $\mathrm{CH} 1 / \mathrm{CH} 3 / \mathrm{CH} 5 / \mathrm{CH} 7$ | $\begin{aligned} & \text { WX3 } \\ & (X 30 \sim X 3 F) \end{aligned}$ | $\begin{aligned} & \text { WX5 } \\ & \text { (X50~X5F) } \end{aligned}$ | $\begin{aligned} & \text { WX7 } \\ & (\text { X70~X7F) } \end{aligned}$ |
|  | Output <br> 14-bit mode range setting | $\begin{aligned} & \text { WY2 } \\ & \text { (Y20~Y2F) } \end{aligned}$ | WY4 (Y40~Y4F) | WY6 (Y60~Y6F) |
|  | Output <br> 14-bit mode range averaging setting | $\begin{aligned} & \text { WY3 } \\ & \text { (Y30~Y3F) } \end{aligned}$ | $\begin{aligned} & \text { WY5 } \\ & \text { (Y50~Y5F) } \end{aligned}$ | $\begin{aligned} & \text { WY7 } \\ & \text { (Y70~Y7F) } \end{aligned}$ |
| FPOR <br> Analog output unit AFP0RDA4 | Input <br> Status information <br> (Power ON/OFF, Write state) | $\begin{aligned} & \text { WX2 } \\ & (X 20 \sim X 2 F) \end{aligned}$ | $\begin{aligned} & \text { WX4 } \\ & (X 40 \sim X 4 F) \end{aligned}$ | $\begin{aligned} & \text { WX6 } \\ & (\text { X60~X6F) } \end{aligned}$ |
|  |  | $\begin{aligned} & \text { WX3 } \\ & (X 30 \sim X 3 F) \end{aligned}$ | $\begin{aligned} & \text { WX5 } \\ & \text { (X50~X5F) } \end{aligned}$ | $\begin{aligned} & \text { WX7 } \\ & (\text { X70~X7F) } \end{aligned}$ |
|  | $\begin{aligned} & \text { Output (Note 2) } \\ & \mathrm{CH} 0 / \mathrm{CH} 2 \end{aligned}$ | WY2 (Y20~Y2F) | WY4 (Y40~Y4F) | WY6 (Y60~Y6F) |
|  | Output (Note 2) CH1/CH3 | WY3 (Y30~Y3F) | WY5 (Y50~Y5F) | $\begin{aligned} & \text { WY7 } \\ & \text { (Y70~Y7F) } \end{aligned}$ |
| FPOR <br> Analog I/O unit AFPORA21 (Note 3) AFP0RA42 | Input $\mathrm{CHO} / \mathrm{CH} 2$ | $\begin{aligned} & \text { WX2 } \\ & \text { (X20~X2F) } \end{aligned}$ | $\begin{aligned} & \text { WX4 } \\ & (X 40 \sim X 4 F) \end{aligned}$ | $\begin{aligned} & \text { WX6 } \\ & \text { (X60~X6F) } \end{aligned}$ |
|  | Input $\mathrm{CH} 1 / \mathrm{CH} 3$ | $\begin{aligned} & \text { WX3 } \\ & \text { (X30~X3F) } \end{aligned}$ | $\begin{aligned} & \text { WX5 } \\ & \text { (X50~X5F) } \end{aligned}$ | $\begin{aligned} & \text { WX7 } \\ & \text { (X70~X7F) } \end{aligned}$ |
|  | $\begin{aligned} & \text { Output (Note 4) } \\ & \text { CHO } \end{aligned}$ | WY2 (Y20~Y2F) | WY4 (Y40~Y4F) | $\begin{aligned} & \text { WY6 } \\ & \text { (Y60~Y6F) } \end{aligned}$ |
|  | Output (Note 4) CH1 | WY3 (Y30~Y3F) | WY5 (Y50~Y5F) | WY7 (Y70~Y7F) |

(Note 1):On AFPORAD4, data of CH 0 to CH 3 is handled.
(Note 2):It can be also used for switching the output range in the 14-bit mode.
(Note 3):On AFP04A21, data of input $\mathrm{CH} 0 / \mathrm{CH} 1$ and output CH 0 is handled.
(Note 4):It can be also used for the input range, averaging setting for input and switching the output range in the 14bit mode.

### 4.2 Analog input unit (FP0R-AD4/AD8)

### 4.2.1 Reading of Input Data (Common to 12-bit Mode and 14-bit Mode)

The analog input unit uses the most significant 2 bits as a flag for switching channels and reads conversion data sequentially.

## - I/O allocation (External input WX)



|  <br> 2:2:2i2:2i2:2:2:2:2;2i2:2:2i2:2 <br> F!E!D:C!B!A!9!8:7!6!5!4!3:2:1!0 |
| :---: |
|  |  |
|  |  |


| Conversion data of |
| :---: |
| CHO/CH2/CH4/CH6 |
| (16 bit with sign) |

Conversion data switch flag

| A1 | A0 | WX3 | WX2 |
| :---: | :---: | :---: | :---: |
| 0 | 0 | CH 1 data | CH 0 data |
| 0 | 1 | CH 3 data | CH 2 data |
| 1 | 0 | CH 5 data | CH 4 data |
| 1 | 1 | CH 7 data | CH 6 data |

## - Role of conversion data switching flag

- The analog input unit reads the analog input data of a maximum of 8 channels using two memory areas (WX2 and WX3). The most significant two bits are allocated as a conversion data switching flag for distinguishing channels.
- Conversion data of even numbered channels can be read as 16-bit data as they are.
- As conversion data of odd numbered channels contain the conversion data switching flag of most significant two bits, mask processing needs to be applied to the data with a user program. Plus conversion data should be masked by " 00 ", and minus conversion data should be masked by "11". Create a program in reference to the following programs.
(Example):For reading data of CH 3

| CH3 data | WX3 | Data after masking | Description |
| :---: | :---: | :---: | :--- |
| 1 | 0100000000000001 | 0000000000000001 | Most significant two bits are <br> masked by "00". |
| -1 | 0111111111111111 | 1111111111111111 | Most significant two bits are <br> masked by "11". |

## ■ Sample program (Analog input: For ranges of -10 V to +10 V and -5 V to +5 V )

The following program shows the case that conversion data of the first expansion analog input unit ( CH 0 to CH 7 ) is read and stored in DT0 to DT7.


| (1) | X3F | The channels of conversion data read by turning on/off the conversion data switching flags X3F and X 3 E are distinguished. |
| :---: | :---: | :---: |
| (2) | X3E |  |
| (3) | X3D | The signs of conversion data of read odd numbered channels are distinguished. When plus, OFF. When minus, ON. |
| (a) | Conversion data of even numbered channels $\mathrm{CH} 0 / \mathrm{CH} 2 / \mathrm{CH} 4 / \mathrm{CH} 6$ is transferred as is. |  |
| (b) | When the data of odd numbered channels $\mathrm{CH} 1 / \mathrm{CH} 3 / \mathrm{CH} 5 / \mathrm{HC} 7$ is positive, the most significant two bits are masked by "00" with F65 WAN (AND) instruction, and the data is stored in DT1/DT3/DT5/DT7. |  |
| © | When the data of odd numbered channels $\mathrm{CH} 1 / \mathrm{CH} 3 / \mathrm{CH} 5 / \mathrm{HC} 7$ is negative, the most significant two bits are masked by "11" with F66 WOR (OR) instruction, and the data is stored in DT1/DT3/DT5/DT7. |  |

## Sample program (For ranges of 0 to $10 \mathrm{~V}, \mathbf{0}$ to 5 V and $\mathbf{0}$ to $\mathbf{2 0 \mathrm { mA } )}$

The following program shows the case that conversion data of the first expansion analog input unit ( CH 0 to CH 7 ) is read and stored in DT0 to DT7.


| (1) | X3F | The channels of conversion data read by turning on/off the conversion data switching flags X 3 F <br> and X 3 E are distinguished. |
| :--- | :--- | :--- |
| (2) | $\times 3 \mathrm{E}$ |  |
| (a) | Conversion data of even numbered channels $\mathrm{CH} 0 / \mathrm{CH} 2 / \mathrm{CH} 4 / \mathrm{CH} 6$ is transferred as is. |  |
| (b) | When the data of odd numbered channels $\mathrm{CH} 1 / \mathrm{CH} 3 / \mathrm{CH} 5 / \mathrm{HC7}$ is positive, the most significant two bits <br> are masked by "00" with F65 WAN (AND) instruction, and the data is stored in DT1/DT3/DT5/DT7. |  |

### 4.2.2 Setting of Input Range and Averaging Processing (14-bit Mode Only)

When selecting the 14-bit mode in the analog input unit (FP0R-AD4/AD8), the input range and averaging method can be switched by user programs. They both can be set for each channel.

## Default settings

The default settings are as follows; Input range for all channels: -10 to +10 V , Averaging processing: Moving average processing 10 times (Max. and min. removal). The averaging processing is enabled when the mode switch No. 5 is ON.

## ■ I/O allocation (External output WY)



## ■ Sample program (Switching input range)

The following program shows the case that the input range of CH 0 to CH 7 of the first expansion analog input unit is set.


| (1) | Input a constant for specifying an input range. Set it according to the $\mathrm{I} / \mathrm{O}$ allocation on the previous page. <br> In the above sample program, HFF 50 is input for setting $\mathrm{Y} 2 \mathrm{~F}-\mathrm{Y} 28$ to 1 and $\mathrm{Y} 27-\mathrm{Y} 20$ to 0 <br> The range for CH 4 to CH 7 is 0 to $5 \mathrm{~V} / 0$ to 20 mA , and that for CHO to CH is -10 V to +10 V. |  |
| :--- | :--- | :--- |
| (2) | WY2 | Set it for switching the input range. |

## ■ Sample program (Switching averaging processing method)

The following program shows the case that the averaging processing method of CH 0 to CH 7 of the first expansion analog input unit is set.


| (1) | Input a constant for specifying an averanging method. Set it according to the I/O allocation on the <br> previous page. <br> In the above sample program, HFF00 is input for setting Y3F-Y38 to 1 and $\mathrm{Y} 37-\mathrm{Y} 30$ to 0. |
| :--- | :--- | :--- |
| The method of CH4 to CH7 is no averaging processing, and that of CHO to CH 3 is moving average 10 |  |
| times. |  |

### 4.3 Analog Output Unit (FPOR-DA4)

### 4.3.1 Writing of Digital Data for Output (12-bit Mode)

With the analog output unit, the conversion output is performed by using two bits as the switching flags of output channels and writing data.

