

FX_{2N}

FX_{2N}-2DA SPECIAL FUNCTIONBLOCK

USER'S GUIDE

JY992D74901B

This manual contains text, diagrams and explanations which will guide the reader in the correct installation and operation of the FX_{2N}-2DA special function block and should be read and understood before attempting to install or use the unit.

Further information can be found in the FX SERIES PROGRAMMING MANUAL, FX_{2N} SERIES HARDWARE MANUAL.

1. INTRODUCTION

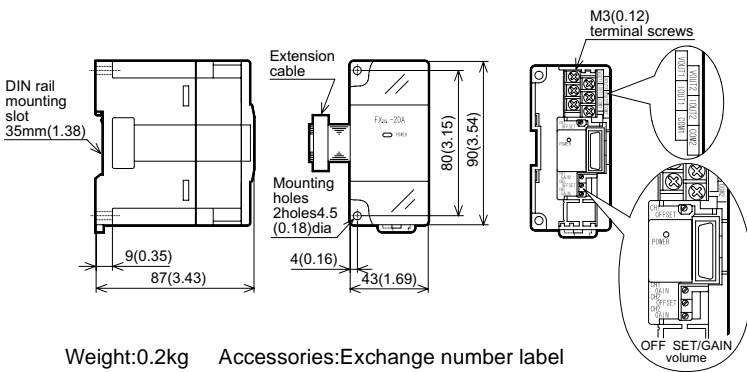
The FX_{2N}-2DA type analog output block (Hereafter referred to as the FX_{2N}-2DA) is used to convert a digital value of 12 bits into an analog output of two points (voltage output and current output), and to forward the values to the Programmable controller (Hereafter referred to as a PLC).

FX_{2N}-2DA can be connected with FX_{0N}, FX_{2N}, and the FX_{2NC} series Programmable controllers.

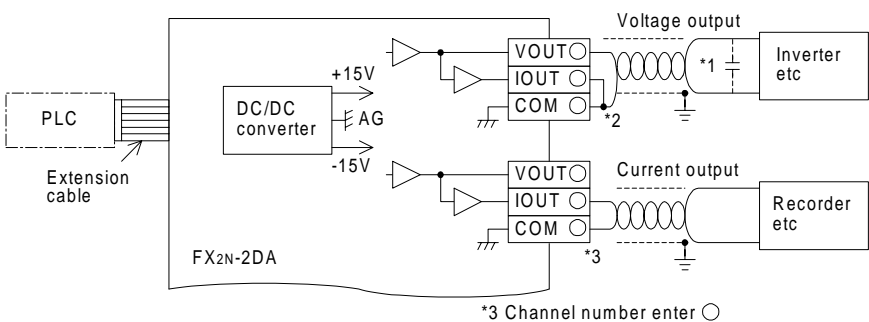
- 1) The analog output is selected from the voltage output or the current output by the method of connecting wires.
At this time, assume setting to be two channels common analog output.
- 2) The two analog output channels can accept output of 0 to 10V DC, 0 to 5V DC, or 4 to 20mA.
(The mixture use for the voltage output/the current output is possible.)
- 3) Resolution is 2.5mV (0 to 10V DC) and 4μA(4 to 20mA).
- 4) The digital to analog conversion characteristics can be adjusted.
- 5) The block occupies 8 I/O points which can be allocated from either inputs or outputs.
- 6) The data transfer with the PLC uses the FROM/TO instruction.

2. EXTERNAL DIMENSIONS AND PARTS

Dimensions:mm (inches)



3. WIRING



*1 Connect a 0.1 to 0.47 μF 25V DC capacitor with the position of *1 when there is voltage ripple in the voltage output or there will be a lot of noise.

*2 For voltage output please short circuit IOUT and COM as shown in the diagram.

4. Connection with Programmable controller

- 1) The number of FX2N-2DA which can be connected is 4 or less in the FX0N series PLC, 8 or less in the FX2N series PLC, and 4 or less in the FX2NC series PLC per Main unit with powered extension units. However the following limitation exists when undermentioned special function blocks are connected.

FX2N :Main unit and powered extension units of I/O 32points or less.

24V DC consumption current total value of undermentioned special function blocks used \leq 190mA

FX2N :Main unit and powered extension units of I/O 48points or more.

24V DC consumption current total value of undermentioned special function blocks used \leq 300mA

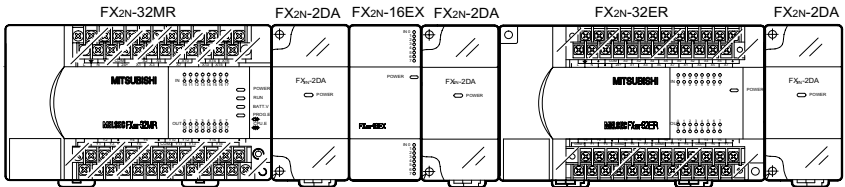
FX2NC:The undermentioned special function blocks can be connected up to 4 regardless of the I/O number of Main units.

FX0N :The undermentioned special function blocks can be connected up to 2 regardless of the I/O number of Main units and powered extension units.

