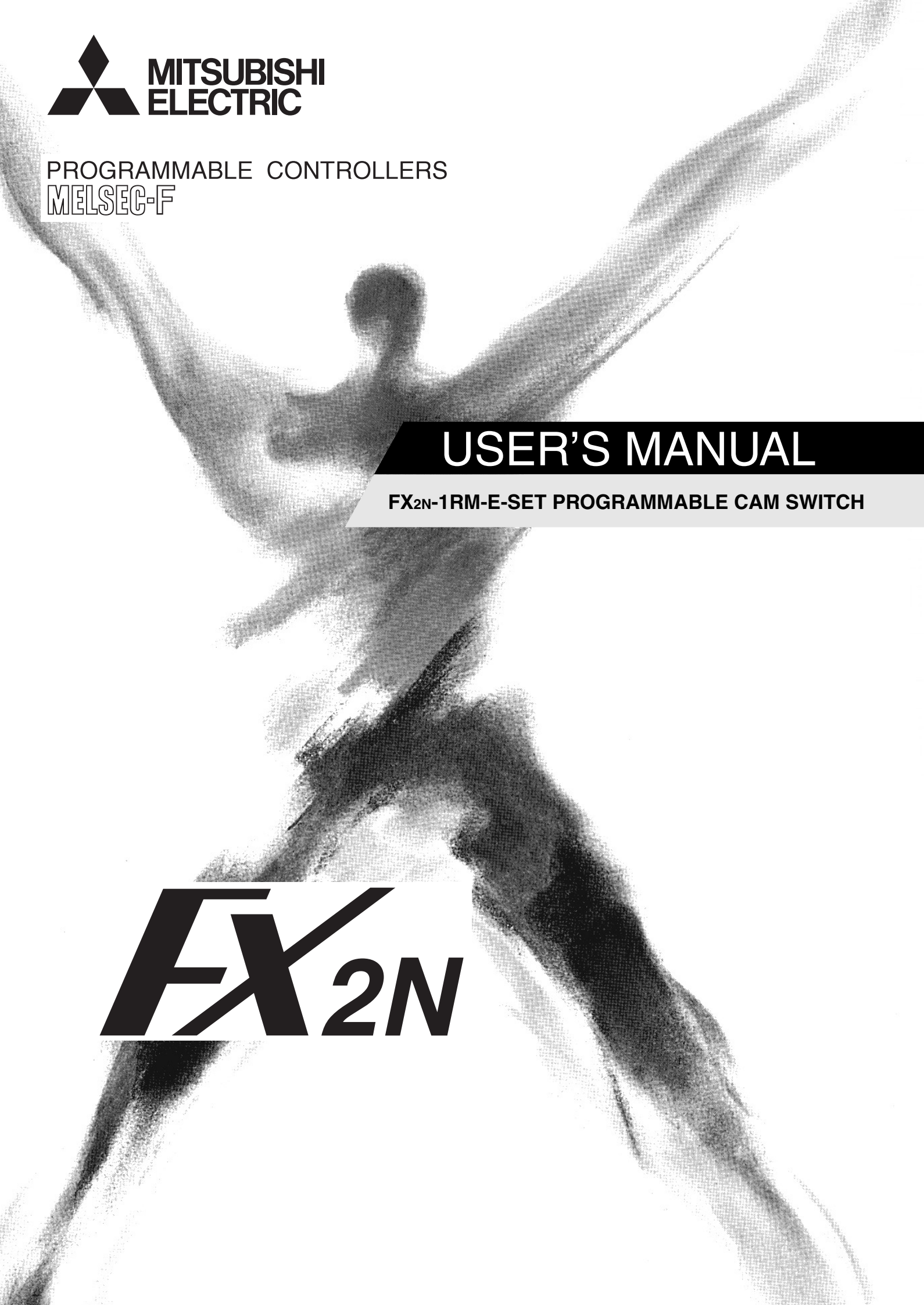
MITSUBISHI ELECTRIC

PROGRAMMABLE CONTROLLERS
MELSEC-F



USER'S MANUAL

FX2N-1RM-E-SET PROGRAMMABLE CAM SWITCH

FX2N

Foreword

- This manual contains text, diagrams and explanations which will guide the reader in the correct installation and operation of the Programmable Cam Switch FX2N-1RM-E-SET. It should be read and understood before attempting to install or use the unit.
- For handling of the FX2N/FX2NC Series PLC main unit and FX2N Series extension blocks as well as details of instructions, refer to the corresponding Hardware manuals and programming manuals offered separately.
- If in doubt at any stage of the installation of Programmable Cam Switch FX2N-1RM-E-SET always consult a professional electrical engineer who is qualified and trained to the local and national standards that applies to the installation site.
- If in doubt about the operation or use of Programmable Cam Switch FX2N-1RM-E-SET please consult the nearest Mitsubishi Electric distributor.
- This manual is subject to change without notice.

Programmable Cam Switch FX2N-1RM-E-SET

USER'S MANUAL

Manual number : JY992D71101
Manual revision : L
Date : April 2015

Guidelines for the safety of the user and protection of the Programmable Cam Switch FX2N-1RM-E-SET

This manual provides information for the use of the programmable cam switch FX2N-1RM-E-SET. The manual has been written to be used by trained and competent personnel. The definition of such a person or persons is as follows;

a) Any engineer who is responsible for the planning, design and construction of automatic equipment using the product associated with this manual should be of a competent nature, trained and qualified to the local and national standards required to fulfill that role. 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 required to fulfill that job. These engineers should also be trained in the use and maintenance of the completed product. This includes being completely familiar with all associated documentation for the said product. All maintenance should be carried out in accordance with established safety practices.

c) All operators of the completed equipment (see Note) should be trained to use this product in a safe manner in compliance to established safety practices. The operators should also be familiar with documentation which is associated with the operation of the completed equipment.

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

Notes on the Symbols Used in this Manual

At various times throughout this manual certain symbols will be used to highlight points of information which are intended to ensure the users personal safety and protect the integrity of equipment. Whenever any of the following symbols are encountered its associated note must be read and understood. Each of the symbols used will now be listed with a brief description of its meaning.

Hardware Warnings

1) Indicates that the identified danger **WILL** cause physical and property damage.

2) Indicates that the identified danger could **POSSIBLY** cause physical and property damage.

3) Indicates a point of further interest or further explanation.

Software Warnings

4) Indicates special care must be taken when using this element of software.

5) Indicates a special point which the user of the associate software element should be aware of.

6) Indicates a point of interest or further explanation.

- Under no circumstances will Mitsubishi Electric be liable 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.
- Please contact a Mitsubishi Electric distributor for more information concerning applications in life critical situations or high reliability.

1. Introduction

This section describes the outline of the programmable cam switch FX2N-1RM and introduces the peripheral equipment.

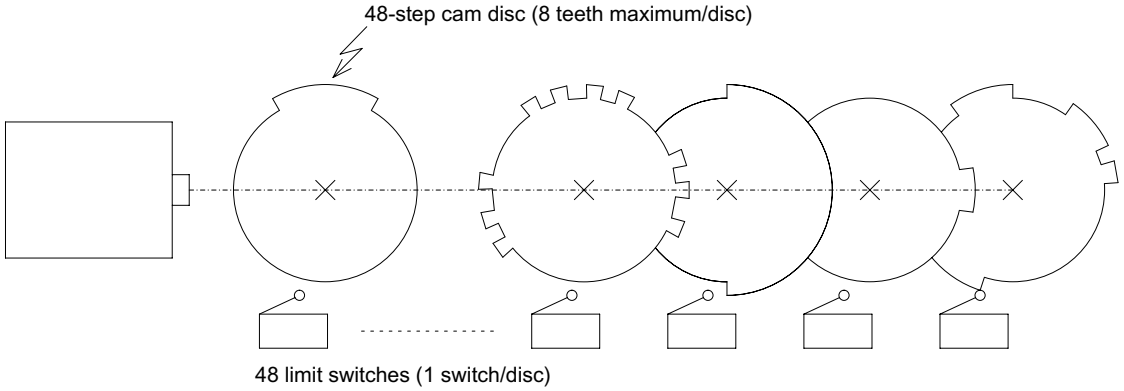
1.1 Outline of the product

The programmable cam switch FX2N-1RM (hereinafter referred to as FX2N-1RM or unit) detects the rotation angle of a machine using a brushless resolver, and turns on/off up to 48 points of transistor outputs at a programmed angle (position).
The basic function of the FX2N-1RM is equivalent to a mechanical cam switch shown in the figure on the next page. However, different from a mechanical cam switch, fine adjustment of the angle of many cam discs assembled in the mechanism and replacement of switches are not required in the FX2N-1RM.