## I/O allocation (12-bit FPO-A04 Compatibility mode)

Two bits, the bits $C$ and $D$, are used as the switching flags.


| A1 | A0 | WY3 |
| :---: | :---: | :--- |
| 0 | 0 | D/A conversion: None |
| 0 | 1 | CH1data |
| 1 | 0 | CH3 data |
| 1 | 1 | D/A conversion: None |


| A1 | A0 | WY2 |
| :---: | :---: | :--- |
| 0 | 0 | D/A conversion: None |
| 0 | 1 | CH0 data |
| 1 | 0 | CH2 data |
| 1 | 1 | D/A conversion: None |

## - Writing conversion data

- The analog output unit writes the analog output digital data of a maximum of 4 channels to two memory areas (WY2/WY3) by user programs. Output data switching flags for specifying channels are allocated to the two bits of the memory area (WY2/WY3).
- In user programs, channels are specified by setting/resetting the output channel swtiching flag right after setting a digital value in the memory area.
- As CH 0 and CH 2 , and CH 1 and CH 3 use each common memory area, data cannot be written to the unit in the same scan. Write data separated into two scans using scan pulse relay R9012, etc. In the channels which are not allocated to the same memory area, data can be written in the same scan.

| Example | Processing | Description |
| :--- | :--- | :--- |
| When CH0 and <br> CH 1 are used | Writing CH0 data in WY2 at the time of " $n$ " scan <br> Writing CH1 data in WY3 at the time of " $n$ " scan | Data can be written in WY2 and WY3 at <br> the time of " $n$ " scan. |
| When CH0 and <br> CH2 are used | Writing CH0 data in WY2 at the time of " $n$ " scan <br> Writing CH2 data in WY2 at the time of " $n+1$ " scan | Data can be written in WY2 once in 2 <br> scanning processes (at the time of " $n$ " <br> and " $n+1$ " scan). |

## ■ When data is regarded as an error

- Digital data from the control unit is written in the analog output unit.

When more than the specified amount of data (-2000 to 2000 for voltage type Unit, 0 to 4000 for current type Unit) is written in the Unit, the Unit regards the data as an error and writes the error flag in WX2. As a result, the D/A conversion is not performed. (For analog output, the previous data remains unchanged. When the correct data is written, the error flag is cleared and D/A conversion is executed.)

- Output data and output switching flag are allocated to the same I/O number. Data error can be detected successfully with the flags when the digital input value is within the range of K4096 to K4095. Even when the digital input value is out of the range, however, data conversion may be mistakenly conducted as shown below. To prevent this problem, be sure to set up the program to check the upper and lower limits of the digital value.
(Example): When writing K4096 in WY2
K4096= 0001000000000000
Analog Output Unit regards Y2D and Y2C as output switching flags:
Y2D, Y2C = $01<-\mathrm{CHO}$
Data $=000000000000<-0$
Consequently, the analog value that is equivalent to the digital value " 0 " is output from CHO .


## - Negative data

-When the negative data (minus data) is written, set the output switching flag to two's complement data. When specifying the minus data in the decimal data, the data automatically becomes two's complement data. Then, set the output switching flag to two's complement data in the same way as the plus data.
(Example): When writing -1 in CH 0
$-1=1111111111111111$ <- Two's complement
Setting the output switching flag: 1101111111111111 (Bit C=1, Bit D=0 for CHO)

## Sample program (12-bit mode: For the range of -10 V to +10 V)

The following program shows the case that the data of DT0 to DT3 is converted and output to the CH 0 to CH 3 of the first expansion analog output unit. The range for checking digital values written in the output area is changed.


| (1) | R9012 | Switches the timing of writing data by the scan pulse realy. |
| :--- | :--- | :--- |
| (2) | Checks whether the lower limit value is within the data range that the unit can convert correctly. |  |
| (3) | Checks whether the upper limit value is within the data range that the unit can convert correctly. |  |
| (4) | Y2C | Output data switching flags for even numbered channels. Channel numbers are specified by <br> the two-bit switching flags right after setting conversion data by the transfer instruction F0 <br> MV. |
| (5) | Y2D | Output data switching flags for odd numbered channels. Channel numbers are specified by <br> the two-bit switching flags right after setting conversion data by the transfer instruction F0 <br> MV. |
| (6) | Y3C | Y3D |
| (7) | Y3D | It is executed when the scan pulse relay is ON and written data is within the upper and lower limits. <br> Data for CH0 is set in DT0, and CH0 is specified by the output data switching flag. |
| (b) | It is executed when the scan pulse relay is ON and written data is within the upper and lower limits. <br> Data for CH1 is set in DT1, and CH1 is specified by the output data switching flag. |  |
| (C) | It is executed when the scan pulse relay is OFF and written data is within the upper and lower limits. <br> Data for CH2 is set in DT2, and CH2 is specified by the output data switching flag. |  |
| (d) | It is executed when the scan pulse relay is OFF and written data is within the upper and lower limits. <br> Data for CH3 is set in DT3, and CH3 is specified by the output data switching flag. |  |

- In the FP0-A04-compatible 12-bit mode, Y2C, Y2D, Y3C and Y3D are used as the output data switching flags. Note that the allocation is different from that in the 14-bit mode.


## ■ Sample program (12-bit mode: For the range of 4 to 20 mA )

The following program shows the case that the data of DT0 to DT3 is converted and output to the CH 0 to CH 3 of the first expansion analog output unit. The range for checking digital values written in the output area is changed.


| (1) | R9012 | Switches the timing of writing data by the scan pulse realy. |
| :--- | :--- | :--- |
| (2) | Checks whether the lower limit value is within the data range that the unit can convert correctly. |  |
| (3) | Checks whether the upper limit value is within the data range that the unit can convert correctly. |  |
| (4) | Y2C | Output data switching flags for even numbered channels. Channel numbers are specified by <br> the two-bit switching flags right after setting conversion data by the transfer instruction F0 <br> MV. |
| (5) | Y2D | Output data switching flags for odd numbered channels. Channel numbers are specified by <br> the two-bit switching flags right after setting conversion data by the transfer instruction F0 <br> MV. |
| (6) | Y3C | Y3D |
| (7) | Y3D | It is executed when the scan pulse relay is ON and written data is within the upper and lower limits. <br> Data for CH0 is set in DT0, and CH0 is specified by the output data switching flag. |
| (b) | It is executed when the scan pulse relay is ON and written data is within the upper and lower limits. <br> Data for CH1 is set in DT1, and CH1 is specified by the output data switching flag. |  |
| (C) | It is executed when the scan pulse relay is OFF and written data is within the upper and lower limits. <br> Data for CH2 is set in DT2, and CH2 is specified by the output data switching flag. |  |
| (d) | It is executed when the scan pulse relay is OFF and written data is within the upper and lower limits. <br> Data for CH3 is set in DT3, and CH3 is specified by the output data switching flag. |  |

- In the FP0-A04-compatible 12-bit mode, Y2C, Y2D, Y3C and Y3D are used as the output data switching flags. Note that the allocation is different from that in the 14-bit mode.


### 4.3.2 Writing of Digital Data for Output (14-bit Mode)

With the analog output unit, the conversion output is performed by using two bits as the switching flags of output channels and writing data.

## ■ I/O allocation (14-bit mode)

In the 14-bit mode, the most significant two bits are used as the switching flags. They are common to the flags for setting ranges.


## ■ Writing data for conversion

- The analog output unit writes the analog output digital data of a maximum of 4 channels to two memory areas (WY2/WY3) by user programs. Output data switching flags for specifying channels are allocated to the two bits of the memory area (WY2/WY3).
- In user programs, channels are specified by setting/resetting the output channel swtiching flag right after setting a digital value in the memory area.
- As CH 0 and CH 2 , and CH 1 and CH 3 use each common memory area, data cannot be written to the unit in the same scan. Write data separated into two scans using scan pulse relay R9012, etc. In the channels which are not allocated to the same memory area, data can be written in the same scan.

| Example | Processing | Description |
| :--- | :--- | :--- |
| When CH0 and <br> CH 1 are used | Writing CH0 data in WY2 at the time of "n" scan <br> Writing CH1 data in WY3 at the time of "n" scan | Data can be written in WY2 and WY3 at <br> the time of "n" scan. |
| When CH0 and <br> CH 2 are used | Writing CH0 data in WY2 at the time of " $n$ " scan <br> Writing CH2 data in WY2 at the time of " $n+1$ " scan | Data can be written in WY2 once in 2 <br> scanning processes (at the time of "n" <br> and " $n+1$ " scan). |

## ■ When data is regarded as an error

- Digital data from the control unit is written in the Analog Output Unit.

When more than the specified amount of data ( -8000 to 8000 for $\pm$ range, 0 to 16000 for + range) is written in the Unit, the Unit regards the data as an error and writes the error flag in WX2. As a result, the D/A conversion is not performed. For analog output, the previous data remains unchanged. When the correct data is written, the error flag is cleared and D/A conversion is executed.

- Output data and output switching flag are allocated to the sane I/O number. Data error can be detected successfully with the flags when the digital input value is within the range of 8192 to +8191 for $\pm$ range, 0 to 16383 for + range. Even when the digital input value is out of the range, however, data conversion may be mistakenly conducted as shown below. To prevent this problem, be sure to set up the program to check the upper and lower limits of the digital value.
(Example): When writing K16384 in WY2
K16384= 0001000000000000
Analog Output Unit regards Y2D and Y2C as output switching flags:
Y2F, Y2E = $01<-\mathrm{CH} 0$
Data $=00000000000000<-0$
Consequently, the analog value that is equivalent to the digital value " 0 " is output from CHO .