	FX2N-2DA	FX2N-2AD	FX0N-3A
Consumption current of 24V DC for one	85mA	50mA	90mA

The capacity of DC 24V power supply which can used for extension blocks of the service power supply and I/O reaches the value by which the total value of the consumption current of the above mentioned special function block is subtracted from a service voltage source capacity the programmable controller original. For instance, the service power supply the FX2N-32MT is 250mA. When two FX2N-2DA blocks are connected, the service power supply is reduced to 80mA.

- 2) The blocks occupy 8 points (The 8 points can be allocated from either inputs or outputs).
- 3) FX2N-2DA consumes 5V DC 30mA.
The total of 5V of the special function block connected with the main unit of the PLC consumption current must not exceed 5V voltage source capacity of the main unit and the powered extension unit.
- 4) The FX2N-2DA and the main unit are connected with the cable at the right of the main unit.



5. SPECIFICATIONS

5.1 Environment specification

Item	Content
Directic Withstand voltage	500V AC 1min(Between analog output terminals and case)

Environmental specifications other than the above-mentioned are the same as the main unit of the Programmable controller. (Refer to the manual of the Programmable controller)

5.2 Power supply specification and others

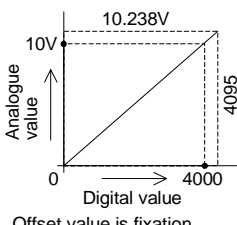
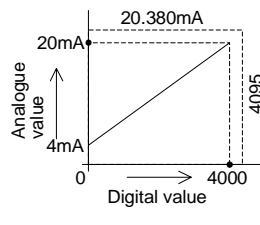
Item	Content
Analog circuits	24V DC \pm 10% 85mA (Internal power supplied from the main unit)
Digital circuits	5V DC 30mA (Internal power supplied from main unit)

Item	Content
Isolation	Photo-coupler isolation between analog and digital circuits. DC/DC converter isolation of power from main unit. (No isolation between analog channels.)
Number of occupied I/O points	The blocks occupy either 8 input or output points. (can be either inputs or outputs)

5.3 Defining gain and offset

Item	Voltage output	Current output
Range of analog output	At shipping, the unit is adjusted to a digital range of 0 to 4000 for an analog voltage output of 0 to 10V DC. When using FX2N-2DA by the current input or the 0 to 5V DC output, it is necessary to readjust by the offset and gain vol-umes.	
	0 to 10V DC, 0 to 5V DC (External load resistance 2K to 1M Ω)	4 to 20mA (External load resistance 500 Ω or less)

Item	Voltage output	Current output
Digital input	12bit	
Resolution	2.5mV(10V/4000) 1.25mV(5V/4000)	4μA {(20-4)/4000}
Integrated accuracy	±1% (full scale 0 to 10V)	±1% (full scale 4 to 20mA)
Processing time	4ms/1 channel (sequence program and synchronization)	

Item	Voltage output	Current output
output characteristics	Analogue value :0 to 10V Digital value :0 to 4000  <p>Offset value is fixation</p>	Analogue value :4 to 20mA Digital value :0 to 4000 
	Only subordinate position 12bit becomes effective when the data of 13bit or more is input, and high rank bit any more is disregarded. Use a digital value within the range from 0 to 4095. The output characteristic can be set to each two channels.	

6. Allocation of buffer memory (BFM)

6.1 Buffer memory

BFM number	b15 to b8	b7 to b3	b2	b1	b0
#0 to #15	Reserved				
#16	Reserved	Current value of output data(8 bit)			
#17	Reserved		D/A subordinate position data holding	CH1 D/A conversion beginning	CH2 D/A conversion beginning
#18 or more	Reserved				

BFM#16:The D/A conversion data of the channel specified with BFM#17 (digital value) is written. The D/A data is written in the binary in order of subordinate position 8bit and high rank 4bit,divided into two portions.

BFM#17:b0***The D/A conversion of CH2 begins by changing of 1→0.

b1***The D/A conversion of CH1 begins by changing of 1→0.

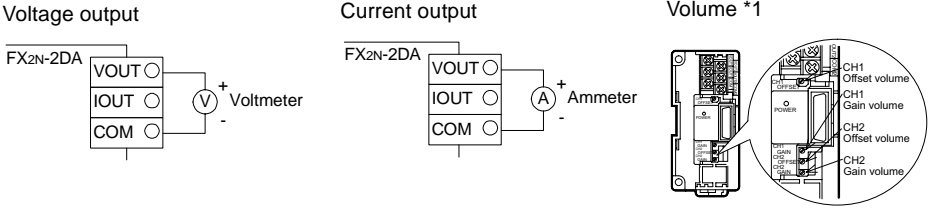
b2***The subordinate position eight bit data for the D/A conversion is held by changing of 1→0.

Write data in above-mentioned buffer memory by "8.Program example".

7. Adjustment of offset and gain

7.1 offset and gain

The offset value and the gain value when the factory is shipped are adjusted for a digital value to become 0 to 4000 for the voltage output 0 to 10V. It is necessary to readjust the offset value and the gain value when FX2N-2DA is used by the current output, and FX2N-2DA is used by the output characteristics other than shipping the factory. The adjustment of the offset value and the gain value sets a digital value to the analogue value actually output by using the Voltmeter and the Ammeter according to the volume of FX2N-2DA.

