MITSUBISHI *Changes for the Better*

FX2NC-4AD Analog input block

Thank you very much for purchasing this product.

In order to handle the product properly please read this manual thoroughly before starting to use the product.

User's Manual

FX2NC

MODEL	FX2NC-4AD
MANUAL Number	JY997D07801A
Date	June 2003

Guidelines for the Safety of the User and Protection of the FX2NC-4AD special function block.

This manual should be used by trained and competent personnel. The definition of such a person or persons is as follows:

a) Any engineer using the product associated with this manual, should be of a competent nature, trained and qualified to the local and national standards. These engineers should be fully aware of all aspects of safety with regards to automated equipment.

b) Any commissioning or service engineer must be of a competent nature, trained and qualified to the local and national standards.

c) All operators of the completed equipment should be trained to use this product in a safe and coordinated manner in compliance to established safety practices.

Note: The term `completed equipment' refers to a third party constructed device which contains or uses the product associated with this manual.

●Note concerning the CE marking●

CE marking does not guarantee that an entire mechanical module produced in accordance with the contents of the notification comply with the following standards. Compliance to EMC standards of the entire mechanical module should be checked by the user / manufacturer.

Standards with which this product complies

Type : Programmable Controller (Open Type Equipment)
Models : Products manufactured starting April 1st, 2003.

Electromagnetic Compatibility Standards (EMC)	Remark
EN61000-6-4:2001 Electromagnetic compatibility -Generic standards - Emission standard for Industrial environment	Compliance with all relevant aspects of the standard. (Radiated Emissions and Mains Terminal Voltage Emissions)
EN61000-6-2:2001 Electromagnetic compatibility -Generic standards Immunity for industrial environments.	Compliance with all relevant aspects of the standard. (RF immunity, Fast transients, ESD, Conducted, Surges, Power magnetic fields, Voltage dips and Voltage interruptions)

For more details please contact the local Mitsubishi Electric sales site.
- Notes for compliance to EMC regulation.
It is necessary to install the FX2NC-4AD in a shielded metal control panel.
For further information manual concerning the FX Series, refer to the following table.

List of Further Information Manuals

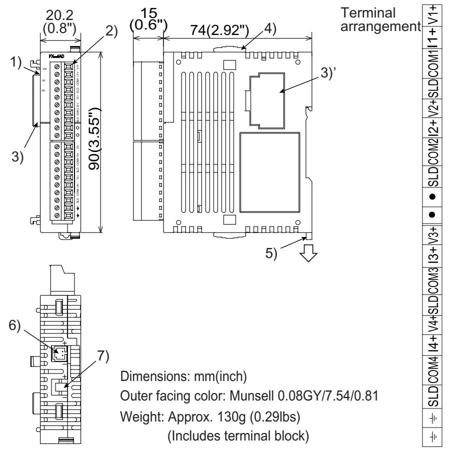
Manual Name	Manual No.	Description
FX2NC Hardware Manual	JY992D76401	This manual contains hardware explanations of wiring, installation and specifications for the FX2NC Series programmable controllers.
FX Programming Manual Ⅱ	JY992D88101	This manual contains instruction explanations for the FX1S, FX1N, FX2N and FX2NC Series programmable controllers.

1. Introduction

The FX2NC-4AD analog input block (hereafter referred to as "FX2NC-4AD") converts 4 points of analog input values (voltage and current inputs) into digital values, and transfers them to the PLC main unit.
The FX2NC-4AD can be connected to the FX2NC Series PLC.

1) A combination of voltage and current analog inputs selectable via the PLC TO instruction should be used to configure the individual input channels.
2) The voltage input range can be selected within -10 to 10V, alternatively, the current input range can be selected within -20 to 20mA and 4 to 20mA. The input characteristics can be adjusted for each channel (except when ○=2, 5, 8 is set in BFM #0 that disables all changes to the offset or gain).
3) The resolution is 0.32 mV (20 V × 1/64,000) or 2.50 mV (20 V × 1/8,000) when voltage input is used, and 1.25 µA (40 mA × 1/32,000) or 5.00 µA (40 mA × 1/8,000) when current input is used.
4) Data transfer with the PLC is performed via the buffer memories of the FX2NC-4AD using FROM/TO instructions.

2. External Dimensions and Part Name



Dimensions: mm(inch)
Outer facing color: Munsell 0.08GY/7.54/0.81
Weight: Approx. 130g (0.29lbs)
(Includes terminal block)

Accessory: Special function block number label, Power crossover cable FX2NC-10BPCB1

1) Status indicator LED
2) Terminal connector (European type)
3),3)'Extension port
4) Slide lock for extension block
5) DIN rail clip
6) Power supply connector (24V DC)
7) Power supply connector (Supply for extension block)

The connector 3)' is equipped with a cover.

- Never wire the ● terminals.

• Status indicator LED

Indication	Description
PW	Lit while 5 V power is normally supplied from PLC.
24 V	Lit while 24 V power is normally supplied to the "24+" and "24-" power supply connector of the FX2NC-4AD.
A/D	Flashes during A/D conversion.

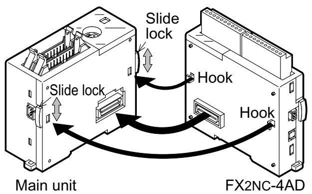
• Install the FX2NC-4AD on the right side of the main unit, extension block or special function block of the FX2NC Series PLC.

• DIN rail installation
The FX2NC-4AD can be installed on DIN rail DIN46277 (width: 35mm (1.38")). When removing the FX2NC-4AD, push downward on the DIN rail attachment hook.

For further details, refer to the Handy Manual packed together with on the PLC main unit.

3. PLC Connection

When connecting the FX2NC-4AD to the FX2NC Series main unit or extension block, remove the extension port cover from the right side of the main unit or extension block, keep the slide lock in the main unit or extension block pulled upward, then align the hook in the FX2NC-4AD with the mounting hole in the former step of the main unit or extension block.



Then push the slide lock downward to fix the FX2NC-4AD. When connecting two or more FX2NC-4AD units, connect an FX2NC-4AD unit to another FX2NC-4AD unit in the same way.

Up to four special function blocks or special function units in total can be connected to the FX2NC Series PLC including those connected to the FX2NC-CNV-IF.

For each connected special function block or special function unit, a unit number is assigned starting with 0 for the special function block and special function unit nearest to the main unit.

From the main unit, use FROM/TO instructions to read or write data stored in the FX2NC-4AD.

4. Wiring

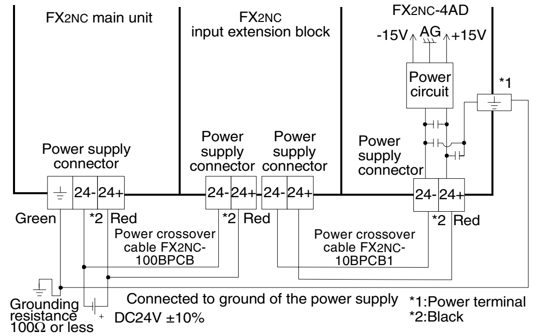
4.1 Power supply wiring

Supply power (24V DC) to the FX2NC-4AD from the power supply connector. When using the power supply connector, the following power cables are available.

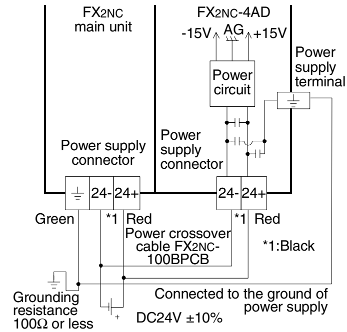
Power cables

FX2NC-10BPCB1:
Power crossover cable (offered as an accessory for the FX2NC-4AD)
FX2NC-100BPCB:
Power cable (offered as an accessory for the FX2NC Series main unit)

1) Connection example with the power supply through crossover wiring to the FX2NC input extension block



2) Connection example to the external power supply

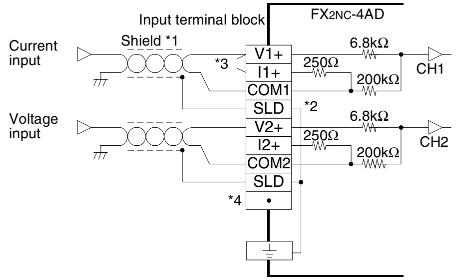


• Connect the "⏚" terminal together with the ground terminal of the PLC main unit to the ground of the power supply equipped with grounding resistance of 100Ω or less.

• For crossover wiring to the next block of the FX2NC-4AD, remove the resin cover from the power crossover connector.

4.2 Input wiring

For terminal arrangement, refer to Chapter 2 of this manual.



*1 When wiring the analog output cable, use a shielded two-core twisted cable, and separate it from other power cables and cables easily affected by induction.
*2 The SLD terminal is connected to the "⏚" terminal inside the FX2NC-4AD.
*3 For current input, short-circuit the VO+ terminal and the IO+ terminal (O: Input channel No.).
*4 Do not wire the "●" terminal.

Terminal connector handling

The FX2NC-4AD is equipped with a terminal connector whose form is equivalent to that of the terminal connector type FX2NC PLC.
For the specifications of the suggested screwdriver, the dimensions of the cable terminal, the external dimensions of the bar terminal equipped with insulating sleeve, and applicable wiring, please refer to the FX2NC Handy Manual.

5. Specifications

5.1 General specifications

The general specifications are equivalent to those of the PLC main unit. (Please refer to the FX2NC Handy Manual.)

5.2 Power supply specifications

Item	Specifications
Analog circuits	24V DC±10%, 130 mA, externally supplied.
Digital circuits	5V DC, 50 mA, supplied from the PLC main unit using an extension port.

5.3 Performance specifications

Item	Specifications
Conversion speed	1 ms x Number of used channels
Isolated method	Photocoupler isolated analog input area from PLC. Trans isolated power supply from analog I/O. Channels are not isolated from each other.
Number of occupied I/O points	8 points (including input and output points)
Applicable PLC	FX2NC Series PLC (Up to four units can be connected including special function blocks and special function units connected to FX2NC-CNV-IF.)
Built-in memory	EEPROM

5.4 Voltage/current input specifications

Item	Voltage input	Current input
Analog input range	-10 to 10V DC (input resistance: 200 kΩ) Adjustment is enabled with the following conditions: Offset value: -10 to 9 V Gain value: 10 V or less "Gain - Offset": > 1 V (except when ○=2, 5, 8 is set in BFM #0 that disables all changes to the offset or gain.) Maximum absolute input: ±15 V	-20 to 20 mA DC, 4 to 20 mA DC (input resistance: 250 Ω) Adjustment is enabled with the following conditions: Offset value: -20 to 17 mA Gain value: 30 mA or less "Gain - Offset": > 3 mA (except when ○=2, 5, 8 is set in BFM #0 that disables all changes to the offset or gain.) Maximum absolute input: ±30 mA
Digital output	Effective numeric value (15 bits) + Sign (1 bit)	Effective numeric value (14 bits) + Sign (1 bit)
Resolution	0.32 mV (20 V × 1/64,000) 2.50mV (20 V × 1/8,000)	1.25 µA (40 mA × 1/32,000) 5.00 µA (40 mA × 1/8,000)
Total accuracy	Ambient temperature: 25 °C ± 5 °C ±0.3% (±60 mV) against full scale 20 V Ambient temperature: 0 to +55 °C ±0.5% (±100 mV) against full scale 20 V	Ambient temperature: 25°C ± 5°C ±0.5% (±200 µA) against full scale 40 mA 4 to 20mA input is same (±200 µA) Ambient temperature: 0 to +55°C ±1% (±400 µA) against full scale 40 mA 4 to 20mA input is same (±400 µA)

6. Buffer Memory (BFM)

Data transfer between the FX2NC-4AD and the PLC main unit is performed via buffer memories (hereafter referred to as "BFM") of the FX2NC-4AD.
Each BFM consists of 1 word, 16 bits. BFM No. 0 to 1799 have assigned functionality, communication with these BFMs should be performed using TO/FROM instructions supplied by the PLC main unit.
When the power is switched ON from OFF, the initial value is written to each BFM. Create a program for the PLC so that the desired contents are written to the BFMs every time the power of the PLC is turned ON.
(The contents stored in BFM #0, #19, #22, #41 to #44 and #51 to #54 are held in the built-in EEPROM, and kept against power failure.)

