Instruction
Manual

FA-M3

Analog Input/Output Modules

IM 34M6H11-01E

YOKOGAWA
Yokogawa Electric Corporation

IM 34M6H11-01E
1st Edition

Applicable Products:

FA-M3 Range-free Multi-controllers

Models and Their Names:

F3AD04-0N Analog Input Module

F3AD08-1N Analog Input Module

F3DA02-0N Analog Output Module

F3DA04-1N Analog Output Module

F3DA08-5N Analog Output Module

The document number and document model code for this manual:

IM 34M6H11-01E

Refer to the document number in all communications; also refer to the document number or the document model code when purchasing additional manuals.

Media No. IM 34M6H11-01E (CD) 1st Edition : Feb. 1999 (YK)

◆ Important

■ About This Manual

(1) This manual should be passed on to the end user.

(2) Before using the module, read this manual completely to get a thorough understanding of the module.

(3) This manual explains the functions contained in this product, but does not warrant that those will suit the particular purpose of the user.

(4) Under absolutely no circumstances may the contents of this manual be transcribed or copied, in part or in whole, without permission.

(5) The contents of this manual are subject to change without prior notice.

(6) Every effort has been made to ensure accuracy in the preparation of this manual. However, should any errors or omissions come to the attention of the user, please contact the nearest Yokogawa Electric representative or sales office.

■ Safety Precautions when Using/Maintaining the Product

The following safety symbols are used on the product as well as in this manual.

CAUTION

This symbol indicates that the operator must follow the instructions laid out in this manual in order to avoid the risk of personnel injuries or fatalities or damage to the instrument. The manual describes what special care the operator must exercise to prevent electrical shock or other dangers that may result in injury or the loss of life.

⏚ Protective ground terminal
Before using the instrument, be sure to ground this terminal.

⏚ Function ground terminal
Before using the instrument, be sure to ground this terminal.

~ Indicates alternating current.

⎓ Indicates direct current.

(1) The following symbols are used only in the instruction manual.

WARNING

Indicates that the operator must refer to the instructions in this manual in order to prevent the instrument (hardware) or software from being damaged, or a system failure from occurring.

CAUTION

Draws attention to information essential for understanding the operation and functions.

TIP

Gives information that complements the present topic.

SEE ALSO

Identifies a source to which to refer.

(2) For the protection and safe use of the product and the system controlled by it, be sure to follow the instructions and precautions on safety stated in this manual whenever handling the product. Take special note that if you handle the product in a manner other than prescribed in these instructions, safety cannot be guaranteed.

(3) If separate protection and/or safety circuits for this product or the system which is controlled by this product are to be installed, ensure that such circuits are installed external to the product.

(4) If component parts or consumables are to be replaced, be sure to use parts specified by the company.

(5) Do not attempt to make modifications or additions internal to the product.

■ Force Majeure

(1) Yokogawa Electric Corporation (hereinafter referred to as Yokogawa Electric) makes no warranties regarding the product except those stated in the WARRANTY that is provided separately.

(2) Yokogawa Electric assumes no liability to any party for any loss or damage, direct or indirect, caused by the user or any unpredictable defect of the product.

■ Software Supplied by the Company

(1) Yokogawa Electric makes no other warranties expressed or implied except as provided in its warranty clause for software supplied by the company.

(2) Use the relevant software with one specified computer only. You must purchase another copy of the software for use with each additional computer.

(3) Copying the software for any purpose other than backup is strictly prohibited.

(4) Store the floppy disks (originals) of this software in a safe place.

(5) Reverse engineering, such as decompiling of the software, is strictly prohibited.

(6) No portion of the software supplied by Yokogawa Electric may be transferred, exchanged, or sublet or leased for use by any third party without prior permission by Yokogawa Electric.

■ General Requirements for Using FA-M3 Controllers

● Avoid installing FA-M3 controllers in the following locations:

- Where the instrument will be exposed to direct sunlight, or where the operating temperature is outside the range 0° to 55°C.
- Where the relative humidity is outside the range 10 to 90%, or where sudden temperature changes may occur and cause condensation.
- Where corrosive or inflammable gases are present.
- Where the instrument will be exposed to direct mechanical vibration or shock.

● Securely tighten screws:

- Securely tighten module mounting screws and terminal screws to avoid problems such as faulty operation.

● Securely fasten connectors of interconnecting cables:

- Securely fasten connectors of interconnecting cables, and check them thoroughly before turning on the power.

● Interlock with emergency-stop circuitry using external relays:

- Equipment incorporating the FA-M3 controllers must be furnished with emergency-stop circuitry that uses external relays. This circuitry should be set up to interlock correctly with controller status (stop/run).

● Ground FA-M3 controllers to an independent Japanese Industrial Standard (JIS) Class 3 Ground:

- Avoid grounding the FG terminal of the FA-M3 controller to the same ground as high-voltage power lines. Ground the terminal to an independent JIS Class 3 ground (ground resistance up to 100 Ω).

● Observe countermeasures against noise:

- When assigning inputs/outputs, the user should avoid locating AC-supplied I/O modules in the vicinity of the CPU module.

● Keep spare parts on hand:

- Stock up on maintenance parts, including spare modules, in advance.

● Discharge static electricity before operating the system:

- Because static charge can accumulate in dry conditions, first touch grounded metal to discharge any static electricity before touching the system.

● Never use solvents such as paint thinner for cleaning:

- Gently clean the surfaces of the FA-M3 controllers with a piece of soft cloth soaked in water or a neutral detergent.
- Do not use solvents such as paint thinner for cleaning, as they may cause deformation, discoloration, or malfunctioning.

- Avoid storing the FA-M3 controllers in places with high temperature or humidity:
  - Since the CPU module has a built-in battery, avoid storing it in places with high temperature or humidity.
  - Since the service life of the battery is drastically reduced by exposure to high temperatures, so take special care (storage temperature can be from -20° to 75°C).

- Always turn off the power before installing or removing modules:
  - Turn off power to the power supply module when installing or removing modules, otherwise damage may result.

- When installing ROM packs and changing switch settings:
  - In some modules you can remove the right-side cover and install ROM packs or change switch settings. While doing this, do not touch any components on the printed-circuit board, otherwise components may be damaged and modules fail.

■ Waste Electrical and Electronic Equipment

Waste Electrical and Electronic Equipment (WEEE), Directive 2002/96/EC
(This directive is only valid in the EU.)

This product complies with the WEEE Directive (2002/96/EC) marking requirement.

The following marking indicates that you must not discard this electrical/electronic product in domestic household waste.

Product Category

With reference to the equipment types in the WEEE directive Annex 1, this product is classified as a “Monitoring and Control instrumentation” product.

Do not dispose in domestic household waste.

When disposing products in the EU, contact your local Yokogawa Europe B. V. office.

◆ Introduction

■ About This Manual

This instruction manual, “Analog Input/Output Modules,” explains the specifications and handling of the analog input/output modules used with an FA-M3 controller.

■ Other Instruction Manuals

Consult the following FA-M3 manuals as necessary when using this module:

- Sequence CPU Instruction Manual - Functions (IM 34M6P12-02E)
- Sequence CPU Instruction Manual - Instructions (IM 34M6P12-03E)
- Sequence CPU Instruction Manual (for F3FP36) (IM 34M6P22-01E)
- Personal Computer Link Command Module Instruction Manual (IM 34M6P41-01E)
- Ladder Diagram Support Program M3 Instruction Manual (IM 34M6Q13-01E)
- BASIC CPU Module and BASIC Programming Tool M3 Instruction Manual (IM 34M6Q22-01E)

■ Trademarks:

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FA-M3
Analog Input/Output Modules

IM 34M6H11-01E 1st Edition

CONTENTS

1. Overview

This chapter provides the general description and features of the analog input/output module.

The Models F3AD04-0N and F3AD08-1N Analog Input Modules and the Models F3DA02-0N, F3DA04-1N and F3DA08-5N Analog Output Modules are used with the FA-M3 Range-free Multi-controller.

The F3AD04-0N is an analog-to-digital conversion input module for the FA-M3. Features included in this module are:

- The input signal ranges from 0 to 5 V DC, 1 to 5 V DC and from -10 to 10 V DC. Any of these ranges can be selected arbitrarily.
- A single module can accommodate four input points.
- 1 ms/point conversion period.
- Provided with easy-to-use features such as scaling and filtering.

The F3AD08-1N is an analog-to-digital conversion input module for the FA-M3. Features included in this module are:

- The input signal ranges from 0 to 5 V DC, 1 to 5 V DC and from -10 to 10 V DC. Any of these ranges can be selected arbitrarily.
- A single module can accommodate eight input points.
- 1 ms/point conversion period.
- Provided with easy-to-use features such as scaling and filtering.

The F3DA02-0N is a digital-to-analog conversion output module for the FA-M3. Features included in this module are:

- The output signal ranges from -10 to 10 V DC or from 4 to 20 mA DC.
- A single module can accommodate two output points.
- Provides a conversion period (output update period) as high as 2 ms.
- Provided with an easy-to-use scaling feature.

The F3DA04-1N is a digital-to-analog conversion output module for the FA-M3. Features included in this module are:

- The output signal ranges from -10 to 10 V DC or from 4 to 20 mA DC.
- A single module can accommodate four output points.
- Provides a conversion period (output update period) as high as 4 ms.
- Provided with an easy-to-use scaling feature.
- The user can select either a hold output or a preset output for each channel if the CPU fails.

The F3DA08-5N is a digital to analog conversion output module. Features included in this module are:

- The output signal ranges from -10 to 10 V DC.
- A single module can accommodate eight output points.
- Provides a conversion period (output update period) as high as 4 ms.
- Provided with an easy-to-use scaling feature.
- The user can select either a hold output or a preset output for each channel if the CPU fails.

Instructions (in ladder diagrams) for special modules as well as BASIC statements are provided to implement analog input-output for the F3AD04-0N, F3AD08-1N, F3DA02-0N, F3DA04-1N and F3DA08-5N.

2. Analog Input Module

This chapter describes the specifications and operation mode of the F3AD04-0N and F3AD08-1N Analog Input Modules.

CONTENTS

2.1 F3AD04-0N Module Specifications

2.1.1 Functional Specifications

Table 2.1 Functional Specifications

Item	Specifications
Number of inputs	4
Absolute maximum rated voltage	18 V DC max. -18 V DC min.
Input signal range*1	0 to 5 VDC (-0.25 to 5.25 V DC) 1 to 5 V DC (-0.25 to 5.25 V DC) -10 to 10 V DC (-11.0 to 11.0 V DC)
Insulation method	Across input terminals and internal circuit: Photocoupler-isolated Across input terminals: Not isolated, negative line common
Withstanding voltage	500 V DC for 1 minute
Input resistance	1 MΩ
Resolution (12-bit A/D)	0 to 5 V and 1 to 5 V DC: 1.4 mV -10 to 10 V DC: 5.7 mV
Overall accuracy	23±2°C: ±0.2% (full scale), 0 to 55°C: ±0.5% (full scale)
Conversion period	1 ms× (number of input points)
Scaling	Upper and lower limit values can be set to any value between -20,000 and 20,000.
Filter	Channels are enabled or disabled individually. *2
Current consumption	210 mA (5 V DC)
External connections	10-point terminal block, M3.5 screws
External dimensions	28.9 (W)×100 (H)×83.2 (D) mm *3
Weight	170 g

*1: Selectable for each channel under program control. The default value is -10 to 10 V DC.
*2: The actual time constant value varies according to the number of channels not skipped and other settings.
*3: Dimensions excluding any protrusions (see Section 2.1.6, External Dimensions for more details).

CAUTION

Do not apply any voltage over the absolute maximum voltage (see Table 2.1) even for a short period of time. Otherwise, the module internal circuitry may fail, and expected specifications may not be attained.

2.1.2 Input to Output Conversion Characteristics

The input to output conversion characteristics with no scaling functions are shown in Figure 2.1 with the input signal ranges selected. The input to output conversion characteristics show analog input values versus digital output values.

SEE ALSO

See also Section 2.3.1 (3), "Scaling."

Table 2.2 Input to Output Conversion Characteristics with No Scaling

Input signal range	Analog input value	Digital output value
-10 to 10 V DC range	-10 to 10 V DC	-20000 to 20000
0 to 5 V DC range	0 to 5 V DC	0 to 10000
1 to 5 V DC range	1 to 5 V DC	2000 to 10000

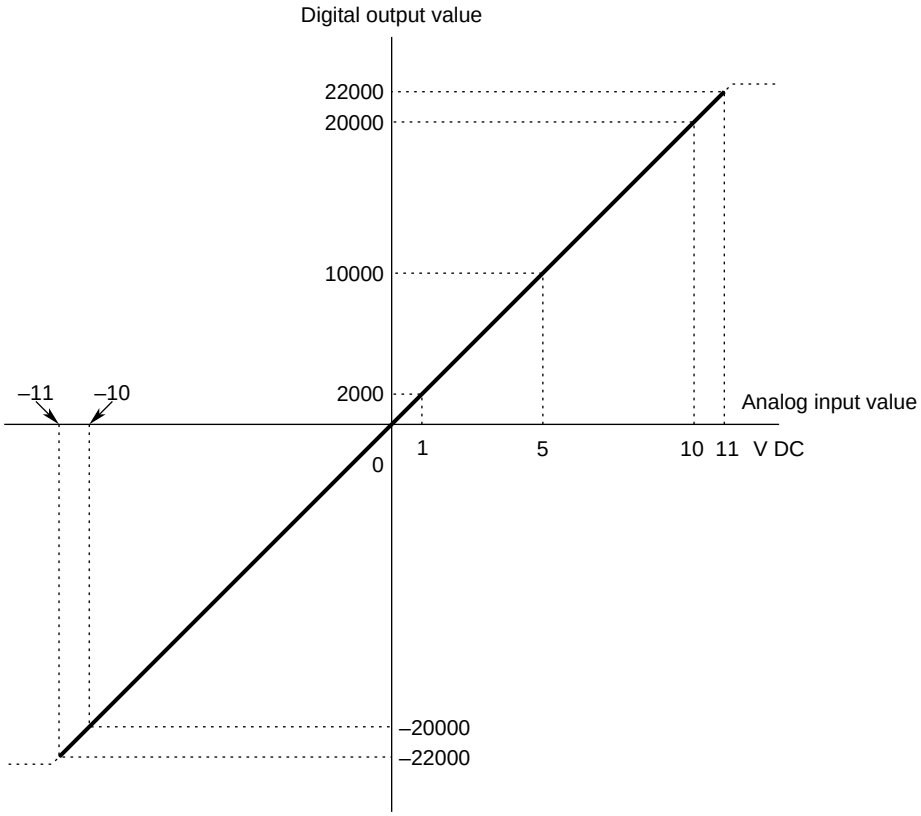
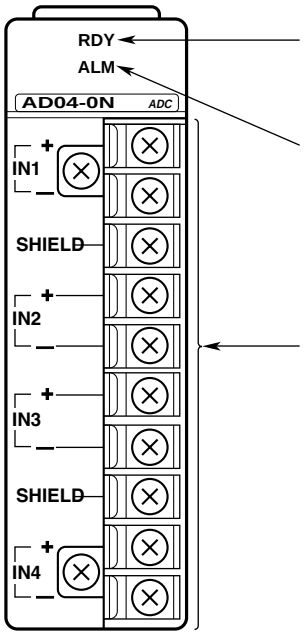


Figure 2.1 Input to Output Conversion Characteristics with No Scaling

2.1.3 Components and Functions



RDY indicator:
Lit when the internal circuit is functioning normally.

ALM indicator:
Lit when calibration data* is lost. In such a case, A/D conversion will be conducted, but its accuracy is not addured. The module requires maintenance service.

Detachable terminal block:
10-point terminal block with M3.5 screws with square captive washers.

*: Calibration data is stored in the module to achieve the intended accuracy. These data are written during calibration work at the factory. The users cannot write these data.

Figure 2.2 Components and Functions

2.1.4 Internal Circuit Diagram

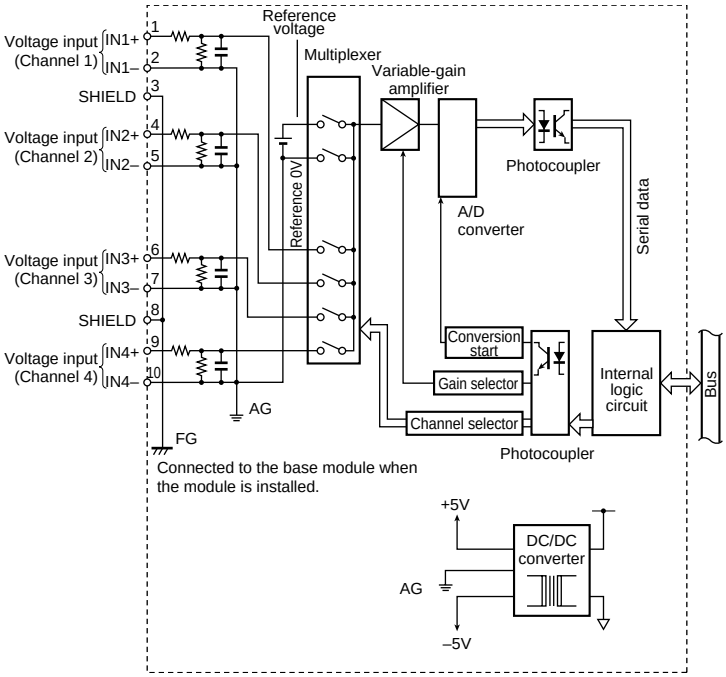
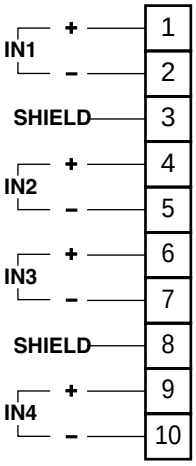


Figure 2.3 Internal Circuit Diagram

2.1.5 External Connections and Wiring Precautions

(1)External Connection Diagram



- Shielded terminal 3 is shared by IN1 and IN2.
- Shielded terminal 8 is shared by IN3 and IN4.
- Shielded terminals are connected to the frame ground of the power supply module via the base module.

Figure 2.4 External Connection Diagram

Table 2.3 Wire Size and Terminals

Connection Method		Terminal block type
Applicable conductor size		0.3 to 0.75 mm^2 (AWG22 to 18)
Wire connection method		Crimp-on type
Wire temperature rating		75°C min
Wire material		Cooper
Crimp-on terminals	Crimp-on terminals	For M3.5 screws
	Tightening torque	0.8 N·m (8 kgf·cm, 6.9lbf·in)
	Applicable crimp-on terminals	Example: Japan Solderless Terminal Mfg. Co., Ltd. : V1.25-M3 Nihon Tanshi Co., Ltd. : RAV1.25-3.5

CAUTION

When connecting a terminal lug to the wire, be sure to use an appropriate crimping tool specified by the manufacturer.

(2) Wiring Precautions

CAUTION

All of the module "IN□-" terminals have been connected to the analog ground terminal inside the module. So, the potentials at IN□- terminals are all identical.

(a) Use a shielded twisted-pair to connect signal lines to F3AD04-0N.

(b) Connect the shielding wire of the twisted pair to the shielding terminal of F3AD04-0N.

(c) Each F3AD04-0N shield terminal is connected to the power supply module FG terminal via the base module.

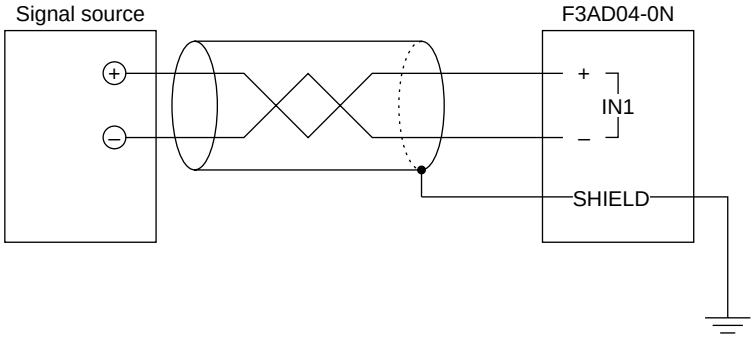


Figure 2.5 Wiring Example

(d) If the negative (-) terminal of the signal line is grounded, it is better to connect the shielding wire of the twisted pair to the signal source shielding terminal (FG).