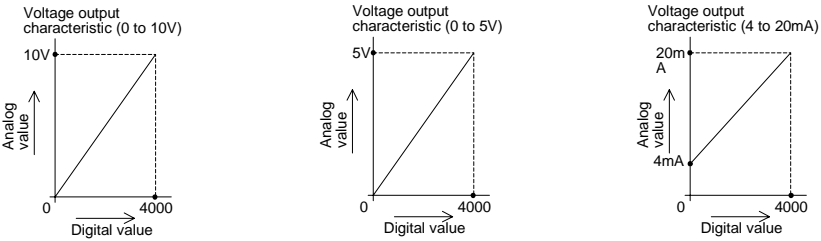


*1 A digital value increases if the volume installed in FX2N-2DA is turned right (clockwise).

7.1.1 Adjustment of gain

The gain value can be set to an arbitrary digital value.

However, to demonstrate the resolution of 12bit to its maximum, a digital range of 0 to 4000 is available.

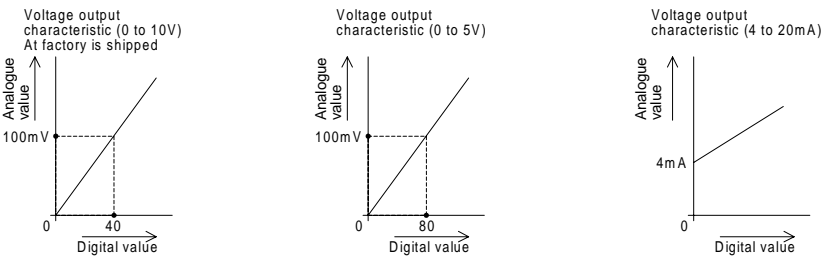


A digital value is adjusted to 4000 at 10V in the analog output value when the voltage is output.

A digital value is adjusted to 4000 at 20mA in the analog output value when the current is output.

7.1.2 Adjustment of offset

The offset value when the voltage is input is 0V, and the offset value when the current is input is 4mA fixation. However, the offset value/the gain value can be minute adjusted if necessary. Set at the following when minute adjusting.



For instance, when a digital range of 0 to 4000 is used with the analogue range of 0 to 10V, a digital value of 40 is equal to an analog output of 100mV, ($40 \times 10V/4000$ digital points), when a digital range of 0 to 4000 is used with the analogue range of 4 to 20mA, a digital value of 0 is equal to an analog output of 4mA.

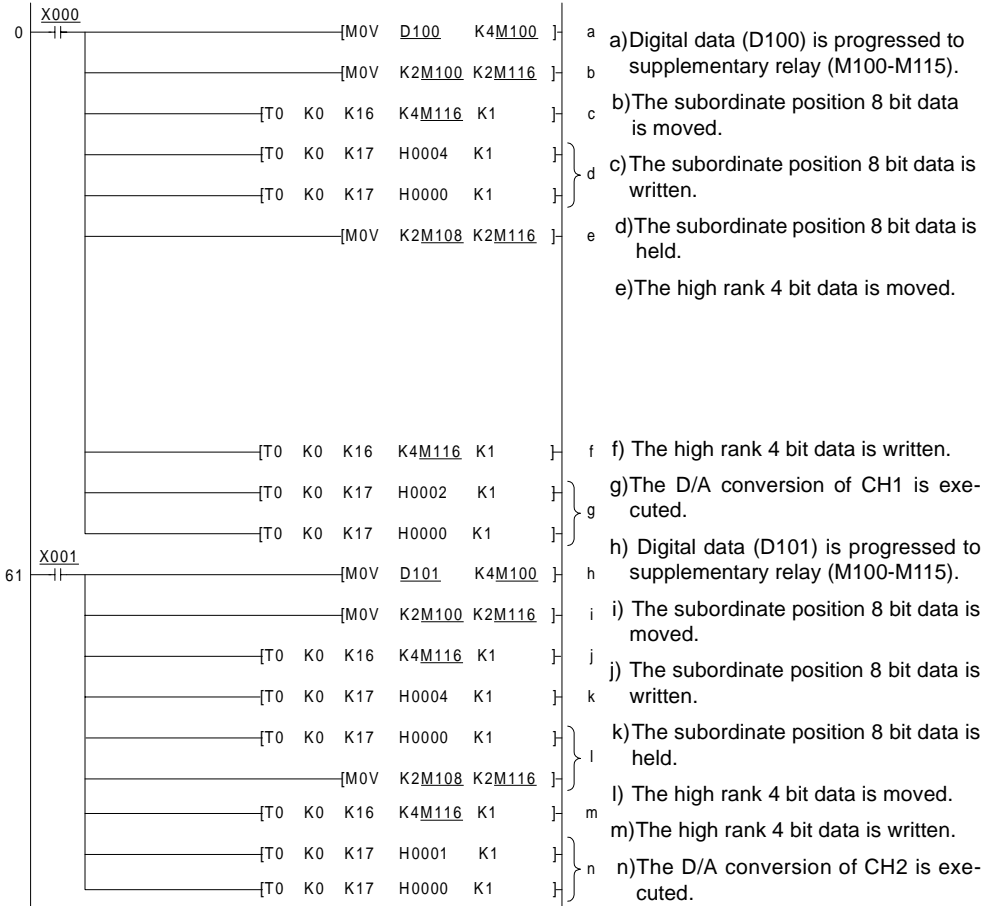
- 1) Do the offset adjustment and the gain adjustment respectively of CH1 and CH2.
- 2) Repeat the offset adjustment and gain adjustment alternately until a stable value is reached.
- 3) Do in order of the gain adjustment and the offset adjustment when you adjust offset/gain.