6.1 Buffer Memories (BFM) lists

BFM No.	Description	Initial value
#0	Specifies input mode of CH1 to CH4.	H0000
#1	Reserved	—
#2	Number of averaging times for CH1 Setting range: 1 to 4,095 times	K1
#3	Number of averaging times for CH2 Setting range: 1 to 4,095 times	K1
#4	Number of averaging times for CH3 Setting range: 1 to 4,095 times	K1
#5	Number of averaging times for CH4 Setting range: 1 to 4,095 times	K1
#6	CH1: Digital filter setting Set range: 0 to 1,600	K0
#7	CH2: Digital filter setting Set range: 0 to 1,600	K0
#8	CH3: Digital filter setting Set range: 0 to 1,600	K0
#9	CH4: Digital filter setting Set range: 0 to 1,600	K0
#10	CH1 data (immediate data or average data)	—
#11	CH2 data (immediate data or average data)	—
#12	CH3 data (immediate data or average data)	—
#13	CH4 data (immediate data or average data)	—
⋮	Reserved	—
#19	Disables setting change of I/O characteristics (BFM #0, BFM #1, BFM #21) and convenient functions (BFM #22). Disables change: K2, Enables change: K1	K1
#20	Initializes functions. (Initializes functions at K1, then returns automatically to K0 after initialization is completed.)	K0
#21	Writes I/O characteristics. (Returns automatically to K0 after write of offset/gain value is finished.)	K0
#22	Sets convenient functions (data addition, upper/lower limit value detection, sudden change detection and minimum/maximum value hold).	K0
⋮	Reserved	—
#26	Upper/lower limit value error status (valid while BFM #22 b1 is ON)	K0
#27	A/D data sudden change detection status (valid while BFM #22 b2 is ON)	K0
#28	Scale over status	K0
#29	Error status	K0
#30	Model code (K2070)	K2070
#31	Reserved	—
#32	Operating time 0 to 64,800 (s) Subsequently, 64,800 is kept. Measurement starts when the power is turned on, and the measured value is reset when the power is turned off.	K0
⋮	Reserved	—
#41	CH1 offset data (mV or µA)	K0
#42	CH2 offset data (mV or µA)	K0
#43	CH3 offset data (mV or µA)	K0
#44	CH4 offset data (mV or µA)	K0
⋮	Reserved	—
#51	CH1 gain data (mV or µA)	K5000
#52	CH2 gain data (mV or µA)	K5000
#53	CH3 gain data (mV or µA)	K5000
#54	CH4 gain data (mV or µA)	K5000
⋮	Reserved	—
#61	CH1 addition data Setting range: -16,000 to 16,000 (valid while BFM #22 b0 is ON)	K0
#62	CH2 addition data Setting range: -16,000 to 16,000 (valid while BFM #22 b0 is ON)	K0
#63	CH3 addition data Setting range: -16,000 to 16,000 (valid while BFM #22 b0 is ON)	K0
#64	CH4 addition data Setting range: -16,000 to 16,000 (valid while BFM #22 b0 is ON)	K0
⋮	Reserved	—
#71	CH1 lower limit error set value (valid while BFM #22 b1 is ON)	Minimum digital value inside input range
#72	CH2 lower limit error set value (valid while BFM #22 b1 is ON)	Minimum digital value inside input range
#73	CH3 lower limit error set value (valid while BFM #22 b1 is ON)	Minimum digital value inside input range
#74	CH4 lower limit error set value (valid while BFM #22 b1 is ON)	Minimum digital value inside input range
⋮	Reserved	—
#81	CH1 upper limit error set value (valid while BFM #22 b1 is ON)	Maximum digital value inside input range
#82	CH2 upper limit error set value (valid while BFM #22 b1 is ON)	Maximum digital value inside input range
#83	CH3 upper limit error set value (valid while BFM #22 b1 is ON)	Maximum digital value inside input range
#84	CH4 upper limit error set value (valid while BFM #22 b1 is ON)	Maximum digital value inside input range
⋮	Reserved	—
#91	CH1 sudden change detection set value Setting range: 1 to 50% of full scale (valid while BFM #22 b2 is ON)	5% of full scale
#92	CH2 sudden change detection set value Setting range: 1 to 50% of full scale (valid while BFM #22 b2 is ON)	5% of full scale
#93	CH3 sudden change detection set value Setting range: 1 to 50% of full scale (valid while BFM #22 b2 is ON)	5% of full scale
#94	CH4 sudden change detection set value Setting range: 1 to 50% of full scale (valid while BFM #22 b2 is ON)	5% of full scale
⋮	Reserved	—
#99	Clear of upper and lower limit value error and sudden change detection error	K0
#100	Reserved	—
#101	CH1 minimum value (valid while BFM #22 b3 is ON)	
#102	CH2 minimum value (valid while BFM #22 b3 is ON)	
#103	CH3 minimum value (valid while BFM #22 b3 is ON)	
#104	CH4 minimum value (valid while BFM #22 b3 is ON)	
⋮	Reserved	—
#109	Minimum value reset	K0
#110	Reserved	—
#111	CH1 maximum value (valid while BFM #22 b3 is ON)	
#112	CH2 maximum value (valid while BFM #22 b3 is ON)	
#113	CH3 maximum value (valid while BFM #22 b3 is ON)	
#114	CH4 maximum value (valid while BFM #22 b3 is ON)	
⋮	Reserved	—
#119	Maximum value reset	K0
⋮	Reserved	—

<table>
<tr><th>BFM No.</th><th colspan="2">Description</th><th>Initial value</th></tr>
<tr><td>#198</td><td colspan="2">Data history sampling time
[Effective only for channels whose number of averaging times (BFM #2 to #5) is 1 and digital filter setting (BFM #6 to #9) is 0]
Setting range: 0 to 30,000 ms</td><td>K0</td></tr>
<tr><td>#199</td><td colspan="2">Resets or stops data history.
[Effective only for channels whose number of averaging times (BFM #2 to #5) is 1 and digital filter setting (BFM #6 to #9) is 0]</td><td>K0</td></tr>
<tr><td>#200</td><td>CH1 data history (1st value)</td><td rowspan="3">Data history sampling is effective only for channels whose number of averaging times (BFM #2 to #5) is 1 and digital filter setting (BFM #6 to #9) is 0.</td><td>K0</td></tr>
<tr><td>⋮</td><td>⋮</td><td>⋮</td></tr>
<tr><td>#1799</td><td>CH4 data history (400th value)</td><td>K0</td></tr>
</table>

6.2 Details of buffer memories

BFM #0: Specifies input mode.

Specify the input mode of CH1 to CH4 by writing a numeric value to BFM #0.
The input mode specification declares, each BFM expressed as a 4-digit hexadecimal code, and each channel No. is assigned to each digit. Specify a numeric value 0 to F in each digit for each channel.

BFM#0
H○○○○ — CH1, CH2, CH3, CH4

○=0: Voltage input mode (-10 to 10V → -32000 to 32000), resolution 0.32mV
○=1: Voltage input mode (-10 to 10V → -4000 to 4000), resolution 2.50mV
○=2: Voltage input mode (-10 to 10V → -10000 to 10000), resolution 1mV
○=3: Current input mode (4 to 20mA → 0 to 16000), resolution 1.25 µA
○=4: Current input mode (4 to 20 mA → 0 to 4000), resolution 5.00 µA
○=5: Current input mode (4mA to 20mA → 4000 to 20000), resolution 1.25 µA
○=6: Current input mode (-20 to 20 mA → -16000 to 16000), resolution 1.25 µA
○=7: Current input mode (-20 to 20 mA → -4000 to 4000), resolution 5.00 µA
○=8: Current input mode (-20 to 20 mA → -20000 to 20000), resolution 1.25 µA
○=9 to E: Unusable
○=F: Corresponding CH is not used.

- The input characteristics are changed automatically according to the setting of BFM #0. (The input characteristics can be changed to independent values except when ○=2, 5, 8 is set in BFM #0 that disables all changes to the offset or gain.)
- It takes approximately 5 seconds to change the input mode (to change each set value).
  Time interval of 5 seconds or more after changing the input mode until the write of each setting (TO instruction) is performed.
- Setting "HFFFF" to allocate all channels as unusable is not allowed.

BFM #2 to BFM #5: Number of averaging times

(Make sure to set the number of averaging times to "1" when using the digital filer.)
The allowable set range of the number of averaging times is 1 to 4,095.
If the number of averaging times is set to "1", the immediate data (current value) is stored in BFM #10 to #13. Otherwise, BFM #10 to BFM #13 will be averaged depending on the value set in BFM #2 to BFM #5.
If the number of averaging times is set to "0" or less, "0" is written. If the number of averaging times is set to "4,096" or more, "4096" is written. In either case, number of averaging times setting error (BFM #29 b10) occurs. The initial set value is "1".

Average data update

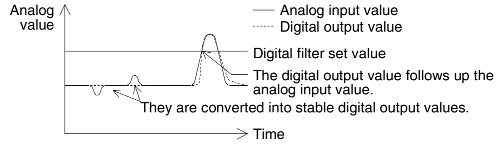
- When the number of averaging times (BFM #2 to BFM #5) is set to "400" or less, the average (BFM #10 to BFM #13) is updated every time the A/D conversion processing is performed.
  The update time is as follows:
  Average data update time = (A/D conversion time) x Number of channels
- When the number of averaging times (BFM #2 to BFM #5) is set to "401" or more, the average (BFM #10 to BFM #13) is updated every time the A/D conversion is performed by as many as the set number of averaging times.
  The update time is as follows:
  Average data update time = (A/D conversion time) x Number of channels x Number of averaging times

In either case above, until the number of A/D conversion times reaches the set number of averaging times for the first time, the average at each time point is stored in BFM #10 to BFM #13.

BFM #6 to BFM #9: Digital filter setting

(Effective only when the number of averaging times is set to "1")
Setting BFM #6 to BFM #9 to "1" invokes, the digital filter which can be provided for each channel. If the fluctuation of the analog input value is less than the set value of BFM #6 to #9, the analog input value is converted into a stabilized digital output value. If the analog input value exceeds the set value, the proceeding digital conversion value will follow and replicate there values. The data is updated every "5ms x Number of channels", and stabilized by the last 20 data.

By this function, unstable analog values can be converted into stable digital values.



The table below shows the relationship between the set value of BFM #6 to #9 and the operation.

Set value < 0	Digital filter function is invalid. Set value error occurs (BFM #29 b11 turns ON.).
Set value = 0	Digital filter function is invalid.
1 ≤ Set value ≤ 1,600	Digital filter function is valid.
1,600 < Set value	Digital filter function is invalid. Set value error occurs (BFM #29 b11 turns ON.).

BFM #10 to BFM #13: Channel data

The A/D conversion data for each channel is written to BFM #10 to #13.

BFM #19: Disables setting change

BFM #19 enables or disables the setting change of the I/O characteristics (BFM #0, #41 to #44, #51 to #54), the convenient functions (BFM #22).
K1: Enables change (factory default).
K2: Disables change.

BFM #20: Initializes functions

BFM #20 initializes all data stored in BFM #0 to BFM #1799, and sets the FX2NC-4AD to factory default.
By initialization, the input characteristics are reset to the values set at factory default (voltage input, offset value K0, gain value K5000).
K0: Normal
K1: Executes initialization. (Writes K1, subsequently returns to K0 when initialization is completed.)

BFM #21: Writes I/O characteristics

Each channel No. is assigned to the lower 4 bits of BFM #21.
When a bit is set to ON, the offset data (BFM #41 to BFM #44) and the gain data (BFM #51 to BFM #54) of the assigned channel No. are written to the built-in memory (EEPROM).
Give the write command to two or more channels at a time. (When entering "HF", all channels are written to.)
When the write is completed, BFM #21 subsequently returns to K0.