1.2 Features

1) The angle can be detected with high precision even while a machine is rotating at high speed.
2) One FX2N-1RM unit can be used individually or up to three FX2N-1RM units can be connected at the end of the system and used as special units of an FX2N/FX3U/FX2NC/FX3UC programmable controller (hereinafter referred to as PLC).
(Refer to Paragraph 1.5 for details.)
3) When transistor output extension blocks for the FX2N are connected, up to 48 points of non-contact outputs are available. Up to 32 points can be turned on at one time. Up to 8 ON/OFF operations (STEP0 to STEP7) are enabled at each point.
(Maximum speed: 830 r/min during direct output)
4) Operation angle setting and monitor display can be performed from the dedicated data setting panel (integrated add-on type) or by FROM/TO instructions given by the PLC main unit.
5) An EEPROM (no battery) is built in. Up to 8 types of programs can be saved.
6) A bank can be switched, a program can be modified, and the automatic angle advance quantity can be modified while the program is running.
7) The ladder support software for personal computers in the PLC and the FX-20P-E (both of them are compatible with FX2N) can be used to save or transfer programs.
8) The cable of the brushless resolver assembled in the machine can be extended up to 100 m (3937 inch). (A relay cable of 5 m (196.85 inch) is offered as standard.)
9) The automatic angle advance function can compensate for the mechanical delay generated while a machine is rotating at a high speed.

< Mechanical cam-operated switch >



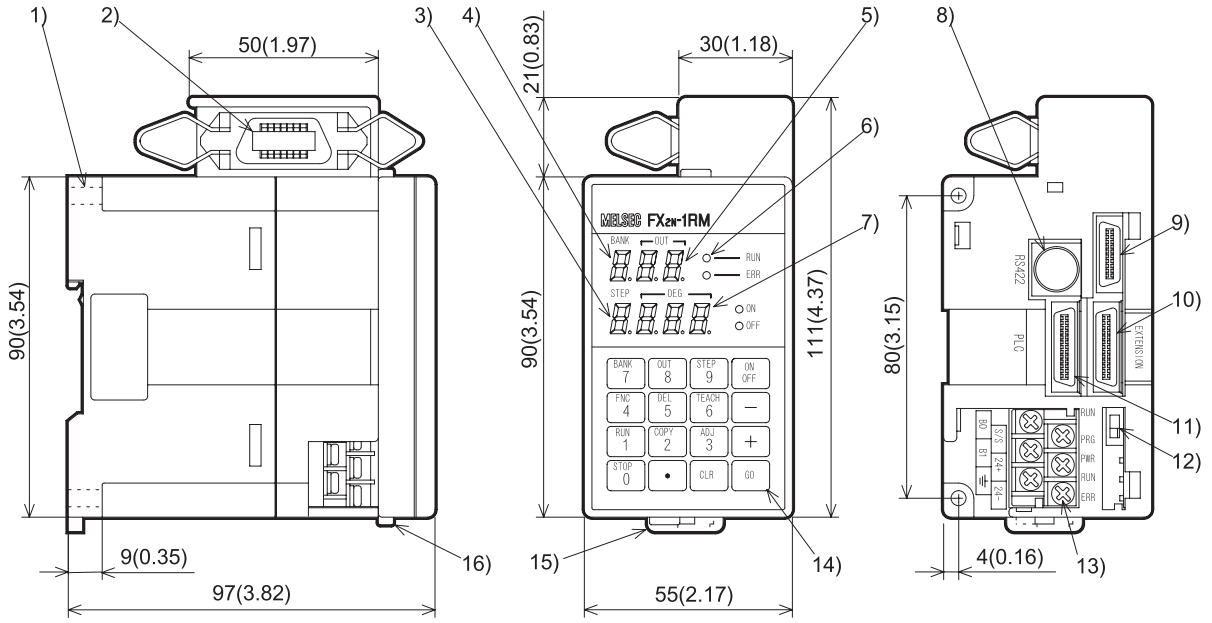
1.3 Product configuration

The FX2N-1RM package contains the following components.

- Programmable cam-operated switch FX2N-1RM (including data setting panel)
- Signal cable FX2N-RS-5CAB
- Resolver F2-720RSV
- Extension cable to connect PLC (55 mm(2.17 inch))

1.4 Outside dimensions and name of each part

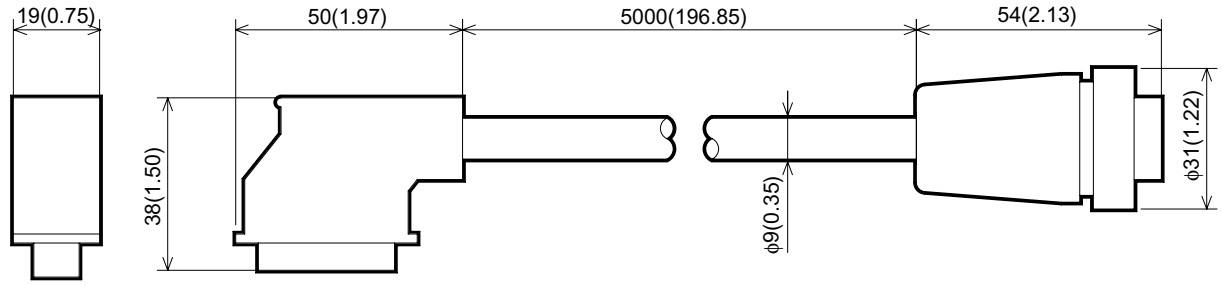
Dimensions: mm (inch)
Weight: approx.0.5kg



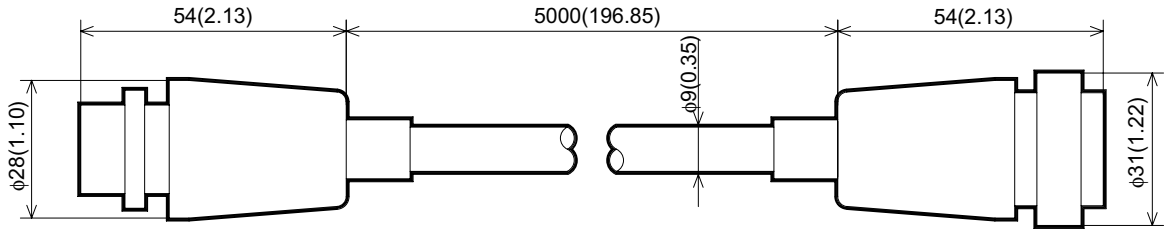
When the data setting panel is removed

1) Mounting hole in 2 positions (2-ϕ 4.5 (1.77))
2) Connector to connect resolver
3) STEP (output pattern) display
4) BANK (program No.) display
5) OUT (output No.) display
6) Operation display LED
RUN: Operation status display
ERR: Error display
ON: ON output setting display (during setting)
OFF: OFF output setting display (during setting)
7) DEG (angle) display
8) Connector to set personal computer or FX-20P-E
9) Connector to connect data setting panel
10) Connector to connect extension block
11) Connector to connect PLC
12) RUN/PRG selector switch
13) Power input/back change-over input terminal (terminal screw M3)
14) Sixteen keys for operation
15) Hook to attach DIN rail
16) Button to attach data setting panel