8. Program example

The following program examples (8.1 and 8.2) are formula circuits.

The device numbers that have been underlined can be assigned by the user during programming.

8.1 At connection to FX0N series PLC



Digital to analog conversion execution input of CH1 :X000

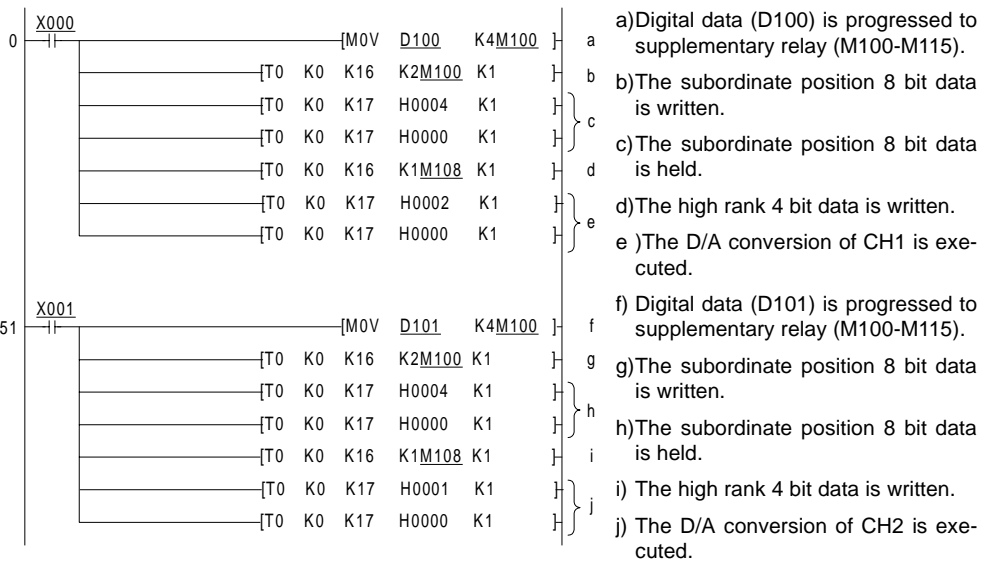
Digital to analog conversion execution input of CH2 :X001

D/A output data CH1:D100 (Replace with auxiliary relay M100 to M131. Assign these numbers only one time)

D/A output data CH2:D101 (Replace with auxiliary relay M100 to M131. Assign these numbers only one time)

Processing time:Time until FX2N-2DA outputs analog value after turning on X000 and X001.
4mS / 1 channel

8.2 At connection to FX2N series PLC



Digital to analog conversion execution input of CH1 :X000

Digital to analog conversion execution input of CH2 :X001

D/A output data CH1:D100 (Replace with auxiliary relay M100 to M115. Assign these numbers only one time)

D/A output data CH2 :D101 (Replace with auxiliary relay M100 to M115. Assign these numbers only one time)

Processing time:Time until FX2N-2DA outputs analog value after turning on X000 and X001.
4ms / 1 channel

9. Notes in drive

- 1) Confirm whether the output wiring of FX2N-2DA and the connection of the extension cable are correctly done.
- 2) Confirm whether the "4. Connection with programmable controller" condition is satisfied.
- 3) When shipped from the factory, the output characteristic is adjusted to 0 to 10V DC.
If a different output characteristic is desired, please adjust as required.
- 4) The mixture use for the voltage output/the current output is possible.

10. Error check

Confirm the following items when it is thought that the FX2N-2DA does not operate normally.

- 1) Confirm the state of POWER LED.
Lit :The extension cable is correctly connected.
Turn off or blinks :Confirm the proper connection of the extension cable.
- 2) Confirm whether it is external wiring per section 3.
- 3) Confirm whether the load resistance of the equipment connected with an analog output terminal is the one corresponding to FX2N-2DA.
- 4) Confirm the voltage and output Current values with a voltmeter and an ammeter. Confirm the digital to analog conversion from the output characteristic. Readjust the offset and gain by "Change and adjustment method of the output characteristic" when you have converted D/A not suitable for the output characteristic. The output characteristic when shipped from the factory is DC0-10V.

Guidelines for the safety of the user and protection of the FX2N-2DA SPECIAL FUNCTION BLOCK

- This manual has been written to be used by trained and competent personnel. This is defined by the European directives for machinery, low voltage and EMC.
- If in doubt at any stage during the installation of the FX2N-2DA always consult a professional electrical engineer who is qualified and trained to the local and national standards. If in doubt about the operation or use of the FX2N-2DA please consult the nearest Mitsubishi Electric distributor.
- Under no circumstances will Mitsubishi Electric be liable or responsible for any consequential damage that may arise as a result of the installation or use of this equipment.
- All examples and diagrams shown in this manual are intended only as an aid to understanding the text, not to guarantee operation. Mitsubishi Electric will accept no responsibility for actual use of the product based on these illustrative examples.
- Owing to the very great variety in possible application of this equipment, you must satisfy yourself as to its suitability for your specific application.