BFM21
b15, b14, b13, b12, b11, b10, b9, b8, b7, b6, b5, b4, b3, b2, b1, b0
Invalid (b15 to b4); b3: CH4, b2: CH3, b1: CH2, b0: CH1

BFM #22: Sets convenient functions

The functions described below are assigned to b0 to b3 of BFM #22. When a bit is set to ON, the assigned function becomes valid.
When a bit is set to OFF, the assigned function becomes invalid.

b0: Data addition function
The data (BFM #10 to BFM #13), minimum/maximum value (BFM #101 to BFM #104, BFM #111 to BFM #114) and data history (BFM #200 to BFM #1799) of each channel is the measured value added by the addition data (BFM #61 to BFM #64).
When using this function, enter the value added by the addition data (BFM #61 to BFM #64) to the lower limit value error set value (BFM #71 to BFM #74) and the upper limit value error set value (BFM #81 to BFM #84).
The addition data (BFM #61 to BFM #64) is not added to the scale over data (BFM #28).

b1: Upper/lower limit value detection function
When the A/D conversion data of each channel is outside the range of the lower limit value error set value (BFM #71 to BFM #74) to the upper limit value error set value (BFM #81 to BFM #84), the result is written to the upper/lower limit value error status (BFM #26).

b2: Sudden change detection function
When the data (BFM #10 to BFM #13) of each channel is updated, if the difference between the previous value and the new value is larger than the sudden change detection set value (BFM #91 to BFM #94), the result is written to the sudden change detection status (BFM #27).

b3: Minimum/maximum value hold function
The minimum value of the data (BFM #10 to BFM #13) of each channel is written to BFM #101 to BFM #104, and the maximum value is written to BFM #111 to BFM #114.

BFM #26: Upper/lower limit error status

The upper /lower limit value detection function (BFM#22 b1), writes detected errors to the corresponding bits in BFM#26 (see table). Upper and lower limit error status for the four channels is located in bit-pairs in the first 8bits of BFM#26.
When the data (BFM #10 to BFM #13) of any channel is outside the range from the lower limit error value (BFM #71 to BFM #74) to the upper limit error value (BFM #81 to BFM #84), the corresponding bit turns ON.
When a bit turns ON, it remains ON until it is reset by BFM #99 or the power is turned OFF.

Even while an upper/lower limit value error is detected, the data (BFM #10 to BFM #13) of each channel continues to be updated.
Bit assignment of **BFM #26**

Bit No.	Channel No.	Description
b0	CH1	Lower limit error
b1		Upper limit error
b2	CH2	Lower limit error
b3		Upper limit error
b4	CH3	Lower limit error
b5		Upper limit error
b6	CH4	Lower limit error
b7		Upper limit error

BFM #27: A/D data sudden change detection status

The sudden change detection function (BFM#22 b2) writes detected errors to the corresponding bits in BFM#27. The sudden change detection status for negative or positive changes is located in the first 8bits of BFM#27 in bit-pairs.
When the data (BFM #10 to BFM #13) of each channel is updated, if the difference between the previous value and the new value is larger than the sudden change detection set value (BFM #91 to BFM #94), the corresponding bit in BFM #27 turns ON.
At this time, when the new value is larger than the previous value, a bit for the + direction turns ON. when the new value is smaller than the previous value, a bit for the - direction turns ON.
When a bit turns ON, it remains ON until it is reset by BFM #99 or the power is turned OFF.
Even while a sudden change error is detected, the data (BFM #10 to BFM #13) of each channel continues to be updated.
Bit assignment of **BFM #27**

Bit No.	Channel No.	Description
b0	CH1	Sudden change error in - direction
b1		Sudden change error in + direction
b2	CH2	Sudden change error in - direction
b3		Sudden change error in + direction
b4	CH3	Sudden change error in - direction
b5		Sudden change error in + direction
b6	CH4	Sudden change error in - direction
b7		Sudden change error in + direction

BFM #28: Scale over status

The result of the analog input value for each individual channel that has exceeded the A/D conversion range will be written to BFM#28.
Range in which A/D conversion is available:

Voltage input mode	Current input mode
- 10.2V to 10.2V	- 20.4mA to 20.4mA

A bit will remain ON unless it is reset from switching the Power OFF or overwriting the ON bit with an OFF bit via a TO instruction.
Even while a scale over error is detected, the data (BFM #10 to BFM #13) of each channel continues to be updated.
Bit assignment of **BFM #28**

Bit No.	Channel No.	Description
b0	CH1	Scale over: Less than lower limit
b1		Scale over: More than upper limit
b2	CH2	Scale over: Less than lower limit
b3		Scale over: More than upper limit
b4	CH3	Scale over: Less than lower limit
b5		Scale over: More than upper limit
b6	CH4	Scale over: Less than lower limit
b7		Scale over: More than upper limit

BFM #29: Error status

Error information is assigned to each bit of BFM #29.
Bit assignment of **BFM #29**

Bit No.	Assignment	Description
b0	Error detected	b0 is ON while either b2 to b4 is ON.
b1	—	—
b2	Power error	24V DC power is not correctly supplied. Check the wiring and supply voltage.
b3	Hardware error	FX2NC-4AD may have malfunctioned. Contact the nearest Mitsubishi Electric System Service center.
b4	A/D conversion value error	A/D conversion value is abnormal. Using the scale over data (BFM #28), check the channel in which the error has occurred.
b5	—	—
b6	BFM read/write disabled	This bit will be ON during the input characteristics change processing. While this bit is ON, correct A/D data will not read from or written to BFMs.
b7	—	—
b8	Set value error detected	This bit will be ON while either b9 to b15 is ON.
b9	Input mode setting error	Input mode (BFM #0) is incorrectly set. Set it within the range from 0 to 8.
b10	Number of averaging times setting error	Number of averaging times is incorrectly set. Set it within the range from 1 to 4,095.
b11	Digital filter setting error	The digital filter setting is incorrect. Reset within the range of 0 to 1,600.
b12	Sudden change detection set value error	Sudden change detection set value is incorrect. Set a correct value.
b13	Upper/lower limit set value error	Upper/lower limit set value is incorrect. Set a correct value.
b14	—	—
b15	Addition data setting error	Addition data is incorrectly set. Set it within range from -16,000 to 16,000.

BFM #30: Model code

BFM #30 stores a fixed value of "K2070".

BFM #32: Operating time

BFM #32 stores the continuous operating time for the FX2NC-4AD.
Measurement starts when the power is turned ON, and the measured value is reset when the power is turned OFF.
The measurement range is from 0 to 64,800 (s). After that, 64,800 is kept.

BFM #41 to BFM #44: Offset data
BFM #51 to BFM #54: Gain data

Offset data: Analog input value when the digital value is "0"
Gain data : Analog input value when the digital value is as shown below (The digital value varies depending on the setting of the input mode.)
Standard digital value for offset and gain in each input mode
(A number in the input mode column indicates a value set in BFM #0.)

Input mode (BFM #0)	0	1	2	3	4	5	6	7	8
Standard offset value	0	0	-	0	0	-	0	0	-
Standard gain value	16000	2000	-	16000	4000	-	16000	4000	-

- Set the offset and gain data for each channel.
- Write the set value in units of "mV" for voltage input or "μA" for current input.
- Do not change the input characteristics when ○=2, 5, 8 is set in BFM #0. (Even if a numerical value is written, it is ignored.)

Initial offset/gain value (Unit: mV for voltage input, μA for current input)

Input mode (BFM #0)	0	1	2	3	4	5	6	7	8
Initial offset value	0			4000			0		
Initial gain value	5000			20000					

Setting range

	Voltage input	Current input
Offset data	-1000 to 9000 (mV)	-20000 to 17000 (μA)
Gain data	Gain value - Offset value = 1,000 to 10,000 (mV)	Gain value - Offset value = 3,000 to 30,000 (μA)

The actual effective input range is "-10 to 10 V" or "-20 to 20 mA".

BFM #61 to BFM #64: Addition data

When using the data addition function (BFM #22 b0), data (BFM #10 to BFM #13), minimum/maximum value (BFM #101 to BFM #104, BFM #111 to BFM #114) and data history (BFM #200 to BFM #1799) of each channel becomes the measured value added by the addition data (BFM #61 to BFM #64).
When using the data addition function, enter the value added by the addition data (BFM #61 to BFM #64) to the lower limit value error set value (BFM #71 to BFM #74) and the upper limit value error set value (BFM #81 to BFM #84).
Setting range: -16,000 to 16,000

BFM #71 to BFM #74: Lower limit, error set value
BFM #81 to BFM #88: Upper limit, error set value

When using the upper/lower limit value detection function (BFM #22 b1), write the lower limit value of each channel to BFM #71 to BFM #74 and the upper limit value of each channel to BFM #81 to BFM #84.
When using the data addition function (BFM #22 b0), enter the value added by the addition data to BFM #61 to BFM #64.
Setting range
The setting range will vary depending on the setting of the input mode (BFM #0). The table below shows the setting range for each input mode. Enter the set value as a digital value.

Input mode (BFM #0)	Setting range	Initial value	
		Lower limit	Upper limit
0: Voltage input mode (-10 to 10 V → -32000 to 32000)	-32768 to 32767	-32768	32767
1: Voltage input mode (-10 to 10 V → -4000 to 4000)	-4096 to 4095	-4096	4095
2: Voltage input mode (-10 to 10 V → -10000 to 10000)	-10200 to 10200	-10200	10200
3: Current input mode (4 to 20 mA → 0 to 16000)	-1 to 16383	-1	16383
4: Current input mode (4 to 20 mA → 0 to 4000)	-1 to 4095	-1	4095
5: Current input mode (4 to 20 mA → 4000 to 20000)	3999 to 20400	3999	20400
6: Current input mode (-20 to 20 mA → -16000 to 16000)	-16384 to 16383	-16384	16383
7: Current input mode (-20 to 20 mA → -4000 to 4000)	-4096 to 4095	-4096	4095
8: Current input mode (-20 to 20 mA → -20000 to 20000)	-20400 to 20400	-20400	20400

BFM #91 to BFM #94: Sudden change detection set value

When using the sudden change detection function (BFM #22 b2), enter the set value to judge the sudden change.
When the data (BFM #10 to BFM #13) of each channel is updated, if the difference between the previous value and the new value is larger than the sudden change detection set value (BFM #91 to BFM #94), the result is written to the sudden change detection status (BFM #27).
Setting range
The setting range will vary depending on the setting of the input mode (BFM #0). The table below shows the setting range for each input mode.
Write the set value in a digital value.

Input mode (BFM #0)	Setting range	Initial value
0: Voltage input mode (-10 to 10 V → -32000 to 32000)	1 to 32767	3200
1: Voltage input mode (-10 to 10 V → -4000 to 4000)	1 to 4095	400
2: Voltage input mode (-10 to 10 V → -10000 to 10000)	1 to 10000	1000
3: Current input mode (4 to 20 mA → 0 to 16000)	1 to 8191	800
4: Current input mode (4 to 20 mA → 0 to 4000)	1 to 2047	200
5: Current input mode (4 to 20 mA → 4000 to 20000)	1 to 8191	800
6: Current input mode (-20 to 20 mA → -16000 to 16000)	1 to 16383	1600
7: Current input mode (-20 to 20 mA → -4000 to 4000)	1 to 4095	400
8: Current input mode (-20 to 20 mA → -20000 to 20000)	1 to 20000	2000

BFM #99: Clears upper/lower limit value error and sudden change detection error

The commands to clear the lower and upper limit value error and the sudden change detection error are assigned to the lower three bits of BFM #99.
The flag of the corresponding error status (BFM #26, BFM #27) is reset for all channels simultaneously when a bit is set to ON.
After the reset is finished, each bit of BFM #99 returns automatically to the OFF state.
The setting of two or more clear commands to ON at the same time is possible.