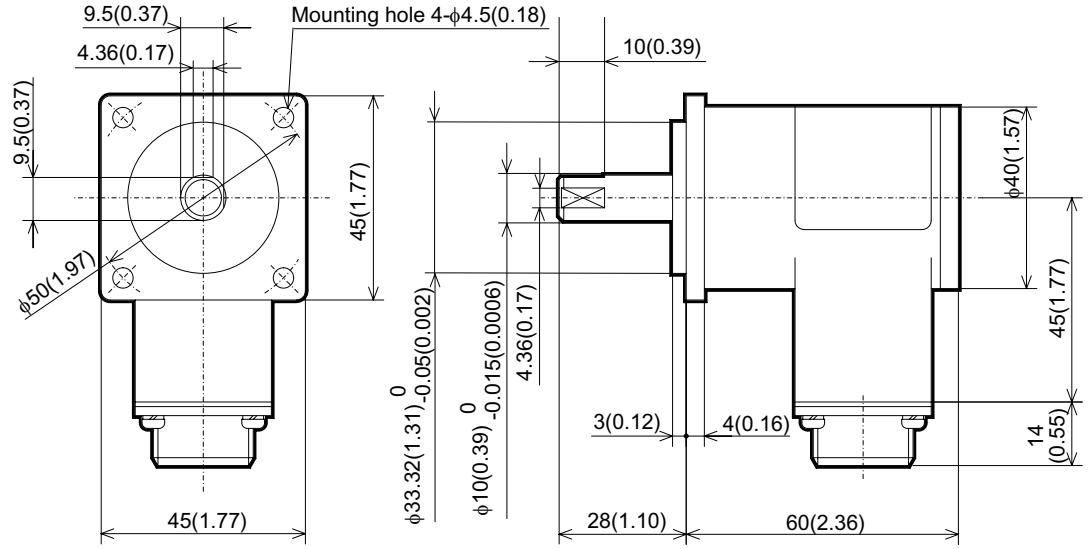
<Signal cable FX2N-RS-5CAB> [Unit: mm (inch)]



<Relay cable F_2-RS-5CAB> (option)

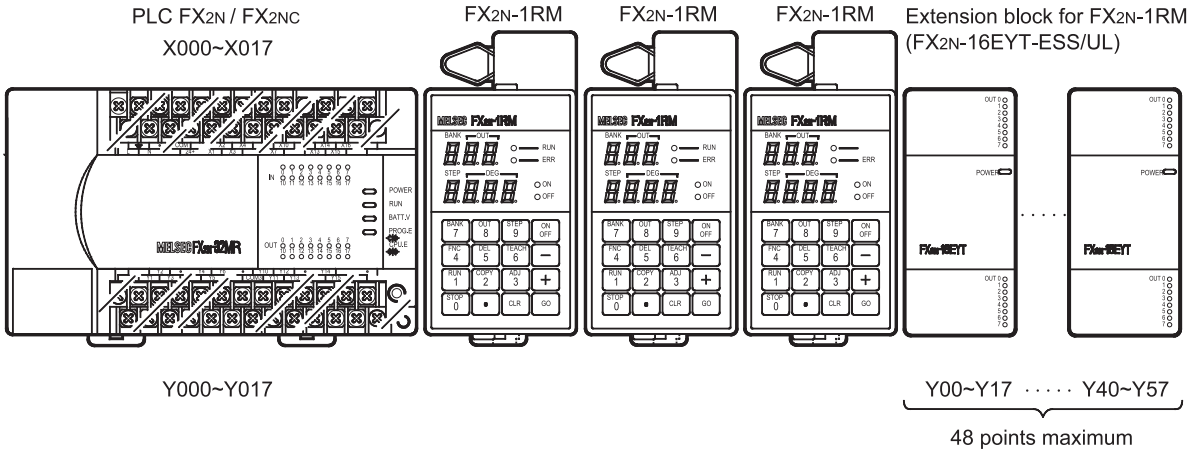


<Resolver F_2-720RSV>



1.5 System configuration

1.5.1 Connecting the FX2N-1RM to PLC



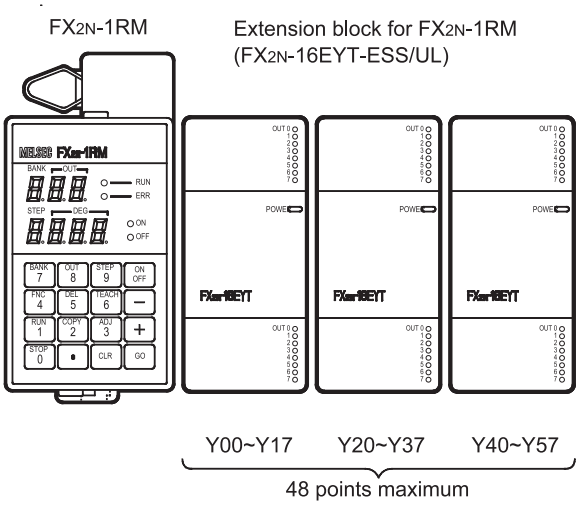
- The FX2N-1RM-SET can connect the following extension block.
  FX2N series extension block. (FX2N-16EYT-ESS/UL)
- Up to 3 FX2N-1RM units can be connected to the PLC main unit at the end of the system.
  The number of blocks that can be connected depends on the PLC main unit and version of the FX2N-1RM.

Main unit	Version of FX2N-1RM	The number which can be connected	Note
FX2N	V1.00 (before 1998/2)	1	—
	V2.00 (from 1998/2)	3	—
FX2NC	From the first product	1	• FX2NC-CNV-IF is necessary for the connection. • FX0N-30EC and FX0N-65EC cannot be used.
FX3U	From the first product	3	—
FX3UC	V1.00 (before 1998/2)	1	• FX2NC-CNV-IF is necessary for the connection. • FX0N-30EC and FX0N-65EC cannot be used.
	V2.00 (from 1998/2)	3	

- The FX2N-1RM units occupy 8 I/O points without regard to the number of units connected. (The ratio of input points and output points is arbitrary.)
- As shown in the diagram up to 48 points offered by output extension blocks can be connected to the FX2N-1RM unit at the end of the system.
  The extension blocks dedicated to outputs connected are treated as the outputs of the FX2N-1RM. They are not recognized by the PLC main unit, and not included in the number of I/O points (256 points maximum) of the PLC main unit.
- Octal numbers are assigned as output Nos. of the extension blocks connected to the FX2N-1RM from the extension block nearest to the FX2N-1RM (Y00 to Y07, U10 to Y17, . . . Y50 to Y57).

- Only output extension blocks are allowed to be connected to the FX2N-1RM.
  (Even if extension blocks dedicated to input are connected, no input can be received and input Nos. are not assigned.)
- Each data or bit information can be read and written between the PLC main unit and the FX2N-1RM using FROM/TO instructions.
  When two or more FX2N-1RM units are connected, data information and bit information can be read and written in only the FX2N-1RM unit nearest to the PLC main unit using FROM/TO instructions directly given by the PLC main unit.
  In the second and third FX2N-1RM units, data information and bit information are read and written from the PLC main unit via the unit nearest to the PLC main unit.
- All the FX2N-1RM units must be installed adjacent to each other.

1.5.2 Using the FX2N-1RM individually

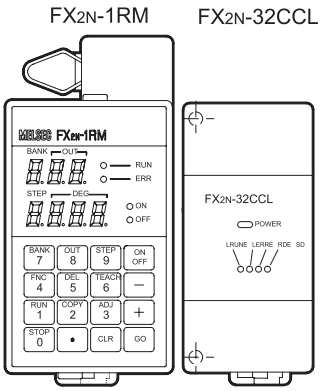


- The FX2N-1RM-SET can connect the following extension block.
  FX2N series extension block. (FX2N-16EYT-ESS/UL)
- Up to 48 output points can be connected to the FX2N-1RM. Octal numbers are assigned as output Nos. from the extension block nearest to the FX2N-1RM (Y00 to Y07, Y10 to Y17, . . . Y50 to Y57).
- Only extension blocks with dedicated output are allowed to be connected to the FX2N-1RM. (If extension blocks with dedicated input are connected, no input can be received and input Nos. are not assigned.)
- Two or more FX2N-1RM cannot connected without connecting the PLC main unit.