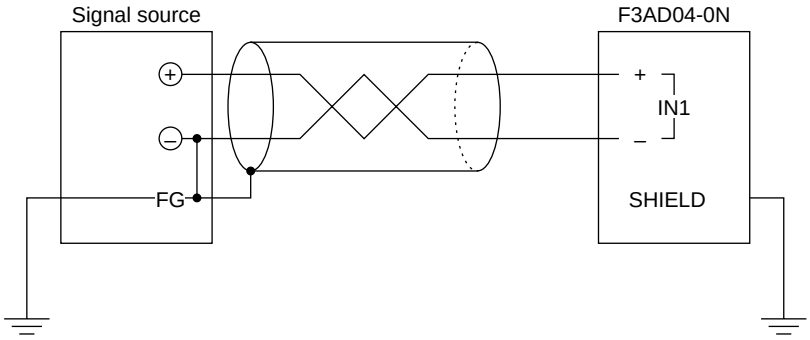


Figure 2.6 Interconnection Diagram Where Negative Signal Line is Grounded.

2.1.6 External Dimensions

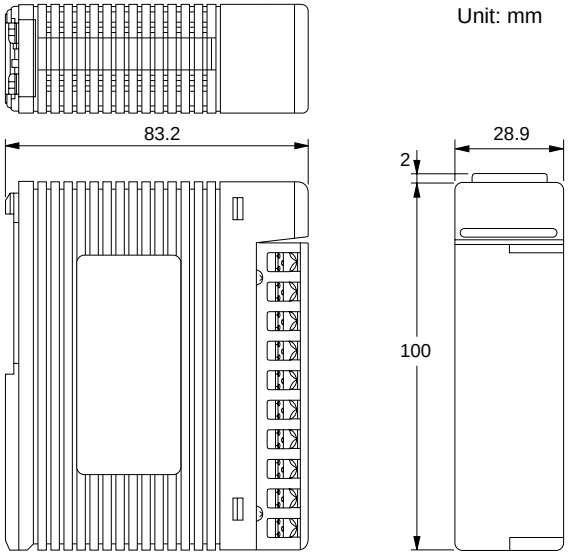


Figure 2.7 External Dimensions

2.2 F3AD08-1N Module Specifications

2.2.1 Functional Specifications

Table 2.4 Functional Specifications

Item	Specifications
Number of inputs	Eight (differential signal inputs)
Absolute maximum rated voltage	18 V DC max. -18 V DC min.
Input signal range*1	0 to 5 V DC (-0.25 to 5.25 V DC) 1 to 5 V DC (-0.25 to 5.25 V DC) -10 to 10 V DC (-11.0 to 11.0 V DC)
Permissible common mode voltage	±6 V DC max. (0 to 5/1 to 5 V DC) ±1 V DC max. (-10 to 10 V DC)
Insulation method	Across input terminals and internal circuit: Photocoupler-isolated Across input terminals: No isolation required.
Dielectric strength	500 V DC for one minute
Input resistance	1 MΩ or more *2
Resolution (12-bit A/D)	0 to 5 V and 1 to 5 V DC: 1.4 mV -10 to 10 V DC: 5.7 mV
Overall accuracy	23±2°C: ±0.2% (full scale), 0 to 55°C: ±0.5% (full scale)
Conversion period	1 ms×(number of input points)
Scaling	Upper and lower limit values can be set to any value between -20000 and 20000.
Filter	Channels are enabled or disabled individually. *3
Current consumption	210 mA (5 V DC)
External connection	18-point terminal block, M3.5 screws
External dimensions	28.9 (W)×100 (H)×83.2 (D) *4
Weight	200 g

*1: Selectable for each channel under program control. The default value is -10 to 10 V DC.
*2: 2 MΩ for channels in which the input terminal IN□- is not connected to the terminal AG.
*3: The actual time constant value varies according to the number of unskipped channel and other settings.
*4: Dimensions excluding any protrusions (see Section 2.2.6, "External Dimensions" for details.)

CAUTION

Do not apply any voltage over the absolute maximum rated voltage (see the table above) even for a short period of time. Otherwise, the module internal circuit may fail, and no expected specifications may be obtained.

2.2.2 Input to Output Conversion Characteristics

The input to output conversion characteristics without scaling functions are shown in Figure 2.8 with the input signal ranges selected. The input to output conversion characteristics show analog input values versus digital output values.

SEE ALSO

Section 2.3.1 (3), "Scaling."

Table 2.5 Input to Output Conversion Characteristics without Scaling

Input signal range	Analog input value	Digital output value
-10 to 10 V DC range	-10 to 10 V DC	-20000 to 20000
0 to 5 V DC range	0 to 5 V DC	0 to 10000
1 to 5 V DC range	1 to 5 V DC	2000 to 10000

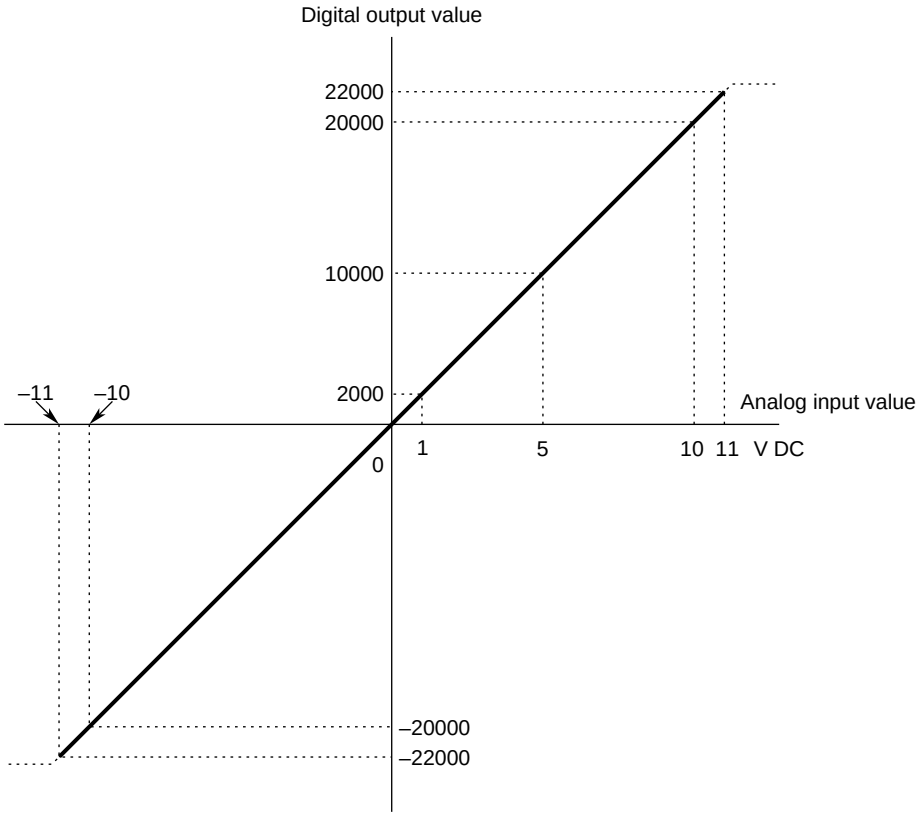
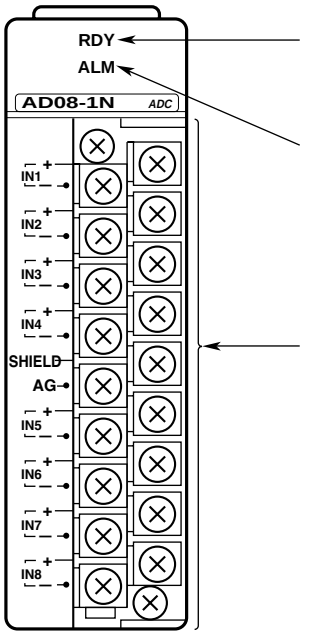


Figure 2.8 Input to Output Conversion Characteristics with No Scaling

2.2.3 Components and Functions



RDY indicator:
Lit when the internal circuit is functioning normally.

ALM indicator:
Lit when calibration data* is lost. In such a case, A/D conversion will be conducted, but its accuracy is not assured. The module requires maintenance service.

Detachable terminal block:
18-point terminal block with M3.5 screws with square captive washers.

* : Calibration data is stored in the module to achieve the intended accuracy. These data are written during calibration work at the factory. Users cannot write these data.

Figure 2.9 Components and Fuctions

2.2.4 Internal Circuit Diagram

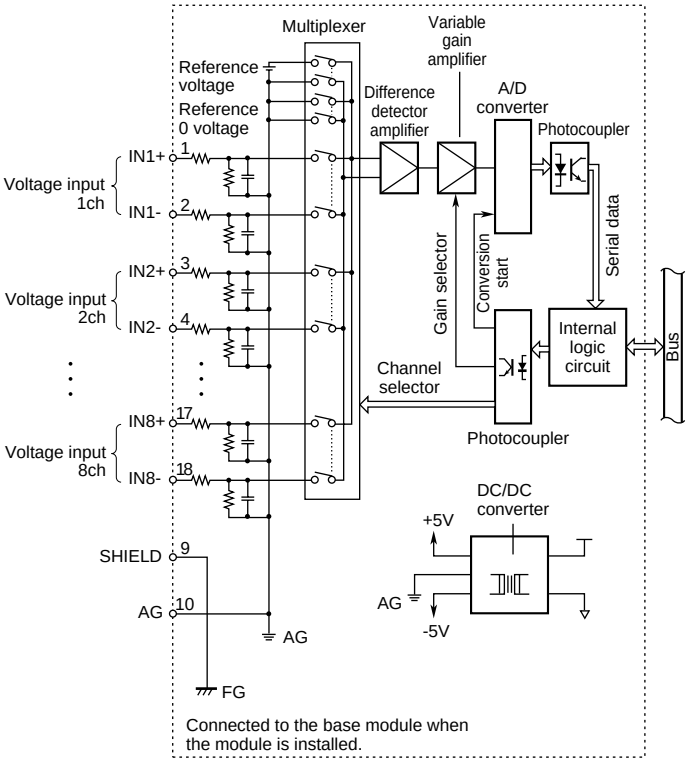
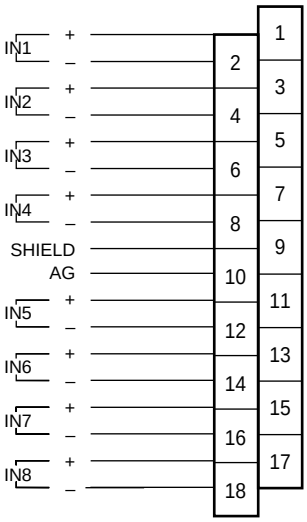


Figure 2.10 Internal Circuit Diagram

2.2.5 External Connections and Wiring Precautions

(1) External Connection Diagram



- The above SHIELD terminal is connected to the frame ground of the power supply module via the base module.
- The AG terminal is connected to the analog ground inside the module.

Figure 2.11 External Connection Diagram

Table 2.6 Wire Size and Terminals

Connection Method		Terminal block type
Applicable conductor size		0.3 to 0.75 mm^2 (AWG22 to 18)
Wire connection method		Crimp-on type
Wire temperature rating		75°C min
Wire material		Cooper
Crimp-on terminals	Crimp-on terminals	For M3.5 screws
	Tightening torque	0.8 N·m (8 kgf·cm, 6.9lbf·in)
	Applicable crimp-on terminals	Example: Japan Solderless Terminal Mfg. Co., Ltd. : V1.25-M3 Nihon Tanshi Co., Ltd. : RAV1.25-3.5

CAUTION

When connecting a terminal lug to the wire, be sure to use an appropriate crimping tool specified by the manufacturer.

(2) Wiring Precautions

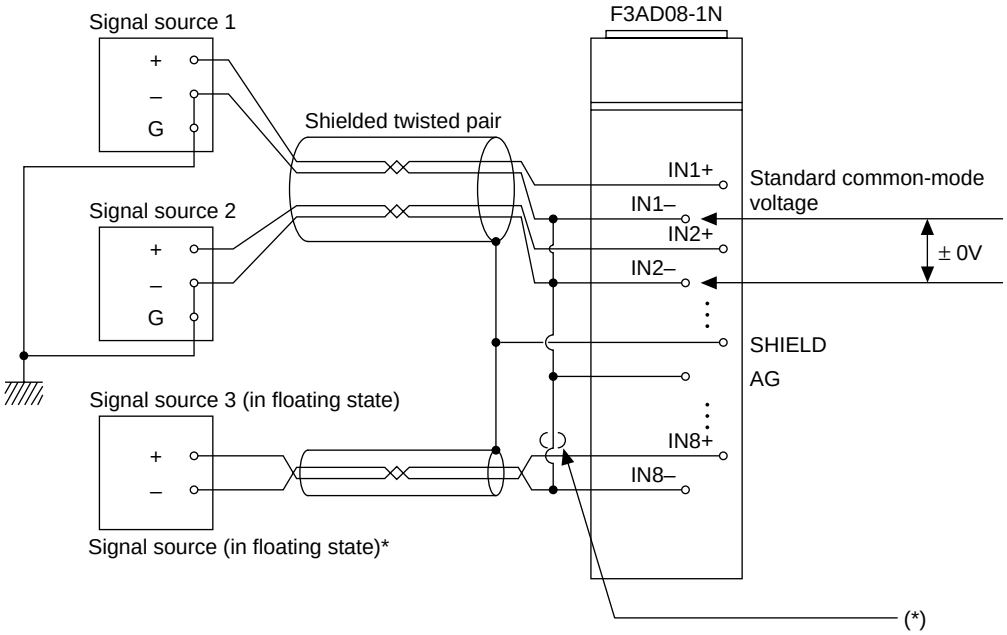
CAUTION

The analog input module uses a differential input circuit in each channel. So, this enables multiple signal sources superimposing common-mode voltage to connect to one F3AD08-1N module. However, if the common-mode voltage exceeds its allowable limits, input read errors occur or modules may be damaged. The common-mode voltage implies the potential of IN□- in each channel, which is connected to the AG terminal.

(a) Use a shielded twisted pair to connect the signal source to the F3AD08-1N module.

(b) Connect the shielding wire of the twisted pair to the shield terminal of the F3AD08-1N module. The SHIELD terminal of the F3AD08-1N is connected to the frame ground (FG) terminal of the power supply module via the base module.

(c) If a signal source to which the common-mode voltage is not superimposed, or a signal source with its negative (-) line not grounded is connected to the signal source with the common-mode voltage, connect a negative input signal line to the AG terminal of the F3AD08-1N module as Figure 2.12 shows.



*: The signal source in a floating state can operate even without connecting the negative input line to the AG terminal of F3AD08-1N. However, if the negative line is connected to the AG terminal, the module's signal-reading ability will increase.

Figure 2.12 Wiring Diagram

(d) When the negative line of the signal source has been grounded, connect the shielding wire of the twisted pair to the SHIELD or FG terminal at the signal source as Figure 2.13 shows.

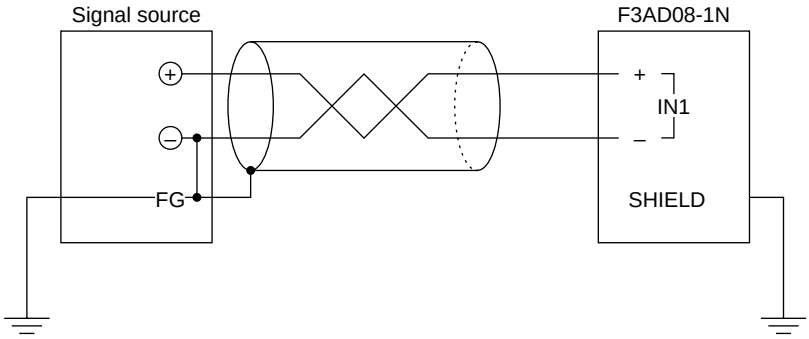


Figure 2.13 Wiring Diagram Involving Grounded Negative Signal Line

(e) Where there is a signal source with common-mode voltage, a signal source superimposing a common-mode voltage within the limits specified can be directly connected to the F3AD08-1N module. In such a case, DO NOT connect the signal source superimposing the common-mode voltage to the AG terminal.

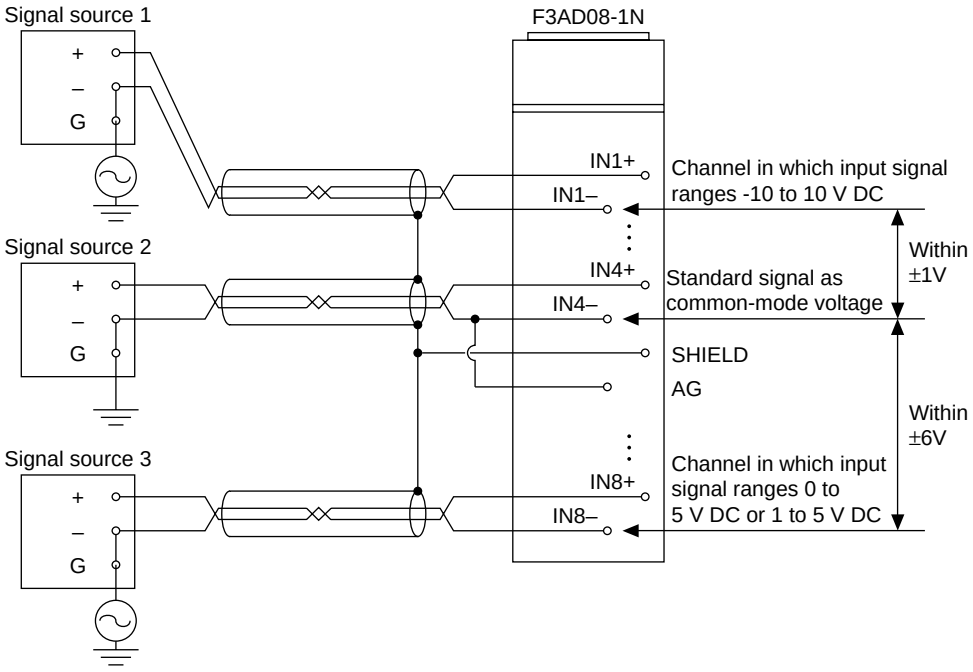


Figure 2.14 Wiring Diagram Where Common-Mode Voltage Is within the Limits Specified

(f) Where there is a signal source with common-mode voltage, a signal source superimposing a common-mode voltage greater than the allowable limits is connected, do the following:

- Use an insulated signal conditioner to lower the common-mode voltage within the limits specified. Then connect the signal source to the F3AD08-1N module as Figure 2.15 shows.

- Connect the signal lines to multiple F3AD08-1N modules to lower the common-mode voltages on the F3AD08-1N modules within the limits specified. In this case, multiple modules may be installed on the same base module.

