**User's Manual**

**FX2NC-4AD Analog input block**

**Introduction**

The FX2NC-4AD analog input block is the FX2NC-4AD module of the FX2NC Series PLC. When connected to the FX2NC Series PLC, it provides input/output conversion for the FX2NC Series PLC as well as for the FX3S, FX3G, FX3UC Series PLCs. The FX2NC-4AD module is a 4-channel analog input module with built-in digital filter and averaging function. It is equipped with a terminal connector for external power supplies.

**2. External Dimensions and Part Name**

- **Dimensions:** 82 x 30 x 24 mm
- **Part Name:**
  - Terminals: 4 points
  - Connector: 10 points
  - Digital filter: 1 point
  - Power supply: 1 point

**3. PLC Connection**

- **Connection Example:**
  - **Power Supply:**
    - 24-VDC Power Supply
  - **Digital Filter:**
    - Internal digital filter

**4. Wiring**

- **4.1 Power Supply Wiring**
  - **Power Supply:**
    - 24-VDC Power Supply
  - **Digital Filter:**
    - Internal digital filter

**Specifications**

- **Current Input:**
  - Min: -10 to 9 V
  - Max: -20 to 17 mA
- **Voltage Input:**
  - Min: -10 to 10 V
  - Max: 4 to 20 mA

**Guidelines for the Safety of the User and Protection of the FX2NC-4AD**

- **a)** Any engineer using the product associated with this manual should be of a competent nature.
- **b)** Any commissioning or service engineer must be of a competent nature, instructed in the safety practices.

**Note:**

- The product is designed for use in industrial applications.
- This manual contains instruction explanations for the FX3S, FX3G, FX3GC, FX3UC Series PLCs and FX-4AD2NC to the FX2NC / FX3UC Series PLC.

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**List of Further Information Manuals**

- **Manual No.**
  - Description
  - Specifications
  - Current input
  - Voltage input

- **BFM #0, BFM #21:**
  - Reserved

- **BFM #5:**
  - Reserved

- **BFM #6 to #9:**
  - Setting range: 1 to 50% of full scale (valid while BFM #22 b2 is ON)

- **BFM #29:**
  - #112 CH2 maximum value (valid while BFM #22 b3 is ON)
FX2NC-4AD Analog input block

Thank you very much for purchasing the product. Please read this manual before using the product.

User's Manual

Introduction
The FX2NC-4AD Analog input block is referred to as "FX2NC-4AD" in this manual. It can be used in combination with FX2NC Series programmable controllers. The FX2NC-4AD is a 4-channel, 16-bit analog input block with the following specifications:

- Measurement range: -10 to +10 V
- Input type: Volt, mA
- Resolution: 0.32 mV (20 V), 1.25 μV (400 V)
- Offset: ±1% (±400 μV)
- Accuracy: ±0.5% (±100 mV)

List of Further Information Manuals

- User's Manual
- Specification Book

2. Dimensions and Part Name

- Accessory Special function block
- Terminal block
- Digital output block
- Analog output block
- Terminal block
- Power supply block
- Motor output block
- Interface block
- Future block

3. Specifications

- Resolution 0.32 mV (20 V)
- Offset ±1% (±400 μV)
- Accuracy ±0.5% (±100 mV)
- Gain value *1 -9 to 10 V *2 -17 to 30 mA *3

4. Wiring

4.1 Power supply wiring
Supplies power (24 V) to the FX2NC-4AD from the power supply connector. Power supply wiring:

- Supplies power (24 V) to the FX2NC-4AD from the power supply connector. The power supply connector is equipped with a power supply input and an output terminal. The output terminal is connected to the main unit. The power supply input is connected to the external power supply.