Bit assignment of BFM #99

Bit No.	Description
b0	Clears lower limit error.
b1	Clears upper limit error.
b2	Clears sudden change detection error.
b3 to b15	Unusable

BFM #101 to BFM #104: Minimum value
BFM #111 to BFM #114: Maximum value

When using the minimum/maximum value hold function (BFM #22 b3), the minimum value of the data (BFM #10 to BFM #13) of each channel is written to BFM #101 to BFM #104, and the maximum value is written to BFM #111 to BFM #114.
When using the data addition function (BFM #22 b0), the minimum/maximum measured value will be added to the addition data (BFM #61 to BFM #64).
Initial value
Minimum/maximum value hold function is not used:K0
Minimum/maximum value hold function is used: Digital value when the power is turned ON

BFM #109: Minimum value reset
BFM #119: Maximum value reset

When using the minimum/maximum value hold function (BFM #22 b3), BFM #109 clears the minimum value stored in BFM #101 to BFM #104, and BFM #119 clears the maximum value stored in BFM #111 to BFM #114.
The channel No. that will be reset is assigned to each bit of BFM #109 and BFM #119. When a bit is set ON, minimum/maximum value of the assigned channel is cleared. (Setting two or more bits ON simultaneously is possible.)
Bit assignment

BFM #109

Bit No.	b15 to b4	b3	b2	b1	b0
Channel No. (BFM No.)	Unusable	CH4 (#104)	CH3 (#103)	CH2 (#102)	CH1 (#101)

BFM #119

Bit No.	b15 to b4	b3	b2	b1	b0
Channel No. (BFM No.)	Unusable	CH4 (#114)	CH3 (#113)	CH2 (#112)	CH1 (#111)

BFM #198: Data history sampling time

Set the data history sampling time.
Setting range: 0 to 30,000 ms
Sampling cycle
When the set value is "0" :1 ms x Number of effective channels
When the set value is "1" or more:Set value (ms) x Number of effective channels

BFM #199: Resets or stops data history

The data history reset function is assigned to the lower 4 bits of BFM #199.
The data history stop function is assigned to the upper 4 bits of BFM #199.
Data history reset function
This function clears the sampled data history for each channel.
The channel No. to be reset is assigned to each of the lower 4 bits of BFM #199.
When a bit is set to ON, the data history (all contents from the 1st value to the 400th value) of the assigned channel is cleared. (The setting of two or more bits to ON simultaneously is possible.)
When the clear operation is completed, each bit returns automatically to the OFF state.
Assignment of lower 4 bits

Bit No.	b7 to b4	b3	b2	b1	b0
Channel No.	Unusable	CH4	CH3	CH2	CH1

Data history stop function
This function will temporarily stop the data history for the individual channels. The channel No. to be temporarily stopped is assigned to each of the upper 4 bits of BFM #199. When a bit is set to ON, sampling of the data history of the assigned channel is temporarily stopped. (Setting two or more bits to ON at a time.)
When a bit is set to OFF, sampling of the data history of the assigned channel restarts.
Assignment of upper 4 bits

Bit No.	b15 to b12	b11	b10	b9	b8
Channel No.	Unusable	CH4	CH3	CH2	CH1

BFM #200 to BFM #1799: Data history

The A/D conversion value of each channel is sampled, and written to the BFMs shown below. The table below shows the assignment between the channel No. and the BFM No. Data is stored in ascending order of the BFM No.

Up to 400 data history items are written for each channel. When the number of history items exceeds 400, the data is overwritten starting from the smallest BFM No.

The data history function is valid only for channels whose number of averaging times (BFM #2 to #5) is set to "1" and digital filter setting (BFM #6 to #9) is set to "0".

Assignment of channel No. and BFM No.

Channel No.	BFM No.				
	1st value	2nd value	3rd value	•••••	400th value
CH1	#200	#201	#202	•••••	#599
CH2	#600	#601	#602	•••••	#999
CH3	#1000	#1001	#1002	•••••	#1399
CH4	#1400	#1401	#1402	•••••	#1799

- If a considerable amount of data history is read from the PLC main unit using a FROM instruction, a watch dog timer error occurs in the PLC main unit.
  In such a case, divide the required data history using multiple FROM instructions, and insert the WDT instruction (watch dog timer refresh instruction) after each FROM instruction.

7. Adjustment of I/O Characteristics

For factory default, the FX2NC-4AD has standard I/O characteristics in accordance with each input mode (BFM #0).

In the voltage and current input mode, adjust the standard I/O characteristics for each channel. (Do not change the input characteristics when 2, 5, 8 is set in BEM #0.)

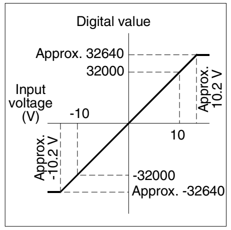
7.1 Standard I/O characteristics

The input mode of the standard I/O characteristics is abbreviated as shown below:

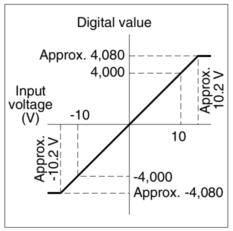
0. Voltage input, -10 to 10V, -32,000 to 32000
① ② ③ ④

①: Input mode set in BFM #0 ②: Input mode
③: Analog input range ④: Digital output range

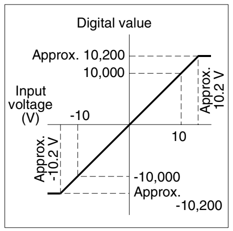
0. Voltage input, -10 to 10 V, -32,000 to 32000



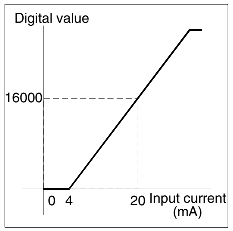
1. Voltage input, -10 to 10 V, -4000 to 4000



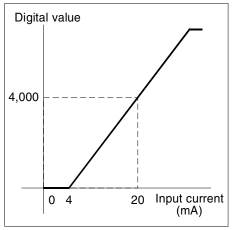
2. Voltage input, -10 to 10V, -10,000 to 10,000



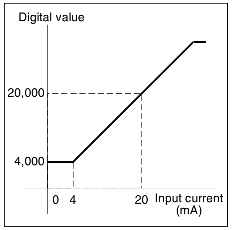
3. Current input, 4 to 20 mA, 0 to 16000



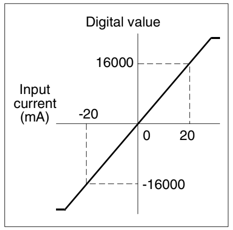
4. Current input, 4 to 20 mA, 0 to 4000



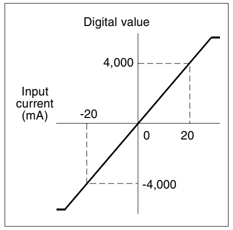
5. Current input, 4 to 20mA, 4,000 to 20,000



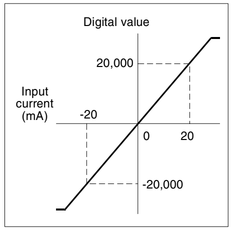
6. Current input, -20 to 20 mA, -16000 to 16000



7. Current input, -20 to 20 mA, -4000 to 4000



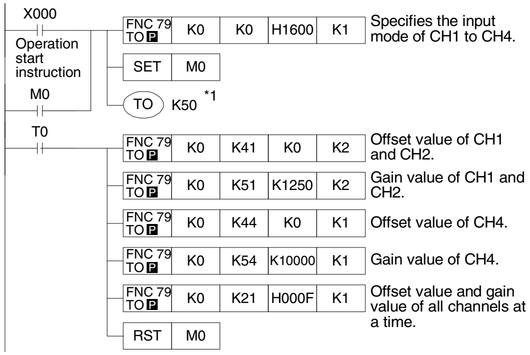
8. Current input, -20 to 20mA, -20,000 to 20,000



7.2 Adjustment of I/O characteristics

Adjust the I/O characteristics using the buffer memories in the FX2NC-4AD.
Firstly, enter the input mode to BFM #0, then enter the offset data to BFM #41 to BFM #44, subsequently enter the gain data to BFM #51 to BFM #54.
Update the offset data and the gain data for each channel using BFM #21.

Example program (Adjustment of CH1, CH2 and CH4)



*1 It takes approximately 5 seconds to change the input mode (BFM #0) (to change each set value).
Assure that a time interval of 5 seconds or more is held after a change of the input mode until execution of write of each setting (TO instruction).

- The I/O characteristics can be written (BFM #21) to either channel, or two or more channels simultaneously.

8. Example program

This section introduces an example program to read analog data from the FX2NC-4AD and connecting to digital data in the PLC.

Condition

System configuration:
The FX2NC-4AD is connected as a special function block nearest to the FX2NC Series PLC main unit (unit No. 0).

Input mode:
CH1 and CH2: Mode 0 (voltage input, -10 to 10 V → -32000 to 32000)
CH3 and CH4: Mode 3 (current input, 4 to 20 mA → 0 to 16000)

Number of averaging times: 1 (initial value) in each channel

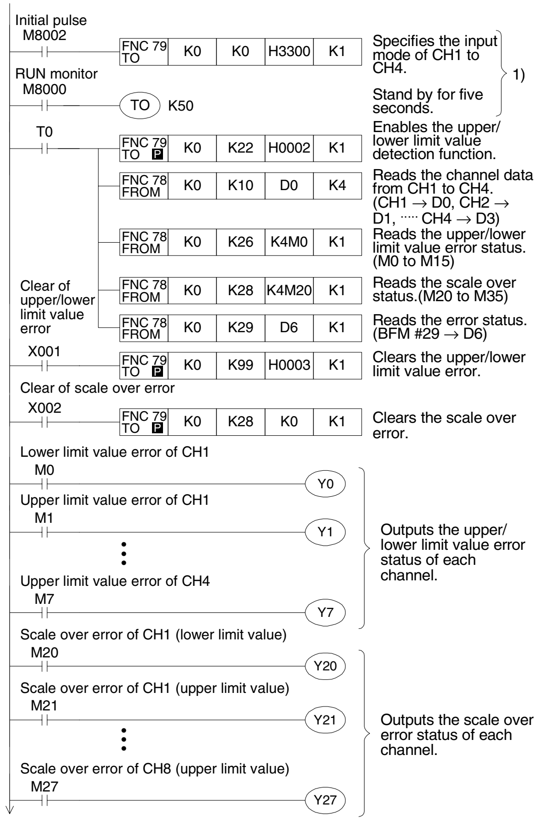
I/O characteristics:
Standard I/O characteristics (initial value) in each channel

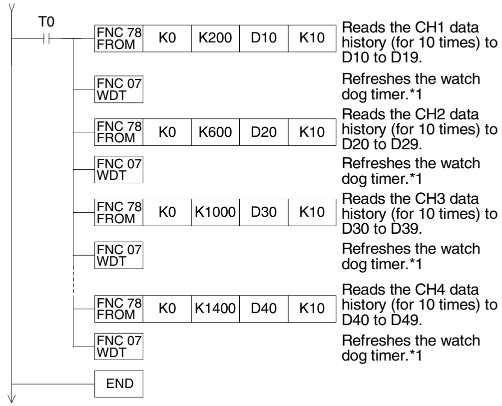
Convenient function: Upper/lower limit value detection function is used.

Data history function:
Used while sampling time is set to 0ms (initial value).
CH1 to CH4: Sampling time = 1ms × 4 (Number of effective channels) = 4ms

I/O assignment:
X001 : Clears the upper/lower limit value error.
X002 : Clears the scale over error.
Y000 to Y017: Output the upper/lower limit value error status of each channel.
Y020 to Y037: Output scale over status of each channel.

Example program





1) The input mode setting will be kept by the EEPROM, therefore, continual channel settings is not needed after powering down.

*1 When multiple data history items are read, the scan time of the PLC becomes longer.
In the FX2NC Series PLC, when the scan time exceeds 200 ms, the CPU error indicator lamp lights and the PLC stops.
When reading many data history items, divide data history items to be read using two or more FROM instructions, then insert the WDT (watch dog timer refresh) instruction between FROM instructions.

MITSUBISHI ELECTRIC CORPORATION
HEAD OFFICE : MITSUBISHI DENKI BLDG MARUNOUTI TOKYO 100-8310
HIMEJI WORKS : 840, CHIYODA CHO, HIMEJI, JAPAN

MITSUBISHI *Changes for the Better*

FX2NC-4AD Analog input block

Thank you very much for purchasing this product.

In order to handle the product properly please read this manual thoroughly before starting to use the product.