1.5.3 CC-Link connection

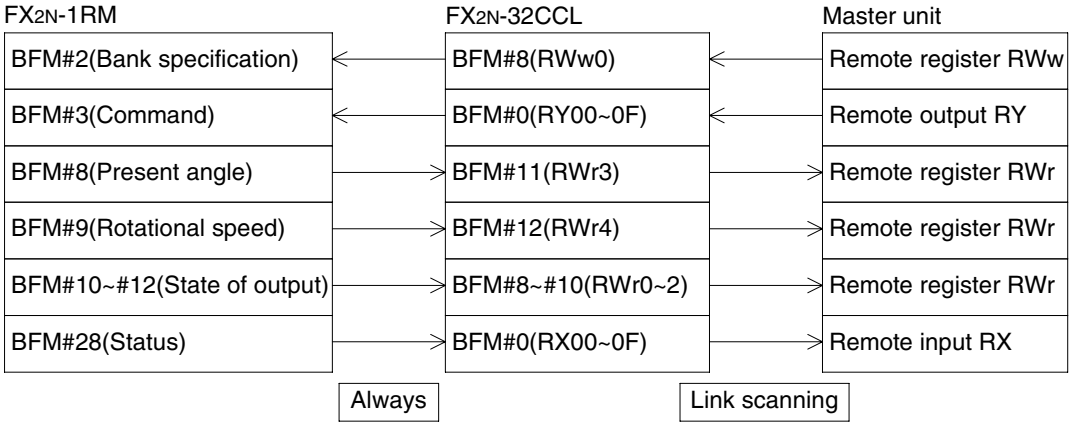
<Using the FX2N-1RM individually>

Composition



- When one FX2N-1RM is used in CC-Link, FX2N-32CCL interface block (here in after referred to as FX2N-32CCL) is connected with the connector for the extension block connection FX2N-1RM.
- FX2N-32CCL can not be used together with the output extension blocks.
- Refer to user's manual of this bale in FX2N-32CCL and connection with master unit.

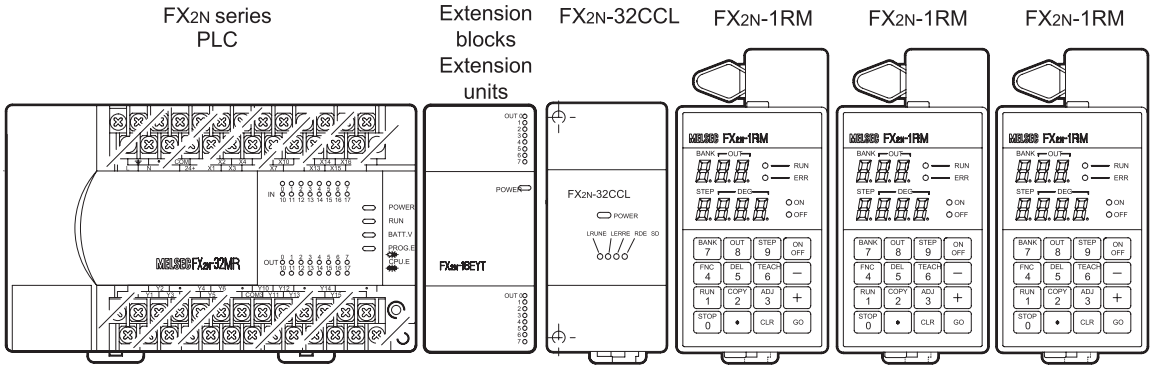
Flow data



- The communication between FX2N-1RM and FX2N-32CCL is always done while energizing the power supply. The communication between FX2N-32CCL and master unit is done to the link scanning.
- When setting the number of occupied stations of FX2N-32CCL is 1, BFM#9 of FX2N-1RM (rotational speed) is not transmitted.
  Set the number of occupied stations in 2 when you transmit the rotational speed.
- When cc-link is connected, setting and the program for the communication are unnecessary in FX2N-1RM. Refer to each user's manual for setting the communication in FX2N-32CCL and master unit

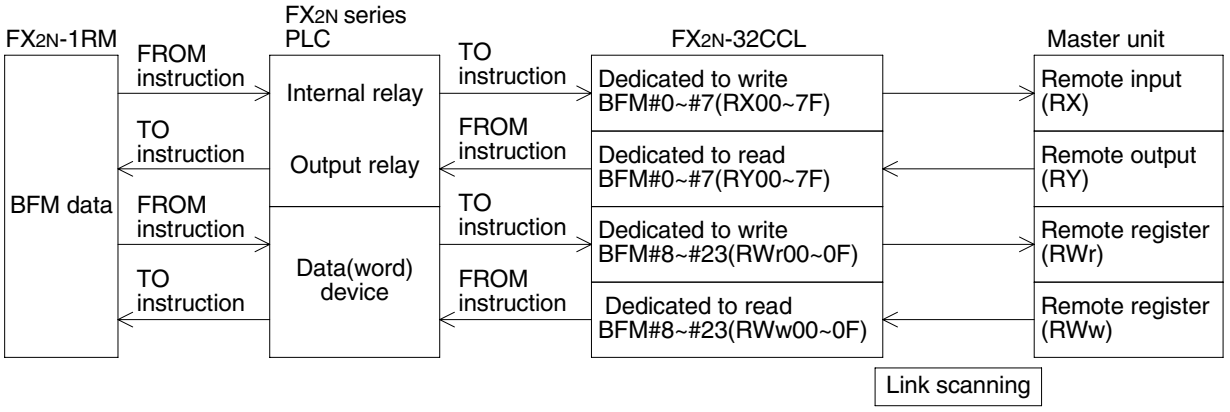
<Two or more FX2N-1RM units are connected with PLC>

Composition



- When two or more FX2N-1RM units ate connected and used for PLC, FX2N-32CCL is connected at the right of the main unit of PLC and FX2N-1RM is connected at the end of the system.
- Connected number of FX2N-1RM and the limitation concerning the connection of the output extension block are the same as time when FX2N-32CCL is not connected. (Refer to paragraph 1.5.1)
- Refer to user's manual of this bale in FX2N-32CCL for power supply wiring of FX2N-32CCL and connection with master unit.

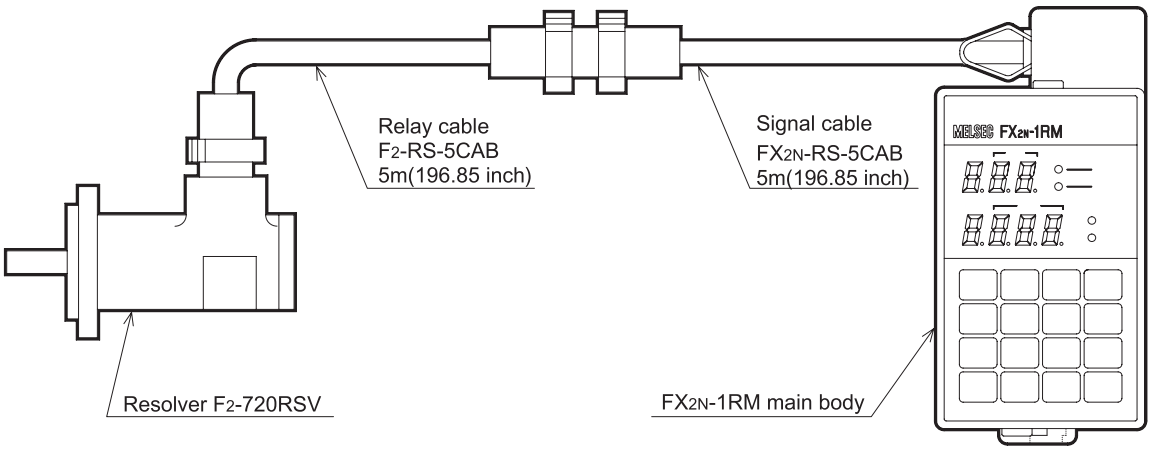
Flow of data



- Data is read/write by between FX2N-1RM, PLC and FX2N-32CCL.
  The communication between FX2N-32CCL and master unit is done to the link scanning.
- When cc-link is connected, setting and the program for the communication are unnecessary in FX2N-1RM. Refer to each user's manual for setting the communication in FX2N-32CCL and master unit