## - Negative data

- When the negative data (minus data) is written, set the output switching flag to two's complement data. When specifying the minus data in the decimal data, the data automatically becomes two's complement data. Then, set the output switching flag to two's complement data in the same way as the plus data.
(Example): When writing -1 in CHO
$-1=1111111111111111$ <- Two's complement
Setting the output switching flag: 0111111111111111 (Bit $\mathrm{F}=1$, Bit $\mathrm{E}=0$ for CHO )


## - Sample program (14-bit mode: For ranges of -10 V to +10 V and -5 V to +5 V )

The following program shows the case that the data of DT0 to DT3 is converted and output to the CH 0 to CH 3 of the first expansion analog output unit. The range for checking digital values written in the output area is changed.


| (1) | R9012 | Switches the timing of writing data by the scan pulse realy. |
| :--- | :--- | :--- |
| (2) | Checks whether the lower limit value is within the data range that the unit can convert correctly. |  |
| (3) | Checks whether the upper limit value is within the data range that the unit can convert correctly. |  |
| (4) | Y2E | Output data switching flags for even numbered channels. Channel numbers are specified by <br> the two-bit switching flags right after setting conversion data by the transfer instruction F0 <br> MV. |
| (5) | Y2F | Output data switching flags for odd numbered channels. Channel numbers are specified by <br> the two-bit switching flags right after setting conversion data by the transfer instruction F0 <br> MV. |
| (6) | Y3E | Y3F |
| (7) | Y3F | It is executed when the scan pulse relay is ON and written data is within the upper and lower limits. <br> Data for CH0 is set in DT0, and CH0 is specified by the output data switching flag. |
| (b) | It is executed when the scan pulse relay is ON and written data is within the upper and lower limits. <br> Data for CH1 is set in DT1, and CH1 is specified by the output data switching flag. |  |
| (C) | It is executed when the scan pulse relay is OFF and written data is within the upper and lower limits. <br> Data for CH2 is set in DT2, and CH2 is specified by the output data switching flag. |  |
| (d) | It is executed when the scan pulse relay is OFF and written data is within the upper and lower limits. <br> Data for CH3 is set in DT3, and CH3 is specified by the output data switching flag. |  |

- In the 14-bit mode, Y2E, Y2F, Y3E, and Y3F are used as the output data switching flags. Note that the allocation is different from that in the FPO-A04-compatible 12-bit mode.

■ Sample program (14-bit mode: For ranges of 0 to $10 \mathrm{~V}, 0$ to $5 \mathrm{~V}, 0$ to 20 mA and 4 to 20 mA )
The following program shows the case that the data of DT0 to DT3 is converted and output to the CH 0 to CH 3 of the first expansion analog output unit. The range for checking digital values written in the output area is changed.


| (1) | R9012 | Switches the timing of writing data by the scan pulse realy. |
| :--- | :--- | :--- |
| (2) | Checks whether the lower limit value is within the data range that the unit can convert correctly. |  |
| (3) | Checks whether the upper limit value is within the data range that the unit can convert correctly. |  |
| (4) | Y2E | Output data switching flags for even numbered channels. Channel numbers are specified by <br> the two-bit switching flags right after setting conversion data by the transfer instruction F0 <br> MV. |
| (5) | Y2F | Output data switching flags for odd numbered channels. Channel numbers are specified by <br> the two-bit switching flags right after setting conversion data by the transfer instruction F0 <br> MV. |
| (6) | Y3E | Y3F |
| (7) | Y3F | It is executed when the scan pulse relay is ON and written data is within the upper and lower limits. <br> Data for CH0 is set in DT0, and CH0 is specified by the output data switching flag. |
| (b) | It is executed when the scan pulse relay is ON and written data is within the upper and lower limits. <br> Data for CH1 is set in DT1, and CH1 is specified by the output data switching flag. |  |
| (C) | It is executed when the scan pulse relay is OFF and written data is within the upper and lower limits. <br> Data for CH2 is set in DT2, and CH2 is specified by the output data switching flag. |  |
| (d) | It is executed when the scan pulse relay is OFF and written data is within the upper and lower limits. <br> Data for CH3 is set in DT3, and CH3 is specified by the output data switching flag. |  |

- In the 14-bit mode, Y2E, Y2F, Y3E, and Y3F are used as the output data switching flags. Note that the allocation is different from that in the FPO-A04-compatible 12-bit mode.


### 4.3.3 Switching of Output Range (14-bit Mode Only)

When selecting the 14-bit mode in the analog output unit (FPOR-DA4), the output range can be switched by user programs. It can be set for each channel.

## ■ I/O allocation (External input WY)



Each output range is specified by setting the following constants.

| Item | Description |
| :--- | :--- |
|  | Input constants for specifying output ranges in the 14-bit area. |
| Output range setting | H30 |
|  | H31 |
|  | -5 to $+10 \mathrm{~V} / 0$ to 20 mA |
|  | H32 |
|  | H33 |
|  | 0 to 10 V |
| 0 | to 5 V |

## ■ Default settings

The default settings are as follows; Output range for all channels: Voltage output range: -10 to +10 V , Current output range: 0 to 20 mA .

## ■ Sample program (Switching output range: For $\mathrm{CHO} / \mathrm{CH} 1$ )

The following program shows the case that the output ranges of CH 0 and CH 1 of the first expansion analog input unit is set.


## Sample program (Switching output range: For $\mathrm{CH} 2 / \mathrm{CH} 3$ )

The following program shows the case that the output ranges of CH 2 and CH 3 of the first expansion analog input unit is set.


| , H30 | WY2 |
| :---: | :---: |
| (1) | (2) |
|  |  |
| H30 | WY3 |
| (1) | (3) |



| (1) | Input a constant for specifying an output range. |  | H30 | -10 to $+10 \mathrm{~V} / 0 \sim 20 \mathrm{~mA}$ |
| :---: | :---: | :---: | :---: | :---: |
|  |  |  | H31 | -5 to $+5 \mathrm{~V} / 4 \sim 20 \mathrm{~mA}$ |
|  |  |  | H32 | 0 to 10 V |
|  |  |  | H33 | 0 to 5 V |
| (2) | WY2 | Set it for switching the output range of CH 0 or $\mathrm{HC2}$. |  |  |
| (3) | WY3 | Set it for switching the output range of CH 1 or HC 3 . |  |  |
| (4) | Y2E | Output data switching flags for even numbered channels. When Y2E/Y2F is OFF, the output range of CH 0 is set. When $\mathrm{Y} 2 \mathrm{E} / \mathrm{Y} 2 \mathrm{~F}$ is ON , the output range of CH 2 is set. |  |  |
| (5) | Y2F |  |  |  |
| (5) | Y3E | Output data switching flags for odd numbered channels. When Y3E/Y3F is OFF, the output range of CH 1 is set. When Y3E/Y3F is ON , the output range of CH 3 is set. |  |  |
| (7) | Y3F |  |  |  |

KEY POINTS

- For $\mathrm{CH} 0 / \mathrm{CH} 1$, the output switching flags are reset. For $\mathrm{CH} 2 / \mathrm{CH} 3$, the output switching flags are set.
- The output switching flags (bit F/bit E) are also used for setting output data. Create a program not to overwrite each other during an operation processing.


### 4.3.4 Status Information (12-bit mode)

With the analog output unit, the following information can be monitored in the external input area WX.

## Status information

| I/O No. | Description |  |
| :--- | :--- | :--- |
| X20 | Analog output unit power | 0: OFF, 1:ON, |
| X21-X23 | Used in the system |  |
| X24 | CH0 data writing status | 0:Normal, 1:Error (Note 1) <br> An error occurs when data written to the memory area (WY2/WY3) is <br> out of each range, and the data conversion is not performed. The <br> error is cleared when data within the range is written and the <br> conversion is performed. |
| X25 | CH1 data writing status |  |

(Note 1): Output data and output CH switch flag are allocated to the same I/O number. Data error can be detected successfully with the flags when the digital input value is within the range of K-4096 to K4095.
Even when the digital input value is out of the range, however, data conversion may be mistakenly conducted. To prevent this problem, be sure to set up the program to check the upper and lower limits of the digital value.

### 4.3.5 Status information (14-bit mode)

With the analog output unit, the following information can be monitored in the external input area WX.

■ Status information

| I/O No. | Description |  |
| :---: | :---: | :---: |
| X20 | Analog output unit power | 0:OFF, 1:ON, |
| X21-X23 | Used in the system |  |
| X24 | CH 0 data writing status | 0:Normal, 1:Error (Note 1) <br> An error occurs when data written to the memory area (WY2/WY3) is out of each range, and the data conversion is not performed. The error is cleared when data within the range is written and the conversion is performed. |
| X25 | CH 1 data writing status |  |
| X26 | CH 2 data writing status |  |
| X27 | CH3 data writing status |  |
| X28-X2F | Used in the system |  |
| X30-X33 | CHO range setting state | The state of a specified output range can be monitored. The following constants are stored for each range. $\begin{aligned} & \mathrm{H} 0:-10 \mathrm{~V} \text { to }+10 \mathrm{~V}, 0 \mathrm{~mA} \text { to } 20 \mathrm{~mA} \\ & \mathrm{H} 1:-5 \mathrm{~V} \text { to }+5 \mathrm{~V}, 4 \mathrm{~mA} \text { to } 20 \mathrm{~mA} \\ & \mathrm{H} 2: 0 \mathrm{~V} \text { to } 10 \mathrm{~V} \\ & \mathrm{H} 3: 0 \mathrm{~V} \text { to } 5 \mathrm{~V} \end{aligned}$ |
| X34-X37 | CH 1 range setting state | Same as above. |
| X38-X3B | CH 2 range setting state | Same as above. |
| X3C-X3F | CH3 range setting state | Same as above. |

(Note 1):As output data and the output switching flag are allocated to the same I/O, a data error is detected correctly only when a digital input value is within (K-8192 to K8191) for the $\pm$ range and (K0 to K16383) for the + range. In the case of digital input values exceeding these ranges, data may be converted without an error, so always insert a program which checks the upper and lower limits.
(Note 2):In the 14-bit mode, the range setting state of each channel specified in WY2 and WY3 can be confirmed.