User's Manual

MODEL	FX2NC-4AD
MANUAL Number	JY997D07801A
Date	June 2003

Guidelines for the Safety of the User and Protection of the FX2NC-4AD special function block.

This manual should be used by trained and competent personnel. The definition of such a person or persons is as follows:

a) Any engineer using the product associated with this manual, should be of a competent nature, trained and qualified to the local and national standards. These engineers should be fully aware of all aspects of safety with regards to automated equipment.

b) Any commissioning or service engineer must be of a competent nature, trained and qualified to the local and national standards.

c) All operators of the completed equipment should be trained to use this product in a safe and coordinated manner in compliance to established safety practices.

Note: The term `completed equipment' refers to a third party constructed device which contains or uses the product associated with this manual.

●Note concerning the CE marking●

CE marking does not guarantee that an entire mechanical module produced in accordance with the contents of the notification comply with the following standards. Compliance to EMC standards of the entire mechanical module should be checked by the user / manufacturer.

Standards with which this product complies
Type : Programmable Controller (Open Type Equipment)
Models : Products manufactured starting April 1st, 2003.

Electromagnetic Compatibility Standards (EMC)	Remark
EN61000-6-4:2001 Electromagnetic compatibility -Generic standards - Emission standard for Industrial environment	Compliance with all relevant aspects of the standard. (Radiated Emissions and Mains Terminal Voltage Emissions)
EN61000-6-2:2001 Electromagnetic compatibility -Generic standards Immunity for industrial environments.	Compliance with all relevant aspects of the standard. (RF immunity, Fast transients, ESD, Conducted, Surges, Power magnetic fields, Voltage dips and Voltage interruptions)

For more details please contact the local Mitsubishi Electric sales site.
- Notes for compliance to EMC regulation.
It is necessary to install the FX2NC-4AD in a shielded metal control panel.
For further information manual concerning the FX Series, refer to the following table.

List of Further Information Manuals

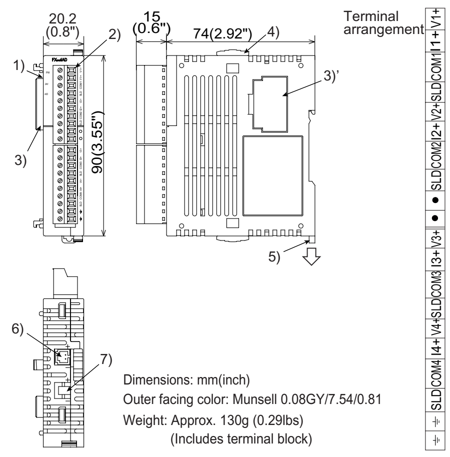
Manual Name	Manual No.	Description
FX2NC Hardware Manual	JY992D76401	This manual contains hardware explanations of wiring, installation and specifications for the FX2NC Series programmable controllers.
FX Programming Manual II	JY992D88101	This manual contains instruction explanations for the FX1S, FX1N, FX2N and FX2NC Series programmable controllers.

1. Introduction

The FX2NC-4AD analog input block (hereafter referred to as "FX2NC-4AD") converts 4 points of analog input values (voltage and current inputs) into digital values, and transfers them to the PLC main unit.
The FX2NC-4AD can be connected to the FX2NC Series PLC.

1) A combination of voltage and current analog inputs selectable via the PLC TO instruction should be used to configure the individual input channels.
2) The voltage input range can be selected within -10 to 10V, alternatively, the current input range can be selected within -20 to 20mA and 4 to 20mA. The input characteristics can be adjusted for each channel (except when ○=2, 5, 8 is set in BFM #0 that disables all changes to the offset or gain).
3) The resolution is 0.32 mV (20 V $\times$ 1/64,000) or 2.50 mV (20 V $\times$ 1/8,000) when voltage input is used, and 1.25 µA (40 mA $\times$ 1/32,000) or 5.00 µA (40 mA $\times$ 1/8,000) when current input is used.
4) Data transfer with the PLC is performed via the buffer memories of the FX2NC-4AD using FROM/TO instructions.

2. External Dimensions and Part Name



Accessory: Special function block number label, Power crossover cable FX2NC-10BPCB1

1) Status indicator LED
2) Terminal connector (European type)
3),3)' Extension port
4) Slide lock for extension block
5) DIN rail clip
6) Power supply connector (24V DC)
7) Power supply connector (Supply for extension block)

The connector 3)' is equipped with a cover.

- Never wire the ● terminals.

• Status indicator LED

Indication	Description
PW	Lit while 5 V power is normally supplied from PLC.
24 V	Lit while 24 V power is normally supplied to the "24+" and "24-" power supply connector of the FX2NC-4AD.
A/D	Flashes during A/D conversion.

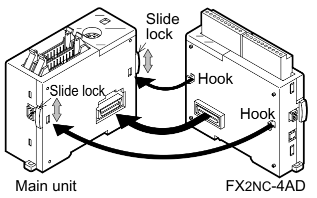
• Install the FX2NC-4AD on the right side of the main unit, extension block or special function block of the FX2NC Series PLC.

• DIN rail installation
The FX2NC-4AD can be installed on DIN rail DIN46277 (width: 35mm (1.38")). When removing the FX2NC-4AD, push downward on the DIN rail attachment hook.

For further details, refer to the Handy Manual packed together with on the PLC main unit.

3. PLC Connection

When connecting the FX2NC-4AD to the FX2NC Series main unit or extension block, remove the extension port cover from the right side of the main unit or extension block, keep the slide lock in the main unit or extension block pulled upward, then align the hook in the FX2NC-4AD with the mounting hole in the former step of the main unit or extension block.



Then push the slide lock downward to fix the FX2NC-4AD. When connecting two or more FX2NC-4AD units, connect an FX2NC-4AD unit to another FX2NC-4AD unit in the same way.
Up to four special function blocks or special function units in total can be connected to the FX2NC Series PLC including those connected to the FX2NC-CNV-IF.
For each connected special function block or special function unit, a unit number is assigned starting with 0 for the special function block and special function unit nearest to the main unit.
From the main unit, use FROM/TO instructions to read or write data stored in the FX2NC-4AD.

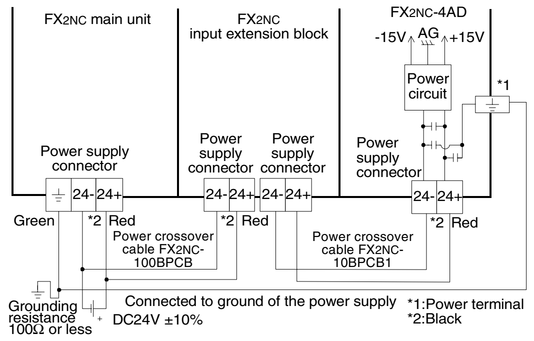
4. Wiring

4.1 Power supply wiring

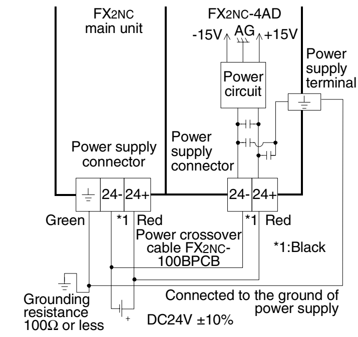
Supply power (24V DC) to the FX2NC-4AD from the power supply connector. When using the power supply connector, the following power cables are available.

Power cables
FX2NC-10BPCB1:
Power crossover cable (offered as an accessory for the FX2NC-4AD)
FX2NC-100BPCB:
Power cable (offered as an accessory for the FX2NC Series main unit)

1) Connection example with the power supply through crossover wiring to the FX2NC input extension block



2) Connection example to the external power supply

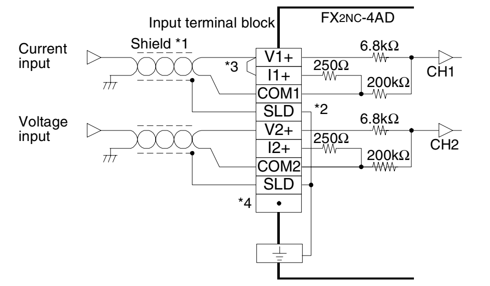


• Connect the " ⏚ " terminal together with the ground terminal of the PLC main unit to the ground of the power supply equipped with grounding resistance of 100Ω or less.

• For crossover wiring to the next block of the FX2NC-4AD, remove the resin cover from the power crossover connector.

4.2 Input wiring

For terminal arrangement, refer to Chapter 2 of this manual.



*1 When wiring the analog output cable, use a shielded two-core twisted cable, and separate it from other power cables and cables easily affected by induction.
*2 The SLD terminal is connected to the " ⏚ " terminal inside the FX2NC-4AD.
*3 For current input, short-circuit the VO+ terminal and the IO+ terminal (O: Input channel No.).
*4 Do not wire the " ● " terminal.

Terminal connector handling
The FX2NC-4AD is equipped with a terminal connector whose form is equivalent to that of the terminal connector type FX2NC PLC.
For the specifications of the suggested screwdriver, the dimensions of the cable terminal, the external dimensions of the bar terminal equipped with insulating sleeve, and applicable wiring, please refer to the FX2NC Handy Manual.

5. Specifications

5.1 General specifications

The general specifications are equivalent to those of the PLC main unit. (Please refer to the FX2NC Handy Manual.)

5.2 Power supply specifications

Item	Specifications
Analog circuits	24V DC±10%, 130 mA, externally supplied.
Digital circuits	5V DC, 50 mA, supplied from the PLC main unit using an extension port.

5.3 Performance specifications

Item	Specifications
Conversion speed	1 ms x Number of used channels
Isolated method	Photocoupler isolated analog input area from PLC. Trans isolated power supply from analog I/O. Channels are not isolated from each other.
Number of occupied I/O points	8 points (including input and output points)
Applicable PLC	FX2NC Series PLC (Up to four units can be connected including special function blocks and special function units connected to FX2NC-CNV-IF.)
Built-in memory	EEPROM

5.4 Voltage/current input specifications

Item	Voltage input	Current input
Analog input range	-10 to 10V DC (input resistance: 200 kΩ) Adjustment is enabled with the following conditions: Offset value: -10 to 9 V Gain value: 10 V or less "Gain - Offset": > 1 V (except when ○=2, 5, 8 is set in BFM #0 that disables all changes to the offset or gain.) Maximum absolute input: ±15 V	-20 to 20 mA DC, 4 to 20 mA DC (input resistance: 250 Ω) Adjustment is enabled with the following conditions: Offset value: -20 to 17 mA Gain value: 30 mA or less "Gain - Offset": > 3 mA (except when ○=2, 5, 8 is set in BFM #0 that disables all changes to the offset or gain.) Maximum absolute input: ±30 mA
Digital output	Effective numeric value (15 bits) + Sign (1 bit)	Effective numeric value (14 bits) + Sign (1 bit)
Resolution	0.32 mV (20 V $\times$ 1/64,000) 2.50mV (20 V $\times$ 1/8,000)	1.25 µA (40 mA $\times$ 1/32,000) 5.00 µA (40 mA $\times$ 1/8,000)
Total accuracy	Ambient temperature: 25 °C ± 5 °C ±0.3% (±60 mV) against full scale 20 V Ambient temperature: 0 to +55 °C ±0.5% (±100 mV) against full scale 20 V	Ambient temperature: 25°C ± 5°C ±0.5% (±200 µA) against full scale 40 mA 4 to 20mA input is same (±200 µA) Ambient temperature: 0 to +55°C ±1% (±400 µA) against full scale 40 mA 4 to 20mA input is same (±400 µA)

6. Buffer Memory (BFM)

Data transfer between the FX2NC-4AD and the PLC main unit is performed via buffer memories (hereafter referred to as "BFM") of the FX2NC-4AD.
Each BFM consists of 1 word, 16 bits. BFM No. 0 to 1799 have assigned functionality, communication with these BFMs should be performed using TO/FROM instructions supplied by the PLC main unit.
When the power is switched ON from OFF, the initial value is written to each BFM. Create a program for the PLC so that the desired contents are written to the BFMs every time the power of the PLC is turned ON.
(The contents stored in BFM #0, #19, #22, #41 to #44 and #51 to #54 are held in the built-in EEPROM, and kept against power failure.)