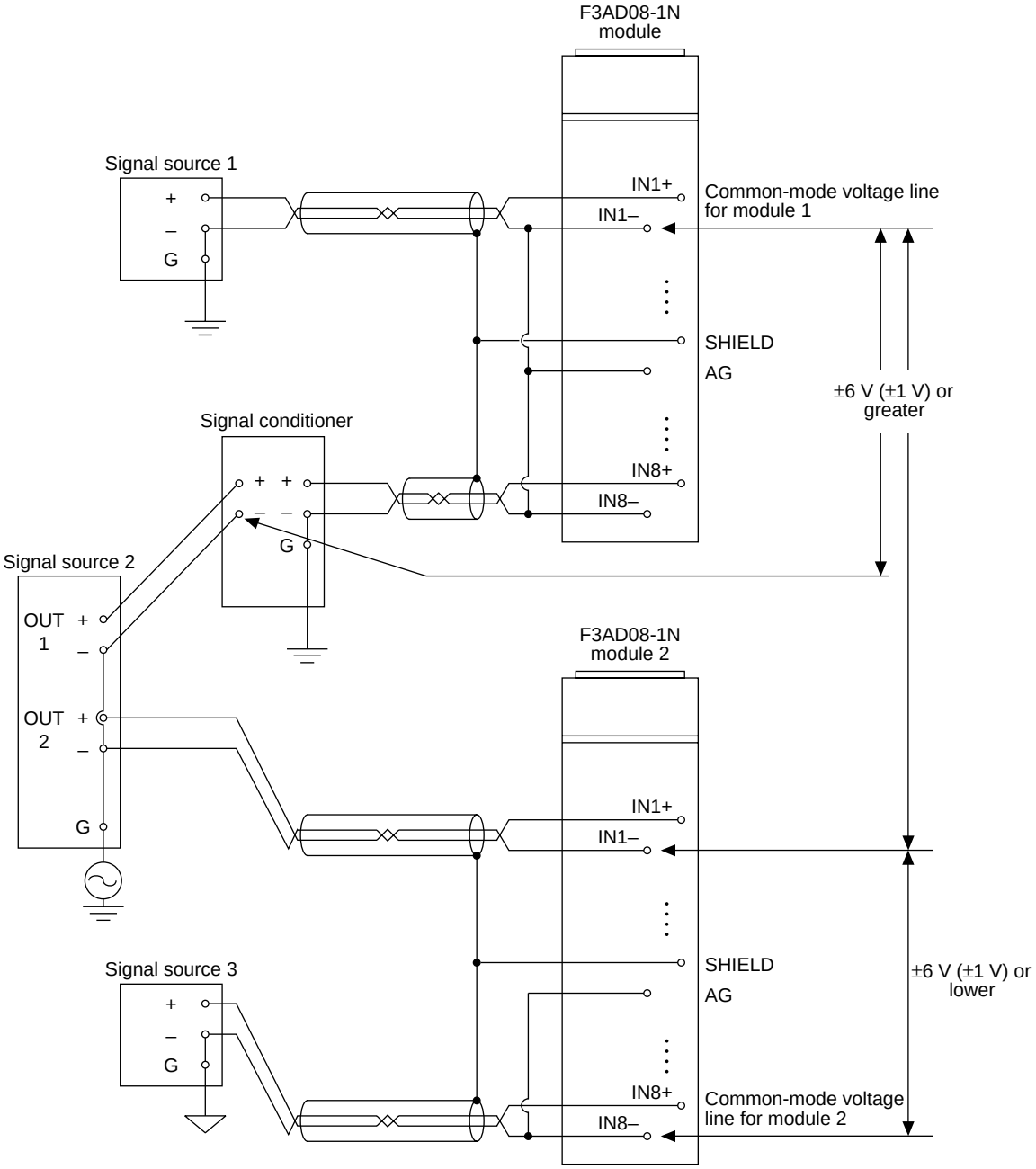


Figure 2.15 Wiring Diagram Where Common-Mode Voltage Is Over Specified Limits

2.2.6 External Dimensions

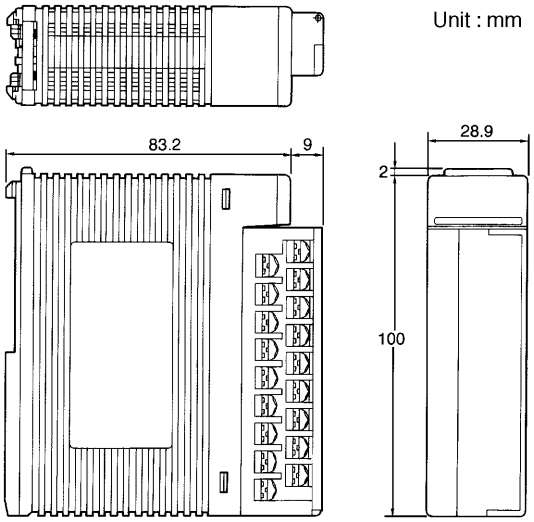


Figure 2.16 External Dimensions

2.3 Operation Mode

2.3.1 Functions and Setting of Operation Mode

The Operation mode involves the input signal range, channel skipping, scaling and filtering functions. Items to be set in individual functions as well as their default values are listed in Table 2.7.

Table 2.7 Functions in Operation Mode and Items to Be Set

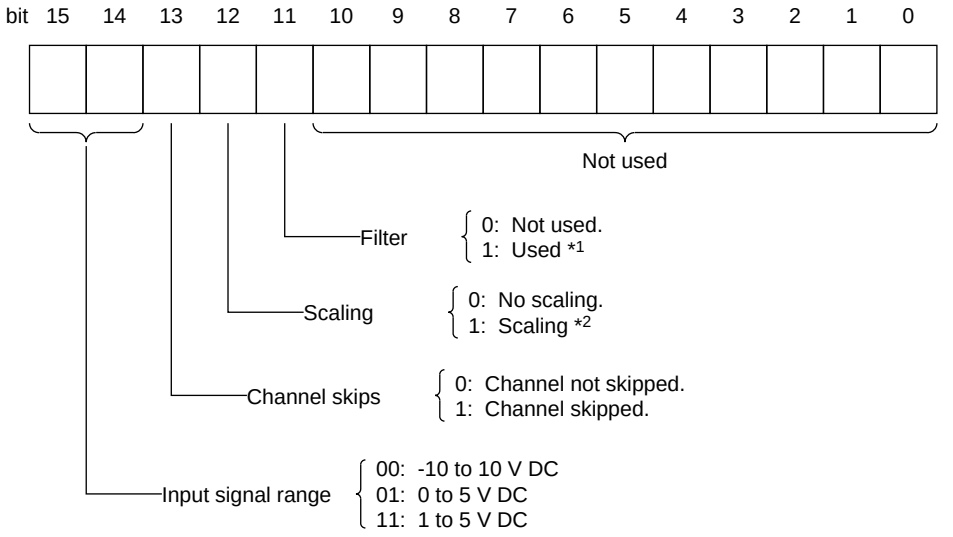
Functions	Items to be set	Default value	Description
Input signal range	-10 to 10 V, 0 to 5 V or 1 to 5 V DC	- 10 to 10 V DC	Section 2.3.1 (1)
Channel skip	Skipped or not skipped	Not skipped	Section 2.3.1 (2)
Scaling	Scaling or no scaling	No scaling	Section 2.3.1 (3)
Filter	Used or not used	Not used	Section 2.3.1 (4)

Any function in the operation mode can be set in each channel. Set 16-bit data to data position numbers set for each channel. For this setting, use a special-module write instruction in a ladder diagram or a BASIC statement as Table 2.8 shows.

Table 2.8 Data Position Numbers in Operation Mode

Ladder	Channel 1	Channel 2	Channel 3	Channel 4	Channel 5 *	Channel 6 *	Channel 7 *	Channel 8 *
	501	502	503	504	505	506	507	508
BASIC	1	2	3	4	5	6	7	8

* Specifications for only F3AD08-1N.



* 1: Set the desired filter setpoint as well (see Section 2.3.1 (4)).
* 2: Set the upper and lower limit values as well (see Section 2.3.1 (3)).

Figure 2.17 Correspondence between Functions in Operation Mode and 16-bit Data

Note: The default value is 0 for bit numbers 0 through 15.

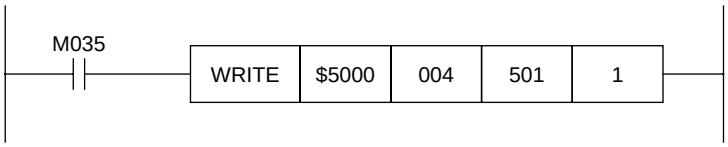
TIP

The set values in the operation mode are canceled whenever the power is turned off. When the power supply is recovered, the module operates on default values. Set the operation mode each time the power is supplied.

Example 1

When such operation mode functions as the input signal range of 0 to 5 V DC, channel not skipped, scaling functions available, and filter not provided are set to channel 1 for the module installed in slot number 004:

(1) Set by WRITE instructions for a special module in the ladder diagram



SEE ALSO

Section 5.1.3 for details on ladder instructions.

(2) Setting with a BASIC statement CONTROL 4, 1: $ 5000

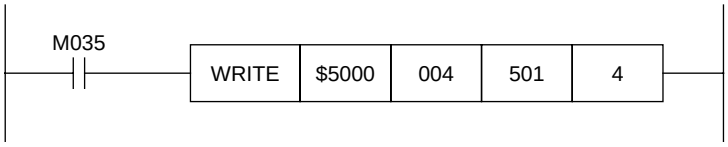
Note: After declaring modules to be used with an ASSIGN statement, set the required operation mode.

SEE ALSO

Section 5.2.7 for details on BASIC instructions.

Example 2

When such operation mode functions as the input signal range of 0 to 5 V DC, channel not skipped, scaling functions available, and filter not provided are set to channels 1 through 4 for the module installed in slot number 004:



(1) Input Signal Range

There are three voltage signal ranges for the input signal ranges. The signal ranges in which the analog to digital conversion can be attained are as follows:

Table 2.9 Input Signal Range

Input signal ranges	Applicable input signal ranges
-10 to 10 V DC	-11.0 to 11.0 V DC
0 to 5 V DC	-0.25 to 5.25 V DC
1 to 5 V DC	-0.25 to 5.25 V DC

* As the default values, the input signal ranges from -10 to 10 V DC.

(2) Channel Skip

The Channel Skip features to stop the analog to digital (A/D) conversion in channels that are not in use. Data in channels that the Channel Skip is set are not updated. This will obtain a data update period of 1 ms× (number of channels used).

The default value is set to "Channel Not Skipped." The A/D conversion in all channels is carried out. The data update period in all channels is 4 ms for F3AD04-0N and 8 ms for F3AD08-1N.

(3) Setting Scaling Functions and Upper and Lower Input Values

The digital output values corresponding to the upper and lower input values in the input signal range can be set from -20000 to 20000 arbitrarily. Scaling enables you to obtain easy to handle types of data. To implement the scaling, do the following:

1) Set "Scaling" in the operation mode.

SEE ALSO

Section 2.3, "Operation Mode."

2) Set digital output values corresponding to the upper and lower input values in the input signal range to the data position number for scaling functions set for each channel. For this, use a special module WRITE instruction in the ladder diagram or a BASIC statement.

Table 2.10 Data Position Numbers for Scaling

Set items		Channel 1	Channel 2	Channel 3	Channel 4	Channel 5*	Channel 6*	Channel 7*	Channel 8*
Digital output values corresponding to upper limit values in the input signal range.	Ladder	520	530	540	550	560	570	580	590
	BASIC	20	30	40	50	60	70	80	90
Digital output values corresponding to lower limit values in the input signal range.	Ladder	521	531	541	551	561	571	581	591
	BASIC	21	31	41	51	61	71	81	91

* Specifications only for F3AD08-1N module.

Digital output values corresponding to the upper and lower limit values in the input signal range can be set within the following limits:

- $-20000 \leq N \leq 20000$ (N = integer)
- Upper limit values must be more than lower limit values.

TIP

No scaling will be conducted in cases where:

- The upper or lower limit value is set as N < -20000 or 20000 < N,
- Values other than integer values are set,
- Upper limit values are equal to or less than lower limit values, and
- Scaling is set in the operation mode, but upper and lower limit values are not set.

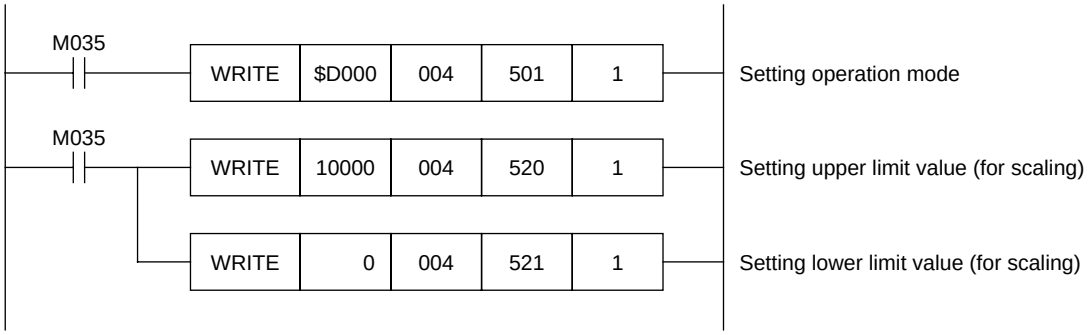
CAUTION

After the scaling operations, digits after the decimal point will be truncated.

Setting Example

When channel 1 for the module installed in slot 004 is scaled to 0 to 10000:

1) Setting with a special module WRITE instruction in the ladder diagrams.



SEE ALSO

Section 5.1.3 for details on ladder instructions.

2) Setting with a BASIC statement

```
CONTROL 4,1;$D000  Setting Operation Mode
CONTROL 4,20;10000  Setting Upper Limit Value of Scaling
CONTROL 4,2;0  Setting Lower Limit Value of Scaling
```

Note: After declaring the use of modules with an ASSIGN statement, carry out the required scaling.

SEE ALSO

Section 5.2.7 for details on BASIC statements.

- Changes in the input to output conversion characteristics in the above example (where the input signal range is 1 to 5 V DC).

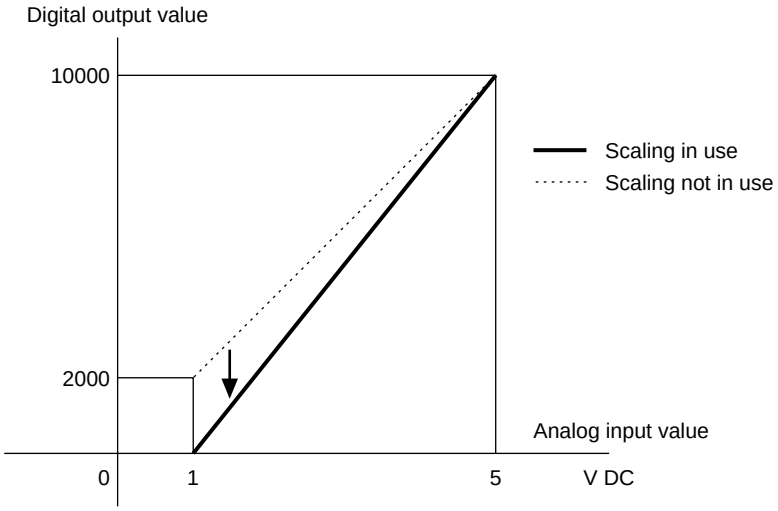


Figure 2.18 Changes in Input to Output Conversion Characteristics When Scaling Is in Use

(4) Filter Functions and Setting Filter Set Values

To cancel noise superimposed on the input voltage, set the first-order lag, low-pass filter functions by software applications.

Use filters in the following procedures:

1) Set the Filter in Use in the operation mode.

SEE ALSO

Section 2.3, "Operation Mode."

2) Set the filter set values to filter data location numbers, which are set for individual channels, either with a special module WRITE instruction in the ladder diagram or with a BASIC statement.

Table 2.11 Filter Data Location Numbers

Set items		Channel 1	Channel 2	Channel 3	Channel 4	Channel 5 *	Channel 6 *	Channel 7 *	Channel 8 *
Filter set values	Ladder	522	532	542	552	562	572	582	592
	BASIC	22	32	42	52	62	72	82	92

* Specifications only for F3AD08-1N

Filter set values must be integers, and 12 time constants can be used depending upon the number of input points and channels used (see Tables 2.12 through 2.19).

Table 2.12 Filter Set Values and Time Constants For Use in Eight Channels*

Filter set values	0 to 15	16 to 31	32 to 63	64 to 127	128 to 255	256 to 510	511 to 1021	1022 to 2043	2044 to 4087	4088 to 8175	8176 to 16351	16352 to 32767
Time constant (ms)	11.5	27.8	59.9	123.0	252.0	508.0	1020.0	2044.0	4092.0	8188.0	16380.0	32764.0

* Specifications only for F3AD08-1N

Table 2.13 Filter Set Values and Time Constants for Use in Seven Channels*

Filter set values	0 to 13	14 to 27	28 to 55	56 to 111	112 to 223	224 to 447	448 to 894	895 to 1788	1789 to 3576	3577 to 7153	7154 to 14307	14308 to 32767
Time constant (ms)	10.1	24.3	52.4	108.5	220.5	444.5	892.5	1788.5	3580.5	7164.5	14332.6	28668.5

Table 2.14 Filter Set Values and Time Constants for Use in Six Channels*

Filter set values	0 to 11	12 to 23	24 to 47	48 to 95	96 to 191	192 to 383	384 to 766	767 to 1532	1533 to 3065	3066 to 6131	6132 to 12263	12264 to 32767
Time constant (ms)	8.7	20.9	44.9	93.0	189.0	381.0	765.0	1533.0	3069.0	6141.0	12285.0	24573.0

Table 2.15 Filter Set Values and Time Constants for Use in Five Channels*

Filter set values	0 to 9	10 to 19	20 to 39	40 to 79	80 to 159	160 to 319	320 to 638	639 to 1277	1278 to 2554	2555 to 5109	5110 to 10219	10220 to 32767
Time constant (ms)	7.2	17.4	37.4	77.5	157.5	317.5	637.5	1277.5	2557.5	5117.5	10237.5	20477.5

* Specifications only for F3AD08-1N modules.

Table 2.16 Filter Set Values and Time Constants for Use in Four Channels

Filter set values	0 to 7	8 to 15	16 to 31	32 to 63	64 to 127	128 to 255	256 to 510	511 to 1021	1022 to 2043	2044 to 4087	4088 to 8175	8176 to 32767
Time constant (ms)	5.8	13.9	30.0	62.0	126.0.	254.00	510.0	1022.0	2046.0	4094.0	8190.0	16382.0

Table 2.17 Filter Set Values and Time Constants for Use in Three Channels

Filter set values	0 to 5	6 to 11	12 to 23	24 to 47	48 to 95	96 to 191	192 to 383	384 to 766	767 to 1532	1533 to 3065	3066 to 6131	6132 to 32767
Time constant (ms)	4.3	10.4	22.5	46.5	94.5	190.5	382.5	766.5	1534.5	3070.5	6142.5	12286.5

Table 2.18 Filter Set Values and Time Constants for Use in Two Channels

Filter set values	0 to 3	4 to 7	8 to 15	16 to 31	32 to 63	64 to 127	128 to 255	256 to 510	511 to 1021	1022 to 2043	2044 to 4087	4088 to 32767
Time constant (ms)	2.9	7.0	15.0	31.0	63.0	127.0	255.0	511.0	1023.0	2047.0	4095.0	8191.0

Table 2.19 Filter Set Values and Time Constants for Use in One Channel

Filter set values	0 to 1	2 to 3	4 to 7	8 to 15	16 to 31	32 to 63	64 to 127	128 to 255	256 to 510	511 to 1021	1022 to 2043	2044 to 32767
Time constant (ms)	1.4	3.5	7.5	15.5	31.5	63.5	127.5	255.5	511.5	1023.5	2047.5	4095.5

TIP

Even though [Filter is used] is set in the operation mode, if the filter value is not set, a minimum time constant will be set.

TIP

Actual time constants are calculated in the following equation:

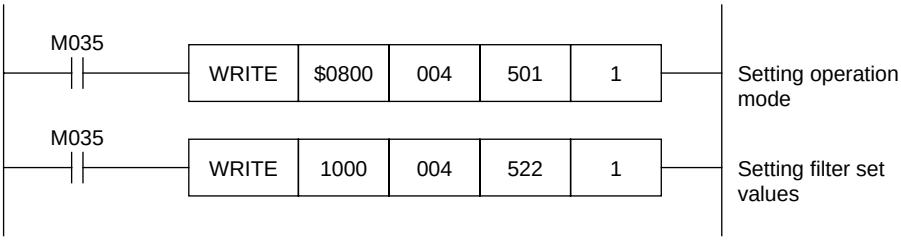
$$T = -\frac{T_0}{\ln\frac{2^n - 1}{2^n}}$$

where, T: time constant (ms)
T_0: conversion speed (1 ms × no. of channels used) (ms)
n: 1 to 12

Setting examples

When the filter set value in channel 1 for the module installed in slot number 004 is set to 1000:

(1) Setting with a special module WRITE instruction in the ladder diagram



SEE ALSO

Section 5.1.3, "Ladder Instructions."

(2) Setting with BASIC statements:

CONTROL 4,1;$0800 Setting operation mode.

CONTROL 4,22;1000 Setting filter set values.

Note: After the module declaration with an ASSIGN statement, execute the required settings.

SEE ALSO

Section 5.2.7, "Detailed BASIC Instructions."

2.3.2 Setting Operation Mode

If the module is used in the operation mode set as default values, no further setting on the mode is required. However, if you want to make a change, follow the mode setting procedures flowcharted below to reset required items only.