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Manual revision : B

Date : JANUARY 1999



HEAD OFFICE : MITSUBISHI DENKI BLDG MARUNOUTI TOKYO 100-8310 TELEX : J24532 CABLE MELCO TOKYO
HIMEJI WORKS : 840, CHIYODA CHO, HIMEJI, JAPAN

FX_{2N}

FX_{2N}-2DA SPECIAL FUNCTIONBLOCK

USER'S GUIDE

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Further information can be found in the FX SERIES PROGRAMMING MANUAL,FX_{2N} SERIES HARDWARE MANUAL.

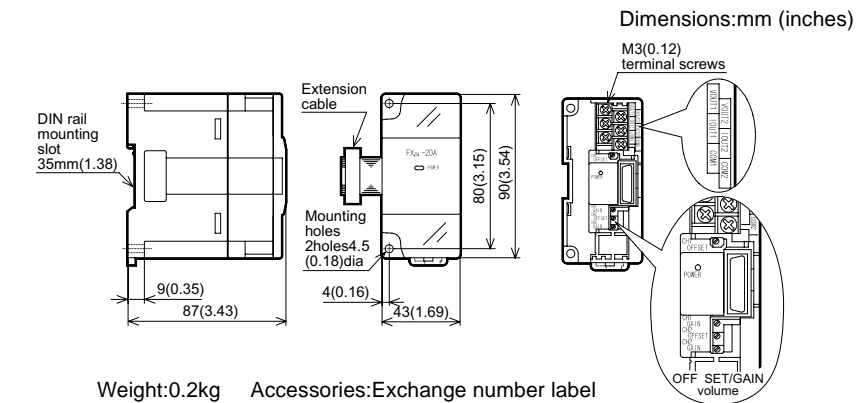
1. INTRODUCTION

The FX_{2N}-2DA type analog output block (Hereafter referred to as the FX_{2N}-2DA) is used to convert a digital value of 12 bits into an analog output of two points (voltage output and current output), and to forward the values to the Programmable controller (Hereafter referred to as a PLC).

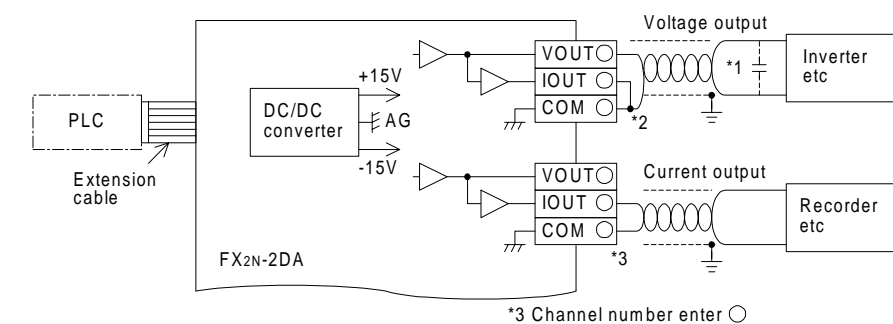
FX_{2N}-2DA can be connected with FX_{0N}, FX_{2N}, and the FX_{2NC} series Programmable controllers.

- The analog output is selected from the voltage output or the current output by the method of connecting wires.
At this time, assume setting to be two channels common analog output.
- The two analog output channels can accept output of 0 to 10V DC, 0 to 5V DC, or 4 to 20mA.
(The mixture use for the voltage output/the current output is possible.)
- Resolution is 2.5mV (0 to 10V DC) and 4μA(4 to 20mA).
- The digital to analog conversion characteristics can be adjusted.
- The block occupies 8 I/O points which can be allocated from either inputs or outputs.
- The data transfer with the PLC uses the FROM/TO instruction.

2. EXTERNAL DIMENSIONS AND PARTS



3. WIRING



*1 Connect a 0.1 to 0.47 μF 25V DC capacitor with the position of *1 when there is voltage ripple in the voltage output or there will be a lot of noise.

*2 For voltage output please short circuit IOUT and COM as shown in the diagram.

4. Connection with Programmable controller

- The number of FX_{2N}-2DA which can be connected is 4 or less in the FX_{0N} series PLC, 8 or less in the FX_{2N} series PLC, and 4 or less in the FX_{2NC} series PLC per Main unit with powered extension units. However the following limitation exists when undermentioned special function blocks are connected.

FX_{2N} :Main unit and powered extension units of I/O 32points or less.
24V DC consumption current total value of undermentioned special function blocks used ≤ 190mA

FX_{2N} :Main unit and powered extension units of I/O 48points or more.
24V DC consumption current total value of undermentioned special function blocks used ≤ 300mA

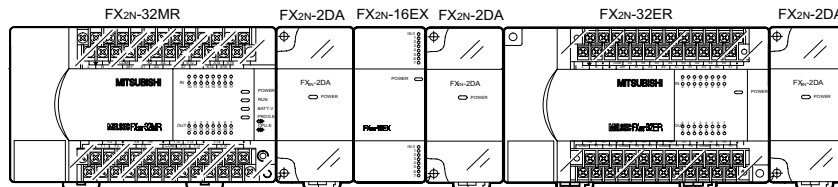
FX_{2NC}:The undermentioned special function blocks can be connected up to 4 regardless of the I/O number of Main units.

FX_{0N} :The undermentioned special function blocks can be connected up to 2 regardless of the I/O number of Main units and powered extension units.