4.2 Input wiring
Data transfers between the FX2NC-4AD and the main unit are performed via BFM and special function blocks. Each BFM consists of 8 bits. Each BFM is assigned a DIP switch that can be set to ON or OFF. Each BFM has the following functionalities:

- A/D conversion
- Automatic gain adjustment
- Automatic offset adjustment
- Average data update

5. Operating Instructions

5.1 BFM input assignment
BFM #0: Specifies input mode.
BFM #10 to BFM #13: Channel data
BFM #19: Disables setting change
BFM #20: Enables setting change
BFM #21: Specifies input select
BFM #22: Special function block
BFM #51 to BFM #54: Convenient functions

5.2 BFM output assignment
BFM #29: Special function block
BFM #29 b1: A/D conversion
BFM #29 b2: Gain setting
BFM #29 b3: Offset setting
BFM #29 b4: Average data update
BFM #29 b5: Setting type

5.3 BFM explanations for the FX2NC-4AD
BFM #0: Specifies input mode.
BFM #10 to BFM #13: Channel data
BFM #19: Disables setting change
BFM #20: Enables setting change
BFM #21: Specifies input select
BFM #22: Special function block
BFM #29 b1: A/D conversion
BFM #29 b2: Gain setting
BFM #29 b3: Offset setting
BFM #29 b4: Average data update
BFM #29 b5: Setting type

6. Additional Instructions

6.1 BFM input assignment
BFM #0: Specifies input mode.
BFM #10 to BFM #13: Channel data
BFM #19: Disables setting change
BFM #20: Enables setting change
BFM #21: Specifies input select
BFM #22: Special function block
BFM #51 to BFM #54: Convenient functions

6.2 BFM output assignment
BFM #29: Special function block
BFM #29 b1: A/D conversion
BFM #29 b2: Gain setting
BFM #29 b3: Offset setting
BFM #29 b4: Average data update
BFM #29 b5: Setting type

6.3 BFM explanations for the FX2NC-4AD
BFM #0: Specifies input mode.
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BFM #21: Specifies input select
BFM #22: Special function block
BFM #29 b1: A/D conversion
BFM #29 b2: Gain setting
BFM #29 b3: Offset setting
BFM #29 b4: Average data update
BFM #29 b5: Setting type

7. Specifications

- Resolution 0.32 mV (20 V)
- Offset ±1% (±400 μV)
- Accuracy ±0.5% (±100 mV)
- Gain value *1 -9 to 10 V *2 -17 to 30 mA *3

8. Wiring

8.1 Power supply wiring
Supplies power (24 V) to the FX2NC-4AD from the power supply connector. The power supply connector is equipped with a power supply input and an output terminal. The output terminal is connected to the main unit. The power supply input is connected to the external power supply.

8.2 Input wiring
Data transfers between the FX2NC-4AD and the main unit are performed via BFM and special function blocks. Each BFM consists of 8 bits. Each BFM is assigned a DIP switch that can be set to ON or OFF. Each BFM has the following functionalities:

- A/D conversion
- Automatic gain adjustment
- Automatic offset adjustment
- Average data update

9. Operating Instructions

9.1 BFM input assignment
BFM #0: Specifies input mode.
BFM #10 to BFM #13: Channel data
BFM #19: Disables setting change
BFM #20: Enables setting change
BFM #21: Specifies input select
BFM #22: Special function block
BFM #51 to BFM #54: Convenient functions

9.2 BFM output assignment
BFM #29: Special function block
BFM #29 b1: A/D conversion
BFM #29 b2: Gain setting
BFM #29 b3: Offset setting
BFM #29 b4: Average data update
BFM #29 b5: Setting type

9.3 BFM explanations for the FX2NC-4AD
BFM #0: Specifies input mode.
BFM #10 to BFM #13: Channel data
BFM #19: Disables setting change
BFM #20: Enables setting change
BFM #21: Specifies input select
BFM #22: Special function block
BFM #29 b1: A/D conversion
BFM #29 b2: Gain setting
BFM #29 b3: Offset setting
BFM #29 b4: Average data update
BFM #29 b5: Setting type

10. Specifications

- Resolution 0.32 mV (20 V)
- Offset ±1% (±400 μV)
- Accuracy ±0.5% (±100 mV)
- Gain value *1 -9 to 10 V *2 -17 to 30 mA *3
7. Adjustment of I/O Characteristics

For the factory default, the FX2N-AD has standard I/O characteristics in accordance with each input mode. In the voltage input current mode, adjust the standard I/O characteristics (Do not change the input characteristics when it is in the digital input mode). The setting range will vary depending on the setting of the input mode (BFM #45). Set the offset and gain data for each channel.