6.1 Buffer Memories (BFM) lists

BFM No.	Description	Initial value
#0	Specifies input mode of CH1 to CH4.	H0000
#1	Reserved	—
#2	Number of averaging times for CH1 Setting range: 1 to 4,095 times	K1
#3	Number of averaging times for CH2 Setting range: 1 to 4,095 times	K1
#4	Number of averaging times for CH3 Setting range: 1 to 4,095 times	K1
#5	Number of averaging times for CH4 Setting range: 1 to 4,095 times	K1
#6	CH1: Digital filter setting Set range: 0 to 1,600	K0
#7	CH2: Digital filter setting Set range: 0 to 1,600	K0
#8	CH3: Digital filter setting Set range: 0 to 1,600	K0
#9	CH4: Digital filter setting Set range: 0 to 1,600	K0
#10	CH1 data (immediate data or average data)	—
#11	CH2 data (immediate data or average data)	—
#12	CH3 data (immediate data or average data)	—
#13	CH4 data (immediate data or average data)	—
⋮	Reserved	—
#19	Disables setting change of I/O characteristics (BFM #0, BFM #1, BFM #21) and convenient functions (BFM #22). Disables change: K2, Enables change: K1	K1
#20	Initializes functions. (Initializes functions at K1, then returns automatically to K0 after initialization is completed.)	K0
#21	Writes I/O characteristics. (Returns automatically to K0 after write of offset/gain value is finished.)	K0
#22	Sets convenient functions (data addition, upper/lower limit value detection, sudden change detection and minimum/maximum value hold).	K0
⋮	Reserved	—
#26	Upper/lower limit value error status (valid while BFM #22 b1 is ON)	K0
#27	A/D data sudden change detection status (valid while BFM #22 b2 is ON)	K0
#28	Scale over status	K0
#29	Error status	K0
#30	Model code (K2070)	K2070
#31	Reserved	—
#32	Operating time 0 to 64,800 (s) Subsequently, 64,800 is kept. Measurement starts when the power is turned on, and the measured value is reset when the power is turned off.	K0
⋮	Reserved	—
#41	CH1 offset data (mV or µA)	K0
#42	CH2 offset data (mV or µA)	K0
#43	CH3 offset data (mV or µA)	K0
#44	CH4 offset data (mV or µA)	K0
⋮	Reserved	—
#51	CH1 gain data (mV or µA)	K5000
#52	CH2 gain data (mV or µA)	K5000
#53	CH3 gain data (mV or µA)	K5000
#54	CH4 gain data (mV or µA)	K5000

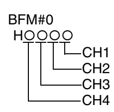
BFM No.	Description	Initial value
⋮	Reserved	—
#61	CH1 addition data Setting range: -16,000 to 16,000 (valid while BFM #22 b0 is ON)	K0
#62	CH2 addition data Setting range: -16,000 to 16,000 (valid while BFM #22 b0 is ON)	K0
#63	CH3 addition data Setting range: -16,000 to 16,000 (valid while BFM #22 b0 is ON)	K0
#64	CH4 addition data Setting range: -16,000 to 16,000 (valid while BFM #22 b0 is ON)	K0
⋮	Reserved	—
#71	CH1 lower limit error set value (valid while BFM #22 b1 is ON)	Minimum digital value inside input range
#72	CH2 lower limit error set value (valid while BFM #22 b1 is ON)	Minimum digital value inside input range
#73	CH3 lower limit error set value (valid while BFM #22 b1 is ON)	Minimum digital value inside input range
#74	CH4 lower limit error set value (valid while BFM #22 b1 is ON)	Minimum digital value inside input range
⋮	Reserved	—
#81	CH1 upper limit error set value (valid while BFM #22 b1 is ON)	Maximum digital value inside input range
#82	CH2 upper limit error set value (valid while BFM #22 b1 is ON)	Maximum digital value inside input range
#83	CH3 upper limit error set value (valid while BFM #22 b1 is ON)	Maximum digital value inside input range
#84	CH4 upper limit error set value (valid while BFM #22 b1 is ON)	Maximum digital value inside input range
⋮	Reserved	—
#91	CH1 sudden change detection set value Setting range: 1 to 50% of full scale (valid while BFM #22 b2 is ON)	5% of full scale
#92	CH2 sudden change detection set value Setting range: 1 to 50% of full scale (valid while BFM #22 b2 is ON)	5% of full scale
#93	CH3 sudden change detection set value Setting range: 1 to 50% of full scale (valid while BFM #22 b2 is ON)	5% of full scale
#94	CH4 sudden change detection set value Setting range: 1 to 50% of full scale (valid while BFM #22 b2 is ON)	5% of full scale
⋮	Reserved	—
#99	Clear of upper and lower limit value error and sudden change detection error	K0
#100	Reserved	—
#101	CH1 minimum value (valid while BFM #22 b3 is ON)	
#102	CH2 minimum value (valid while BFM #22 b3 is ON)	
#103	CH3 minimum value (valid while BFM #22 b3 is ON)	
#104	CH4 minimum value (valid while BFM #22 b3 is ON)	
⋮	Reserved	—
#109	Minimum value reset	K0
#110	Reserved	—
#111	CH1 maximum value (valid while BFM #22 b3 is ON)	
#112	CH2 maximum value (valid while BFM #22 b3 is ON)	
#113	CH3 maximum value (valid while BFM #22 b3 is ON)	
#114	CH4 maximum value (valid while BFM #22 b3 is ON)	
⋮	Reserved	—
#119	Maximum value reset	K0
⋮	Reserved	—

BFM No.	Description		Initial value
#198	Data history sampling time [Effective only for channels whose number of averaging times (BFM #2 to #5) is 1 and digital filter setting (BFM #6 to #9) is 0] Setting range: 0 to 30,000 ms		K0
#199	Resets or stops data history. [Effective only for channels whose number of averaging times (BFM #2 to #5) is 1 and digital filter setting (BFM #6 to #9) is 0]		K0
#200	CH1 data history (1st value)	Data history sampling is effective only for channels whose number of averaging times (BFM #2 to #5) is 1 and digital filter setting (BFM #6 to #9) is 0.	K0
⋮	⋮		⋮
#1799	CH4 data history (400th value)		K0

6.2 Details of buffer memories

BFM #0: Specifies input mode.

Specify the input mode of CH1 to CH4 by writing a numeric value to BFM #0.
The input mode specification declares, each BFM expressed as a 4-digit hexadecimal code, and each channel No. is assigned to each digit. Specify a numeric value 0 to F in each digit for each channel.



○=0: Voltage input mode (-10 to 10V → -32000 to 32000), resolution 0.32mV
○=1: Voltage input mode (-10 to 10V → -4000 to 4000), resolution 2.50mV
○=2: Voltage input mode (-10 to 10V → -10000 to 10000), resolution 1mV
○=3: Current input mode (4 to 20mA → 0 to 16000), resolution 1.25 µA
○=4: Current input mode (4 to 20 mA → 0 to 4000), resolution 5.00 µA
○=5: Current input mode (4mA to 20mA → 4000 to 20000), resolution 1.25 µA
○=6: Current input mode (-20 to 20 mA → -16000 to 16000), resolution 1.25 µA
○=7: Current input mode (-20 to 20 mA → -4000 to 4000), resolution 5.00 µA
○=8: Current input mode (-20 to 20 mA → -20000 to 20000), resolution 1.25 µA
○=9 to E:Unusable
○=F: Corresponding CH is not used.

• The input characteristics are changed automatically according to the setting of BFM #0. (The input characteristics can be changed to independent values except when ○=2, 5, 8 is set in BFM #0 that disables all changes to the offset or gain.)

• It takes approximately 5 seconds to change the input mode (to change each set value).
Time interval of 5 seconds or more after changing the input mode until the write of each setting (TO instruction) is performed.

• Setting "HFFFF" to allocate all channels as unusable is not allowed.

BFM #2 to BFM #5: Number of averaging times

(Make sure to set the number of averaging times to "1" when using the digital filer.)
The allowable set range of the number of averaging times is 1 to 4,095.
If the number of averaging times is set to "1", the immediate data (current value) is stored in BFM #10 to #13. Otherwise, BFM #10 to BFM #13 will be averaged depending on the value set in BFM #2 to BFM #5.
If the number of averaging times is set to "0" or less, "0" is written. If the number of averaging times is set to "4,096" or more, "4096" is written. In either case, number of averaging times setting error (BFM #29 b10) occurs. The initial set value is "1".

Average data update

• When the number of averaging times (BFM #2 to BFM #5) is set to "400" or less, the average (BFM #10 to BFM #13) is updated every time the A/D conversion processing is performed.
The update time is as follows:
Average data update time = (A/D conversion time) x Number of channels

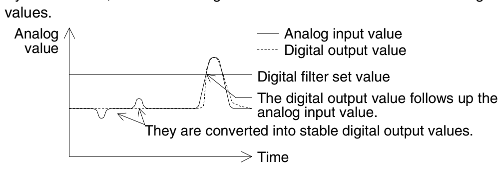
• When the number of averaging times (BFM #2 to BFM #5) is set to "401" or more, the average (BFM #10 to BFM #13) is updated every time the A/D conversion is performed by as many as the set number of averaging times.
The update time is as follows:
Average data update time = (A/D conversion time) x Number of channels x Number of averaging times

In either case above, until the number of A/D conversion times reaches the set number of averaging times for the first time, the average at each time point is stored in BFM #10 to BFM #13.

BFM #6 to BFM #9: Digital filter setting

(Effective only when the number of averaging times is set to "1")
Setting BFM #6 to BFM #9 to "1" invokes, the digital filter which can be provided for each channel. If the fluctuation of the analog input value is less than the set value of BFM #6 to #9, the analog input value is converted into a stabilized digital output value. If the analog input value exceeds the set value, the proceeding digital conversion value will follow and replicate there values. The data is updated every "5ms x Number of channels", and stabilized by the last 20 data.

By this function, unstable analog values can be converted into stable digital values.



The table below shows the relationship between the set value of BFM #6 to #9 and the operation.

Set value < 0	Digital filter function is invalid. Set value error occurs (BFM #29 b11 turns ON.).
Set value = 0	Digital filter function is invalid.
1 ≤ Set value ≤ 1,600	Digital filter function is valid.
1,600 < Set value	Digital filter function is invalid. Set value error occurs (BFM #29 b11 turns ON.).

BFM #10 to BFM #13: Channel data

The A/D conversion data for each channel is written to BFM #10 to #13.

BFM #19: Disables setting change

BFM #19 enables or disables the setting change of the I/O characteristics (BFM #0, #41 to #44, #51 to #54), the convenient functions (BFM #22).
K1: Enables change (factory default).
K2: Disables change.

BFM #20: Initializes functions

BFM #20 initializes all data stored in BFM #0 to BFM #1799, and sets the FX2NC-4AD to factory default.
By initialization, the input characteristics are reset to the values set at factory default (voltage input, offset value K0, gain value K5000).
K0: Normal
K1: Executes initialization. (Writes K1, subsequently returns to K0 when initialization is completed.)

BFM #21: Writes I/O characteristics

Each channel No. is assigned to the lower 4 bits of BFM #21.
When a bit is set to ON, the offset data (BFM #41 to BFM #44) and the gain data (BFM #51 to BFM #54) of the assigned channel No. are written to the built-in memory (EEPROM).
Give the write command to two or more channels at a time. (When entering "HF", all channels are written to.)
When the write is completed, BFM #21 subsequently returns to K0.