	FX _{2N} -2DA	FX _{2N} -2AD	FX _{0N} -3A
Consumption current of 24V DC for one	85mA	50mA	90mA

The capacity of DC 24V power supply which can used for extension blocks of the service power supply and I/O reaches the value by which the total value of the consumption current of the above mentioned special function block is subtracted from a service voltage source capacity the programmable controller original. For instance, the service power supply the FX_{2N}-32MT is 250mA. When two FX_{2N}-2DA blocks are connected, the service power supply is reduced to 80mA.

- The blocks occupy 8 points (The 8 points can be allocated from either inputs or outputs).
- FX_{2N}-2DA consumes 5V DC 30mA.
The total of 5V of the special function block connected with the main unit of the PLC consumption current must not exceed 5V voltage source capacity of the main unit and the powered extension unit.
- The FX_{2N}-2DA and the main unit are connected with the cable at the right of the main unit.



5. SPECIFICATIONS

5.1 Environment specification

Item	Content
Directric Withstand voltage	500V AC 1min(Between analog output terminals and case)

Environmental specifications other than the above-mentioned are the same as the main unit of the Programmable controller. (Refer to the manual of the Programmable controller)

5.2 Power supply specification and others

Item	Content
Analog circuits	24V DC ±10% 85mA (Internal power supplied from the main unit)
Digital circuits	5V DC 30mA (Internal power supplied from main unit)

Item	Content
Isolation	Photo-coupler isolation between analog and digital circuits. DC/DC converter isolation of power from main unit. (No isolation between analog channels.)
Number of occupied I/O points	The blocks occupy either 8 input or output points. (can be either inputs or outputs)

5.3 Defining gain and offset

Item	Voltage output	Current output
Range of analog output	At shipping, the unit is adjusted to a digital range of 0 to 4000 for an analog voltage output of 0 to 10V DC. When using FX _{2N} -2DA by the current input or the 0 to 5V DC output, it is necessary to readjust by the offset and gain volumes. 0 to 10V DC, 0 to 5V DC (External load resistance 2K to 1MΩ)	4 to 20mA (External load resistance 500Ω or less)

Item	Voltage output	Current output
Digital input	12bit	
Resolution	2.5mV(10V/4000) 1.25mV(5V/4000)	4μA {(20-4)/4000}
Integrated accuracy	±1% (full scale 0 to 10V)	±1% (full scale 4 to 20mA)
Processing time	4ms/1 channel (sequence program and synchronization)	

Item	Voltage output	Current output
output characteristics	<p>Analogue value :0 to 10V Digital value :0 to 4000</p> <p>Offset value is fixation</p>	<p>Analogue value :4 to 20mA Digital value :0 to 4000</p>
	<p>Only subordinate position 12bit becomes effective when the data of 13bit or more is input, and high rank bit any more is disregarded. Use a digital value within the range from 0 to 4095. The output characteristic can be set to each two channels.</p>	

6. Allocation of buffer memory (BFM)

6.1 Buffer memory

BFM number	b15 to b8	b7 to b3	b2	b1	b0
#0 to #15	Reserved				
#16	Reserved	Current value of output data(8 bit)			
#17	Reserved	D/A subordinate position data holding	CH1 D/A conversion beginning	CH2 D/A conversion beginning	
#18 or more	Reserved				

BFM#16:The D/A conversion data of the channel specified with BFM#17 (digital value) is written.
The D/A data is written in the binary in order of subordinate position 8bit and high rank 4bit,divided into two portions.

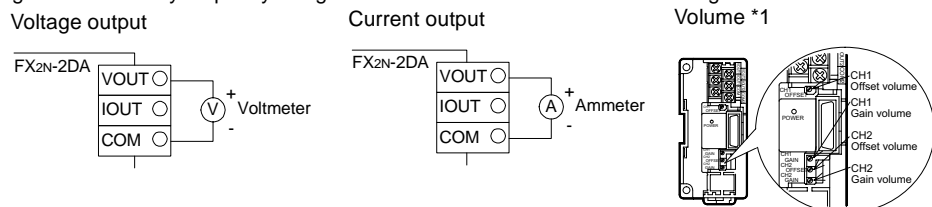
BFM#17:b0...The D/A conversion of CH2 begins by changing of 1→0.
b1...The D/A conversion of CH1 begins by changing of 1→0.
b2...The subordinate position eight bit data for the D/A conversion is held by changing of 1→0.

Write data in above-mentioned buffer memory by "8.Program example".

7. Adjustment of offset and gain

7.1 offset and gain

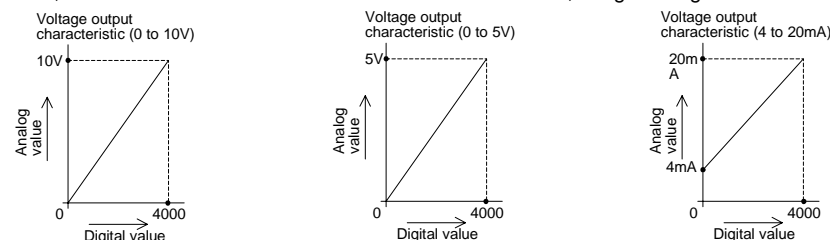
The offset value and the gain value when the factory is shipped are adjusted for a digital value to become 0 to 4000 for the voltage output 0 to 10V. It is necessary to readjust the offset value and the gain value when FX2N-2DA is used by the current output, and FX2N-2DA is used by the output characteristics other than shipping the factory. The adjustment of the offset value and the gain value sets a digital value to the analogue value actually output by using the Voltmeter and the Ammeter according to the volume of FX2N-2DA.