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8. Adjustment of I/O Characteristics

For factory default, the FX2N-AD has standard I/O characteristics in accordance with each input mode. In the voltage input current mode, adjust the standard I/O characteristics (Do not change the input characteristics when it is in the digital input mode). The setting range will vary depending on the setting of the input mode (BFM #45). Set the offset and gain data for each channel.

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Example programs

(A) (B) (C)

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For safe use

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MITSUBISHI ELECTRIC CORPORATION
BFM #0: Scale over status

The results of the analog input value for each individual channel that has exceeded the input range will be written to BFM #0.

BFM #2: Operating time

When using the addition function, the initial value added by the addition function error (BFM #22 b0) and the upper limit error value set by BFM #1 (or BFM M27) are the same value.

BFM #3: Error value

When using the data addition function (BFM #22 b0), the data BFM (BFM #61 to BFM #64) and BFM (BFM #81 to BFM #84) of each channel is the measured value added by the addition function error (BFM #22 b0), the result is written to the corresponding data in the past data (BFM #10 to BFM #13). Even if there is an upper/lower limit error detected, the data BFM (BFM #10 to BFM #13), the data BFM (BFM #61 to BFM #64), and BFM (BFM #81 to BFM #84) of each channel is the measured value added by the addition function error (BFM #22 b0), the corresponding data will not be overwritten.

BFM #4: Error status

The bit assignment of BFM #4 (BFM #4) is written to the corresponding error in the digital data (BFM #0) to detect the upper/lower limit error value set by BFM #1 (or BFM M27) and the upper limit error value set by BFM #1 (or BFM M27).

BFM #5: BFM assignment

The channel number (BFM No.) and BFM number (BFM No.) of each channel is written to the corresponding data in the past data (BFM #10 to BFM #13).

BFM #7: Error code

When using the sudden change detection function (BFM #22 b2), enter the channel number (BFM No.) and the channel number (BFM No.) of each channel is written to the corresponding data in the past data (BFM #10 to BFM #13).

BFM #8: Mode code

BFM #8 stores a fixed value of "0000B."
Introduction

The FX2NC analog input block is referred to as "FX2NC-4AD", connects to the PLC through a buffer memory and currently supports 4 digital inputs with OR/NOR and 4 digital inputs with AND/NOR. This block is designed to be used with a compact design and high reliability. The block can be used in the FX-1S, FX-2S, FX-3S series PLC that supports the FX-2NC-4AD. The block is a special function version of the FX2NC Series PLC.

Items that can be specified on the FX2NC-4AD block

- Difference in setting values of data history
- Enables setting change of I/O characteristics
- Enables setting of data history

2. Equipment Dimensions and Port Name

Width: 88 mm
Depth: 22 mm
Height: 40 mm

Port Name

- Input channel No. 1
- Input channel No. 2

3. PLC Connection

When connecting the FX2NC-4AD to the PLC, connect the FX2NC-4AD to the PLC using the specified interface or port. In either case above, until the number of A/D conversion times reaches the number of channels specified, the block will not start the data output function. Therefore, after the connection, take the following steps:

- Connect the FX2NC-4AD to the PLC with the specified interface or port.
- Turn ON the power of the PLC.