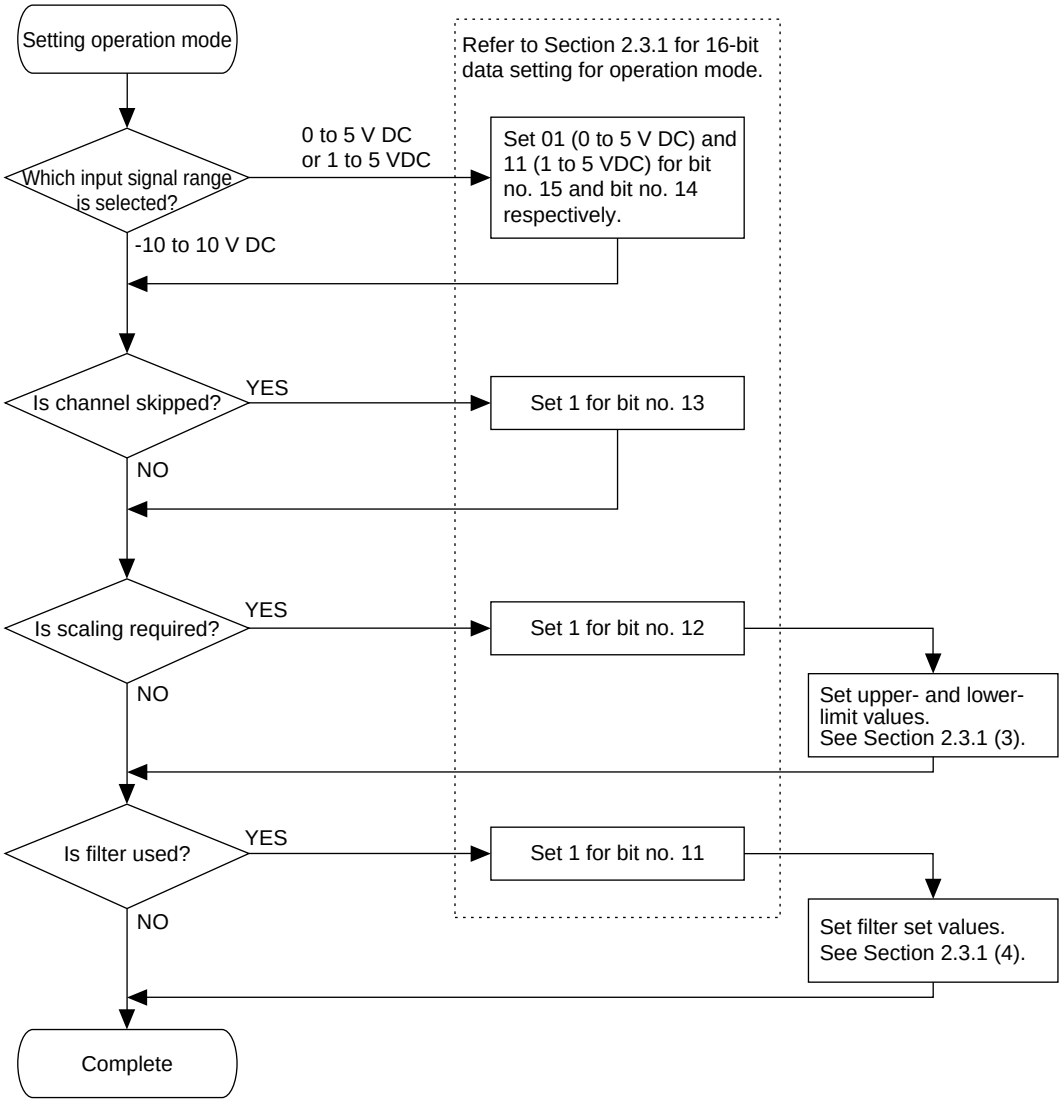


Figure 2.19 Operation Mode Setting Flow

TIP

The operation mode set results and the scaling and filter set values are canceled if the power turns off. When the power turns on, the module will then work in default operation mode. Set the operation mode each time the power turns on.

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3. Analog Output Module

This chapter describes the specifications and operation mode of the F3DA02-0N, F3DA04-1N and F3DA08-5N Analog Output Modules.

CONTENTS

3.1 F3DA02-0N Module Specifications

3.1.1 Functional Specifications

Table 3.1 Functional Specifications

Item	Specifications
Number of output points	2
Output signal range*1	-10 to 10 DC (-11.0 V to 11.0 V DC) 4 mA to 20 mA DC (1.25 to 21.0 mA DC) (one line common, floating type)
Insulation method	Across output terminals and internal circuit: Photocoupler-isolated Across output terminals: Not isolated negative-line common
Dielectric strength	500 V DC for 1 minute
Permissible load resistance	Voltage output mode: 5 kΩ min. Current output mode: 600 Ω max.
Resolution (12-bit A/D)	Voltage output: 5.7 mV Current output: 5.7 μA
Overall accuracy	23 ±2°C : ±0.2% (full scale) 0 to 55°C : ±0.5% (full scale)
Conversion period	2 ms (fixed)
Current consumption	100 mA (5 V DC)
External power supply*2	Absolute maximum rated voltage : 30 V DC Operating power limits : 24 V DC ±10%, 150 mA
Scaling	Upper- and lower-limit values can be set to any value between -20,000 and 20,000
External connection	10-point terminal block, M3.5 screws
External dimensions	28.9 (W) × 100 (H) × 83.2 (D) mm*3
Weight	155 g

*1: Selectable for each channel by selecting terminals.
*2: The F3DA01-0N module requires an external power supply.
*3: Physical dimensions excluding any protrusions (see Section 3.1.6, “External Dimensions,” provided later in this manual.)

CAUTION

DO NOT apply any voltage over the absolute maximum rated voltage (see the table above) even for a short period of time. Otherwise, the internal circuitry may fail, and no expected specifications may be obtained.

3.1.2 Input to Output Conversion Characteristics

The input to output conversion characteristics with no scaling functions are shown in Figure 3.1, depending on the output signal range. The input to output conversion characteristics show digital input values versus analog output values.

SEE ALSO

Section 3.4.1 (1) for scaling.

Table 3.2 Input to Output Conversion Characteristics with No Scaling Functions

Output signal range	Digital input value	Analog output value
- 10 to 10 V DC	-20000 to 20000	-10 to 10 V DC
4 to 20 mA DC	2000 to 10000	4 to 20 mA DC

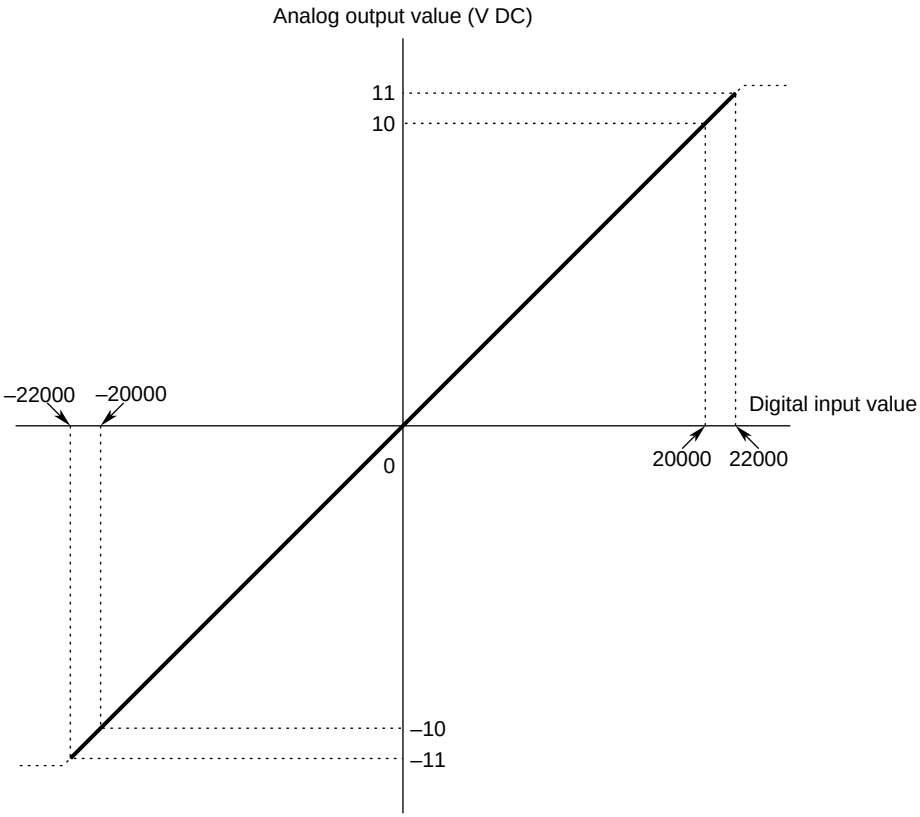


Figure 3.1 Input to Output Conversion Characteristics with No Scaling Functions

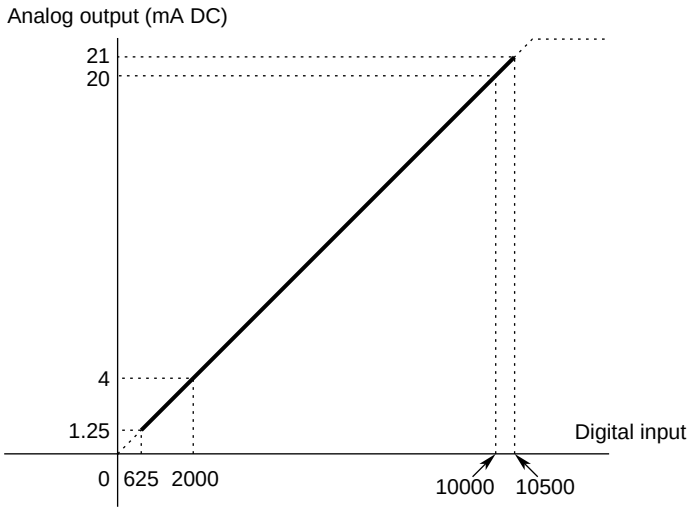
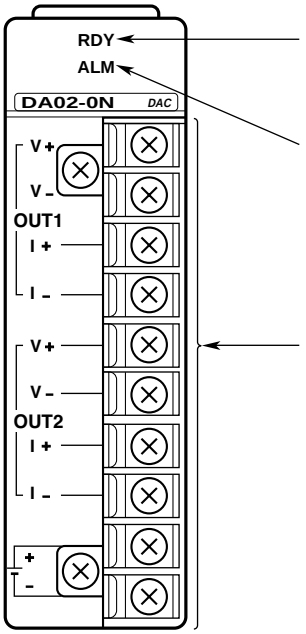


Figure 3.2 Input to Output Conversion Characteristics with No Scaling Functions

3.1.3 Components and Functions



RDY indicator:
Lit when the internal circuit is functioning normally.

ALM indicator:
Lit when calibration data* is lost. In such a case, D/A conversion will be conducted, but its accuracy is not assured. The module requires maintenance service.

Detachable terminal block:
10-point terminal block with M3.5 screws with square captive washers.

*: Calibration data is stored in the module to achieve the intended accuracy. These data are written during the calibration work at the factory. Users cannot write these data.

Figure 3.3 Components and Functions

3.1.4 Internal Circuit Diagram

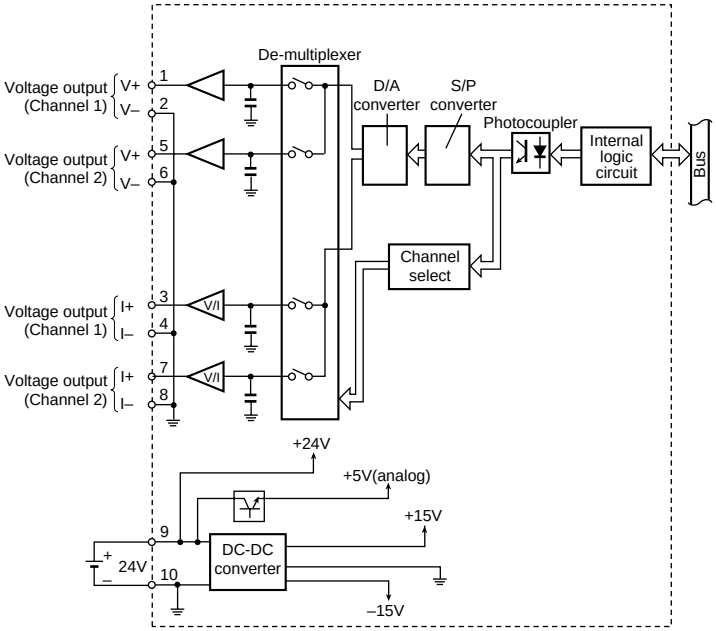


Figure 3.4 Internal Circuit Diagram

3.1.5 External Connections and Wiring Precautions

(1)External Connection Diagram

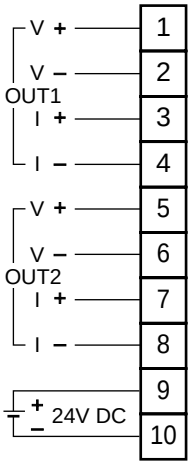


Figure 3.5 External Connection Diagram

Table 3.3 Wire Size and Terminals

Connection Method		Terminal block type
Applicable conductor size		0.3 to 0.75 mm^2 (AWG22 to 18)
Wire connection method		Crimp-on type
Wire temperature rating		75°C min
Wire material		Cooper
Crimp-on terminals	Crimp-on terminals	For M3.5 screws
	Tightening torque	0.8 N·m (8 kgf·cm, 6.9lbf·in)
	Applicable crimp-on terminals	Example: Japan Solderless Terminal Mfg. Co., Ltd. : V1.25-M3 Nihon Tanshi Co., Ltd. : RAV1.25-3.5

CAUTION

When connecting a terminal lug to the wire, be sure to use an appropriate crimping tool specified by the manufacturer.

(2) Wiring Precautions

(1) Use a shielded twisted-pair cable to connect the F3AD02-0N module to the destination equipment.

(2) Ground the shielding wire of the twisted pair cable at the destination equipment as Figure 3.6 shows.

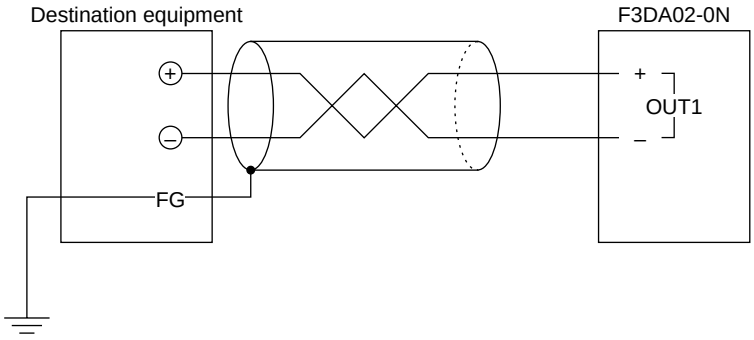


Figure 3.6 Wiring Diagram

3.1.6 External Dimensions

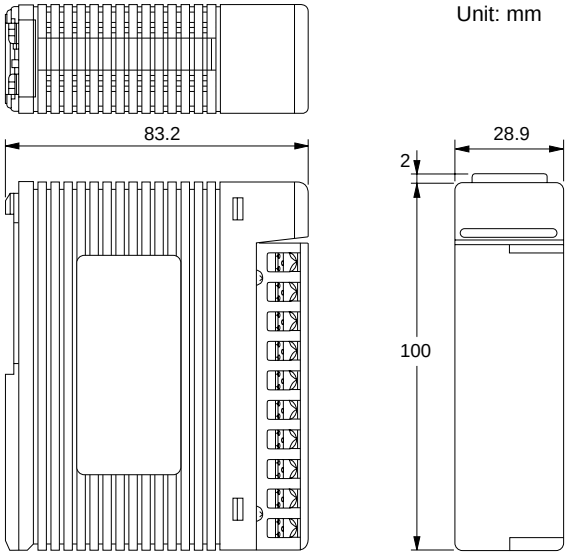


Figure 3.7 External Dimensions

3.2 F3DA04-1N Module Specifications

3.2.1 Functional Specifications

Table 3.4 Functional Specifications

Item	Specifications
Number of output points	4
Output signal range*1	-10 to 10 DC (-11.0 V to 11.0 V DC) 4 mA to 20 mA DC (1.25 mA to 21.0 mA DC) (one line common, floating type)
Insulation method	Across input terminals and internal circuit: Photocoupler-isolated Across input terminals: No isolation, negative-line common
Dielectric strength	500 V DC for 1 minute
Permissible load resistance	Voltage output mode : 5 kΩ min. Current output mode : 600 Ω max.
Resolution (12-bit A/D)	Voltage output : 5.7 mV Current output : 5.7 μA
Overall accuracy	23 ±2°C : ±0.2% (full scale) 0 to 55°C : ±0.5% (full scale)
Conversion period	4 ms (fixed)
Current consumption	100 mA (5 V DC)
External power supply *2	Absolute maximum rated voltage : 30 V DC Operating power limits : 24 V DC ±10%, 180 mA
Scaling	Upper- and lower- limit values can be set to any value ranging from -20,000 to 20,000.
Operation while in a CPU failure	Two output modes are supported: 1) Hold output : The fail-time value is retained 2) Preset output : A default value is generated.
External connections	18-point terminal block, M3.5 screws
External dimensions	28.9 (W) × 100 (H) × 83.2 (D) mm *3
Weight	200 g

*1: Selectable for each channel by selecting terminals.
*2: An external power supply is required to use this module.
*3: Physical dimensions excluding any protrusions (see Section 3.2.6, “External Dimensions,” provided later in this manual.)

CAUTION

DO NOT apply any voltage over the absolute maximum rated voltage (see Table 3.4 above) even for a short period of time. Otherwise, the module internal circuitry may fail and no expected specifications may be obtained.

3.2.2 Input to Output Conversion Characteristics

The input to output conversion characteristics with no scaling functions are shown in Figure 3.8, depending on the output signal range. The input to output conversion characteristics show digital input values versus analog output values.

SEE ALSO

Section 3.4.1 (1) for scaling.

Table 3.5 Input to Output Conversion Characteristics with No Scaling Functions

Output signal range	Digital input value	Analog output value
- 10 to 10 V DC	-20000 to 20000	-10 to 10 V DC
4 to 20 mA DC	2000 to 10000	4 to 20 mA DC

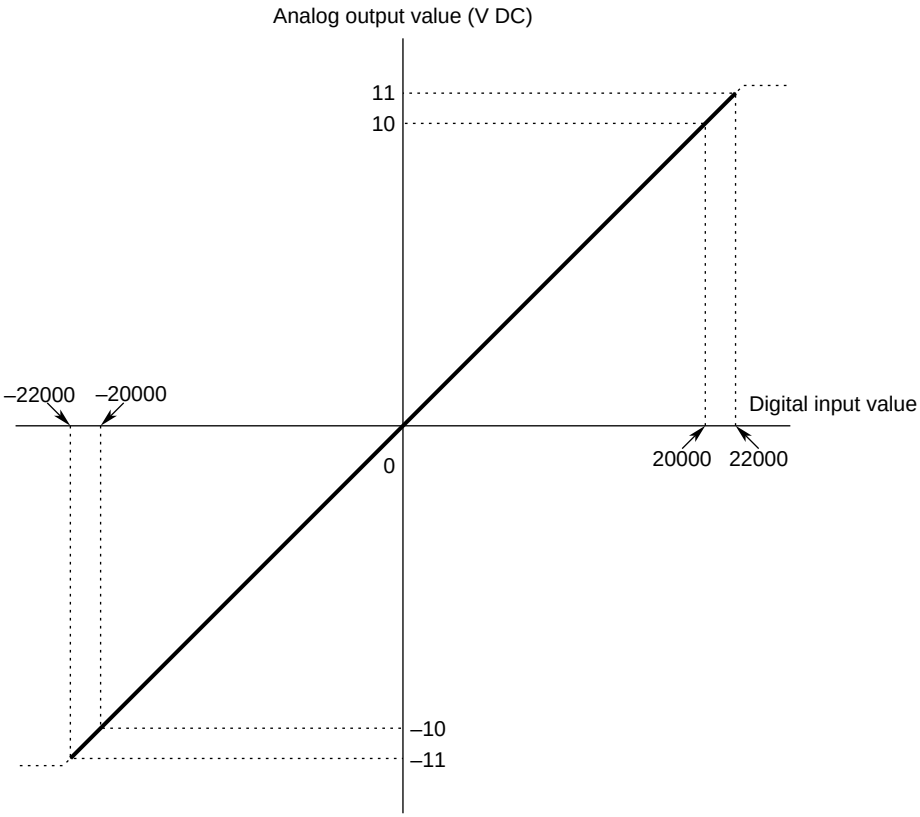


Figure 3.8 Input to Output Conversion Characteristics with No Scaling Functions

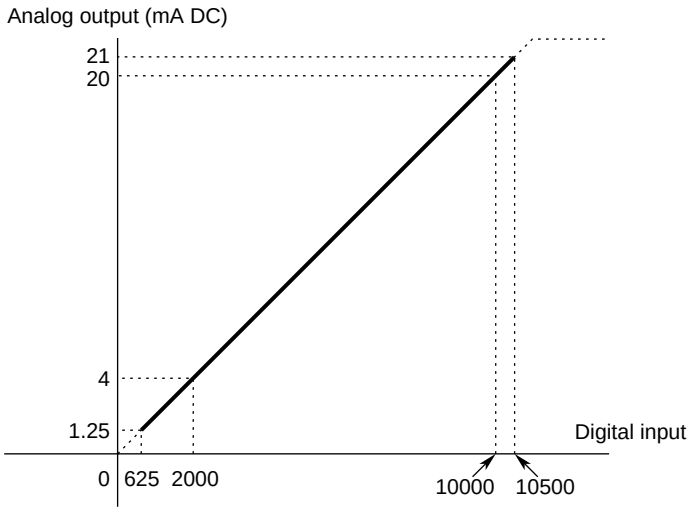
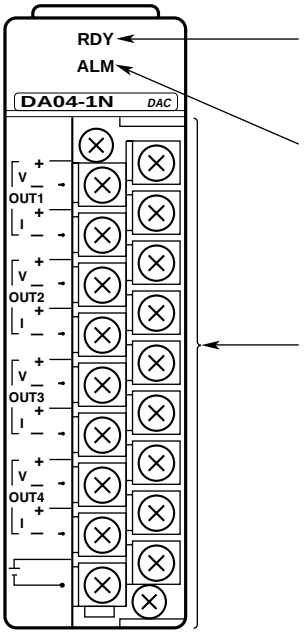


Figure 3.9 Input to Output Conversion Characteristics with No Scaling Functions

3.2.3 Components and Functions



RDY indicator
Lit when the internal circuit is fuctioning normally.