*1 A digital value increases if the volume installed in FX2N-2DA is turned right (clockwise).

7.1.1 Adjustment of gain

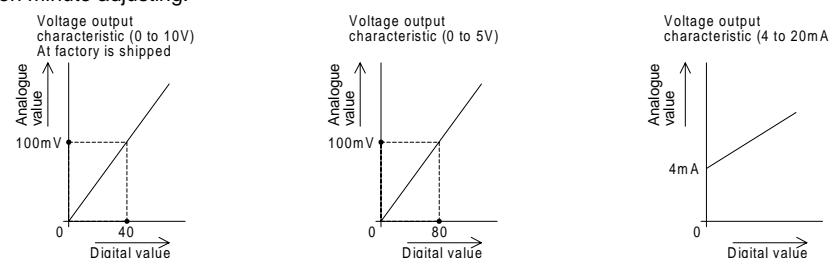
The gain value can be set to an arbitrary digital value. However, to demonstrate the resolution of 12bit to its maximum, a digital range of 0 to 4000 is available.



A digital value is adjusted to 4000 at 10V in the analog output value when the voltage is output.
A digital value is adjusted to 4000 at 20mA in the analog output value when the current is output.

7.1.2 Adjustment of offset

The offset value when the voltage is input is 0V, and the offset value when the current is input is 4mA fixation. However, the offset value/the gain value can be minute adjusted if necessary. Set at the following when minute adjusting.



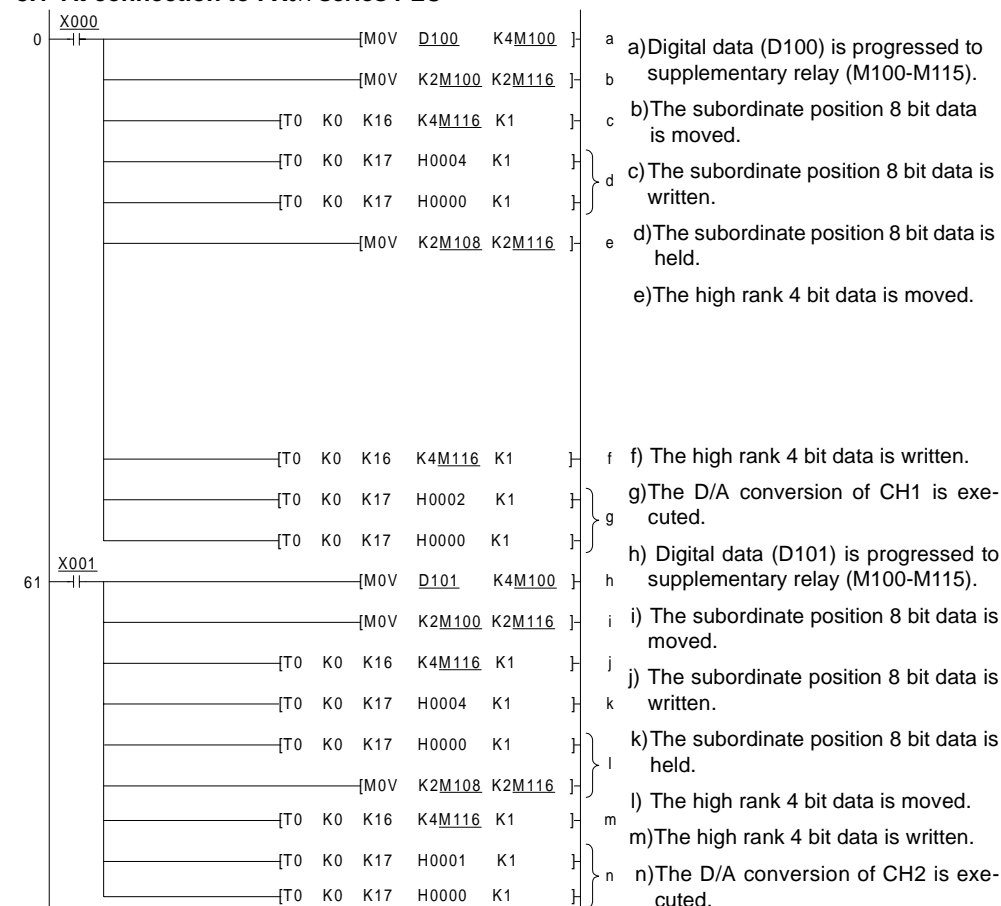
For instance, when a digital range of 0 to 4000 is used with the analogue range of 0 to 10V, a digital value of 40 is equal to an analog output of 100mV, ($40 \times 10V/4000$ digital points), when a digital range of 0 to 4000 is used with the analogue range of 4 to 20mA, a digital value of 0 is equal to an analog output of 4mA.

- 1) Do the offset adjustment and the gain adjustment respectively of CH1 and CH2.
- 2) Repeat the offset adjustment and gain adjustment alternately until a stable value is reached.
- 3) Do in order of the gain adjustment and the offset adjustment when you adjust offset/gain.