1.5.4 Resolver and connection cable

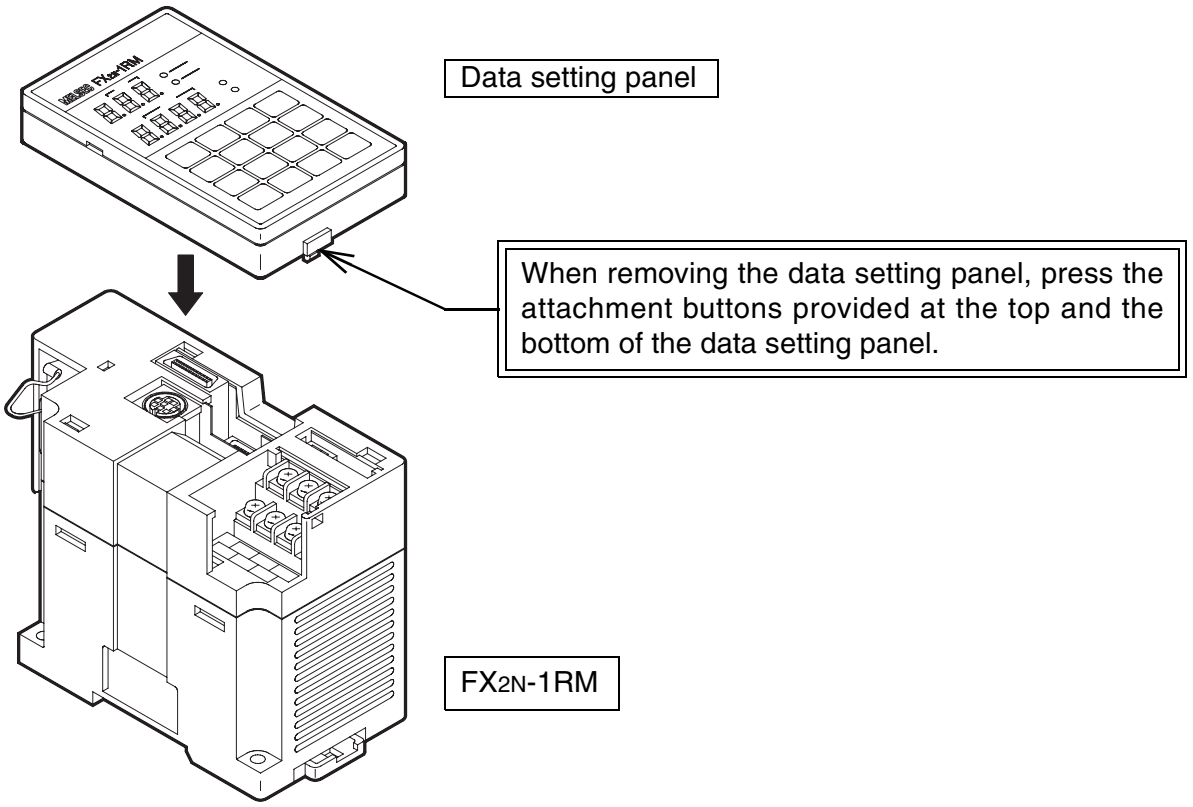
<Connection diagram>



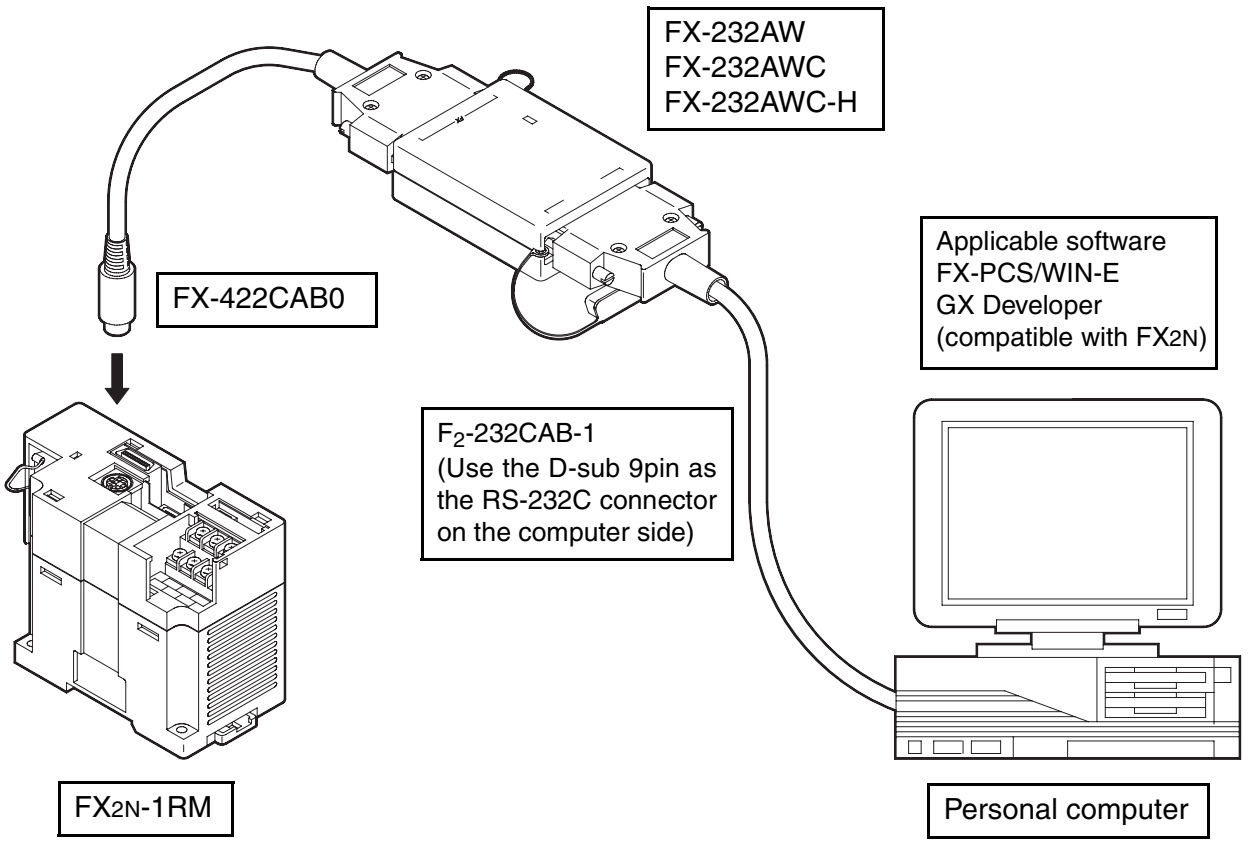
When the signal cable is not long enough, relay cables can be connected for extension as shown in the figure above. Two or more relay cables can be used.
The maximum extension length is 100 m (3937 inch).

1.5.5 Connecting the peripheral equipment

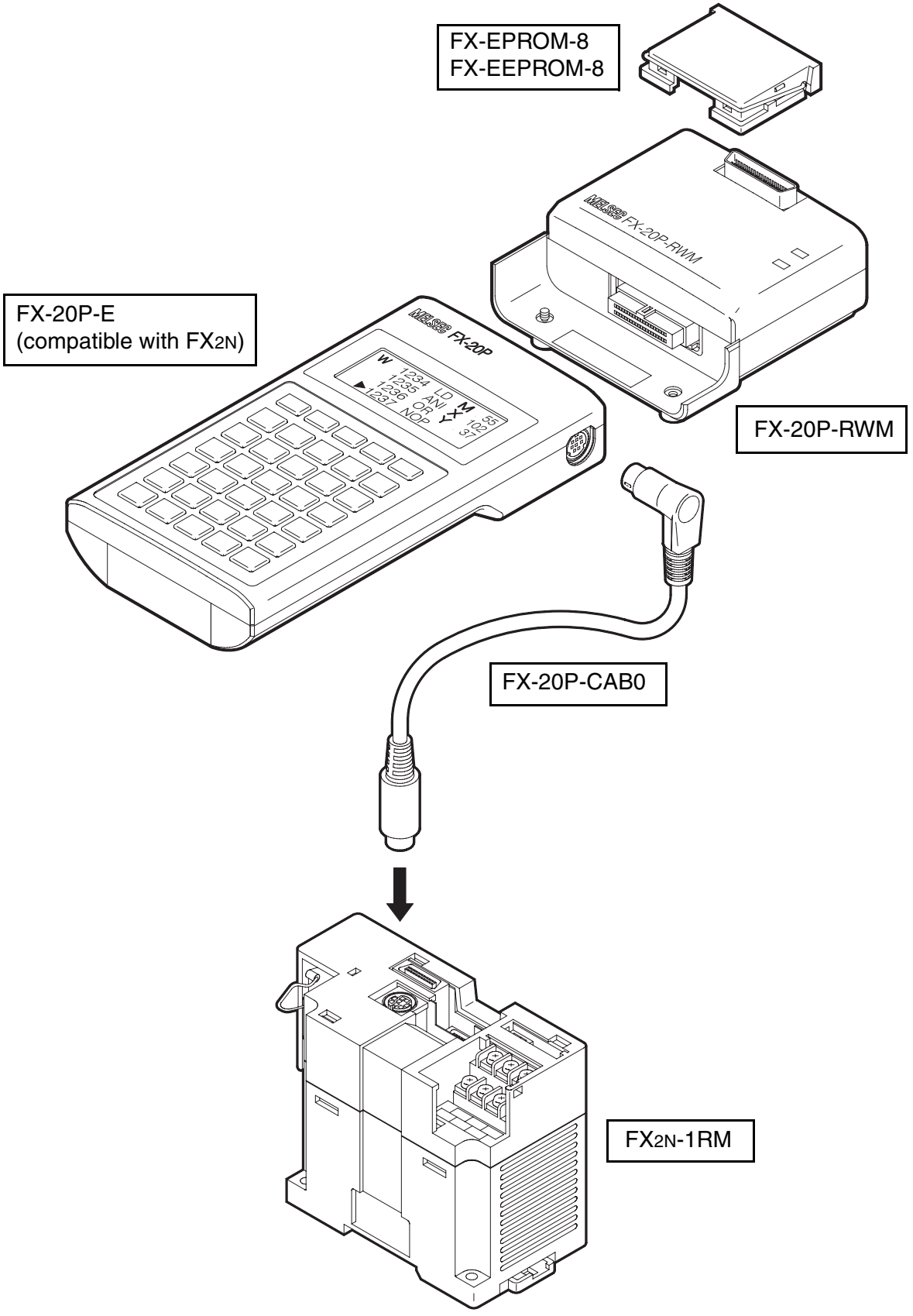
< Data setting panel >
This panel allows data setting, data read, monitoring, copy between banks, teaching and fine adjustment in the RUN mode.