### 4.4 Analog I/O Unit (FP0R-A21/A42)

### 4.4.1 Reading of Analog Input Values (For A21)

With the analog input unit A21, data can be read as signed 16-bit data as is.

## ■ I/O allocation (External input WX)




| WX3 | WX2 |
| :---: | :---: |
| CH1data | CH0 data |

## ■ Sample program (For FPOR-A21)

The following program shows the case that conversion data of the first expansion analog input unit (FPOR-A21) (CH0 to CH7) is read and stored in DT0 to DT7.

(a) The conversion data of CHO is stored into DTO.
(b) The conversion data of CH 1 is stored into DT1.

### 4.4.2 Reading of Analog Input Values (For A42)

The analog input unit uses the most significant 2 bits as a flag for switching channels and reads conversion data sequentially.

## - I/O allocation (External input WX)



> 2!2!2:2!2:2!2:2!2!2:2:2!2
> FiE:DiCiBiA!9:8:7:6:5:4:3:2:1:0

Conversion data of $\mathrm{CH} 0 / \mathrm{CH} 2$
(16 bit with sign)

Conversion data switch flag

| A1 | A0 | WX3 | WX2 |
| :---: | :---: | :---: | :---: |
| 0 | 0 | CH 1 data | CH 0 data |
| 0 | 1 | CH 3 data | CH 2 data |

## ■ Role of conversion data switching flag

- The analog I/O unit (FPOR-A42) reads the analog input data of a maximum of 4 channels using two memory areas (WX2 and WX3). The most significant two bits are allocated as a conversion data switching flag for distinguishing channels.
- Conversion data of even numbered channels can be read as 16-bit data as they are.
- As conversion data of odd numbered channels contain the conversion data switching flag of most significant two bits, mask processing needs to be applied to the data with a user program. Plus conversion data should be masked by " 00 ", and minus conversion data should be masked by "11". Create a program in reference to the following programs.
(Example): For reading data of CH 3

| CH3 data | WX3 | Data after masking | Description |
| :---: | :---: | :---: | :--- |
| 1 | 0100000000000001 | 0000000000000001 | Most significant two bits are <br> masked by "00". |
| -1 | 0111111111111111 | 1111111111111111 | Most significant two bits are <br> masked by "11". |

## Sample program (FP0R-A42: For ranges of -10 V to +10 V and -5 V to +5 V )

The following program shows the case that conversion data of the first expansion analog I/O unit (FPOR-A42) (CH0 to CH3) is read and stored in DT0 to DT3.


| (1) | X3E | The channels of conversion data read by turning on/off the conversion data switching flag X3E <br> are distinguished. |
| :--- | :--- | :--- |
| (2) | X3D | The signs of read conversion data of CH1/CH3 are distinguished. When plus, OFF. When minus, <br> ON. |
| (a) | The conversion data of CH0 is transferred to DT0. |  |
| (b | When the data of CH1 is positive, the most significant two bits are masked by "00" with F65 WAN (AND) <br> instruction, and the data is stored in DT1. |  |
| © | When the data of CH1 is negative, the most significant two bits are masked by "11" with F66 WOR (OR) <br> instruction, and the data is stored in DT1. |  |
| (d) | The conversion data of CH2 is transferred to DT2. |  |
| © | When the data of CH3 is positive, the most significant two bits are masked by "00" with F65 WAN (AND) <br> instruction, and the data is stored in DT3. |  |
| © | When the data of CH3 is negative, the most significant two bits are masked by "11" with F66 WOR (OR) <br> instruction, and the data is stored in DT3. |  |

■ Sample program (FP0R-A42: (For ranges of 0 to $10 \mathrm{~V}, 0$ to 5 V and 0 to 20 mA )

(Note):In the case of data of CH 1 , it can be replaced with the transfer instruction F0 MV as the conversion data switching flag is "00".

## 4．4．3 Writing of Digital Data for Output（12－bit Mode）

The analog I／O unit（FPOR－A42／A21）writes data for conversion as the output switching flags are not contained in the 12－bit mode．
－I／O allocation（12－bit mode）

| WY3 | WY2 |
| :---: | :---: |
| CH1 data | CH0 data |

## ■ Writing data for conversion

－The analog I／O unit writes the analog output digital data of a maximum of 2 channels to two memory areas（WY2／WY3）by user programs．

## 氏日家 NOTE

－Always insert a program which checks the upper and lower limits to make written digital values be within the allowable data ranges referring the programs described on the following pages．

| Mode | Range setting | Lower limit | Upper limit |
| :---: | :---: | :---: | :---: |
| 12－bit mode | $\pm$ range | -2000 | 2000 |
|  | ＋range | 0 | 4000 |

Sample program（12－bit mode：-10 V to +10 V range）
The following program shows the case that the data of DT0 to DT1 is converted and output to the CH 0 to CH 1 of the first expansion analog I／O unit（FP0R－A42／A21）．


## ■ Sample program (12-bit mode: 0 to 20 mA range)



| (1) | R9010 | Always ON relay |
| :--- | :--- | :--- |
| (2) | Checks whether the lower limit value is within the data range that the unit can convert correctly. |  |
| (3) | Checks whether the upper limit value is within the data range that the unit can convert correctly. |  |
| (a) | It is executed when the execution condition is ON and written data is within the upper and lower limits. <br> Data for CH0 is set in DT0, and CH0 is specified by the output data switching flag. |  |
| (b) | It is executed when the execution condition is ON and written data is within the upper and lower limits. <br> Data for CH1 is set in DT1, and CH1 is specified by the output data switching flag. |  |

### 4.4.4 Writing of Digital Data for Output (14-bit Mode)

With the analog I/O unit (FPOR-A42/A21), the conversion output is performed by using two bits as the switching flags of output channels and writing data.

## ■ I/O allocation (14-bit mode)

In the 14-bit mode, the most significant two bits are used as the switching flags. They are common to the flags for setting ranges.


## Writing data for conversion

- The analog I/O unit writes the analog output digital data of a maximum of 2 channels to two memory areas (WY2/WY3) by user programs.


## NOTE

- Protect output switching flags from being overwritten by a subsequent program after writing data. Output data becomes invalid.
- Always insert a program which checks the upper and lower limits to make written digital values be within the allowable data ranges referring the programs described on the following pages.

| Mode | Range setting | Lower limit | Upper limit |
| :---: | :---: | :---: | :---: |
| 14-bit mode | $\pm$ range | -8000 | 8000 |
|  | +range | 0 | 16000 |

- For the analog I/O unit (FPOR-A21/A42), the data setting becomes valid when the output switching flags (Y2F, Y2E) or (Y3F, Y3E) are (0, 0) or (1, 1). When written digital values are within the range in the above table, it is not necessary to add programs for setting or setting the output switching flags after data transmission like the following programs because the output switching flags (Y2F, Y2E) or (Y3F, Y3E) are always $(0,0)$ or (1, 1).


## ■ Sample program (14-bit mode: For ranges of -10 V to +10 V and -5 V to +5 V )

The following program shows the case that the data of DT0 to DT1 is converted and output to the CH 0 to CH 1 of the first expansion analog I/O unit (FP0R-A42/A21). The range for checking digital values written in the output area is changed.


- Sample program (14-bit mode: (For ranges of 0 to $10 \mathrm{~V}, 0$ to $5 \mathrm{~V}, 0$ to 20 mA and 4 to
$\mathbf{2 0} \mathrm{mA}$ )


| (1) | R9010 | Always ON relay |
| :--- | :--- | :--- |
| (2) | Checks whether the lower limit value is within the data range that the unit can convert correctly. |  |
| (3) | Checks whether the upper limit value is within the data range that the unit can convert correctly. |  |
| (a) | It is executed when the execution condition is ON and written data is within the upper and lower limits. <br> Data for CH0 is set in DT0, and CH0 is specified by the output data switching flag. |  |
| (b) | It is executed when the execution condition is ON and written data is within the upper and lower limits. <br> Data for CH1 is set in DT1, and CH1 is specified by the output data switching flag. |  |

### 4.4.5 Switching of Input Range and Averaging Method (14-bit Mode Only)

When selecting the 14-bit mode in the analog I/O unit (FPOR-A21/A42), the input range or averaging method for each channel can be set by user programs.

## - I/O allocation (External output WY)



Set the contents allocated to CH 0 to CH 3 for the input averaging processing and input range by replacing the following 8-bit data with Hex data.


| D1 | D0 | Averaging (Common to each channel) |
| :---: | :---: | :---: |
| 0 | 0 | Moving average 10 times (Max. and min. removal) |
| 0 | 1 | No. of averaging times: 64 |
| 1 | 0 | No. of averaging times: 128 |
| 1 | 1 | No averaging |


| D1 | D0 | Range (Common to each channel) |
| :---: | :---: | :--- |
| 0 | 0 | -10 V to +10 V |
| 0 | 1 | -5 V to +5 V |
| 1 | 0 | 0 to 10 V |
| 1 | 1 | 0 to $5 \mathrm{~V} / 0$ to 20 mA |

## Default settings

The default settings are as follows; Input range for all channels: -10 to +10 V , Averaing processing: Moving average processing 10 times (Max. and min. removal). The averaging processing is enabled when the mode switch No. 5 is ON.

## ■ Sample program (Input range switching)

The following program shows the case that the input range of CH 0 to CH 3 of the first expansion analog I/O unit (FPOR-A42/A21) is set.



| (1) | Input a constant for specifying an input range. Set it according to the I/O allocation on the previous page. In the above sample program, HFO is input for setting Y27-Y24 to 1 and Y23-Y20 to 0 . The range for $\mathrm{CH} 3 / \mathrm{CH} 2$ is 0 to $5 \mathrm{~V} / 0$ to 20 mA , and that for $\mathrm{CH} 1 / \mathrm{CH} 0$ is -10 V to +10 V . |  |
| :---: | :---: | :---: |
| (2) | WY2 | Set it for switching the input range. |
| (3) | Y2E | Data switching flags. When Y2E is ON and Y2F is OFF, the input range is set. |
| (4) | Y2F |  |

## ■ Sample program (Input averaging switching)

The following program shows the case that the averaging processing method of CH 0 to CH 3 of the first expansion analog I/O unit (FPOR-A42/A21) is set.


| (1) | Input a constant for specifying an averanging method. Set it according to the I/O allocation on the previous <br> page. <br> In the above sample program, HFO is input for setting Y37-Y34 to 1 and Y 33 - Y 30 to 0. <br> The method of $\mathrm{CH} 3 / \mathrm{CH} 2$ is no averaging processing, and that of $\mathrm{CH} 1 / \mathrm{CHO}$ is moving average 10 times. |  |
| :--- | :--- | :--- |
| (2) | WY3 | Set it for switching the averaging processing method. |
| (3) | Y3E |  |
| (4) | Y3F | Data switching flags. When Y3E is ON and Y3F is OFF, the averaging method of input is set. |

- The input range setting and the input averaging method for four channels are set collectively.