ALM indicator:
Lit when calibration data* is lost. In such a case, the F3DA04-1N will carry out D/A conversion but will not satisfy the conversion accuracy (the module requires maintenance service).

Detachable terminal block:
18-point terminal block with M3.5 screws with square captive washers.

* : Calibration data is stored in the module to achieve the intended accuracy. The data is written during the calibration work at the factory. It may not be programmed (written) by the user.

Figure 3.10 Components and Functions

3.2.4 Internal Circuit Diagram

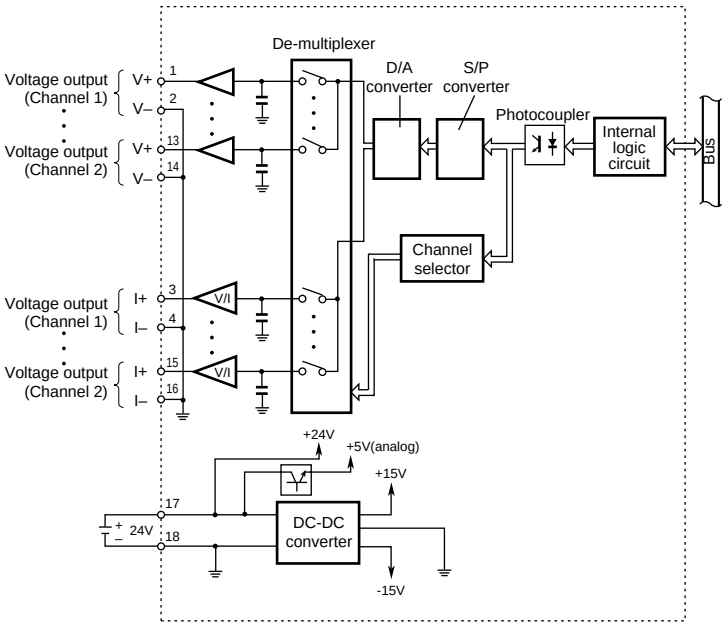


Figure 3.11 Internal Circuit Diagram

3.2.5 External Connections and Wiring Precautions

(1) External Connection Diagram

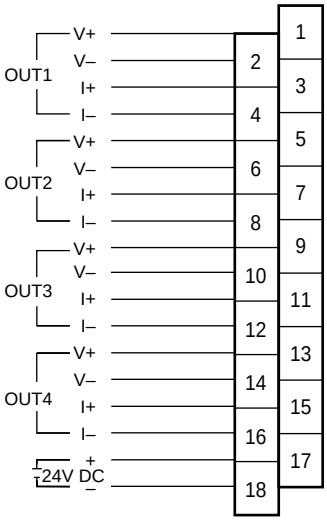


Figure 3.12 External Connection Diagram

Table 3.6 Wire and Terminals

Connection Method		Terminal block type
Applicable conductor size		0.3 to 0.75 mm^2 (AWG22 to 18)
Wire connection method		Crimp-on type
Wire temperature rating		75°C min
Wire material		Cooper
Crimp-on terminals	Crimp-on terminals	For M3.5 screws
	Tightening torque	0.8 N·m (8 kgf·cm, 6.9lbf·in)
	Applicable crimp-on terminals	Example: Japan Solderless Terminal Mfg. Co., Ltd. : V1.25-M3 Nihon Tanshi Co., Ltd. : RAV1.25-3.5

CAUTION

When connecting a terminal lug to the wire, be sure to use an appropriate crimping tool specified by the manufacturer.

(2) Wiring Precautions

(1) Use a shielded twisted-pair cable to connect the F3AD04-1N module to the destination equipment.

(2) Ground the shielding wire of the twisted pair cable at the destination equipment as Figure 3.13 shows.

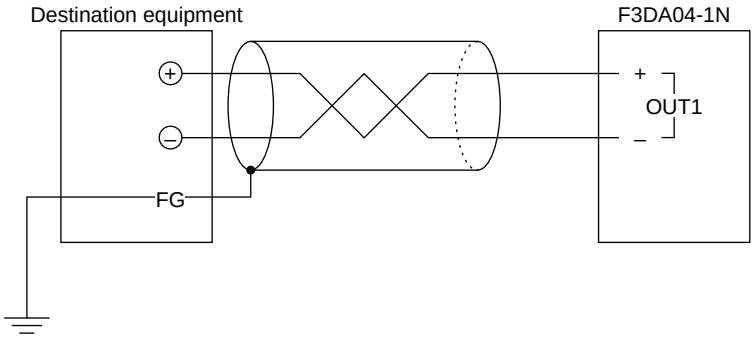


Figure 3.13 Wiring Diagram

3.2.6 External Dimensions

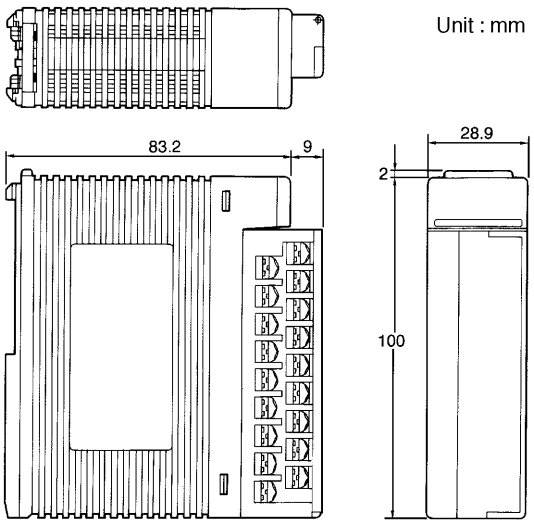


Figure 3.14 External Dimensions

3.3 F3DA08-5N Module Specifications

3.3.1 Functional Specifications

Table 3.7 Functional Specifications

Item	Specifications
Number of output points	8
Output signal range *1	-10 to 10 DC (-11.0 V to 11.0 V DC) (one line common, floating type)
Insulation method	Across input terminals and internal circuit: Photocoupler-isolated Across input terminals: Not isolated negative-line common
Dielectric strength	500 V DC for 1 minute
Permissible load resistance	5 kΩmin.
Resolution (12-bit A/D)	5.7 mV
Overall accuracy	23±2°C: ±0.2% (full scale) 0 to 55 : ±0.5% (full scale)
Conversion period	4 ms (fixed)
Current consumption	100 mA (5 V DC)
External power supply *2	Absolute maximum rated voltage : 30 V DC Operating power limits : 24 V DC ±10%, 180 mA
Scaling	Upper- and lower- limit values can be set to any value ranging from -20,000 to 20,000.
Operation while in a CPU failure	Two output modes are supported: 1) Hold output : Values during the failure time are retained. 2) Preset output : The default value is generated. *3
External connections	18-point terminal block, M3.5 screws
External dimensions	28.9 (W) × 100 (H) × 83.2 (D) mm *3
Weight	200 g

*1: Selectable for each channel by selecting terminals.
*2: An external power supply is required to use this module.
*3: Physical dimensions excluding any protrusions (see External Dimensions provided later in this manual.)

CAUTION

DO NOT apply any voltage over the absolute maximum rated voltage (see Table 3.7 above) even for a short period of time. Otherwise, the module internal circuitry may fail and no expected specifications may be obtained.

3.3.2 Input to Output Conversion Characteristics

The input to output conversion characteristics with no scaling functions are shown in Figure 3.15, depending on the output signal range. The input to output conversion characteristics show digital input values versus analog output values.

SEE ALSO

Section 3.4.1 (1) for scaling.

Table 3.8 Input to Output Conversion Characteristics with No Scaling Functions

Output signal range	Digital input value	Analog output value
- 10 to 10 V DC	-20000 to 20000	-10 to 10 V DC

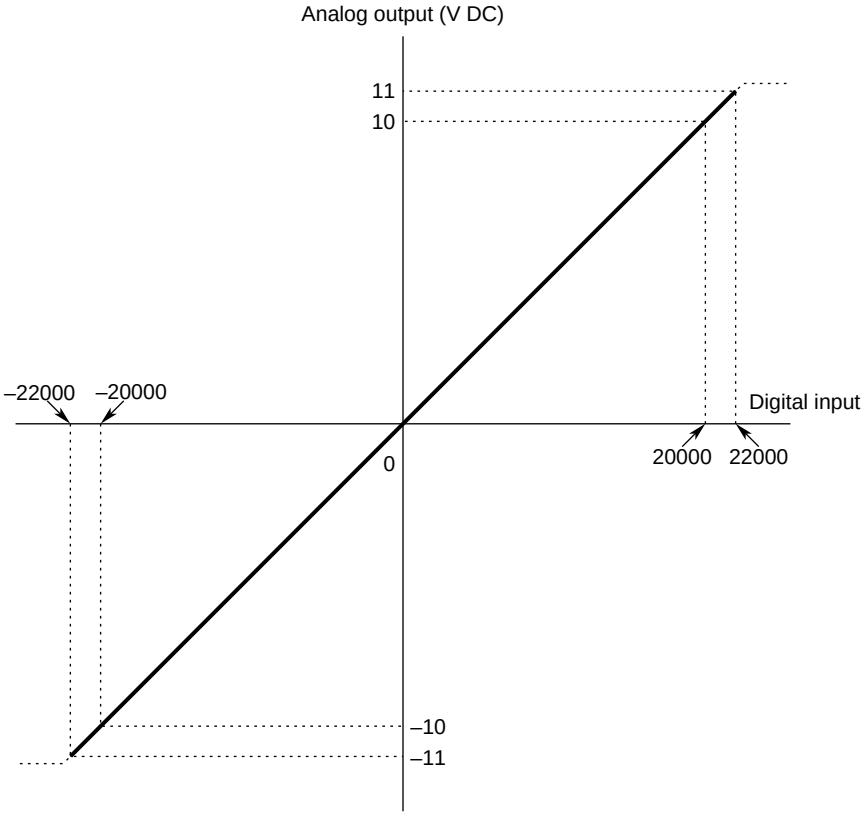
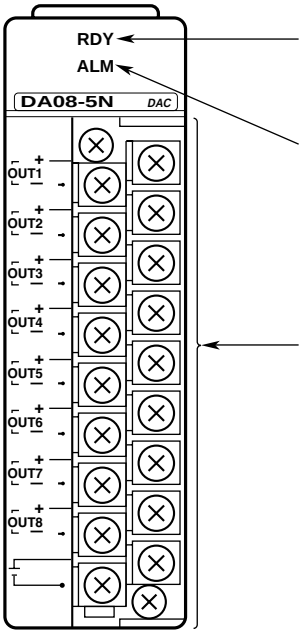


Figure 3.15 Input to Output Conversion Characteristics with No Scaling Functions

3.3.3 Components and Functions



RDY indicator:
Lit when the internal circuit is fuctioning normally.

ALM indicator:
Lit when calibration data* is lost.
In such a case, the F3DA08-5N will carry out D/A conversion but will not satisfy the conversion accuracy.
For this, the module requires maintenance service.

Detachable terminal block:
18-point terminal block with M3.5 screws with square captive washers.

* : Calibration data is stored in the module to achieve the intended accuracy. The data is written during the calibration work at the factory. It may not be programmed (written) by the user.

Figure 3.16 Components and Functions

3.3.4 Internal Circuit Diagram

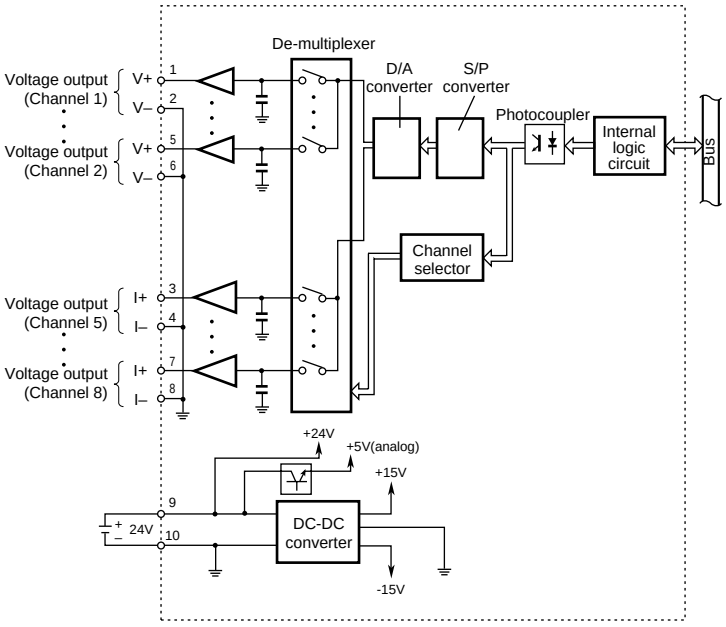


Figure 3.17 Internal Circuit Diagram

3.3.5 External Connections and Wiring Precautions

(1) External Connection Diagram

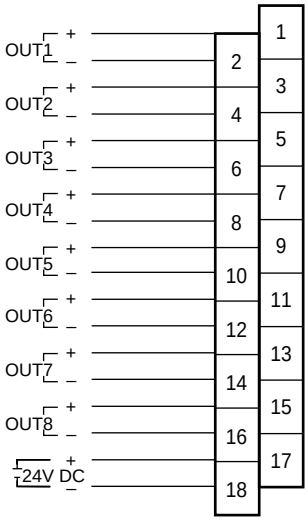


Figure 3.18 External Connection Diagram

Table 3.9 Wire and Terminals

Connection Method		Terminal block type
Applicable conductor size		0.3 to 0.75 mm^2 (AWG22 to 18)
Wire connection method		Crimp-on type
Wire temperature rating		75°C min
Wire material		Cooper
Crimp-on terminals	Crimp-on terminals	For M3.5 screws
	Tightening torque	0.8 N·m (8 kgf·cm, 6.9lbf·in)
	Applicable crimp-on terminals	Example: Japan Solderless Terminal Mfg. Co., Ltd. : V1.25-M3 Nihon Tanshi Co., Ltd. : RAV1.25-3.5

CAUTION

When connecting a terminal lug to the wire, be sure to use an appropriate crimping tool specified by the manufacturer.

(2) Wiring Precautions

(1) Use a shielded twisted-pair cable to connect the F3AD08-5N module to the destination equipment.

(2) Ground the shielding wire of the twisted pair cable at the destination equipment as Figure 3.19 shows.

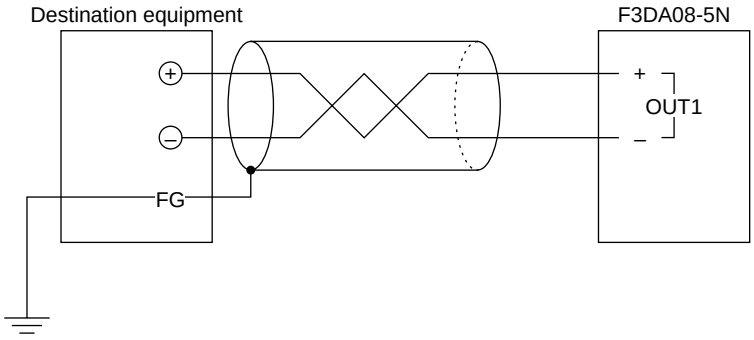


Figure 3.19 Wiring Diagram

3.3.6 External Dimensions

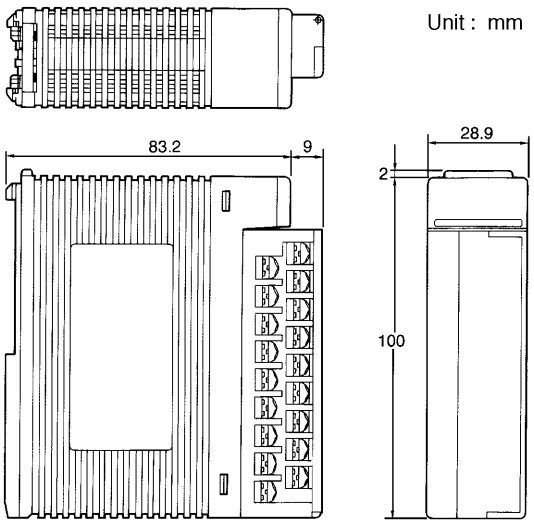


Figure 3.20 External Dimensions

3.4 Operation Mode

3.4.1 Functions and Setting of Operation Mode

(1)Scaling Functions and Setting of Upper- and Lower-Limit Values

Digital input values corresponding to the upper- and lower-limit values in the output signal range can be set to -20000 to 20000. Using the scaling functions, users can convert data to easy-to-handle data. To use scaling functions, set to the data location numbers for scaling, which have been set on a channel-by-channel basis, digital input values corresponding to the upper- and lower-limit values in the output signal range either with a special module WRITE instruction in the ladder diagram or with a BASIC statement.

Table 3.10 Data Location Numbers for Scaling

Set items		Channel 1	Channel 2	Channel 3*	Channel 4*	Channel 5**	Channel 6**	Channel 7**	Channel 8**
Digital input values corresponding to upper limit values in the output signal range	Ladder	520	530	540	550	560	570	580	590
	BASIC	20	30	40	50	60	70	80	90
Digital input values corresponding to lower limit values in the output signal range	Ladder	521	531	541	551	561	571	581	591
	BASIC	21	31	41	51	61	71	81	91

* Specifications for F3DA04-1N and F3DA08-5N.
** Specifications only for F3DA08-5N.

Digital input values which correspond to the upper- and lower-limit values in the output signal range can be set within the limits specified below:

$-20000 \leq N \leq 20000$ (N = integer)

Upper-limit values must be greater than lower-limit values.

TIP

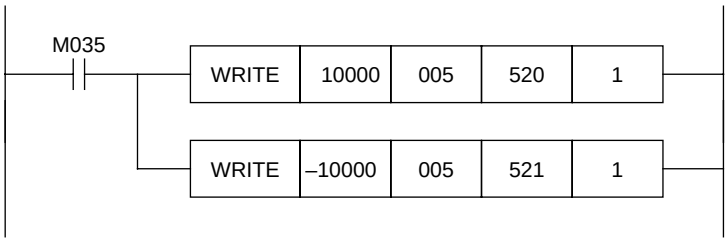
If any of the following setting is made, no scaling functions will be provided.

- In cases where N, even though its range must be N < -20000 or 20000 < N, is set as an upper-limit or a lower-limit value.
- In cases where N is not an integer.
- In cases where upper limit values ≤ lower limit values. If any of these settings is carried out, input to output conversion characteristics with no scaling will remain.