< Personal computer >
A personal computer allows save and transfer of programs.



<FX-20P-E>
The FX-20P-E allows the save and transfer of programs.
Use the FX-20P-RWM and a memory cassette to save programs.



1.5.6 Cautions on use of a personal computer and the FX-20P-E

- Only the program transfer function is available from a personal computer or the FX-20P-E to the FX2N-1RM. The monitor function, the test function, the current value change function, etc. are not available. (If such a function is used, a communication error occurs.)
  Set the parameter as shown in the table below when transferring programs.

PLC model	FX2N	
Memory capacity	8K step	
File register	14 blocks (7,000 points)	
Comment	0 block	
Latch range	M500~M1023	Equivalent to values at time of shipment from plant
	S500~S999	
	C100~C199	
	C220~C255	
	D200~D511	
Program	All NOP (unattended)	

  If a program is transferred while the parameters are not set as shown above, a parameter mismatch error or program mismatch error occurs.

- Use a personal computer or the FX-20P-E only when FX2N-1RM is in PRG mode (halt condition). The following may occur if they are used in RUN mode:
  - FX2N-1RM is overloaded because the power is also supplies the peripheral equipment and the FX2N-1RM stops.
  - Communication between the peripheral equipment and FX2N-1RM becomes very slow and a communication error takes place.
- When a program is transferred from a personal computer or the FX-20P-E, D1000 to D7143 correspond to BFM #1000 to BFM #7143, D7144 to D7145 correspond to BFM #0 to BFM #1, and D7146 to D7159 correspond to BFM #13 to BFM #26.
  At this time, the angle data and FNC instructions (FNC70 to 75, 90) among D1000 to D7159 are fixed to a double value (720 degrees/rotation) without regard to the setting of the resolution (selected by the data setting panel or BFM #0 b6).
  D7144 (BFM #0), D7146 (BFM #13) and D7148 (BFM #15) are treated by one time value.

  Example

  ON/OFF angle
  At BFM #1000=100°, D1000 becomes 200.

  FNC

  When FNC 70 (BCD output) is set, D1000 becomes 2140. Continuing D1001 reaches twice value at strobing ON time.

  $$D1000 = (\underline{1000} + \underline{70}) \times 2 = \underline{2140}$$

  1000: fixed value; 70: FNC number; 2140: value of D1000

  When strobing ON time is 50ms, D1001 becomes 100.

  When individual automatic angle advance function is set, D6376 to D6393 reach the value twice the number of rotations, the turning ON angles, and the turning OFF angles of S0 to S6.

- The table below shows the applicable versions for personal computers and the FX-20P-E.

Peripheral equipment	FX2N-1RM	
	V. 2.20 or earlier	V. 2.30 or later
FX-PCS/WIN-E(V.1.00 to V.2.11)	applicable	
FX-PCS/WIN-E(V.3.00 or later)	not applicable	applicable
GX Developer	not applicable	applicable from SW2D5□-GPPW-E
FX-20P-E	applicable from V. 3.00	

Memo

2. Installation

This section describes how to install the FX2N-1RM and the resolver.

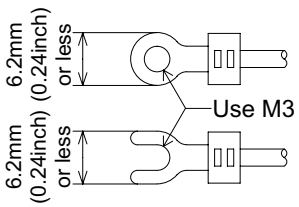
2.1 Installation method

The FX2N-1RM can be mounted via a DIN rail or directly mounted with M4 screws.

< When mounted via a DIN rail >
The FX2N-1RM can be mounted to a DIN rail DIN 46277 (Width: 35 mm (1.38 inch)) without any modification.
When removing the FX2N-1RM, pull the DIN rail mounting hook downward.

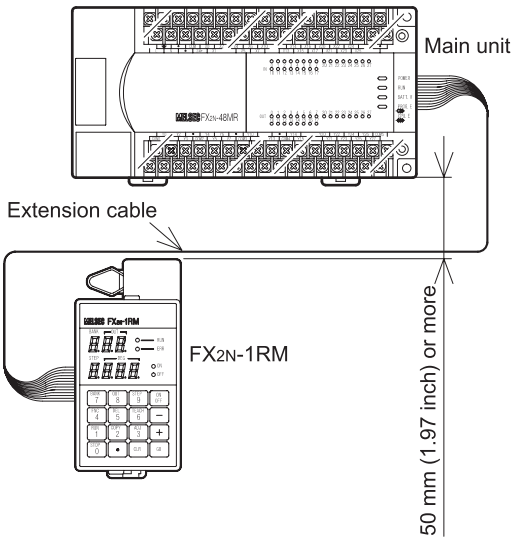
< When directly mounted >
Mount the FX2N-1RM with M4 screws while referring to section 1.4 Outside dimensions and name of each part.
Assure clearance of 1 to 2 mm (0.04 to 0.08 inch) between units.

2.2 Wiring

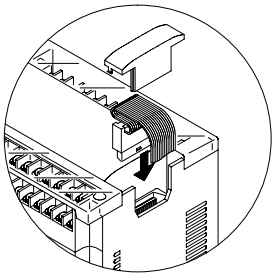


- Use crimp-style terminals of the size shown on the left.
- The terminal tightening torque should be 0.5 to 0.8 N·m. Tighten terminals securely so that malfunction cannot occur.