In addition, before starting to use the product, the following points must be observed:

- The product is designed for use in industrial applications.
- The condition below must be met: 3 mA
- Concerning the EMC regulations, comply with the following standards:
  - For equipment requirements and tests:
    - Equipment requirements and tests for EMI (Electromagnetic Interference)
    - Emissions
    - Susceptibility

4. Wiring

4.1 Power supply specifications

Supply power specification (FX2NC-4AD) to the power supply connected to the PLC. For analog input power supply, the following power supplies are available:

- Power cables
  - FX2NC-100BPCB
  - Power cable (150 cm, 240 mm²)

- Power pin specifications:
  - Pin:
    - Pin No.: 1, 2, 3, 4
    - Pin Name:
      - Pin 1: +24V
      - Pin 2: -24V
      - Pin 3: Power supply ground
      - Pin 4: Power supply common

4.2 Input wiring

For terminal assignment, refer to Chapter 3 of this manual.

5. Specifications

5.1 General specifications

The general specifications are the same as those of the main unit. For details, refer to the PLC main unit manual.

5.2 Power supply specifications

- Power supply circuit:
  - 100V, 200V, 200-240V (3 phase, 50/60 Hz)

- Power consumption:
  - rated output: 10W

- Power requirements:
  - rated voltage: 200V, 200-240V (3 phase, 50/60 Hz)

5.3 Performance specifications

- Response time:
  - 1.0 ms (at maximum)

- Input signal range:
  - 0 to 5V

- Output signal range:
  - 0 to 5V

- Resolution:
  - 12-bit

6. Details of buffer memories

BFM-1: Specific input mode

Specify the plug-in block immediately after the input channel No. (BFM-1). The input channel No. specified for each plug-in block is written to the buffer memory (BFM-1) for each plug-in block. Use the BITORJ instructions to use BFM-1 instructions.

BFM-2: Enables setting change of I/O characteristics

In addition to the functions of BFM-1, this function enables setting change of I/O characteristics by specifying the value set in BFM-2. Use the BUSORJ instructions to use BFM-2 instructions.

BFM-3: Enables setting of data history

In addition to the functions of BFM-1 and BFM-2, this function enables setting of data history by specifying the value set in BFM-3. Use the BUSORJ instructions to use BFM-3 instructions.

BFM-4: Details of buffer memories

The table below shows the relationship between the set value of BFM-4 and the value output from the analog input block.

<table>
<thead>
<tr>
<th>BFM-4</th>
<th>Description</th>
<th>Initial value</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>No change</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>Change</td>
<td>1</td>
</tr>
</tbody>
</table>

Average data update

- The value of the averaged values (BFM-4 #1 to BFM-4 #4) is sent at "A" times per second.
- The update time is as follows:
  - Value = 100 ms
  - Value = 10 ms
  - Value = 1 ms

- Do not change the value set in BFM-4

6.1. Buffer Memories (BFM)

- BFM-1: Specific input mode
  - Specifies the plug-in block immediately after the input channel No. (BFM-1).
  - The input channel No. specified for each plug-in block is written to the buffer memory (BFM-1) for each plug-in block.
  - Use the BITORJ instructions to use BFM-1 instructions.

- BFM-2: Enables setting change of I/O characteristics
  - In addition to the functions of BFM-1, this function enables setting change of I/O characteristics by specifying the value set in BFM-2.
  - Use the BUSORJ instructions to use BFM-2 instructions.

- BFM-3: Enables setting of data history
  - In addition to the functions of BFM-1 and BFM-2, this function enables setting of data history by specifying the value set in BFM-3.
  - Use the BUSORJ instructions to use BFM-3 instructions.

- BFM-4: Details of buffer memories
  - The table below shows the relationship between the set value of BFM-4 and the value output from the analog input block.

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Average data update

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- The update time is as follows:
  - Value = 100 ms
  - Value = 10 ms
  - Value = 1 ms

- Do not change the value set in BFM-4
BFM #10: Assignment of BFM No.