Setting examples:

When channel 1 of the module installed in slot number 005 is scaled from -10000 to 10000:

(1) Using special module WRITE instructions.



See Section 5.1.3 for the detailed ladder instructions.

(2) Using BASIC statements.

```
CONTROL 5,20;10000
CONTROL 5,21;-10000
```

Note: After declaring using modules with an ASSIGN statement, execute the required settings.

SEE ALSO

Section 5.2.7 for the detailed BASIC instructions.

- Changes in input to output conversion characteristics in the above example:

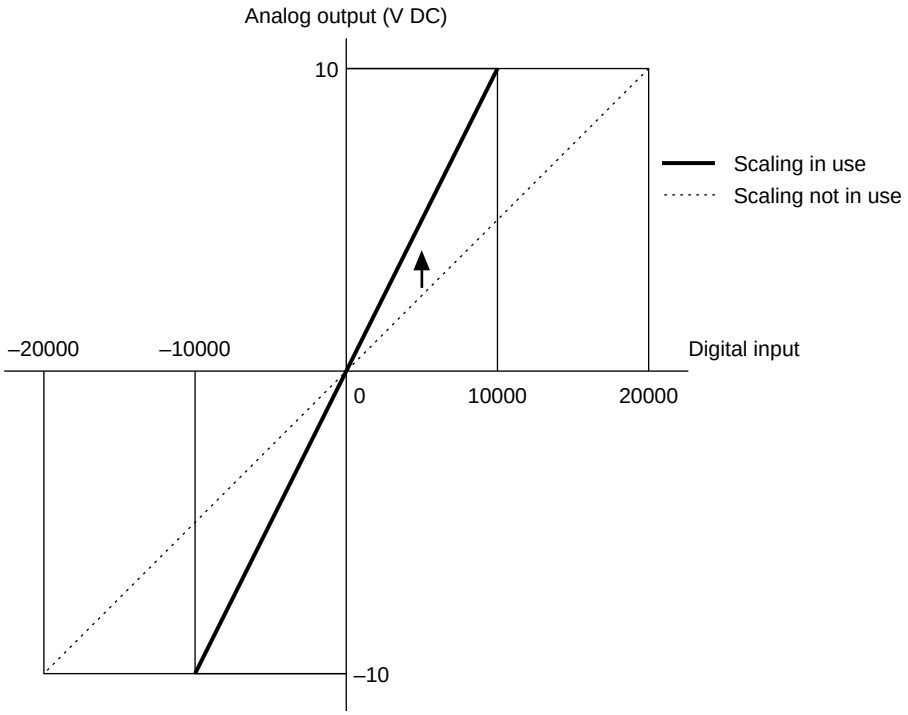


Figure 3.21 Input to Output Conversion Characteristics Changes (Voltage Output) When Scaling Is in Use

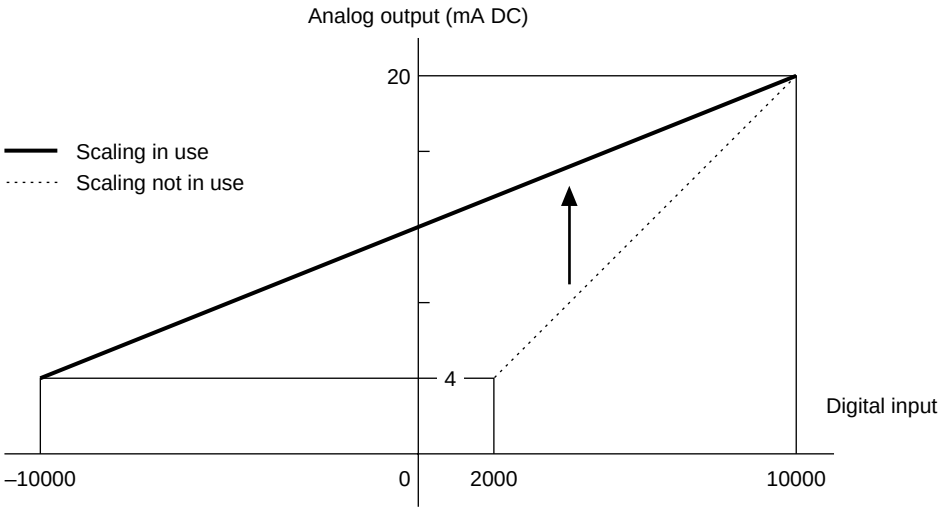


Figure 3.22 Input to Output Conversion Characteristics Changes (Current Output) When Scaling is in Use

(2)Operation Mode and Its Setting When Sequence CPU Fails

- For F3DA02-0N

  When the sequence CPU fails, the output is held.

- For F3DA04-1N and F3DA08-5N

  If "operation mode when the sequence CPU fails," listed in the table below, is set, the reset output is provided when the sequence CPU fails. For the set items and default values, see Table 3.11. The default values are those assumed when no values have been set.

Table 3.11 Operation Mode Functions When Sequence CPU Fails and Their Set Items

Functions	Set items	Default set items
Operation mode when sequence CPU fails	Output when CPU fails - output holding/set value output	Output hold

The operation mode in a sequence CPU failure can be set on a channel-by-channel basis. To set output values in a sequence CPU failure, set 1 to a data location number (bit number 15) both for operation mode in a sequence CPU failure and for output values in a CPU failure, which are defined on a channel-by-channel basis (refer to Table 3.9 and Figure 3.17). For this setting, use either a special module WRITE instruction or a BASIC statement (refer to the following description).

Table 3.12 Data Location Numbers in Operation Mode in a Sequence CPU Failure

Set items		Channel 1	Channel 2	Channel 3	Channel 4	Channel 5*	Channel 6*	Channel 7*	Channel 8*
Operation mode	Ladder	501	502	503	504	505	506	507	508
	BASIC	1	2	3	4	5	6	7	8
Output values in a sequence CPU failure	Ladder	522	532	542	552	562	572	582	592
	BASIC	22	32	42	52	62	72	82	92

* Specifications only for the F3DA08-5N module.

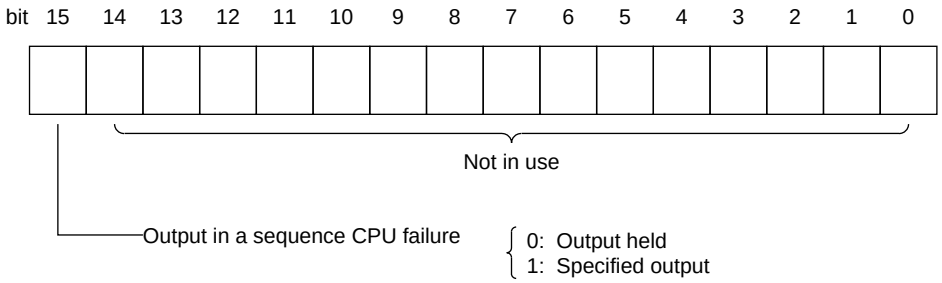


Figure 3.23 Relationships between Operation Mode Functions in a Sequence CPU Failure and 16-bit Data

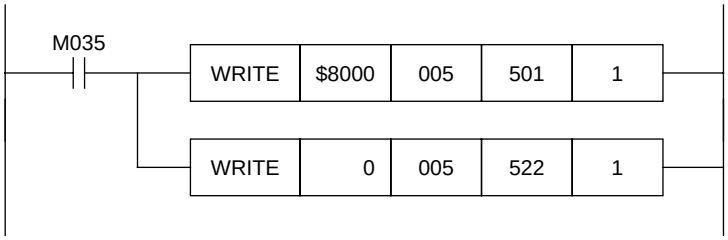
TIP

The set items in operation mode in a sequence CPU failure will be canceled if the power turns off. When the power turns on, the module will then work in default operation mode. Set the operation mode in a sequence CPU failure each time the power turns on. If the "Set Value Output" in the operation mode in a sequence CPU failure is set, but the "output values in a CPU failure" is not set, the module will operate as output values in a CPU failure remain 0 (zero).

Setting Example:

When the operation mode in a sequence CPU failure is set to "Set Value Output" and the output value in a CPU failure is set to 0 in channel 1 of the module installed in slot number 005:

(1) Setting with a special module WRITE instruction in the ladder diagram:



SEE ALSO

Section 5.1.3 for details on ladder instructions.

(2) Setting with a BASIC statement

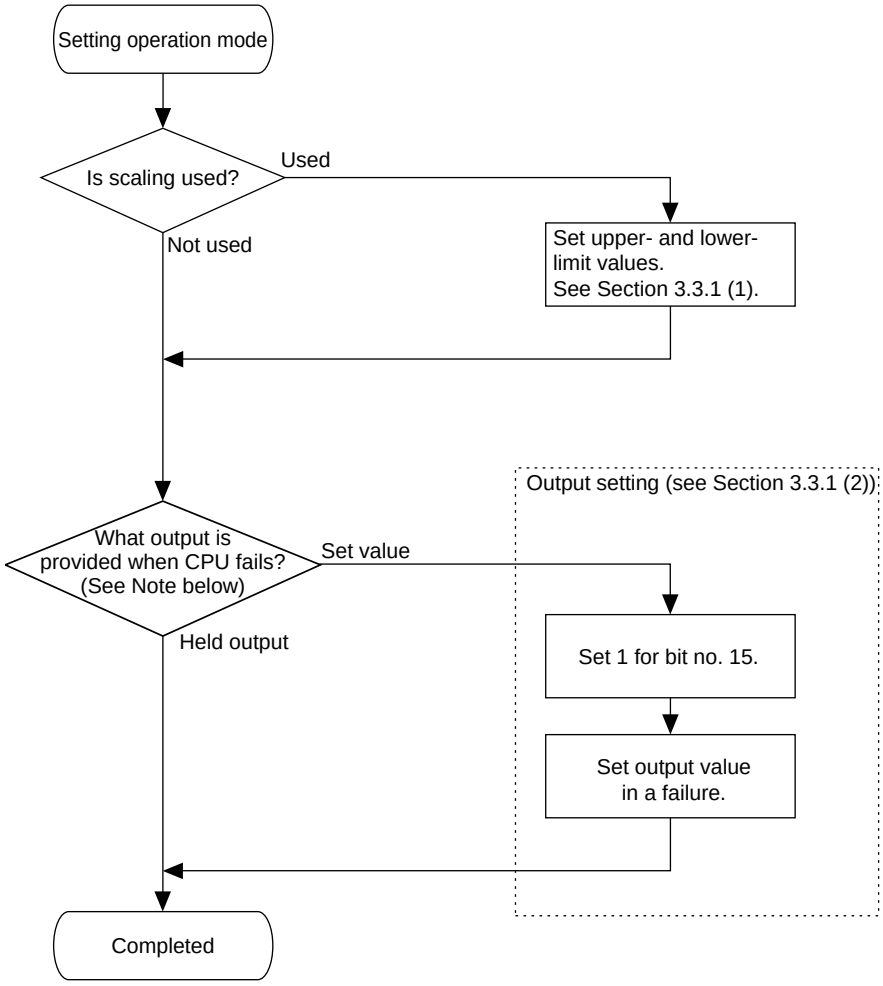
```
CONTROL 5,1;$8000
CONTROL 5,22;0
```

SEE ALSO

Section 5.2.7 for details on BASIC instructions.

3.4.2 Setting Operation Mode

If the module is used in the operation mode set as default values, no any further setting on the mode is required. However, if you want to change, follow the mode setting procedures flowcharted below to reset required items only.



Note: For specifications for F3DA04-1N and F3DA08-5N.

Figure 3.24 Operation Mode Set Flow

TIP

The operation mode set results and the scaling and filter set values are canceled if the power is turned off. When the power turns on, the module will then work in default operation mode. Set the operation mode each time the power is turned on.

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4. Attaching and Detaching Modules

This chapter describes how to attach and detach the analog input/output modules.

CONTENTS

4.1 Attaching Modules

Figure 4.1 shows how to attach the analog input/output module to the base module. First hook the anchor slot at the bottom of the module to be attached onto the anchor pin on the bottom of the base module. Push the top of the module in the direction of the arrow shown in the figure (toward the base module) until the yellow, spring-loaded anchor/release button clicks into place.

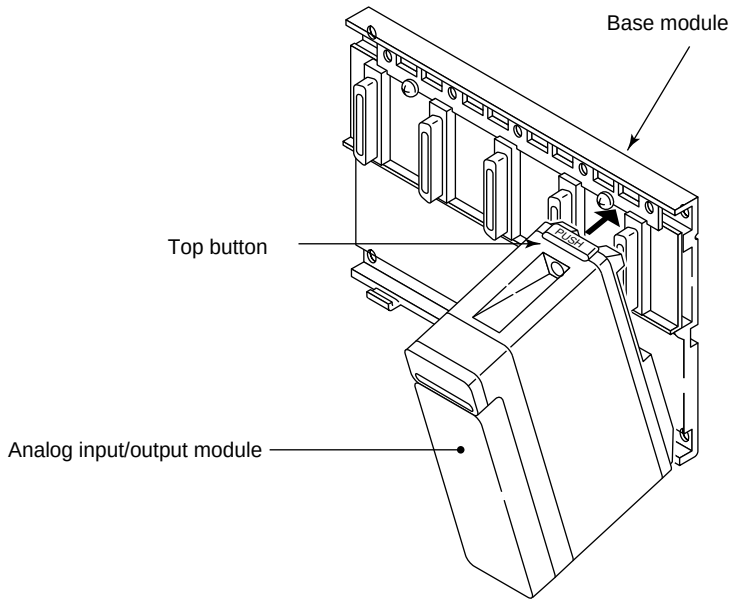

Figure 4.1 Attaching Module

CAUTION

DO NOT bend the connector on the rear of the module by force during the above operation. If the module is forcibly pushed with its improper connection, the connector may bend and this damage will cause a module installation error during the self-diagnosis.

4.2 Detaching Modules

To remove the module from the base module, reverse the above operation by pressing the yellow anchor/release button to unlock it, and tilting the module away from the base module. Then lift the module off of the anchor pin at the base.

4.3 Installing Modules in Severe Vibration Environments

If the modules are used in intense vibration environments, fasten the modules with a screw directly beneath the yellow anchor/release button as shown in Figure 4.2. For this, use a 12-mm long M4 binder screw. With an appropriate Phillips screwdriver, tighten the upper side of the module with this screw. During this operation, the user must tilt the screwdriver somewhat using the guide channel at the top of the module. A clearance of approximately 80 mm between the module and the duct above it is necessary to allow the screwdriver to access the screw.

CAUTION

During the above installation, DO NOT overtighten the module fixing screw.

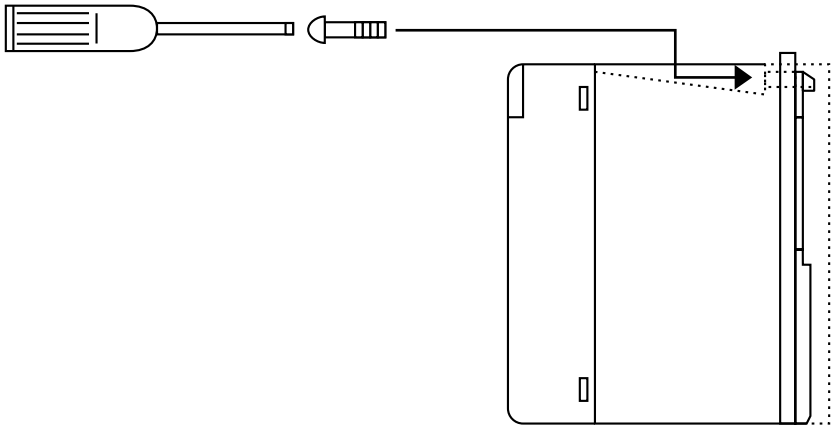

Figure 4.2 Tightening Module

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5. Accessing the Module

This chapter describes the method to access the module by using ladder and BASIC instructions. Moreover, concrete program examples are also given.

CONTENTS

5.1 Access by Using Ladder Instructions for a Special Module

5.1.1 Data Positions

(1) F3AD04-0N Module

The data positions (ladder) of the F3AD04-0N Analog Input Module are shown in Table 5.1.

There are 3 areas for data:

1) Input data

   The area in which the input voltage data of each channel are stored

2) Operation mode

   The area in which the operation mode of each channel are set

3) Operation details data

   The area in which the upper and lower limits of the scaling and filter set points are set

Table 5.1 F3AD04-0N Module Data Positions (Ladder)

Area	Date position	Content
Input data	1	Input voltage of channel 1
	2	Input voltage of channel 2
	3	Input voltage of channel 3
	4	Input voltage of channel 4
Operation mode	501	Operation mode setting for channel 1 (Input signal range, skip, scaling, filter)
	502	Operation mode setting for channel 2 (Input signal range, skip, scaling, filter)
	503	Operation mode setting for channel 3(Input signal range, skip, scaling, filter)
	504	Operation mode setting for channel 4 (Input signal range, skip, scaling, filter)
Operation details data	520	Upper limit of scaling for channel 1
	521	Lower limit of scaling for channel 1
	522	Filter set point for channel 1
	530	Upper limit of scaling for channel 2
	531	Lower limit of scaling for channel 2
	532	Filter set point for channel 2
	540	Upper limit of scaling for channel 3
	541	Lower limit of scaling for channel 3
	542	Filter set point for channel 3
	550	Upper limit of scaling for channel 4
	551	Lower limit of scaling for channel 4
	552	Filter set point for channel 4

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(2) F3AD08-1N Module

The data positions (ladder) of the F3AD08-1N Analog Input Module are shown in Table 5.2.

There are 3 ares for data:

1) Input data

   The area in which the input voltage data of each channel are stored

2) Operation mode

   The area in which the operation mode of each channel is set

3) Operation details data

   The area in which the upper and lower limits of the scaling and filter set points are set

Table 5.2 F3AD08-1N Module Data Positions (Ladder)

Area	Date position	Content
Input data	1	Input voltage of channel 1
	2	Input voltage of channel 2
	3	Input voltage of channel 3
	4	Input voltage of channel 4
	5	Input voltage of channel 5
	6	Input voltage of channel 6
	7	Input voltage of channel 7
	8	Input voltage of channel 8
Operation mode	501	Operation mode setting for channel 1 (Input signal range, skip, scaling, filter)
	502	Operation mode setting for channel 2 (Input signal range, skip, scaling, filter)
	503	Operation mode setting for channel 3 (Input signal range, skip, scaling, filter)
	504	Operation mode setting for channel 4 (Input signal range, skip, scaling, filter)
	505	Operation mode setting for channel 5 (Input signal range, skip, scaling, filter)
	506	Operation mode setting for channel 6 (Input signal range, skip, scaling, filter)
	507	Operation mode setting for channel 7 (Input signal range, skip, scaling, filter)
	508	Operation mode setting for channel 8 (Input signal range, skip, scaling, filter)
Operation details data	520	Upper limit of scaling for channel 1
	521	Lower limit of scaling for channel 1
	522	Filter set point for channel 1
	530	Upper limit of scaling for channel 2
	531	Lower limit of scaling for channel 2
	532	Filter set point for channel 2
	540	Upper limit of scaling for channel 3
	541	Lower limit of scaling for channel 3
	542	Filter set point for channel 3
	550	Upper limit of scaling for channel 4
	551	Lower limit of scaling for channel 4
	552	Filter set point for channel 4
	560	Upper limit of scaling for channel 5
	561	Lower limit of scaling for channel 5
	562	Filter set point for channel 5
	570	Upper limit of scaling for channel 6
	571	Lower limit of scaling for channel 6
	572	Filter set point for channel 6
	580	Upper limit of scaling for channel 7
	581	Lower limit of scaling for channel 7
	582	Filter set point for channel 7
	590	Upper limit of scaling for channel 8
	591	Lower limit of scaling for channel 8
	592	Filter set point for channel 8

(3) F3DA02-0N Module

The data positions (ladder) of the the F3DA02-0N Analog Output Module are given in Table 5.3.

There are 2 areas for data:

1) Output data

   The area in which the data of the output voltage/current of each channel are written

2) Operation details data

   The area in which the upper and lower limits of scaling are set

Table 5.3 F3DA02-0N Data Positions (Ladder)

Area	Date position	Content
Output data	1	Output voltage / current for channel 1
	2	Output voltage / current for channel 2
Operation details data	520	Upper limit of scaling for channel 1
	521	Lower limit of scaling for channel 1
	530	Upper limit of scaling for channel 2
	531	Lower limit of scaling for channel 2

(4) F3DA04-1N Module

The data positions (ladder) of the F3DA04-1N Analog Output Module are given in Table 5.4.