### 4.4.6 Switching of Output Range (14-bit Mode Only)

When selecting the 14-bit mode in the analog I/O unit (FPOR-A21/A42), the output range can be switched by user programs. It can be set for each channel.

## ■ I/O allocation (External output WY)



Each output range is specified by setting the following constants.

| Item | Description |
| :---: | :---: |
| Output range setting | Input constants for specifying output ranges in the 14-bit area. $\begin{array}{ll} \mathrm{H} 30 & -10 \text { to }+10 \mathrm{~V} / 0 \text { to } 20 \mathrm{~mA} \\ \mathrm{H} 31 & -5 \text { to }+5 \mathrm{~V} / 4 \text { to } 20 \mathrm{~mA} \\ \mathrm{H} 32 & 0 \text { to } 10 \mathrm{~V} \\ \mathrm{H} 33 & 0 \text { to } 5 \mathrm{~V} \end{array}$ |

## - Default settings

The default settings are as follows; Output range for all channels: Voltage output range: -10 to +10 V , Current output range: 0 to 20 mA .

- The output ranges are set for two channels separately.


## ■ Sample program (Output range switching)

The following program shows the case that the input range of CH 0 and CH 1 of the first expansion analog I/O unit (FPOR-A21/A42) is set.



| (1) | Input a constant for specifying an output range. |  | H30 | -10 to $+10 \mathrm{~V} / 0$ to 20 mA |
| :---: | :---: | :---: | :---: | :---: |
|  |  |  | H31 | -5 to $+5 \mathrm{~V} / 4$ to 20 mA |
|  |  |  | H32 | 0 to 10 V |
|  |  |  | H33 | 0 to 5V |
| (2) | WY2 | Set it for switching the output range of CHO . |  |  |
| (3) | WY3 | Set it for switching the output range of CH 1 . |  |  |
| (4) | Y2E | Output data switching flag for CHO . When Y2E is OFF and Y2F is ON, the output range of CHO is set. |  |  |
| (5) | Y2F |  |  |  |
| (5) | Y3E | Output data switching flag for CH 1 . When Y3E is OFF and Y3F is ON , the output range of CH 1 is set. |  |  |
| (7) | Y3F |  |  |  |

### 4.5 I/O Conversion Characteristics

### 4.5.1 Input Conversion Characteristics (Voltage Range)

## ■ -10V to +10V DC input

| Conversion characteristic | Correspondence table of A/D Conversion values |  |  |
| :---: | :---: | :---: | :---: |
| (K) | Input voltage (V) | Digital value |  |
|  |  | 12-bit | 14-bit |
| 20008000 - - - - - - - - - - - | -10.0 | -2000 | -8000 |
|  | -5.0 | -1000 | -4000 |
| 10004000 | 0 | 0 | 0 |
| - | 5.0 | 1000 | 4000 |
| 01,1 | 10.0 | 2000 | 8000 |
| i | If the input value is out of the range |  |  |
| -1000-4000 | Input voltage (V) | Digital value |  |
| - |  | 12-bit | 14-bit |
| -2000 -8000 1/ . . . . - - . . . . . . - - | -10V or less | -2000 | -8000 |
|  | 10 V or more | 2000 | 8000 |

(Note 1): In the analog input unit Ver.1.1 or earlier or the analog I/O unit, a digital conversion value equivalent to the analog input of approx. 2 V is saved in the device $(W X)$, for the channels to which no input is connected. The analog input unit Ver.1.2 or later are equivalent to approx. 0 V .
■-5V to +5V DC input (14-bit mode only)

| Conversion characteristic | Correspondence table of A/D Conversion values |  |
| :---: | :---: | :---: |
|  |  | Digital value |
|  | Input voltage (V) | 14-bit |
|  | -5.0 | -8000 |
|  | -2.5 | -4000 |
|  | 0 | 0 |
|  | 2.5 | 4000 |
|  | 5.0 | 8000 |
|  | If the input val | the range |
|  |  | Digital value |
|  | Input voltage (V) | 14-bit |
|  | -5 V or less | -8000 |
|  | 5 V or more | 8000 |

(Note 1): In the analog input unit Ver.1.1 or earlier or the analog I/O unit, a digital conversion value equivalent to the analog input of approx. 2 V is saved in the device (WX), for the channels to which no input is connected. The analog input unit Ver.1.2 or later are equivalent to approx. OV.

## OV to 10V DC input (14-bit mode only)

| Conversion characteristic | Correspondence table of A/D Conversion values |  |
| :---: | :---: | :---: |
|  |  | Digital value |
|  | Input voltage ( | 14-bit |
|  | 0.0 | 0 |
|  | 2.5 | 4000 |
| $12000-$ | 5.0 | 8000 |
| - | 7.5 | 12000 |
| 8000 - | 10.0 | 16000 |
| - | Processing if the range is exceeded |  |
| 4000 - | Input voltage (V) | Digital value |
|  | , vol | 14-bit |
| 1 1 1  <br> 2.5 5 7.5 $10(\mathrm{~V})$ | OV or less (including negative value) | 0 |
|  | 10 V or more | 16000 |

(Note 1): In the analog input unit Ver. 1.1 or earlier or the analog I/O unit, a digital conversion value equivalent to the analog input of approx. 2 V is saved in the device (WX), for the channels to which no input is connected. The analog input unit Ver.1.2 or later are equivalent to approx. 0 V .

## ■ OV to 5V DC input


(Note 1): In the analog input unit Ver.1.1 or earlier or the analog I/O unit, a digital conversion value equivalent to the analog input of approx. 2 V is saved in the device (WX), for the channels to which no input is connected. The analog input unit Ver.1.2 or later are equivalent to approx. 0 V .

- -100 mV to +100 mV DC input (12-bit mode only)

| Conversion characteristic | Correspondence table of A/D Conversion values |  |
| :---: | :---: | :---: |
|  | Input voltage (mV) | Digital value |
|  |  | 12-bit |
| (K) | -100.0 | -2000 |
|  | -75.0 | -1500 |
| ¢----------> | -50.0 | -1000 |
| $100 \cdot 1$ | -25.0 | -500 |
| 1000 | 0.0 | 0 |
| । | +25.0 | +500 |
|  | +50.0 | +1000 |
|  | +75.0 | +1500 |
| -1000 ' | +100.0 | +2000 |
|  | Processing if the range is exceeded |  |
| $\begin{array}{cccccc} \\ -100 & -50 & 0 & & \\ \end{array}$ | Input voltage (V) | Digital value |
|  |  | 12-bit |
|  | -100 mV or less | -2000 |
|  | +100mV or more | +2000 |

(Note 1): Installed in the unit of Ver.1.2 and after (only 12-bit mode).

### 4.5.2 Input conversion Characteristics (Current Range)

## OmA to 20 mA DC input

| Conversion characteristic | Correspondence table of A/D Conversion values |  |  |
| :---: | :---: | :---: | :---: |
|  | Input current (mA) | Digital value |  |
|  |  | 12-bit | 14-bit |
|  | 0.0 | 0 | 0 |
|  | 5.0 | 1000 | 4000 |
| $300012000-$ | 10.0 | 2000 | 8000 |
| - | 15.0 | 3000 | 12000 |
| $20008000-$ | 20.0 | 4000 | 16000 |
| - | Processing if the range is exceeded |  |  |
| 1000 4000- | Input current (mA) | Digital value |  |
|  |  | 12-bit | 14-bit |
| $0 \quad 0 \quad$1 1   <br> 5 10 15 $20(\mathrm{~mA})$ | OmA or less(including negative value) | 0 | 0 |
|  | 20 mA or more | 4000 | 16000 |

### 4.5.3 Output conversion Characteristics (Voltage Range)

## - -10V to 10V DC output

| Conversion characteristic | Correspondence table of D/A Conversion values |  |  |
| :---: | :---: | :---: | :---: |
| (V) | Digital value |  |  |
|  | 12-bit | 14-bit | Output voltage (V) |
|  | -2000 | -8000 | -10.0 |
|  | -1000 | -4000 | -5.0 |
|  | 0 | 0 | 0.0 |
|  | 1000 | 4000 | 5.0 |
|  | 2000 | 8000 | 10.0 |
|  | Proc | ing if the ran | is exceeded |
|  | Digital | value | Output voltage (V) |
|  | -2001 or less | -8001 or less | Refer to the following |
| $\begin{array}{lllll}-8000 & -4000 & 0 & 4000 & 8000 \\ -2000 & -1000 & 0 & 1000 & 2000 \\ \text { (K) }\end{array}$ | 2001 or more | 8001 or more | notes. |

- -5 V to 5 V DC output (14-bit mode only)

| Conversion characteristic | Correspondence table of D/A Conversion values |  |
| :---: | :---: | :---: |
| (V) <br> 50 - . . . . . - - - | Digital value 14-bit | Output voltage (V) |
| 1 | -8000 | -5.0 |
|  | -4000 | -2.5 |
| 1 , | 0 | 0.0 |
| 1 | 4000 | 2.5 |
|  | 8000 | 5.0 |
| - ${ }^{\text {! }}$ | Processing if | is exceeded |
|  | Digital input value | Output voltage (V) |
| -5.0 1 _ . . . - - . . . . . - | -8001 or less | Refer to the following notes. |
| -8000 $-4000 \quad 0 \quad 4000$ 8000 (K) | 8001 or more |  |