8. Program example

The following program examples (8.1 and 8.2) are formula circuits. The device numbers that have been underlined can be assigned by the user during programming.

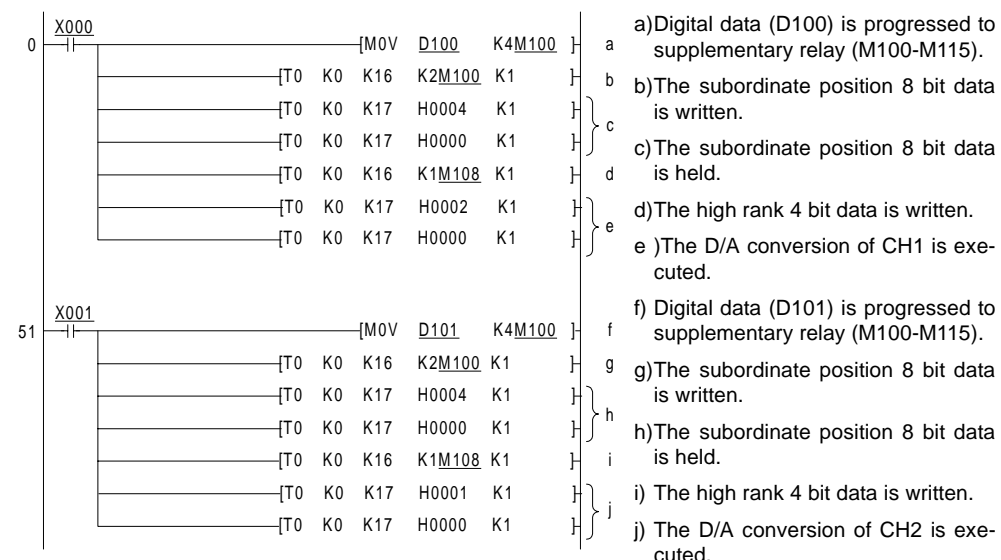
8.1 At connection to FX0N series PLC



Digital to analog conversion execution input of CH1 :X000
Digital to analog conversion execution input of CH2 :X001
D/A output data CH1:D100 (Replace with auxiliary relay M100 to M131. Assign these numbers only one time)
D/A output data CH2:D101 (Replace with auxiliary relay M100 to M131. Assign these numbers only one time)

Processing time:Time until FX2N-2DA outputs analog value after turning on X000 and X001.
4mS / 1 channel

8.2 At connection to FX2N series PLC



Digital to analog conversion execution input of CH1 :X000
Digital to analog conversion execution input of CH2 :X001
D/A output data CH1:D100 (Replace with auxiliary relay M100 to M115. Assign these numbers only one time)
D/A output data CH2 :D101 (Replace with auxiliary relay M100 to M115. Assign these numbers only one time)

Processing time:Time until FX2N-2DA outputs analog value after turning on X000 and X001.
4ms / 1 channel

9. Notes in drive

- 1) Confirm whether the output wiring of FX2N-2DA and the connection of the extension cable are correctly done.
- 2) Confirm whether the "4. Connection with programmable controller" condition is satisfied.
- 3) When shipped from the factory, the output characteristic is adjusted to 0 to 10V DC. If a different output characteristic is desired, please adjust as required.
- 4) The mixture use for the voltage output/the current output is possible.

10. Error check

Confirm the following items when it is thought that the FX2N-2DA does not operate normally.

- 1) Confirm the state of POWER LED.
Lit :The extension cable is correctly connected.
Turn off or blinks :Confirm the proper connection of the extension cable.
- 2) Confirm whether it is external wiring per section 3.
- 3) Confirm whether the load resistance of the equipment connected with an analog output terminal is the one corresponding to FX2N-2DA.
- 4) Confirm the voltage and output Current values with a voltmeter and an ammeter. Confirm the digital to analog conversion from the output characteristic. Readjust the offset and gain by "Change and adjustment method of the output characteristic" when you have converted D/A not suitable for the output characteristic. The output characteristic when shipped from the factory is DC0-10V.

Guidelines for the safety of the user and protection of the FX2N-2DA SPECIAL FUNCTION BLOCK

- This manual has been written to be used by trained and competent personnel. This is defined by the European directives for machinery, low voltage and EMC.
- If in doubt at any stage during the installation of the FX2N-2DA always consult a professional electrical engineer who is qualified and trained to the local and national standards. If in doubt about the operation or use of the FX2N-2DA please consult the nearest Mitsubishi Electric distributor.
- Under no circumstances will Mitsubishi Electric be liable or responsible for any consequential damage that may arise as a result of the installation or use of this equipment.
- All examples and diagrams shown in this manual are intended only as an aid to understanding the text, not to guarantee operation. Mitsubishi Electric will accept no responsibility for actual use of the product based on these illustrative examples.
- Owing to the very great variety in possible application of this equipment, you must satisfy yourself as to its suitability for your specific application.

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Date : JANUARY 1999

MITSUBISHI ELECTRIC CORPORATION

HEAD OFFICE : MITSUBISHI DENKI BLDG MARUNOUTI TOKYO 100-8310 TELEX : J24532 CABLE MELCO TOKYO
HIMEJI WORKS : 840, CHIYODA CHO, HIMEJI, JAPAN

JY992D74901B

Effective JAN 1999
Specifications are subject to
change without notice