When arranged in 2 rows



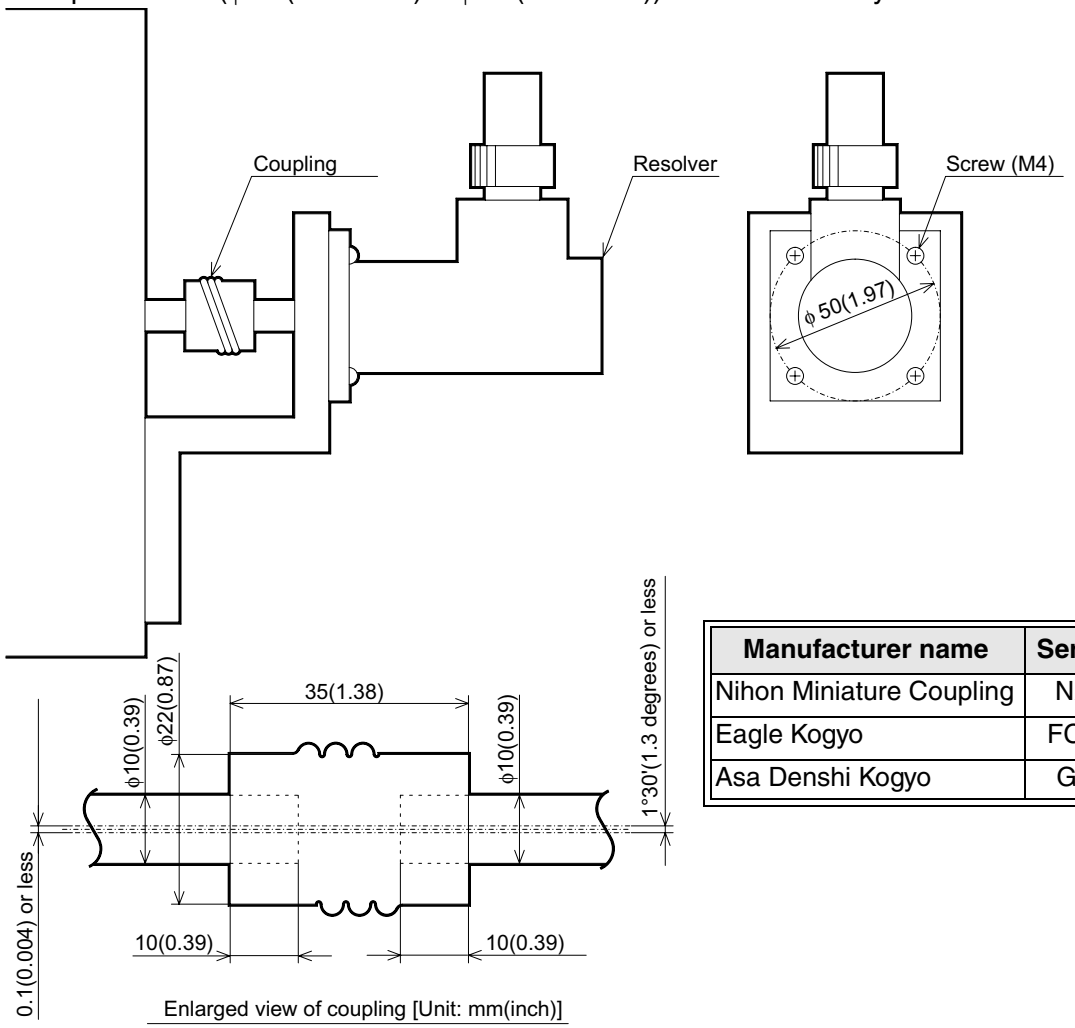
- An extension cable of 55 mm (2.17 inch) is offered as an accessory of the FX2N-1RM.
  An extension cable of FX0N-30EC(300mm,11.81 inch) and FX0N-65EC(650mm,25.59 inch) are offered as options.
  For 1-row arrangement: Cable of 55 mm(2.17 inch)
  For 2-row arrangement: Cable of 300mm(11.81 inch), 650 mm(25.59 inch) (option)
  (When FX2N-1RM is connected with an FX2NC/FX3UC series PLC, these extension cables cannot be used.)
- A cable is built in an extension block.
- When connecting an extension cable, fold it and accommodate it in the connector cover of the counterpart equipment as shown in the figure on the right.



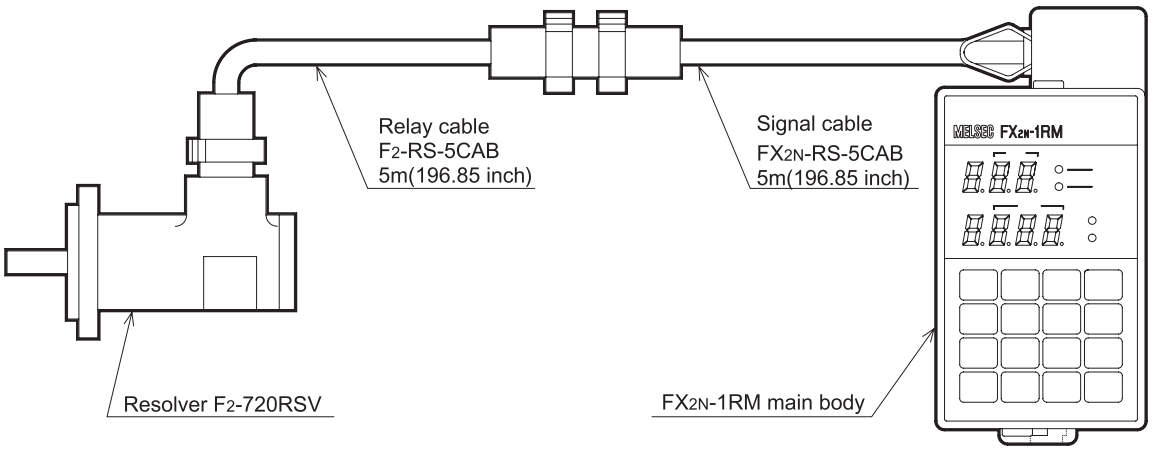
2.3 Installing the resolver

When installing a resolver, pay rigid attention to eccentricity of the rotation shaft and tilt of the shaft. Attach a resolver to a machine via an elastic coupling.

Example: NA-15 (ϕ10 (0.39 inch) × ϕ10 (0.39 inch)) manufactured by Nihon Miniature Coupling



Manufacturer name	Series name
Nihon Miniature Coupling	NA Series
Eagle Kogyo	FCS Series
Asa Denshi Kogyo	GJ Series



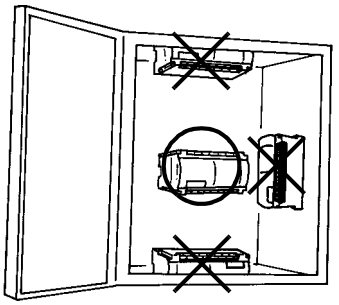
When the signal cable is not long enough, relay cables can be connected for extension as shown in the figure above.

Cautions on installation

- Use the unit in the environment in accordance with the environmental specifications described in Paragraph 3.1 in this manual.
  Do not use the unit in a place with dust, soot, conductive dust, corrosive gases (Salt air, Cl_2, H_2S, SO_2, NO_2, etc.) or flammable gases. Do not use in places exposed to high temperature, condensation, wind and rain, vibrations or possible impacts.
  If the unit is used in such a place, electrical shocks, fires, malfunction, damage to the unit or deterioration in the performance of the unit may occur.
- Do not drop cutting chips and electric wire chips into the ventilation window of the PLC while drilling screw holes or performing the wiring work.
  If such chips are dropped, fires, failures or malfunction may occur.
- When the installation work is completed, remove the dust preventive sheet attached to the ventilation window of the PLC.
  If the sheet is not removed, fires, failures or malfunction may occur.
- Connect cables such as extension cables and memory cassettes securely to the specified connectors respectively.
  If such cables and cassettes are not connected correctly, malfunction may occur caused by imperfect contact.

Note

- When a dust preventive sheet is provided on an extension block, adhere it on the ventilation window during the installation/wiring work.
- Never install the unit on the floor, on the ceiling or in the vertical direction. If the unit is installed in such a way, the temperature may become too high.
  Make sure to install the unit in the horizontal direction as shown in the figure on the right.
- Arrange extension cables so that connectors on the left side of extension units, extension blocks, and special units are connected on the side near the main unit.
- Assure clearance of 50 mm (1.97 inch) or more between the unit main unit and other equipment or structure. Keep a high voltage cable, high voltage equipment, and power equipment from the unit as much as possible.



Cautions on wiring

- Make sure to shut down all the phases of the power supply outside the PLC before starting the installation/wiring work.
  If all the phases are not shut down, electrical shocks or damage to the product may occur.
- Make sure to attach the terminal covers offered as accessories before supplying the power and operating the product after the installation/wiring work has been finished.
  If the covers are not attached, electrical shocks may occur.

Note

- Never let the signal input line and the signal output line of the PLC go through the same cable.
- Never let the signal input line and the signal output line of the PLC go through the duct together with other power lines and output lines.
  Never bind the signal input line and the signal output line of the PLC together with other power lines and output lines.
- When the cautions above are observed, no problem should be expected with regard to noise even if the input/output wiring is extended to 50 to 100 m (1968.5 to 3937.0 inch). It is recommended, however, to set the wiring length to 20 m (787.4 inch) or less to assure safety.
- Extension cables are most susceptible to noise. When wiring them, keep them away from the output of the PLC and other power lines by at least 30 to 50 mm (1.18 to 1.97 inch).

3. Specifications

This section describes the specifications of the FX2N-1RM and the resolver.

Cautions on design

- Provide a safety circuit outside the PLC so that the entire system can operate conservatively in any case even if an error has occurred in the external power supply or a failure has occurred in the PLC.
  If a safety circuit is not provided, an accident may occur caused by malfunction or erroneous output.