## $\mathcal{F}^{\prime}{ }^{\prime}$ K KEY POINTS

- The following operations are performed when a value exceeding the allowable range is written. Always insert a program for checking the upper and lower limits right before a program for writing data.

| Mode | Data range |  | Description |
| :--- | :--- | :--- | :--- |
| 12-bit <br> mode | -2049 or less | 2048 or more | The bits D and C of a written value may be regarded as <br> channel switching flags and converted to an unintended <br> value and output. |
|  | -2048 to -2001 | 2001 to 2047 | The value does not change and the previous value is <br> held. |
| $14-$-bit <br> mode | -8193 or less | 8192 or more | The bits F and E of a written value may be regarded as <br> channel switching flags and converted to an unintended <br> value and output. |
|  | -8192 to -8001 | 8001 to 8191 | The value does not change and the previous value is <br> held. |

OV to 10V DC output (14-bit mode only)


OV to 5V DC output (14-bit mode only)

| Conversion characteristic | Correspondence table of D/A Conversion values |  |
| :---: | :---: | :---: |
| (V)  <br> 5 $\ldots$ | Digital value <br> 14-bit | Output voltage (V) |
| , | 0 | 0.0 |
| , | 4000 | 1.25 |
| 1 | 8000 | 2.5 |
|  | 12000 | 3.75 |
| $2.5-$ | 160000 | 5.0 |
|  | Processing if the | ge is exceeded |
| - | Digital input value | Output voltage (V) |
|  | Including negative value | efer to the following |
| 0 4000 8000 12000 $16000(K)$ | 16001 or more | notes. |

## F\% KEY POINTS

- The following operations are performed when a value exceeding the allowable range is written. Always insert a program for checking the upper and lower limits right before a program for writing data.

| Mode | Data range |  | Description |
| :--- | :--- | :--- | :--- |
| $14-$ bit <br> mode | -1 or less | 16384 or more | The bits F and E of a written value may be regarded as <br> channel switching flags and converted to an unintended <br> value and output. |
|  | --- | 16001 to 16383 | The value does not change and the previous value is <br> held. |

### 4.5.4 Output conversion Characteristics (Current Range)

## 0 mA to 20 mA output


(Note):For the 12-bit mode, the values for FPOR-A21/A42 are shown. For FPOR-DA4 (12-bit mode), the range is 4 mA to 20 mA .

## 4 mA to 20 mA output


(Note):For the 12-bit mode, the values for FPOR-DA4 are shown. For FPOR-A21/A42 (12-bit mode), the range is 0 mA to 20 mA .

## F'K KEY POINTS

- The following operations are performed when a value exceeding the allowable range is written. Always insert a program for checking the upper and lower limits right before a program for writing data.

| Mode | Data range |  | Description |
| :--- | :--- | :--- | :--- |
| $12-$ bit <br> mode | -4097 or less | 4096 or more | The bits D and C of a written value may be regarded as <br> channel switching flags and converted to an unintended <br> value and output. |
|  | -4096 to -1 | 4001 to 4095 | The value does not change and the previous value is <br> held. |
|  | -1 or less | 16384 or more | The bits F and E of a written value may be regarded as <br> channel switching flags and converted to an unintended <br> value and output. |
|  | --- | 16001 to 16383 | The value does not change and the previous value is <br> held. |

## 5

## Analog Input Averaging Processing

### 5.1 Types of Averaging Processing

### 5.1.1 Moving Average 10 Times

When the averaging function is set to on, the internal processing of the analog unit is as shown in the diagram below

## - Moving Average Processing

- Averages and stores converted values obtained by sampling.
- Calculates the average of data for past eight times excluding the maximum and minimum values from the latest data, and stores it in the external input area (WX). If a fraction results from the calculation, it is rounded off.

(Note):The above figure shows the processing when the number of input channels is two.


### 5.1.2 Number of Averaging Times ( 64 times/128 times: 14 -bit Mode Only)

Only when the 14-bit mode is selected, the number of averaging times is selectable.

## ■ Processing when selecting the number of averaging times

- Averages and stores converted values obtained by sampling.
- When the number of obtained analog input data reaches the specified number of averaging times ( 64 or 128 times), performs the average processing and stores the result as a digital value.
- Stores the first obtained data in the external input area (WX) when the number of obtained data is less than the number of averaging times.

(Note):To make the explanation simple, the above figure shows the processing which averages data by five times. In the actual processing, calculation is carried out with the average of data for 64 times or 128 times.


## ■ Setting method of the number of averaging times processing

The number of averaging times can be changed by being written to the output relay area (WY) in a user program.

### 5.2 Setting of Averaging Processing

### 5.2.1 Enabling Averaging Processing

The averaging processing can be set by the following methods.
■ 12-bit FP0-A80 compatibility mode / FP0-A21 compatibility mode
The averaging processing is enabled only when the mode switch No. 5 of the unit is ON.

- The averaging method of all channels is the moving average 10 times (Max. and min. removal).


## 14-bit mode

- The averaging processing is enabled only when the mode switch No. 5 of the unit is ON.
- The default is the moving average 10 times (Max. and min. removal).
- It is possible to specify the averaging method (Moving average 10 times / No. of averaging times: 64 / No. of averaging times: 128 / No averaging) by a user program for each channel.

REFERENCE

- For details of the setting method of the mode switch, refer to the chapter 2 "Names and Functions of Parts".
- For details of the programming method for the analog input unit (FPORAD4/AD8), refer to "4.2.2 Setting of Input Range and Averaging Processing (14-bit Mode Only)".
- For details of the programming method for the analog I/O unit (FPORA21/A42), refer to PAGEREF"4.4.5 Switching of Input Range and Averaging Method (14-bit Mode Only)".


## 6

## Specifications

### 6.1 Table of Specifications

### 6.1.1 General Specifications

## Specifications

| Item | Description |  |
| :---: | :---: | :---: |
| Rated operating voltage | 24 V DC |  |
| Operating voltage range | 20.4 to 28.8 V DC (Unit input voltage) |  |
| Rated current consumption | AFP0RDA4:180 mA or less AFPORA21: 80 mA or less AFPORA42:120 mA or less |  |
| Allowable instantaneous power-off time | 10ms |  |
| Current consumption increase of control unit | AFPORAD4/ AFP0RAD8 $: 45 \mathrm{~mA}$ or less (Note 1) <br> AFPORDA4 $: 10 \mathrm{~mA}$ or less <br> AFPORA21/ AFP0RA42 $: 10 \mathrm{~mA}$ or less |  |
| Ambient temperature | $0^{\circ} \mathrm{C}$ to $+55^{\circ} \mathrm{C}$ |  |
| Storage temperature | $-40^{\circ} \mathrm{C}$ to $+70^{\circ} \mathrm{C}$ |  |
| Ambient humidity | 10 to $95 \% \mathrm{RH}$ (at $25^{\circ} \mathrm{C}$ non condensing) |  |
| Storage humidity | 10 to $95 \% \mathrm{RH}$ (at $25^{\circ} \mathrm{C}$ non condensing) |  |
| Breakdown voltage (Note 2) | Between I/O terminal and control unit power supply terminal / ground terminal | 500 V AC for 1 minute |
|  | <AFP0RA21/AFP0RA42 <br> Between analog input terminal and analog output terminal |  |
| Insulation resistance | Between I/O terminal and control unit power supply terminal / ground terminal | Min. $100 \mathrm{M} \Omega$ (measured with a 500V DC megger) |
|  | <AFP0RA21/AFP0RA42> <br> Between analog input terminal and analog output terminal |  |
| Vibration resistance | Based on JIS B 3502 and IEC 61131-2: <br> 5 to 8.4 Hz , half amplitude 3.5 mm <br> 8.4 to 150 Hz , constant acceleration $9.8 \mathrm{~m} / \mathrm{s}^{2}$ <br> $\mathrm{X}, \mathrm{Y}$ and Z axes, 10 sweeps ( 1 octave $/ \mathrm{mm}$ ) |  |
| Shock resistance | Based on JIS B 3502 and IEC 61131-2 $147 \mathrm{~m} / \mathrm{s}^{2}$ or more, $\mathrm{X}, \mathrm{Y}$ and Z axes, 3 times |  |
| Noise immunity | 1000 V [P-P] with pulse widths $50 \mathrm{~ns}, 1 \mu \mathrm{~s}$ (using noise simulator) (Applied to the power supply part of the control unit) |  |
| Operating condition | Must be free from corrosive gases and excessive dust. |  |
| Overvoltage category | Category II |  |
| Pollution level | Pollution level 2 |  |
| Weight | AFPORAD4/ AFP0RA21 :Approx. 75 g <br> AFPORAD8/ AFP0RDA4/ AFP0RA42 :Approx. 85 g |  |

(Note 1): In the case of the unit of Ver.1.2 and after; 20 mA for the unit of Ver.1.1 or older.
(Note 2): Cutoff current: 5 mA (factory default setting).