BFM21
$\underbrace{b15,\ b14,\ b13,\ b12,\ b11,\ b10,\ b9,\ b8,\ \underline{b7},\ \underline{b6},\ \underline{b5},\ \underline{b4}}_{\text{Invalid}},\ \underset{CH4}{\underline{b3}},\ \underset{CH3}{\underline{b2}},\ \underset{CH2}{\underline{b1}},\ \underset{CH1}{\underline{b0}}$

BFM #22: Sets convenient functions

The functions described below are assigned to b0 to b3 of BFM #22. When a bit is set to ON, the assigned function becomes valid.
When a bit is set to OFF, the assigned function becomes invalid.

b0: Data addition function
The data (BFM #10 to BFM #13), minimum/maximum value (BFM #101 to BFM #104, BFM #111 to BFM #114) and data history (BFM #200 to BFM #1799) of each channel is the measured value added by the addition data (BFM #61 to BFM #64).
When using this function, enter the value added by the addition data (BFM #61 to BFM #64) to the lower limit value error set value (BFM #71 to BFM #74) and the upper limit value error set value (BFM #81 to BFM #84).
The addition data (BFM #61 to BFM #64) is not added to the scale over data (BFM #28).

b1: Upper/lower limit value detection function
When the A/D conversion data of each channel is outside the range of the lower limit value error set value (BFM #71 to BFM #74) to the upper limit value error set value (BFM #81 to BFM #84), the result is written to the upper/lower limit value error status (BFM #26).

b2: Sudden change detection function
When the data (BFM #10 to BFM #13) of each channel is updated, if the difference between the previous value and the new value is larger than the sudden change detection set value (BFM #91 to BFM #94), the result is written to the sudden change detection status (BFM #27).

b3: Minimum/maximum value hold function
The minimum value of the data (BFM #10 to BFM #13) of each channel is written to BFM #101 to BFM #104, and the maximum value is written to BFM #111 to BFM #114.

BFM #26: Upper/lower limit error status

The upper /lower limit value detection function (BFM#22 b1), writes detected errors to the corresponding bits in BFM#26 (see table). Upper and lower limit error status for the four channels is located in bit-pairs in the first 8bits of BFM#26.
When the data (BFM #10 to BFM #13) of any channel is outside the range from the lower limit error value (BFM #71 to BFM #74) to the upper limit error value (BFM #81 to BFM #84), the corresponding bit turns ON.
When a bit turns ON, it remains ON until it is reset by BFM #99 or the power is turned OFF.

Even while an upper/lower limit value error is detected, the data (BFM #10 to BFM #13) of each channel continues to be updated.
Bit assignment of **BFM #26**

Bit No.	Channel No.	Description
b0	CH1	Lower limit error
b1		Upper limit error
b2	CH2	Lower limit error
b3		Upper limit error
b4	CH3	Lower limit error
b5		Upper limit error
b6	CH4	Lower limit error
b7		Upper limit error

BFM #27: A/D data sudden change detection status
The sudden change detection function (BFM#22 b2) writes detected errors to the corresponding bits in BFM#27. The sudden change detection status for negative or positive changes is located in the first 8bits of BFM#27 in bit-pairs.
When the data (BFM #10 to BFM #13) of each channel is updated, if the difference between the previous value and the new value is larger than the sudden change detection set value (BFM #91 to BFM #94), the corresponding bit in BFM #27 turns ON.
At this time, when the new value is larger than the previous value, a bit for the + direction turns ON. when the new value is smaller than the previous value, a bit for the - direction turns ON.
When a bit turns ON, it remains ON until it is reset by BFM #99 or the power is turned OFF.
Even while a sudden change error is detected, the data (BFM #10 to BFM #13) of each channel continues to be updated.
Bit assignment of **BFM #27**

Bit No.	Channel No.	Description
b0	CH1	Sudden change error in - direction
b1		Sudden change error in + direction
b2	CH2	Sudden change error in - direction
b3		Sudden change error in + direction
b4	CH3	Sudden change error in - direction
b5		Sudden change error in + direction
b6	CH4	Sudden change error in - direction
b7		Sudden change error in + direction

BFM #28: Scale over status
The result of the analog input value for each individual channel that has exceeded the A/D conversion range will be written to BFM#28.
Range in which A/D conversion is available:

Voltage input mode	Current input mode
- 10.2V to 10.2V	- 20.4mA to 20.4mA

A bit will remain ON unless it is reset from switching the Power OFF or overwriting the ON bit with an OFF bit via a TO instruction.
Even while a scale over error is detected, the data (BFM #10 to BFM #13) of each channel continues to be updated.
Bit assignment of **BFM #28**

Bit No.	Channel No.	Description
b0	CH1	Scale over: Less than lower limit
b1		Scale over: More than upper limit
b2	CH2	Scale over: Less than lower limit
b3		Scale over: More than upper limit
b4	CH3	Scale over: Less than lower limit
b5		Scale over: More than upper limit
b6	CH4	Scale over: Less than lower limit
b7		Scale over: More than upper limit

BFM #29: Error status
Error information is assigned to each bit of BFM #29.
Bit assignment of **BFM #29**

Bit No.	Assignment	Description
b0	Error detected	b0 is ON while either b2 to b4 is ON.
b1	—	—
b2	Power error	24V DC power is not correctly supplied. Check the wiring and supply voltage.
b3	Hardware error	FX2NC-4AD may have malfunctioned. Contact the nearest Mitsubishi Electric System Service center.
b4	A/D conversion value error	A/D conversion value is abnormal. Using the scale over data (BFM #28), check the channel in which the error has occurred.
b5	—	—
b6	BFM read/write disabled	This bit will be ON during the input characteristics change processing. While this bit is ON, correct A/D data will not read from or written to BFMs.
b7	—	—
b8	Set value error detected	This bit will be ON while either b9 to b15 is ON.
b9	Input mode setting error	Input mode (BFM #0) is incorrectly set. Set it within the range from 0 to 8.
b10	Number of averaging times setting error	Number of averaging times is incorrectly set. Set it within the range from 1 to 4,095.
b11	Digital filter setting error	The digital filter setting is incorrect. Reset within the range of 0 to 1,600.
b12	Sudden change detection set value error	Sudden change detection set value is incorrect. Set a correct value.
b13	Upper/lower limit set value error	Upper/lower limit set value is incorrect. Set a correct value.
b14	—	—
b15	Addition data setting error	Addition data is incorrectly set. Set it within range from -16,000 to 16,000.

BFM #30: Model code
BFM #30 stores a fixed value of "K2070".
BFM #32: Operating time
BFM #32 stores the continuous operating time for the FX2NC-4AD.
Measurement starts when the power is turned ON, and the measured value is reset when the power is turned OFF.
The measurement range is from 0 to 64,800 (s). After that, 64,800 is kept.
BFM #41 to BFM #44: Offset data
BFM #51 to BFM #54: Gain data
Offset data:Analog input value when the digital value is "0"
Gain data :Analog input value when the digital value is as shown below (The digital value varies depending on the setting of the input mode.)
Standard digital value for offset and gain in each input mode
(A number in the input mode column indicates a value set in BFM #0.)

Input mode (BFM #0)	0	1	2	3	4	5	6	7	8
Standard offset value	0	0	-	0	0	-	0	0	-
Standard gain value	16000	2000	-	16000	4000	-	16000	4000	-

- Set the offset and gain data for each channel.
- Write the set value in units of "mV" for voltage input or "µA" for current input.
- Do not change the input characteristics when ○=2, 5, 8 is set in BFM #0. (Even if a numerical value is written, it is ignored.)

Initial offset/gain value (Unit: mV for voltage input, µA for current input)

Input mode (BFM #0)	0	1	2	3	4	5	6	7	8
Initial offset value	0			4000			0		
Initial gain value	5000			20000					

Setting range

	Voltage input	Current input
Offset data	-1000 to 9000 (mV)	-20000 to 17000 (µA)
Gain data	Gain value - Offset value = 1,000 to 10,000 (mV)	Gain value - Offset value = 3,000 to 30,000 (µA)

The actual effective input range is "-10 to 10 V" or "-20 to 20 mA".
BFM #61 to BFM #64: Addition data
When using the data addition function (BFM #22 b0), data (BFM #10 to BFM #13), minimum/maximum value (BFM #101 to BFM #104, BFM #111 to BFM #114) and data history (BFM #200 to BFM #1799) of each channel becomes the measured value added by the addition data (BFM #61 to BFM #64).
When using the data addition function, enter the value added by the addition data (BFM #61 to BFM #64) to the lower limit value error set value (BFM #71 to BFM #74) and the upper limit value error set value (BFM #81 to BFM #84).
Setting range: -16,000 to 16,000

BFM #71 to BFM #74: Lower limit, error set value
BFM #81 to BFM #88: Upper limit, error set value
When using the upper/lower limit value detection function (BFM #22 b1), write the lower limit value of each channel to BFM #71 to BFM #74, and the upper limit value of each channel to BFM #81 to BFM #84.
When using the data addition function (BFM #22 b0), enter the value added by the addition data to BFM #61 to BFM #64.
Setting range
The setting range will vary depending on the setting of the input mode (BFM #0). The table below shows the setting range for each input mode. Enter the set value as a digital value.

Input mode (BFM #0)	Setting range	Initial value	
		Lower limit	Upper limit
0: Voltage input mode (-10 to 10 V → -32000 to 32000)	-32768 to 32767	-32768	32767
1: Voltage input mode (-10 to 10 V → -4000 to 4000)	-4096 to 4095	-4096	4095
2: Voltage input mode (-10 to 10 V → -10000 to 10000)	-10200 to 10200	-10200	10200
3: Current input mode (4 to 20 mA → 0 to 16000)	-1 to 16383	-1	16383
4: Current input mode (4 to 20 mA → 0 to 4000)	-1 to 4095	-1	4095
5: Current input mode (4 to 20 mA → 4000 to 20000)	3999 to 20400	3999	20400
6: Current input mode (-20 to 20 mA → -16000 to 16000)	-16384 to 16383	-16384	16383
7: Current input mode (-20 to 20 mA → -4000 to 4000)	-4096 to 4095	-4096	4095
8: Current input mode (-20 to 20 mA → -20000 to 20000)	-20400 to 20400	-20400	20400

BFM #91 to BFM #94: Sudden change detection set value
When using the sudden change detection function (BFM #22 b2), enter the set value to judge the sudden change.
When the data (BFM #10 to BFM #13) of each channel is updated, if the difference between the previous value and the new value is larger than the sudden change detection set value (BFM #91 to BFM #94), the result is written to the sudden change detection status (BFM #27).
Setting range
The setting range will vary depending on the setting of the input mode (BFM #0).
The table below shows the setting range for each input mode.
Write the set value in a digital value.

Input mode (BFM #0)	Setting range	Initial value
0: Voltage input mode (-10 to 10 V → -32000 to 32000)	1 to 32767	3200
1: Voltage input mode (-10 to 10 V → -4000 to 4000)	1 to 4095	400
2: Voltage input mode (-10 to 10 V → -10000 to 10000)	1 to 10000	1000
3: Current input mode (4 to 20 mA → 0 to 16000)	1 to 8191	800
4: Current input mode (4 to 20 mA → 0 to 4000)	1 to 2047	200
5: Current input mode (4 to 20 mA → 4000 to 20000)	1 to 8191	800
6: Current input mode (-20 to 20 mA → -16000 to 16000)	1 to 16383	1600
7: Current input mode (-20 to 20 mA → -4000 to 4000)	1 to 4095	400
8: Current input mode (-20 to 20 mA → -20000 to 20000)	1 to 20000	2000

BFM #99: Clears upper/lower limit value error and sudden change detection error
The commands to clear the lower and upper limit value error and the sudden change detection error are assigned to the lower three bits of BFM #99.
The flag of the corresponding error status (BFM #26, BFM #27) is reset for all channels simultaneously when a bit is set to ON.
After the reset is finished, each bit of BFM #99 returns automatically to the OFF state.
The setting of two or more clear commands to ON at the same time is possible.