- **BFM #10**: Data addition function
- **BFM #15**: Minimum value reset
- **BFM #17**: Upper/lower limit set value
- **BFM #19**: Upper/lower limit value detection function
- **BFM #20**: Power error
- **BFM #21**: Data addition function
- **BFM #22**: Upper/lower limit set value
- **BFM #23**: Scale over: Less than lower limit
- **BFM #24**: Scale over: More than upper limit
- **BFM #25**: Offset data
- **BFM #26**: Upper/lower limit set value
- **BFM #27**: Upper/lower limit value detection function
- **BFM #29**: Assign channel No. and BFM No.
- **BFM #30**: Data addition function

**7. Adjustment of I/O Characteristics**

For history detail, the FxNC-FAD has standard I/O characteristics in accordance with each input mode. In the voltage and current input mode, adjust the standard I/O characteristics for each channel. (Do not change the input characteristics if it is a 20mA current input mode.)

**BFM #10: Assignment of BFM No.**

1. **BFM #10**: Data addition function
2. **BFM #15**: Minimum value reset
3. **BFM #17**: Upper/lower limit set value
4. **BFM #19**: Upper/lower limit value detection function
5. **BFM #20**: Power error
6. **BFM #21**: Data addition function
7. **BFM #22**: Upper/lower limit set value
8. **BFM #23**: Scale over: Less than lower limit
9. **BFM #24**: Scale over: More than upper limit
10. **BFM #25**: Offset data
11. **BFM #26**: Upper/lower limit set value
12. **BFM #27**: Upper/lower limit value detection function
13. **BFM #29**: Assign channel No. and BFM No.
14. **BFM #30**: Data addition function

**7.1 Standard I/O characteristics**

The FxNC-FAD's standard I/O characteristics are as follows:

- **Input mode**: Set in BFM #0
- **Input range**: Depends on the input mode (0: Voltage, 1: Current)
- **Scale over**: More than upper limit (BFM #24), Less than lower limit (BFM #23)
- **Offset data**: An analog input value when the digital value is 0
- **Standard offset value**: 0 for voltage input, 0.00004 for current input

**7.2 Adjustment of I/O characteristics**

To adjust the I/O characteristics, use the FxNC-FAD's diagnostic functions to view and change the settings. The FxNC-FAD provides the following functions for adjusting I/O characteristics:

- **BFM #10**: Data addition function
- **BFM #15**: Minimum value reset
- **BFM #17**: Upper/lower limit set value
- **BFM #19**: Upper/lower limit value detection function
- **BFM #20**: Power error
- **BFM #21**: Data addition function
- **BFM #22**: Upper/lower limit set value
- **BFM #23**: Scale over: Less than lower limit
- **BFM #24**: Scale over: More than upper limit
- **BFM #25**: Offset data
- **BFM #26**: Upper/lower limit set value
- **BFM #27**: Upper/lower limit value detection function
- **BFM #29**: Assign channel No. and BFM No.
- **BFM #30**: Data addition function

**Example program (Adjustment of CH1, CH2 and CH3)**

```
.asc

5000 ; Channel No. 1, CH1
5001 ; Channel No. 2, CH2
5002 ; Channel No. 3, CH3
5003

.TT

X001 ; Clears the upper/lower limit value error.
X002 ; Clears the upper/lower limit set value
X003 ; Clears the upper/lower limit set value
X004 ; Clears the upper/lower limit value error.

END
```

**BFM #10: Setup of Channel No.**

- **BFM #10**: Data addition function
- **BFM #15**: Minimum value reset
- **BFM #17**: Upper/lower limit set value
- **BFM #19**: Upper/lower limit value detection function
- **BFM #20**: Power error
- **BFM #21**: Data addition function
- **BFM #22**: Upper/lower limit set value
- **BFM #23**: Scale over: Less than lower limit
- **BFM #24**: Scale over: More than upper limit
- **BFM #25**: Offset data
- **BFM #26**: Upper/lower limit set value
- **BFM #27**: Upper/lower limit value detection function
- **BFM #29**: Assign channel No. and BFM No.
- **BFM #30**: Data addition function