### 6.1.2 Input Specifications

| Item |  |  | Description |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  | Analog input unit |  | Analog I/O unit |  |
|  |  |  | AFP0RAD4 | AFP0RAD8 | AFP0RA21 | AFP0RA42 |
| Number of channels |  |  | 4 ch | 8 ch | 2 ch | 4 ch |
| Input range (Resolution) | Voltage |  | -10 to 10 V DC (Resolution:1/16,000) (Note 1) <br> -5 to 5 V DC (Resolution:1/16,000) <br> 0 to 10 V DC (Resolution:1/16,000) <br> 0 to 5 V DC (Resolution:1/16,000) |  |  |  |
|  |  |  | $\begin{aligned} & \text {-100 to } 100 \mathrm{mV} \mathrm{DC} \\ & \text { (Resolution:1/4,000) (Note 4) } \end{aligned}$ |  | - |  |
|  | Current |  | 0 to 20 mA (Resolution:1/16,000) (Note1) |  |  |  |
| Digital input range (Note 2) | -10 to 10 V DC |  | K -2000 to K2000 (12-bit mode)/ K-8000 to K8000 (14-bit mode) |  |  |  |
|  | -5 to 5 V DC |  | K-8000 to K8000 (14-bit mode only) |  |  |  |
|  | $\begin{aligned} & 0 \text { to } 10 \mathrm{~V} \mathrm{DC} \\ & 0 \text { to } 5 \mathrm{VDC} \\ & \hline \end{aligned}$ |  | K0 to K16000 (14-bit mode only) |  |  |  |
|  | $\begin{aligned} & -100 \text { to } 100 \mathrm{mV} \mathrm{DC} \\ & \text { (Note 4) } \end{aligned}$ |  | K -2000 to K2000 (12-bit mode only) |  |  |  |
|  | 0 to 20 mA |  | K0 to K4000 (14-bit mode)/ K0 to K16000 (14-bit mode) |  |  |  |
| Conversion speed |  |  | $2 \mathrm{~ms} / \mathrm{All}$ channels (Note 3) |  |  |  |
| Overall precision | $\begin{aligned} & \mathscr{0} \\ & \frac{\pi}{0} \\ & \hline> \end{aligned}$ | At $\pm 100 \mathrm{mV}$ (Note 4) | $\pm 0.6 \%$ F.S. or less (at $25^{\circ} \mathrm{C}$ ) <br> $\pm 1.0 \%$ F.S. or less (at 0 to $+55^{\circ} \mathrm{C}$ ) |  |  |  |
|  |  | Others | $\pm 0.2 \% \mathrm{~F}$.S. or less (at $25^{\circ} \mathrm{C}$ ) $\pm 0.4 \% \mathrm{~F} . \mathrm{S}$. or less (at 0 to $+55^{\circ} \mathrm{C}$ ) |  |  |  |
|  | Current |  | $\pm 0.3 \% \mathrm{~F} . \mathrm{S}$. or less (at $25^{\circ} \mathrm{C}$ ) $\pm 0.6 \% \mathrm{~F}$.S. or less (at 0 to $+55^{\circ} \mathrm{C}$ ) |  |  |  |
| Input impedance | Voltage |  | Approx. $1 \mathrm{M} \Omega$ |  |  |  |
|  | Current |  | Approx. $250 \Omega$ |  |  |  |
| Absolute maximum input | Voltage |  | -15 to 15 V (Voltage input) |  |  |  |
|  | Current |  | -30 to 30 mA (Current input) |  |  |  |
| Insulation method | Between output terminal to internal circuit |  | Photocoupler Insulation-type DC/DC converter |  |  |  |
|  | Between the channels |  | Uninsulated |  |  |  |
| FP0 Compatibility |  |  | Switched to the 12-bit operation by the dip switch. |  |  |  |
| External connection method |  |  | Connection terminal block connection |  |  |  |

(Note 1):The resolution in the 12-bit mode is $1 / 4,000$.
(Note 2): In the analog input unit Ver.1.1 or older or the analog I/O unit, a digital conversion value equivalent to the analog input of approx. 2 V is saved in the device (WX), for the channels to which no input is connected. The analog input unit Ver.1.2 or after are equivalent to approx. 0 V .
(Note 3): The time shown in the figure below is required to reflect analog input values in the input device area (WX) read by the control unit. The following figure shows the values when the range of -10 to +10 V is used.

(Note 4): Installed in the unit of Ver.1.2 and after (only 12-bit mode)

### 6.1.3 Output Specifications

| Item |  | Description |  |  |
| :---: | :---: | :---: | :---: | :---: |
|  |  | Analog output unit | Analog I/O unit |  |
|  |  | AFP0RDA4 | AFP0RA21 | AFP0RA42 |
| Number of outputs |  | 4 ch | 1 ch | 2 ch |
| Output range <br> (Resolution | Voltage | -10 to 10 V DC (Resolution:1/16,000) (Note 1) <br> -5 to 5 V DC (Resolution:1/16,000) <br> 0 to 10 V DC (Resolution:1/16,000) <br> 0 to 5 V DC (Resolution:1/16,000) |  |  |
|  | Current | 0 to 20 mA (Resolution:1/16,000) (Note1) <br> 4 to 20 mA (Resolution:1/16,000) (Note1) |  |  |
| Digital output range | -10 to 10 V DC | K-2000 to K2000 (12-bit mode)/ K-8000 to K8000 (14-bit mode) |  |  |
|  | -5 to 5 V DC | K-8000 to K8000 (14-bit mode only) |  |  |
|  | 0 to 10 V DC 0 to 5 V DC | K0 to K16000 (14-bit mode only) |  |  |
|  | 0 to 20 mA 4 to 20 mA | K0 to K4000 (12-bit mode)/ K0 ~ K16000 (14-bit mode) (Note1) |  |  |
| Conversion speed |  | $500 \mu \mathrm{~s} /$ All channels (Note 2) |  |  |
| Overall precision | Voltage | $\pm 0.2 \% \mathrm{~F} . \mathrm{S}$. or less (at $25^{\circ} \mathrm{C}$ ) $\pm 0.4 \% \mathrm{~F} . \mathrm{S}$. or less (at 0 to $+55^{\circ} \mathrm{C}$ ) |  |  |
|  | Current | $\pm 0.3 \% \mathrm{~F} . \mathrm{S}$. or less (at $25^{\circ} \mathrm{C}$ ) $\pm 0.6 \% \mathrm{~F} . \mathrm{S}$. or less (at 0 to $+55^{\circ} \mathrm{C}$ ) |  |  |
| Output impedance |  | $0.5 \Omega$ or less (Voltage output) |  |  |
| Maximum outputcurrent |  | $\pm 10 \mathrm{~mA}$ (Voltage output) |  |  |
| Allowable outputload resistance |  | $600 \Omega$ or less (Current output) |  |  |
| Insulation method | Between input terminal to internal circuit | Photocoupler Insulation-type DC/DC converter |  |  |
|  | Between the channels | Uninsulated |  |  |
| External connection method |  | Connection terminal block connection |  |  |

(Note 1):The resolution in the 12-bit mode is $1 / 4,000$. Also, the output current range in the 12 -bit mode is 4 to 20 mA for AFPORDA4, and 0 to 20 mA for AFPORA21/AFP0RA42.
(Note 2): The time shown in the figure below is required to reflect the values in the output device area (WY) of the control unit as analog output values. The following figure shows the values when the range of -10 to +10 V is used.


## Precautions on the characteristics of analog output

- When the power to the control unit turns on or off, voltage (equivalent to 2 V ) may be output for approx. 2 ms from the output terminal. If it will be a problem on your system, take necessary measures externally to avoid the transitional condition, e.g. turning on PLC before external devices or turning off external devices before PLC.


### 6.2 Dimension

■ FPOR-AD4 / FP0R-A21

(Note): FP0R-AD4 has no power supply connector.

## ■ FP0R-AD8 / FP0R-DA4 / FP0R-A42


(Note): FP0R-AD8 has no power supply connector.

## 7

## Compatibility with Conventional Models

### 7.1 Analog Input Unit

### 7.1.1 Compatibility with Conventional Models

Specification Comparison Chart

| Item |  | FP0-A80 | FP0RAD4 / FP0RAD8 |  |
| :---: | :---: | :---: | :---: | :---: |
| Appearance |  |  |  |  |
| Resolution and Operation mode |  | 12-bit (1/4000) | $\begin{gathered} \hline \text { 12-bit }(1 / 4000) \\ \text { 14-bit }(1 / 16000) \text { (Note 1) } \end{gathered}$ |  |
| Number of channels |  | 8 ch | 4 ch or 8 ch (Each model) |  |
| Analog input voltage range | -10 to 10 V DC | Not available | Available |  |
|  | -5 to 5 V DC | Not available | Available (Note 2) |  |
|  | 0 to 10 V DC | Not available | Available (Note 2) |  |
|  | 0 to 5 V DC | Available | Available |  |
|  | -100 to 100 m V DC | Available | Available (Note 4) |  |
| Analog input current range | 0 to 20 mA | Available | Available |  |
| Conversion speed |  | $1 \mathrm{~ms} /$ channel | $2 \mathrm{~ms} / \mathrm{All}$ channels |  |
| Overall precision | Voltage | $\begin{gathered} \pm 0.6 \% \text { F.S. or less (at } 25^{\circ} \mathrm{C} \text { ) } \\ \pm 1 \% \mathrm{~F} . \mathrm{S} \text {. or less (at } 0 \text { to } 55^{\circ} \mathrm{C} \text { ) } \end{gathered}$ | $\begin{aligned} & \text { At } \pm 100 \mathrm{mV} \\ & \text { (Note 4) } \end{aligned}$ | $\begin{gathered} \pm 0.6 \% \mathrm{~F} . \mathrm{S} . \text { or less } \\ \text { (at } 25^{\circ} \mathrm{C} \text { ) } \\ \pm 1.0 \% \mathrm{~F} . \mathrm{S} \text { or less } \\ \text { (at } 0 \text { to } 55^{\circ} \mathrm{C} \text { ) } \\ \hline \end{gathered}$ |
|  |  |  | Others | $\pm 0.2 \% \mathrm{~F} . \mathrm{S}$. or less (at $25^{\circ} \mathrm{C}$ ) <br> $\pm 0.4 \%$ F.S. or less (at 0 to $55^{\circ} \mathrm{C}$ ) |
|  | Current |  | $\begin{gathered} \pm 0.3 \% \text { F.S. or less (at } 25^{\circ} \mathrm{C} \text { ) } \\ \pm 0.6 \% \mathrm{~F} \text {. . or less (at } 0 \text { to } 55^{\circ} \mathrm{C} \text { ) } \end{gathered}$ |  |
| Analog input averaging function |  | Available (Moving average) | Available (Moving average 10 times/ No. of averaging times: 64 times or 128 times) (Note 3) |  |
| Power supply (24V DC) | External power supply | Needed, 60mA or less | Not needed |  |
|  | Control unit consumption current increment | 20 mA or less | 45 mA or less (Note 5) |  |

(Note 1):The resolution and operation mode is switched by the mode switch.
(Note 2):When selecting the 14 -bit mode, the range can be set for each channel separately by user programs. Also, the ranges of -5 to $5 \mathrm{~V} D \mathrm{and} 0$ to 10 V DC can be set by user programs only when selecting the 14-bit mode.
(Note 3):When selecting the 14-bit mode, the averaging method can be set for each channel separately by user programs. For details of the averaging methods, refer to the chapter 5 "Analog Input Averaging Processing".
(Note 4): Installed in the unit of Ver.1.2 and after (only 12-bit mode).
(Note 5): In the case of the unit of Ver.1.2 and after; 20 mA for the unit of Ver.1.1 or older.