There are 3 areas for data:

1) Output data

   The area in which the data of the output voltage/current of each channel are written

2) Operation mode

   The area in which the operation mode of each channel is set

3) Operation details data

   The area in which the upper and lower limits and the output at the time of a CPU failure are set

Table 5.4 F3DA04-1N Module Data Positions (Ladder)

Area	Date position	Content
Output data	1	Output voltage/current for channel 1
	2	Output voltage/current for channel 2
	3	Output voltage/current for channel 3
	4	Output voltage/current for channel 4
Operation mode	501	Operation mode for channel 1(output mode specification at time of CPU failure)
	502	Operation mode for channel 2 (output mode specification at time of CPU failure)
	503	Operation mode for channel 3 (output mode specification at time of CPU failure)
	504	Operation mode for channel 4 (output mode specification at time of CPU failure)
Operation details data	520	Upper limit of scaling for channel 1
	521	Lower limit of scaling for channel 1
	522	Output for channel 1 at time of CPU failure
	530	Upper limit of scaling for channel 2
	531	Lower limit of scaling for channel 2
	532	Output for channel 2 at time of CPU failure
	540	Upper limit of scaling for channel 3
	541	Lower limit of scaling for channel 3
	542	Output for channel 3 at time of CPU failure
	550	Upper limit of scaling for channel 4
	551	Lower limit of scaling for channel 4
	552	Output for channel 4 at time of CPU failure

(5) F3DA08-5N Module

The data positions (ladder) of the F3DA08-5N Analog Output Module are given in Table 5.5.

There are 3 regions for data:

1) Output data

   The area in which the data of the output voltage/current of each channel are written

2) Operation mode

   The area in which the operation mode of each channel is set

3) Operation details data

   The area in which the upper and lower limits and the output at the time of a CPU failure are set

Table 5.5 F3DA08-5N Module Data Positions (Ladder)

Area	Date position	Content
Output data	1	Output voltage/current for channel 1
	2	Output voltage/current for channel 2
	3	Output voltage/current for channel 3
	4	Output voltage/current for channel 4
	5	Output voltage/current for channel 5
	6	Output voltage/current for channel 6
	7	Output voltage/current for channel 7
	8	Output voltage/current for channel 8
Operation mode	501	Operation mode for channel 1 (output mode specification at time of CPU failure)
	502	Operation mode for channel 2 (output mode specification at time of CPU failure)
	503	Operation mode for channel 3 (output mode specification at time of CPU failure)
	504	Operation mode for channel 4 (output mode specification at time of CPU failure)
	505	Operation mode for channel 5 (output mode specification at time of CPU failure)
	506	Operation mode for channel 6 (output mode specification at time of CPU failure)
	507	Operation mode for channel 7 (output mode specification at time of CPU failure)
	508	Operation mode for channel 8 (output mode specification at time of CPU failure)
Operation details data	520	Upper limit of scaling for channel 1
	521	Lower limit of scaling for channel 1
	522	Output for channel 1 at time of CPU failure
	530	Upper limit of scaling for channel 2
	531	Lower limit of scaling for channel 2
	532	Output for channel 2 at time of CPU failure
	540	Upper limit of scaling for channel 3
	541	Lower limit of scaling for channel 3
	542	Output for channel 3 at time of CPU failure
	550	Upper limit of scaling for channel 4
	551	Lower limit of scaling for channel 4
	552	Output for channel 4 at time of CPU failure
	560	Upper limit of scaling for channel 5
	561	Lower limit of scaling for channel 5
	562	Output for channel 5 at time of CPU failure
	570	Upper limit of scaling for channel 6
	571	Lower limit of scaling for channel 6
	572	Output for channel 6 at time of CPU failure
	580	Output for channel 7 at the time of CPU failure
	581	Upper limit of scaling for channel 7
	582	Lower limit of scaling for channel 7
	590	Upper limit of scaling for channel 8
	591	Lower limit of scaling for channel 8
	592	Output for channel 8 at time of CPU failure

5.1.2 Reading the Data (READ/HRD)

Use the special module instruction and special module High-speed Read instruction to read the data from the analog input and output modules. Refer to the following instruction manual for details on the special module instruction and special module High-speed Read instruction:

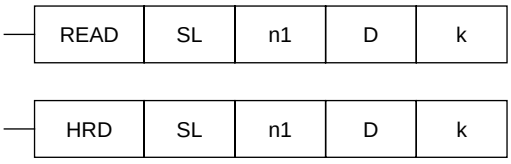
Sequence CPU Instruction Manual Instruction (IM 34M6P12-03E)

• Explanation of instructions

Table 5.6 Special Module Read/High-Speed Read Command

FUN No.	instruction	Mnemonic	Symbol	Input condition		Execution condition	Step count	Processing unit	Carry
				Necessary	Not necessary				
81	Special module read	READ	READ	●	–		5	16 bits	–
81P		↑READ	READ				6		
83	Special module high-speed read	HRD	HRD	●	–		5	16 bits	–
83P		↑HRD	HRD				6		

• Symbols



SL: Slot Number
n1: First data position for reading
D: First device for writing data read
k: Transfer data count

Slot number ····· 3-digit integer with the following structure (leading 0's can be omitted).

X XX
- XX → Physical slot (1-16) where the analog input/output module is installed.
- X → Unit number
  Main unit: 0
  sub-unit: 1-7

First Data Position for reading ·····Number from which to start reading (Tables 5.1 through 5.4).
First Device for writing data read ····As regards the device which can be used, refer to Sequence CPU Instruction Manual Instructions.
Transfer data count ·····Number of data to be read.

TIP

The special module long-word read command cannot be used. The operation is not guaranteed if the special module long-word read command is used for reading the data from the analog input/output module.

(1) Reading data from the analog input/output module

- Specify the data position of the input data in the First Data Position for Reading (n1).
- The data position of the input data corresponds to the channel number.

< Program example of reading analog data >

When X00501 is on, it reads four data channels from channels 1 to 4 of the analog input/ output module installed in slot number 106 into the data registers (D0001 to D0004).

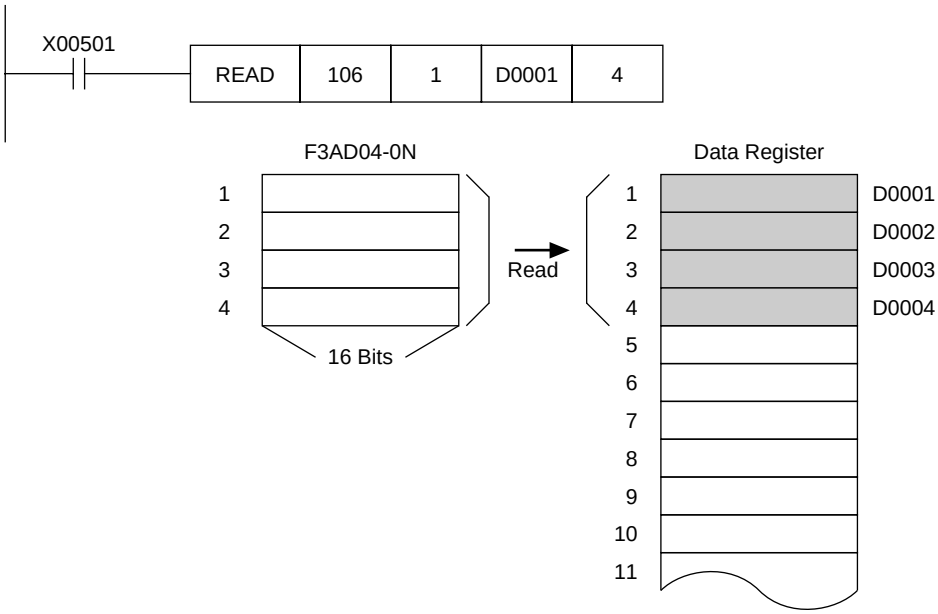


Figure. 5.1 Reading Analog Data

(2) Reading the operation mode and scaling value

Specify the data position of the operation mode, operation details data or scaling data in the First Data Position (n1).

< Program example of reading the operation mode >

When X00501 is on, it reads the operation mode data of three channels from channel 1 to channel 3 of the analog input/output module installed in slot number 106 into the data registers (D0001 to D0003).

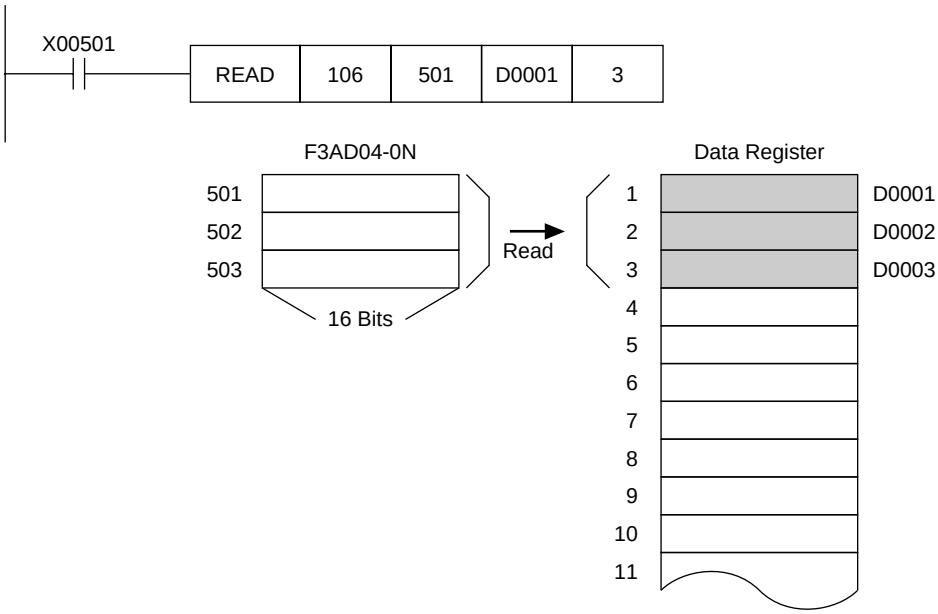


Figure. 5.2 Reading the Operation Mode

5.1.3 Writing the Data (WRITE/HWR)

Use the special module write instruction and special module high-speed write instruction for data to the analog input module and analog output module. Refer to the following instruction manual for details on the special module write instruction and special module high-speed write instruction.

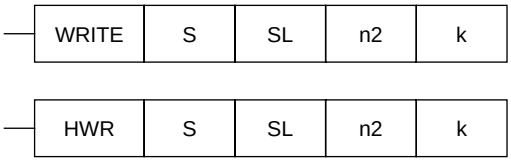
Sequence CPU Instruction Manual Instructions (IM34M6P12-03E)

• Explanation of commands

Table 5.7 Special Module Write/High-Speed Write Command

FUN No.	instruction	Mnemonic	Symbol	Input condition		Execution condition	Step count	Processing unit	Carry
				Necessary	Not necessary				
82	Special module write	WRITE	WRITE	●	–		5	16 bits	–
82P		↑WRITE	WRITE				6		
84	Special module high -speed write	HWR	HWR	●	–		5	16 bits	–
84P		↑HWR	HWR				6		

• Symbols



S: First device for writing data
SL: Slot Number
n2: First Data position for reading
k: Transfer Data Count

Starting device for writing data ···· As regards the device which can be used, please "refer to the Sequence CPU Instruction Manual Instructions.

Slot number ···· 3-digit integer having the following configuration (leading 0's can be omitted).

Physical slot position (1-16) where the analog input/output module is installed.

Unit number
Main unit: 0
Sub-unit: 1-7

First data position for writing ····· Data position where writing starts (Tables 5.1 through 5.4).

Transfer data count ····· Number of data to be written.

TIP

The special module long-word write command cannot be used. The operation is not guaranteed if the special module long-word write command is used for writing data on the analog input/output module.

(1)Writing data on the analog input/output module

- Specify the data position of the output data in the first data position for write data (n2).
- The data position of the output data corresponds to the channel number.

< Program example of writing analog data >

When X00502 is on, it writes (outputs) the data to channels 1 and 2 of the analog output module installed in slot number 107. It assumes that the data to be written are stored in data registers D0011 to D0012.

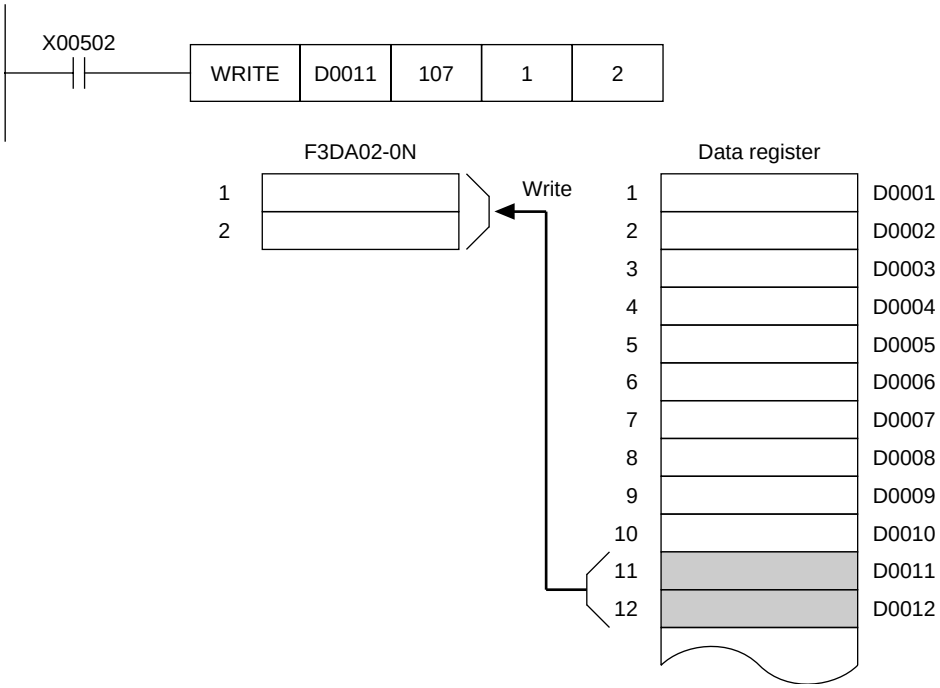


Figure. 5.3 Writing the Analog Data

(2)Writing the operation mode and scaling value

Specify the data position of the operation mode, operation details data and scaling data in the first data position for write data (n2).

<Program example of setting scaling value>

When X00501 is on, it sets the lower limit 0 and the upper limit 10000 for scaling in channel 1 of the analog output module installed in slot number 004.

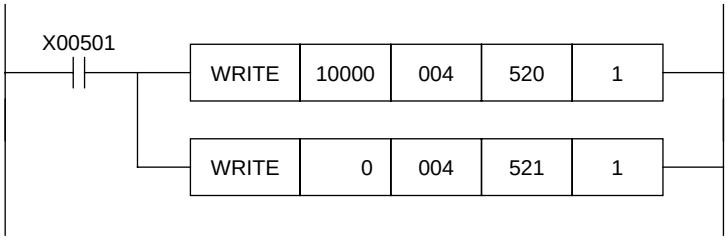


Figure. 5.4 Setting the Scaling Values

5.2 Access Using BASIC Statements

5.2.1 Statement List

The BASIC statements given in Table 5.8 can be used in the analog input/output module.

Operation of the module cannot be guaranteed if statements other than those given in Table 5.7 are used.

Table 5.8 BASIC Statements Which Can Be Used

Function	Format of statement	Explanation	F3AD04-0N F3AD08-1N	F3DA02-0N F3DA04-1N F3DA08-5N
Declaration of use of module	(Example) ASSIGN AD04=SL SL :Slot number	Defines the correspondence between modules and slots. Execute this statement without fail before accessing the analog input/output module. Use this statement within the main program.	✓	✓
	(Example) ASSIGN DA02=SL SL :Slot number			
Reading data from analog input module	ENTER SL, n NOFORMAT;I or ENTER SL NOFORMA; I SL : Slot number n : Data position number (channel number) I : Variable name in which read data are stored	Reads the analog data of channel number n of the analog input module installed at slot number SL and stores it in input variable I. If the channel number is not specified , it stores the read analog data sequentially from channel number 1 into input array variable I.	✓	
Writing data to analog output module	OUTPUT SL ,n NOFORMAT;I or OUTPUT SL FORMA; I SL : Slot number n : Data position number (channel number) I : Variable name in which output data are stored	Writes the analog output data stored in output variable I on channel number n of the analog output module installed at slot number SL. If the channel number is not specified , it writes the analog output data stored in output array variable I sequentially from channel number 1.		✓
Reading operation mode and scaling value	STATUS SL, n ; P or STATUS SL ; P SL : Slot number n : Data position number P : Variable name in which read data are stored	Reads the operation mode and scaling value at data position number n of the analog input output module installed at slot number SL and stores it in input variable P.	✓	✓
Setting operation mode and scaling value	CONTROL SL , n; P or CONTROL S; P SL : Slot number n : Data position number P : Set data	Sets the operation mode and scaling value at data position number n of the analog input output module installed at slot number SL. Specify the operation mode and scaling by set data P.	✓	✓

5.2.2 Data Positions

(1) F3AD04-0N Module

The data positions (BASIC) of the F3AD04-0N Analog Input Module are shown in Table 5.9.

There are 3 areas for data:

1) Input data

   The area in which the input voltage data of each channel are stored

2) Operation mode

   The area in which the operation mode of each channel is set

3) Operation details data

   The area in which the upper and lower limits of the scaling and filter set values are set

Table 5.9 F3AD04-0N Module Data Positions (BASIC)

Area	Date position	Content
Input data	1	Input voltage of channel 1
	2	Input voltage of channel 2
	3	Input voltage of channel 3
	4	Input voltage of channel 4
Operation	1	Operation mode setting for channel 1 (Input signal range, skip, scaling, filter)
	2	Operation mode setting for channel 2 (Input signal range, skip, scaling, filter)
	3	Operation mode setting for channel 3 (Input signal range, skip, scaling, filter)
	4	Operation mode setting for channel 4 (Input signal range, skip, scaling, filter)
Operation details data	20	Upper limit of scaling for channel 1
	21	Lower limit of scaling for channel 1
	22	Filter set point for channel 1
	30	Upper limit of scaling for channel 2
	31	Lower limit of scaling for channel 2
	32	Filter set point for channel 2
	40	Upper limit of scaling for channel 3
	41	Lower limit of scaling for channel 3
	42	Filter set point for channel 3
	50	Upper limit of scaling for channel 4
	51	Lower limit of scaling for channel 4
	52	Filter set point for channel 4

(2) F3AD08-1N Module

The data positions (BASIC) of the analog input module (F3AD08-1N) are shown in Table 5.10.

There are 3 areas for data:

1) Input data

   The area in which the input voltage data of each channel are stored

2) Operation mode

   The area in which the operation mode of each channel is set

3) Operation details data

   The area in which the upper and lower limits of the scaling and filer set point values are set

Table 5.10 F3AD08-1N Module Data Positions (BASIC)

Area	Date position	Content
Input data	1	Input voltage of channel 1
	2	Input voltage of channel 2
	3	Input voltage of channel 3
	4	Input voltage of channel 4
	5	Input voltage of channel 5
	6	Input voltage of channel 6
	7	Input voltage of channel 7
	8	Input voltage of channel 8
Operation mode	1	Operation mode setting for channel 1 (Input signal range, skip, scaling, filter)
	2	Operation mode setting for channel 2 (Input signal range, skip, scaling, filter)
	3	Operation mode setting for channel 3 (Input signal range, skip, scaling, filter)
	4	Operation mode setting for channel 4 (Input signal range, skip, scaling, filter)
	5	Operation mode setting for channel 5 (Input signal range, skip, scaling, filter)
	6	Operation mode setting for channel 6 (Input signal range, skip, scaling, filter)
	7	Operation mode setting for channel 7 (Input signal range, skip, scaling, filter)
	8	Operation mode setting for channel 8 (Input signal range, skip, scaling, filter)
Operation details data	20	Upper limit of scaling for channel 1
	21	Lower limit of scaling for channel 1
	22	Filter set point for channel 1
	30	Upper limit of scaling for channel 2
	31	Lower limit of scaling for channel 2
	32	Filter set point for channel 2
	40	Upper limit of scaling for channel 3
	41	Lower limit of scaling for channel 3
	42	Filter set point for channel 3
	50	Upper limit of scaling for channel 4
	51	Lower limit of scaling for channel 4
	52	Filter set point for channel 4
	60	Upper limit of scaling for channel 5
	61	Lower limit of scaling for channel 5
	62	Filter set point for channel 5
	70	Upper limit of scaling for channel 6
	71	Lower limit of scaling for channel 6
	72	Filter set point for channel 6
	80	Upper limit of scaling for channel 7
	81	Lower limit of scaling for channel 7
	82	Filter set point for channel 7
	90	Upper limit of scaling for channel 8
	91	Lower limit of scaling for channel 8
	92	Filter set point for channel 8

(3) F3DA02-0N Module

The data positions (ladder) of the F3DA02-0N Analog Output Module are given in Table 5.11.