Bit assignment of BFM #99

Bit No.	Description
b0	Clears lower limit error.
b1	Clears upper limit error.
b2	Clears sudden change detection error.
b3 to b15	Unusable

BFM #101 to BFM #104: Minimum value
BFM #111 to BFM #114: Maximum value
When using the minimum/maximum value hold function (BFM #22 b3), the minimum value of the data (BFM #10 to BFM #13) of each channel is written to BFM #101 to BFM #104, and the maximum value is written to BFM #111 to BFM #114.
When using the data addition function (BFM #22 b0), the minimum/maximum measured value will be added to the addition data (BFM #61 to BFM #64).
Initial value
Minimum/maximum value hold function is not used:K0
Minimum/maximum value hold function is used: Digital value when the power is turned ON

BFM #109: Minimum value reset
BFM #119: Maximum value reset
When using the minimum/maximum value hold function (BFM #22 b3), BFM #109 clears the minimum value stored in BFM #101 to BFM #104, and BFM #119 clears the maximum value stored in BFM #111 to BFM #114.
The channel No. that will be reset is assigned to each bit of BFM #109 and BFM #119. When a bit is set ON, minimum/maximum value of the assigned channel is cleared. (Setting two or more bits ON simultaneously is possible.)
Bit assignment

BFM #109

Bit No.	b15 to b4	b3	b2	b1	b0
Channel No. (BFM No.)	Unusable	CH4 (#104)	CH3 (#103)	CH2 (#102)	CH1 (#101)

BFM #119

Bit No.	b15 to b4	b3	b2	b1	b0
Channel No. (BFM No.)	Unusable	CH4 (#114)	CH3 (#113)	CH2 (#112)	CH1 (#111)

BFM #198: Data history sampling time
Set the data history sampling time.
Setting range: 0 to 30,000 ms
Sampling cycle
When the set value is "0" :1 ms x Number of effective channels
When the set value is "1" or more:Set value (ms) x Number of effective channels

BFM #199: Resets or stops data history
The data history reset function is assigned to the lower 4 bits of BFM #199.
The data history stop function is assigned to the upper 4 bits of BFM #199.
Data history reset function
This function clears the sampled data history for each channel.
The channel No. to be reset is assigned to each of the lower 4 bits of BFM #199.
When a bit is set to ON, the data history (all contents from the 1st value to the 400th value) of the assigned channel is cleared. (The setting of two or more bits to ON simultaneously is possible.)
When the clear operation is completed, each bit returns automatically to the OFF state.
Assignment of lower 4 bits

Bit No.	b7 to b4	b3	b2	b1	b0
Channel No.	Unusable	CH4	CH3	CH2	CH1

Data history stop function
This function will temporarily stop the data history for the individual channels. The channel No. to be temporarily stopped is assigned to each of the upper 4 bits of BFM #199. When a bit is set to ON, sampling of the data history of the assigned channel is temporarily stopped. (Setting two or more bits to ON at a time.)
When a bit is set to OFF, sampling of the data history of the assigned channel restarts.
Assignment of upper 4 bits

Bit No.	b15 to b12	b11	b10	b9	b8
Channel No.	Unusable	CH4	CH3	CH2	CH1

BFM #200 to BFM #1799: Data history
The A/D conversion value of each channel is sampled, and written to the BFMs shown below. The table below shows the assignment between the channel No. and the BFM No. Data is stored in ascending order of the BFM No.
Up to 400 data history items are written for each channel. When the number of history items exceeds 400, the data is overwritten starting from the smallest BFM No.
The data history function is valid only for channels whose number of averaging times (BFM #2 to #5) is set to "1" and digital filter setting (BFM #6 to #9) is set to "0".
Assignment of channel No. and BFM No.

Channel No.	BFM No.				
	1st value	2nd value	3rd value	•••••	400th value
CH1	#200	#201	#202	•••••	#599
CH2	#600	#601	#602	•••••	#999
CH3	#1000	#1001	#1002	•••••	#1399
CH4	#1400	#1401	#1402	•••••	#1799

- If a considerable amount of data history is read from the PLC main unit using a FROM instruction, a watch dog timer error occurs in the PLC main unit.
  In such a case, divide the required data history using multiple FROM instructions, and insert the WDT instruction (watch dog timer refresh instruction) after each FROM instruction.

7. Adjustment of I/O Characteristics

For factory default, the FX2NC-4AD has standard I/O characteristics in accordance with each input mode (BFM #0).
In the voltage and current input mode, adjust the standard I/O characteristics for each channel. (Do not change the input characteristics when 2, 5, 8 is set in BEM #0.)

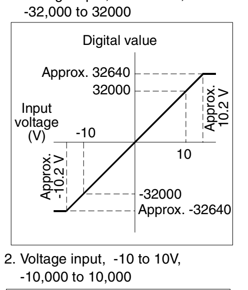
7.1 Standard I/O characteristics

The input mode of the standard I/O characteristics is abbreviated as shown below:

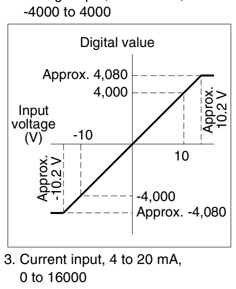
0. Voltage input, -10 to 10V, -32,000 to 32000
① ② ③ ④

①: Input mode set in BFM #0 ②: Input mode
③: Analog input range ④: Digital output range

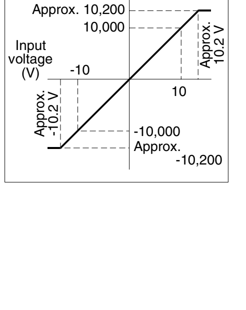
0. Voltage input, -10 to 10 V, -32,000 to 32000



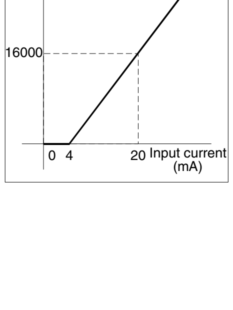
1. Voltage input, -10 to 10 V, -4000 to 4000



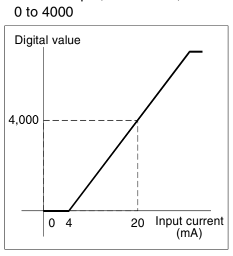
2. Voltage input, -10 to 10V, -10,000 to 10,000



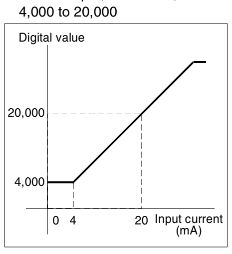
3. Current input, 4 to 20 mA, 0 to 16000



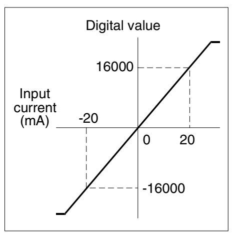
4. Current input, 4 to 20 mA, 0 to 4000



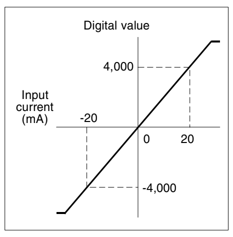
5. Current input, 4 to 20mA, 4,000 to 20,000



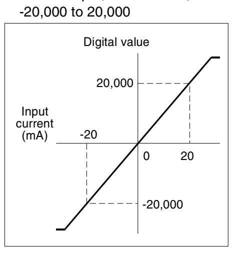
6. Current input, -20 to 20 mA, -16000 to 16000



7. Current input, -20 to 20 mA, -4000 to 4000

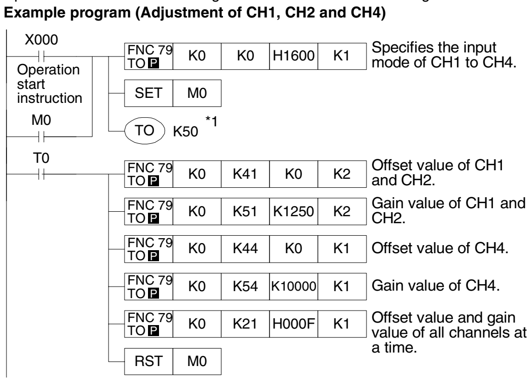


8. Current input, -20 to 20mA, -20,000 to 20,000



7.2 Adjustment of I/O characteristics

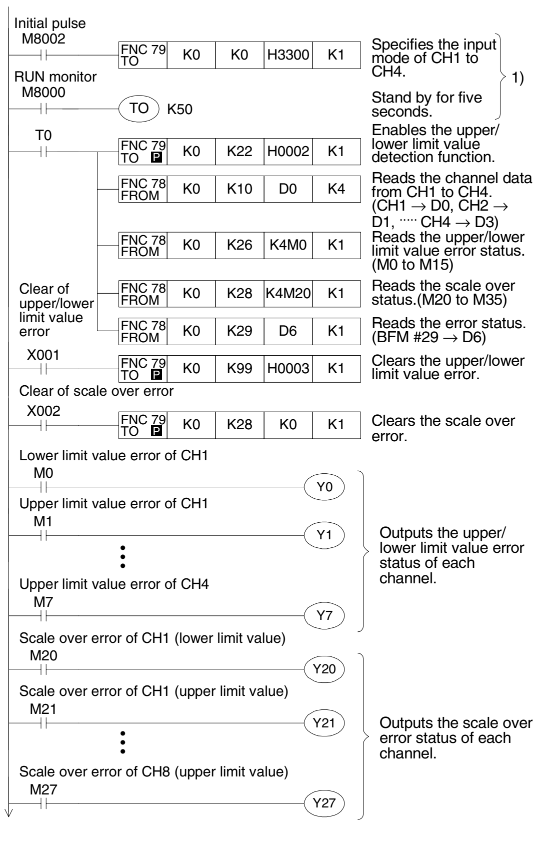
Adjust the I/O characteristics using the buffer memories in the FX2NC-4AD.
Firstly, enter the input mode to BFM #0, then enter the offset data to BFM #41 to BFM #44, subsequently enter the gain data to BFM #51 to BFM #54.
Update the offset data and the gain data for each channel using BFM #21.
Example program (Adjustment of CH1, CH2 and CH4)

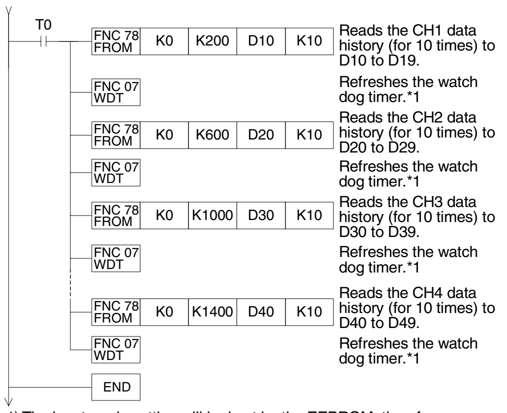


*1 It takes approximately 5 seconds to change the input mode (BFM #0) (to change each set value).
Assure that a time interval of 5 seconds or more is held after a change of the input mode until execution of write of each setting (TO instruction).
- The I/O characteristics can be written (BFM #21) to either channel, or two or more channels simultaneously.

8. Example program

This section introduces an example program to read analog data from the FX2NC-4AD and connecting to digital data in the PLC.
Condition
System configuration:
The FX2NC-4AD is connected as a special function block nearest to the FX2NC Series PLC main unit (unit No. 0).
Input mode:
CH1 and CH2: Mode 0 (voltage input, -10 to 10 V → -32000 to 32000)
CH3 and CH4: Mode 3 (current input, 4 to 20 mA → 0 to 16000)
Number of averaging times: 1 (initial value) in each channel
I/O characteristics:
Standard I/O characteristics (initial value) in each channel
Convenient function: Upper/lower limit value detection function is used.
Data history function:
Used while sampling time is set to 0ms (initial value).
CH1 to CH4: Sampling time = 1ms × 4 (Number of effective channels) = 4ms
I/O assignment:
X001 : Clears the upper/lower limit value error.
X002 : Clears the scale over error.
Y000 to Y017: Output the upper/lower limit value error status of each channel.
Y020 to Y037: Output scale over status of each channel.
Example program





1) The input mode setting will be kept by the EEPROM, therefore, continual channel settings is not needed after powering down.

*1 When multiple data history items are read, the scan time of the PLC becomes longer.
In the FX2NC Series PLC, when the scan time exceeds 200 ms, the CPU error indicator lamp lights and the PLC stops.
When reading many data history items, divide data history items to be read using two or more FROM instructions, then insert the WDT (watch dog timer refresh) instruction between FROM instructions.

MITSUBISHI ELECTRIC CORPORATION
HEAD OFFICE : MITSUBISHI DENKI BLDG MARUNOUTI TOKYO 100-8310
HIMEJI WORKS : 840, CHIYODA CHO, HIMEJI, JAPAN