### 7.1.2 Points of Replacement

The points for replacing the conventional model FP0-A80 with the new model FPORAD* as an alternative are described below.

## Specification

This product can be used equivalently to FP0-A80. (Note 1)

## - Hardware (Note 2)

- The mode switch is set in the same way as FPO-A80. However, if both mode switches 1 and 2 are ON, the product operates in the 14-bit mode. (Note 1)
- The supply of power ( 24 V DC ) from an external device is not needed for the new analog input units FPOR-AD4 and FPOR-AD8.


## ■ Software

User programs created for the conventional model FP0-A80 can be used as they are.
(Note 1): The units of Ver.1.1 or older cannot be set to the voltage range -100 to +100 mV DC.
(Note 2): In the unit of Ver. 1.1 or older, a digital conversion value equivalent to the analog input of approx. 2 V is saved in the device (WX), for the channels to which no input is connected.

- For details of the setting method of the mode switch, refer to "2.1.2 Setting of Mode Switch".


### 7.2 Analog Output Unit

### 7.2.1 Compatibility with Conventional Models

Specification Comparison Chart

| Item |  | FP0-A04V/ FP0-A04I | FPORDA4 |
| :---: | :---: | :---: | :---: |
| Appearance |  |  |  |
|  | DIP switch | None | Equipped |
|  | Terminal block | 1 | 2 (For voltage output / For current output) |
| Resolution and Operation mode |  | 12-bit (1/4000) | $\begin{gathered} \text { 12-bit }(1 / 4000) \\ \text { 14-bit }(1 / 16000)(\text { Note } 1) \end{gathered}$ |
| Number of channels |  | 4 ch | 4 ch |
| Analog output range |  | Voltage/Current (Each model) | Voltage/Current <br> (Built in one unit) |
| Analog output voltage range | -10 to 10 V DC | Available (FP0-A04V) | Available (Note 2) |
|  | -5 to5 V DC | Not available | Available (Note 2) |
|  | 0 to 10 V DC | Not available | Available (Note 2) |
|  | 0 to 5 V DC | Not available | Available (Note 2) |
| Analog input current range | 0 to 20 mA | Not available | Available (Note 2) |
|  | 4 to 20 mA | Available (FP0-A04I) | Available (Note 2) |
| Conversion speed |  | $500 \mu$ / channel | $500 \mu$ / All channels |
| Overall precision | Voltage | $\begin{gathered} \pm 0.6 \% \text { F.S. or less (at } 25^{\circ} \mathrm{C} \text { ) } \\ \pm 1 \% \mathrm{~F} \text {.S. or less (at } 0 \text { to } 55^{\circ} \mathrm{C} \text { ) } \end{gathered}$ | $\pm 0.2 \% \mathrm{~F} . \mathrm{S}$. or less (at $25^{\circ} \mathrm{C}$ ) <br> $\pm 0.4 \%$ F.S. or less (at 0 to $55^{\circ} \mathrm{C}$ ) |
|  | Current |  | $\pm 0.3 \%$ F.S. or less (at $25^{\circ} \mathrm{C}$ ) <br> $\pm 0.6 \% \mathrm{~F}$.S. or less (at 0 to $55^{\circ} \mathrm{C}$ ) |
| Power supply (24V DC) | External power supply | 100 mA or less (FP0A04V) <br> 130 mA or less (FPOA04I) | 180 mA or less |
|  | Control unit consumption current increment | 20 mA or less | 10 mA or less |

(Note 1):The resolution and operation mode is switched by the mode switch.
(Note 2):When selecting the 14-bit mode, the range can be set for each channel separately by user programs. Also, the ranges of -5 to +5 V DC, 0 to 10 V DC and 0 to 20 mA DC can be set by user programs only when selecting the 14 -bit mode.

### 7.2.2 Points of Replacement

The points for replacing the conventional models FPOA04V or FPOA04I with the new model FPORDA4 as an alternative are described below.

## - Hardware

- Turn off the mode switch No. 1 and select "12-bit FPOA04 compatibility mode". The voltage output range is "-10 to 10 VDC ", and the current output range is " 4 to 20 mADC ".
- The new model FPORDA4 has two terminal blocks for the voltage output and current output. They are connected according to the application.
- In the case of FPORDA4, select whether to output signals to the voltage output or current output for each channel with the mode switch. The factory default setting is the voltage output for all channels. Change the mode switch setting as necessary.

| Item | FP0A04V compatibility | FP0A04I compatibility |
| :---: | :---: | :---: |
| Appearance |  |  |
| Terminal block | The terminal block on the voltage output side is used. | The terminal block on the current output side is used. |
| Mode switch | The 12-bit FPOA04 compatibility mode is selected. <br> The voltage output is selected for all channels. | The 12-bit FPOA04 compatibility mode is selected. <br> The current output is selected for all channels. |

## Software

User programs created for the conventional models FPOA04V and FPOA04I can be used as they are.

REFERENCE

- For details of the setting method of the mode switch, refer to "2.2.2 Setting of Mode Switch".


### 7.3 Analog I/O Unit

### 7.3.1 Compatibility with Conventional Models

■ Specification Comparison Chart

| Item |  | FP0-A21 | FP0R-A21 / FP0R-A42 |
| :---: | :---: | :---: | :---: |
| Appearance |  |  |  |
| Resolution and Operation mode |  | 12-bit (1/4000) | $\begin{gathered} \hline \text { 12-bit (1/4000) } \\ \text { 14-bit }(1 / 16000)(\text { Note } 1) \end{gathered}$ |
| Number of channels |  | Input 2 ch/Output 1 ch | A21:Input 2 ch/Output 1 ch A42:Input 4 ch/Output 2 ch |
| Analog input voltage range | -10 to 10 V DC | Available | Available |
|  | -5 to 5 V DC | Not available | Available (Note 2) |
|  | 0 to 10 V DC | Not available | Available (Note 2) |
|  | 0 to 5 V DC | Available | Available |
| Analog input current range | 0 to 20 mA | Available | Available |
| Analog output voltage range | -10 to 10 V DC | Available | Available |
|  | -5 to 5 V DC | Not available | Available (Note 3) |
|  | 0 to 10 V DC | Not available | Available (Note 3) |
|  | 0 to 5 V DC | Not available | Available (Note 3) |
| Analog output current range | 0 to 20 mA | Available | Available |
|  | 4 to 20 mA | Not available | Available (Note 3) |
| Conversion speed |  | $1 \mathrm{~ms} /$ channel | Input 2 ms / All channels Output $500 \mu \mathrm{~s} / \mathrm{All}$ channels |
| Overall precision | Voltage | $\begin{gathered} \pm 0.6 \% \text { F.S. or less (at } 25^{\circ} \mathrm{C} \text { ) } \\ \pm 1 \% \text { F.S. or less (at } 0 \text { to } 55^{\circ} \mathrm{C} \text { ) } \end{gathered}$ | $\pm 0.2 \%$ F.S. or less (at $25^{\circ} \mathrm{C}$ ) $\pm 0.4 \% \mathrm{~F} . \mathrm{S}$. or less (at 0 to $55^{\circ} \mathrm{C}$ ) |
|  | Current |  | $\pm 0.3 \%$ F.S. or less (at $25^{\circ} \mathrm{C}$ ) <br> $\pm 0.6 \% \mathrm{~F} . \mathrm{S}$. or less (at 0 to $55^{\circ} \mathrm{C}$ ) |
| Analog input averaging function |  | Not available | Available (Moving average 10 times/ No. of averaging times: 64 times or 128 times) (Note 4) |
| Power supply (24V DC) | External power supply | 100 mA or less | A21:80 mA or less A42:120 mA or less |
|  | Control unit consumption current increment | 20 mA or less | 10 mA or less |

(Note 1): The resolution and operation mode is switched by the mode switch.
(Note 2): When selecting the 14-bit mode, the range can be set for each channel separately by user programs. Also, the ranges of -5 to 5 V DC and 0 to 10 V DC can be set by user programs only when selecting the 14-bit mode.
(Note 3): When selecting the 14-bit mode, the range can be set for each channel separately by user programs. Also, the ranges of 0 to 10 V DC and 4 to 20 mA DC can be set by user programs only when selecting the 14-bit mode.
(Note 4): When selecting the 14-bit mode, the averaging method can be set for each channel separately by user programs. For details of the averaging methods, refer to the chapter 5 "Analog Input Averaging Processing".

### 7.3.2 Points of Replacement

The points for replacing the conventional model FP0A21 with the new model FPORA21 as an alternative are described below.

## - Hardware

- Although the positions of the mode switch and the terminal blocks are slightly different between the conventional model FPOA21 and the new model FPORA21, the setting methods of the switches and the pin layout of the terminal blocks are compatible.
- The mode switch is set in the same way as FP0-A21.
- The connections of the terminal blocks are also the same.
- For the new model FPORA21, a digital conversion value equivalent to the analog input value of approx. 2 V is shown for the channels to which no input is connected.



## ■ Software

User programs created for the conventional model FPOA21 can be used as they are.

## ■ Replacement of FP0-A21 with FP0RA42

For replacing two FP0A21 units with FPORA42, the user program should be changed. The output range is either 0 to 20 mA or -10 to +10 V .

- For details of the setting method of the mode switch, refer to "2.3.2 Setting of Mode Switch".


## Record of changes

| Manual No. | Date | Record of Changes |
| :--- | :--- | :--- |
| WUME-FPORAIO-01 | June.2015 | First Edition |
| WUME-FPXHAIO-02 | Oct.2015 | Second Edition <br> -Error correction (Chapter 3.2.1) <br> Third Edition |
| - Specification change (Chapter 2.1.2, Chapter 4.5.1, |  |  |
| Chapter 6.1.1, Chapter 6.1.2, Chapter 7.1.1, Chapter |  |  |
| 7.1.2) |  |  |