There are 2 areas for data:

1) Output data

   The area in which the data of the output voltage/current of each channel are written

2) Operation details data

   The area in which the upper and lower limits of scaling are set

Table 5.11 F3DA02-0N Module Data Positions (BASIC)

Area	Date position	Content
Input data	1	Output voltage/current for channel 1
	2	Output voltage/current for channel 2
Operation details data	20	Upper limit of scaling for channel 1
	21	Lower limit of scaling for channel 1
	30	Upper limit of scaling for channel 2
	31	Lower limit of scaling for channel 2

(4) F3DA04-1N Module

The data positions (BASIC) of the F3DA04-1N Analog Output Module are given in Table 5.12.

There are 3 areas for data:

1) Output data

   The area in which the data of the output voltage/current of each channel are written

2) Operation mode

   The area in which the operation mode of each channel is set

3) Operation details data

   The area in which the upper and lower limits for scaling and the output at the time of a CPU failure are set

Table 5.12 F3DA04-1N Module Data Positions (BASIC)

Area	Date position	Content
Input data	1	Output voltage/current for channel 1
	2	Output voltage/current for channel 2
	3	Output voltage/current for channel 3
	4	Output voltage/current for channel 4
Operation mode	1	Operation mode for channel 1 (output mode specification at time of CPU failure)
	2	Operation mode for channel 2 (output mode specification at time of CPU failure)
	3	Operation mode for channel 3 (output mode specification at time of CPU failure)
	4	Operation mode for channel 4 (output mode specification at time of CPU failure)
Operation details data	20	Upper limit of scaling for channel 1
	21	Lower limit of scaling for channel 1
	22	Output for channel 1 at time of CPU failure
	30	Upper limit of scaling for channel 2
	31	Lower limit of scaling for channel 2
	32	Output for channel 2 at time of CPU failure
	40	Upper limit of scaling for channel 3
	41	Lower limit of scaling for channel 3
	42	Output for channel 3 at time of CPU failure
	50	Upper limit of scaling for channel 4
	51	Lower limit of scaling for channel 4
	52	Output for channel 4 at time of CPU failure

(5) F3DA08-5N Module

The data positions (BASIC) of the F3DA08-5N Analog Output Module are given in Table 5.13.

There 3 areas for data:

1) Output data

   The area in which the data of the output voltage/current of each channel are written

2) Operation mode

   The area in which the operation mode of each channel is set

3) Operation details data

   The area in which the upper and lower limits for scaling and the output at the time of a CPU failure are set

Table 5.13 F3DA08-5N Module Data Positions (BASIC)

Area	Date position	Content
Input data	1	Output voltage/current for channel 1
	2	Output voltage/current for channel 2
	3	Output voltage/current for channel 3
	4	Output voltage/current for channel 4
	5	Output voltage/current for channel 5
	6	Output voltage/current for channel 6
	7	Output voltage/current for channel 7
	8	Output voltage/current for channel 8
Operation mode	1	Operation mode for channel 1 (output mode specification at time of CPU failure)
	2	Operation mode for channel 2 (output mode specification at time of CPU failure)
	3	Operation mode for channel 3 (output mode specification at time of CPU failure)
	4	Operation mode for channel 4 (output mode specification at time of CPU failure)
	5	Operation mode for channel 5 (output mode specification at time of CPU failure)
	6	Operation mode for channel 6 (output mode specification at time of CPU failure)
	7	Operation mode for channel 7 (output mode specification at time of CPU failure)
	8	Operation mode for channel 8 (output mode specification at time of CPU failure)
Operation details data	20	Upper limit of scaling for channel 1
	21	Lower limit of scaling for channel 1
	22	Output for channel 1 at time of CPU failure
	30	Upper limit of scaling for channel 2
	31	Lower limit of scaling for channel 2
	32	Output for channel 2 at time of CPU failure
	40	Upper limit of scaling for channel 3
	41	Lower limit of scaling for channel 3
	42	Output for channel 3 at time of CPU failure
	50	Upper limit of scaling for channel 4
	51	Lower limit of scaling for channel 4
	52	Output for channel 4 at time of CPU failure
	60	Upper limit of scaling for channel 5
	61	Lower limit of scaling for channel 5
	62	Output for channel 5 at time of CPU failure
	70	Upper limit of scaling for channel 6
	71	Lower limit of scaling for channel 6
	72	Output for channel 6 at time of CPU failure
	80	Upper limit of scaling for channel 7
	81	Lower limit of scaling for channel 7
	82	Output for channel 7at time of CPU failure
	90	Upper limit of scaling for channel 8
	91	Lower limit of scaling for channel 8
	92	Output for channel 8 at time of CPU failure

5.2.3 Declaration of Use of Module (ASSIGN)

Declaration of use of the module is always carried out by the ASSIGN statement before accessing the analog input/output module.

The ASSIGN statement defines the module name and slot number.

Use the ASSIGN statement within the main program.

```
ASSIGN  AD04=SL
          |
          +--> Module
                 AD04:Analog input module
                 AD08:Analog input module
                 DA02:Analog output module
                 DA04:Analog output module
                 DA08:Analog output module
       SL: Slot number (numeric value or variable)
           3-digit integer of the following structure (leading 0's can be omitted)
           X XX
           |  |
           |  +--> Physical slot position (1-16) where module is installed
           |
           +--> Unit number
                  main unit: 0
                  sub-unit:  1-7
```

5.2.4 Reading Data from the Analog Input Module (ENTER)

The ENTER statement is used for reading data from the analog input module.

The data read are stored in the specified input variable or input variable array. If the channel number is not specified, it reads from channel number 1. The number of channels read is determined by the number of input variables.

```
ENTER  SL,  n  NOFORMAT ; I
                          |
                          +--> Input variable numeric variable (integer).
       |    |
       |    +--> Channel number (numeric value or variable)
       |              n: 1-4 (for F3AD04-0N)
       |                 1-8 (for F3AD08-1N)
       |
       +--> Slot number (numeric value or variable)
```

ENTER SL NOFORMAT ; I1, I2,····· I□
I1 to I□:Input data storage variable list (integer numeric variable; maximum number is the total number of channels used).
□: 1-4 (for F3AD04-0N)
1-8 (for F3AD08-1N)
Other parameters are the same as listed above.

ENTER SL NOFORMAT ; I
I: Integer array variable for input data storage.
Other parameters are the same as those listed above.

TIP

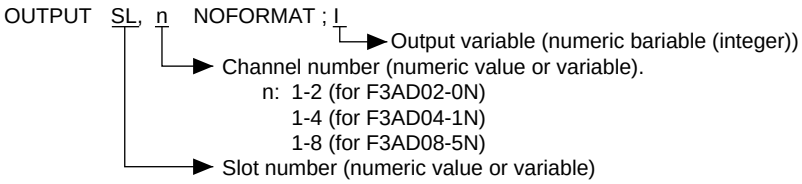
For both input and input data storage variables, only integers can be used. Double integers cannot be used. Operation is not guaranteed if a double integer variable is used for an input variable or input data storage variable.

5.2.5 Writing Data to the Analog Output Module (OUTPUT)

The OUTPUT statement is used for writing data to the analog output module.

It writes (outputs) data stored in the output variable or output variable array on a specified channel of the analog output module.

If the channel number is not specified, it writes from channel number 1. The amount of data written is determined by the number of variables specified.



OUTPUT SL NOFORMAT ; I1,····· I□
I1 to I□: Output data storage variable list (integer numeric variable; maximum number of items is the total number of channels used).
□: 1-2 (for F3AD02-0N)
1-4 (for F3AD04-1N)
1-8 (for F3AD08-5N)
Other parameters are the same as those listed above.

OUTPUT SL NOFORMAT ; I
I: Integer array variable for output data storage.
Other parameters are the same as those listed above.

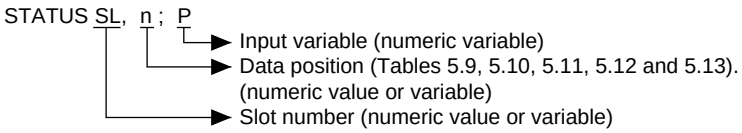
TIP

For both output and output data storage variables, only integers can be used. Double integers cannot be used. Operation is not guaranteed if a double integer variable is used for an output variable or output data storage variable.

5.2.6 Reading the Operation Mode and Scaling Value (STATUS)

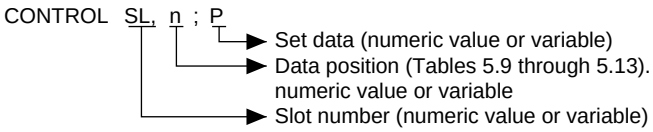
The STATUS statement is used for reading the operation mode and scaling value of the analog input module.

It reads the operation mode of the specified data position and stores it in an input variable or input variable array.



5.2.7 Writing the Operation Mode and Scaling Value (CONTROL)

The CONTROL statement is used for setting the operation mode or scaling filter value of the analog input/output module.



5.3 Program Examples

5.3.1 Analog Input Module

This example sets the following operation modes for every channel of the analog input module installed in slot number 004 and reads input data.

Table 5.14 Analog Input Module Operation Mode

	Input signal range (V DC)	Scaling	Filter time constant (ms)
Channel 1	1 to 5	0 to 10000	1000
Channel 2	0 to 5	–	50
Channel 3	-10 to 10	–	–
Channel 4	Not used (skip)		

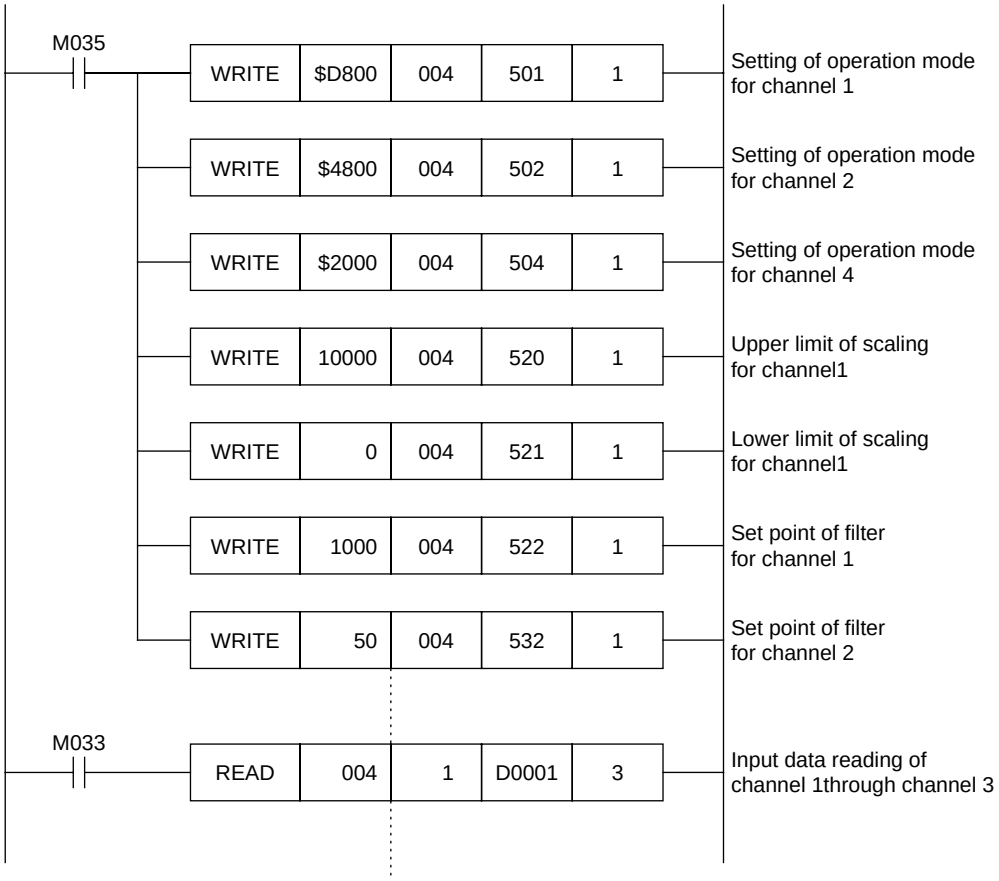
The sixteen-bits and hexadecimal data of the operation modes are as follows:

Channel 1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0
	$	D			8				0				0			
Channel 2	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0
	$	4			8				0				0			

Channel 3 Since it is used by default, this setting is not neccessary

Channel 4	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	$	2			0				0				0			

1) Example of Ladder Program



2) Example of BASIC Program

```
 10  ! F3AD04-0N Program
 20  !
 30  DEFINT A-Z
 40  OPTION BASE 1
 50  DIM ENTBUFF(3)
 60  SL=4
 70  ASSIGN AD04=SL                    Declaration of use of module
 80  CONTROL SL,1;$D800                Setting of operation mode for channel 1
 90  CONTROL SL,2;$4800                Setting of operation mode for channel 2
100  CONTROL SL,4;$2000                Setting of operation mode for channel 4
110  CONTROL SL,20;10000               Upper limit of scaling for channel 1
120  CONTROL SL,21;0                   Lower limit of scaling for channel 1
130  CONTROL SL,22;1000                Set point of filter for channel 1
140  CONTROL SL,32;50                  Set point of filter for channel 2
                :
300  ENTER SL NOFORMAT;ENTBUFF(*)      Input data reading of channels 1 through 3
310  DISP ENTBUFF(*)
                :
```

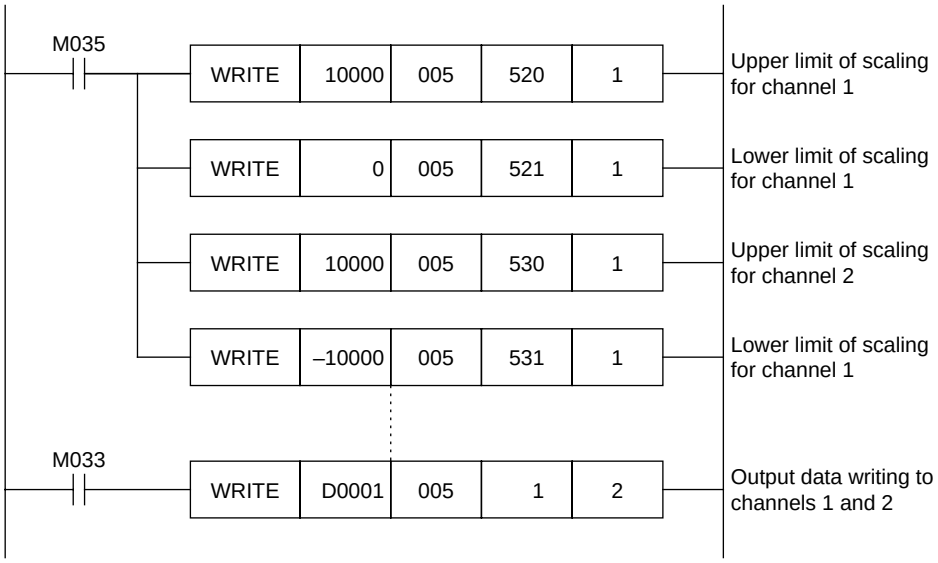
5.3.2 Analog Output Module

This example carries out scaling for every channel of the analog output module installed in slot number 005 as follows:

Table 5.15 Analog Output Module Scaling

	Scaling
Channel 1	0 to 10000
Channel 2	-10000 to 10000

1) Example of Ladder Program



2) Example of BASIC Program

```
 10  ! F3DA02-0N Program
 20  !
 30  DEFINT A-Z
 40  OPTION BASE 1
 50  DIM OUTBUFF(2)
 60  FOR I=1 TO 2
 70     READ OUTBUFF(I)
 80  NEXT I
 90  SL=5
100  ASSIGN DA02=SL                    Declaration of use of module
110  CONTROL SL,20;10000               Upper limit of scaling for channel 1
120  CONTROL SL,21;0                   Lower limit of scaling for channel 1
130  CONTROL SL,30;10000               Upper filter set point for channel 2
140  CONTROL SL,31;-10000              Upper filter set point for channel 2
                :
300  OUTPUT SL NOFORMAT;OUTBUFF(*)     Output data writing to channels 1 and 2
310  DATA 1000,-1000
                :
```

6. Q & A

This chapter is a series of questions and answers.

CONTENTS

6.1 How to Handle Possible Errors

Q. What should be done when the ALM indicator is on? Will there be a problem if it is left as it is?

A. The indicator is faulty. If it is left as it is, the accuracy in the specifications cannot be attained. Contact your nearest Yokogawa representative or sales office and have it replaced.

Q. A/D conversion results cannot be read.

A. Verify the following:

(1) Is the RDY indicator on? Yes→ A1 No→ (2)

(2) Is the RDY indicator on if the module is inserted in another slot?

Yes→ A2 No→ A3

CAUTION

The module should be inserted or removed after switching off the power supply module. Otherwise the module may be damaged.

A1. Verify the address being read and the operation mode of each channel. If the address being read is correct and there is no error in the setting of the mode, the module be faully. Contact your nearest Yokogawa representative or sales office.

A2. The backboard may be faulty Contact your nearest Yokogawa representative or sales office.

A3. The module may be faulty. Contact your nearest Yokogawa representative or sales office.

Q. D/A conversion results are not output.

A. Verify the following :

(1) Are the voltage and capacity of the external power supply as per the specifications?

Yes→ (2) No→ A1

(2) Is the RDY LED on? Yes→A2 No→ (3)

(3) Is the RDY LED on if the module is inserted in another slot?

Yes→ A3 No→ A4

CAUTION

The module should be inserted or removed after switching off the power supply module. Otherwise the module may be damaged.

A1. Connect the external power supply shown in Functional Specifications to the terminal for the external power supply of the module.

A2. Verify the address being written and the operation mode of each channel. If the address being written is correct and there is no error in the setting of the mode, the module is faully. Contact your nearest Yokogawa represeutative or sales office.

A3. The backboard may be faulty. Contact your nearest Yokogawa represeutative or sales office.

A4. The module may be faulty. Contact your nearest Yokogawa represeutative or sales office.

6.2 Hints on Usage

Q. Describe how to read the 4 to 20 [mA] signal.

A. Connect the 250 [Ω] resistance between the positive and negative terminals of each channel. Select the resistance carefully because its precision and stability influence the conversion results of the F3AD04-0N and the F3AD08-1N. Precision of the resistance is not necessary when using it after calibration of the system using the scaling function. For information on the scaling function, refer to Section 2.3 "Operation mode."

Q. Describe how to output the 4 to 20 [mA] signal.

A. It can be output by using the F3AD02-0N and F3DA04-1N. The 4 to 20 [mA] signal cannot be output in the F3DA08-5N. One terminal each is provided for the current output and voltage output in the F3DA02-0N and F3DA04-1N. Therefore, ensure that you connect to the terminal for the current output.

Q. In case of the F3AD04-0N and F3AD08-1N, is it possible to do sampling simultaneously on all channels ?

A. No, It is not. There is a difference of 1 [ms] because it samples each channel sequentially.

Q. How much time is required to verify a change in the signal by means of the ladder ?

A. The time required is determined by the number of channels used in the analog input module, the scan time of the ladder and the timing of occurrence of the change which is to be detected.

Minimum time is 1 [ms].

Maximum time is 1 + number of channels used + period of ladder [ms].

CAUTION

It is assumed that a digital filter is not used in the F3AD04-0N or F3AD08-1N. When a digital filter is used, delay in the filter should also be considered.

Q. How much time is required to verify change in the written output data from the ladder at the analog output module terminal?

A. The time required is determined by the type of analog output module used and the scan time of the ladder.

Minimum time is 1 [ms].

Maximum time is

3 + period of ladder [ms] (in the case of F3DA02-0N) or,

5 + period of ladder [ms] (in the case of F3DA04-1N and F3DA08-5N).

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