1) Make sure to construct a circuit outside the PLC as to an emergency stop circuit, a protection circuit, an interlock circuit for reverse operations such as normal rotation and reverse rotation and an interlock circuit to prevent mechanical damages such as for upper and lower limits for positioning.

2) When the PLC CPU has detected an abnormality by the self-diagnosis function such as a watchdog timer error, all the outputs are turned off. When an abnormality has occurred in the I/O control area, etc. which cannot be detected by the PLC CPU, the output control may be disabled.
Design the external circuit and the mechanism so that the machine can operate conservatively in such cases.

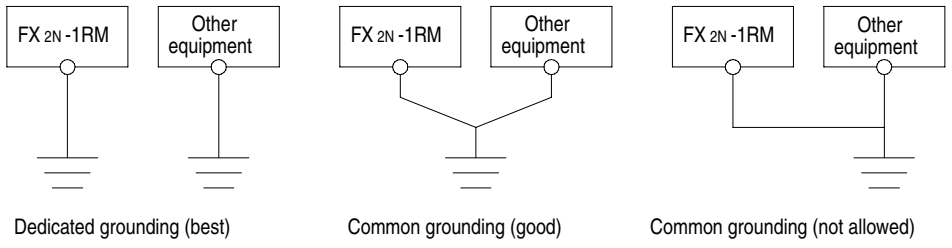
3) The output current of the service power supply for the sensor varies depending on the model and existence of extension blocks. If overload has occurred, the voltage is automatically dropped, the input to the PLC is disabled, and all the outputs are turned off.
Design the external circuit and the mechanism so that the machine can operate conservatively in such a case.

4) When a failure has occurred in a relay, transistor, TRIAC, etc. in the output unit, the output may be kept turned ON or OFF.
Design the external circuit and the mechanism so that the machine can operate conservatively with regard to an output signal which may lead to a serious accident.

3.1 General specifications

<table>
<tr><td>Ambient temperature</td><td colspan="5">0 to 55°C when operating and -20 to 70°C when stored</td></tr>
<tr><td>Ambient humidity</td><td colspan="5">35 to 85% RH (no condensation) when operating</td></tr>
<tr><td rowspan="4">Vibration resistance</td><td></td><td>Frequency (Hz)</td><td>Acceleration (m/s^2)</td><td>Half amplitude (m/m)</td><td rowspan="4">Sweep Count for X, Y, Z: 10 times (80 min in each direction)</td></tr>
<tr><td rowspan="2">When installed on DIN rail</td><td>10 to 57</td><td>–</td><td>0.035</td></tr>
<tr><td>57 to 150</td><td>4.9</td><td>–</td></tr>
<tr><td>When installed directly</td><td>10 to 57</td><td>–</td><td>0.5 (2G maximum)</td></tr>
<tr><td>Impact resistance</td><td colspan="5">98 m/s^2 Acceleration, Action time: 11ms, 3 times by half-sine pulse in each direction X, Y, and Z</td></tr>
<tr><td>Noise resistance</td><td colspan="5">By noise simulator at noise voltage of 1,000 Vp-p, noise width of 1 μs rise time of 1 ns and period of 30 to 100 Hz</td></tr>
<tr><td>Dielectric withstand voltage</td><td colspan="2">500 V AC for one minute</td><td colspan="3">Between all terminals as a whole and ground terminal</td></tr>
<tr><td>Insulation resistance</td><td colspan="2">5 MΩ or more by 500 VDC megger</td><td colspan="3">Between all terminals as a whole and ground terminal</td></tr>
<tr><td>Grounding</td><td colspan="5">Class D grounding (grounding resistance: 100 Ω or less)
<Common grounding with a heavy electrical system is not allowed>*1
Ground the PLC independently or jointly.</td></tr>
<tr><td>Working atmosphere</td><td colspan="5">Free from corrosive or flammable gas and excessive conductive dust</td></tr>
<tr><td>Working altitude</td><td colspan="5"><2000m*2</td></tr>
</table>

*1:



*2: Do not use the PLC under pressure higher than the atmospheric pressure. Doing so may damage the PLC.

3.2 Performance specifications

Applicable PLC	The bus of an FX2N, FX3U, FX2NC and FX3UC series PLC can be connected. A single drive is also possible. (Refer to subsection 1.5.1.)
Program memory	Built-in EEPROM memory (no battery)
Number of cam output points	48 internal output points. Data is read by PLC. In addition, 48 points can be connected when transistor output extension blocks or triac output extension blocks are connected. (When extension blocks are connected, up to 32 points can be turned on at a time.)
Detector	Brushless resolver (F2-720RSV for F2-32RM)
Control resolution	720 divisions/rotation (0.5 degree) or 360 divisions/rotation (1 degree)
Response speed	415 r/min/0.5 degree or 830 r/min/degree When the current angle transfer function is used, response speed becomes 207r/min/0.5degree or 415r/min/degree.
Number of program banks	8 banks (specified by PLC) or 4 banks (specified by external input)
Setting unit	Dedicated data setting unit (integrated add-on type) Peripheral equipment for PLC via PLC (Sequence program is required.)
Number of times of ON/OFF	8 times/cam output
Input	2 bank input points (code input of 0 to 3), 24 VDC, 7 mA, response time 3 ms, photocoupler isolation
Setting switch	RUN/PRG selector switch and 16 keys (input from data setting panel)
LED indication	POWER, RUN, ERROR, 7-segment × 7 digits, LED × 4

3.3 Resolver specifications

Excitation method	Two-phase excitation, 1-phase output (5 kHz)
Mechanical allowable rotation speed	3000r/min
Cable distance	100 m (3937 inch) maximum
Vibration resistance	10 to 2000 kHz (15 G maximum), 2 hours in each of 3 directions
Impact resistance	50 G, 11 ms, 3 times in each of 6 directions
Abrasion torque	0.0118N·m or less
Protection structure	IP52
Ambient temperature	-10 to +85°C

3.4 Power supply specifications

Rated voltage	24 VDC+10%, -15%
Allowable instantaneous power interruption period	5ms
Power consumption	3 W (when operating individually), 5 W (at 32 points output ON)

3.5 Input specifications

Input signal voltage	24 VDC ±10%
Input signal current	7 mA/24 VDC
Input ON current	4.5 mA or more
Input OFF current	1.5 mA or less
Input response time	Approximately 3 ms
Input signal format	Contact input or NPN/PNP open collector
Circuit isolation	Photocoupler isolation

4. External Wiring

This section describes wiring of the power supply and the input.

Cautions on wiring

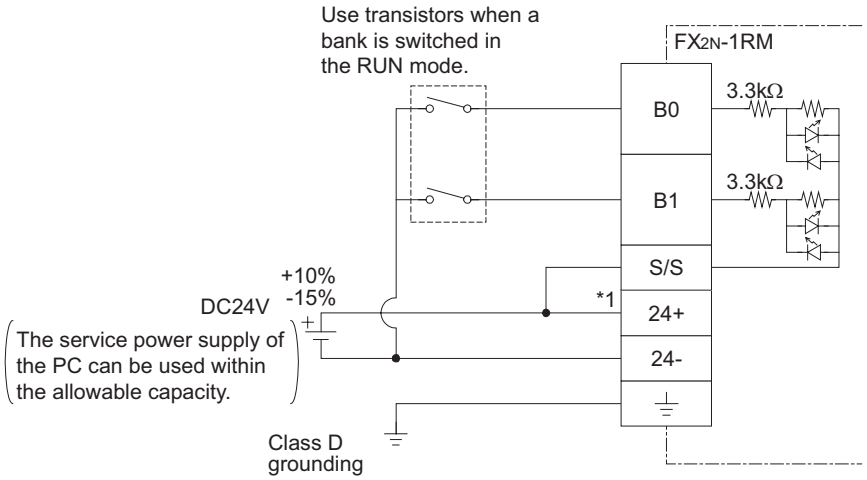
- Do not connect the AC power supply to DC I/O terminals or DC power terminals.
  If such connection is performed, the FX2N-1RM may burned out.
- Do not perform wiring from the outside to an unused terminal [·] of the main unit or an extension block.
  If such wiring is performed, the unit may be damaged.
- Perform Class D grounding to the ground terminal in the FX2N-1RM or the main unit using an electric wire of 2 mm^2 or more.
  However, do not perform common grounding with a strong electric system.

Note

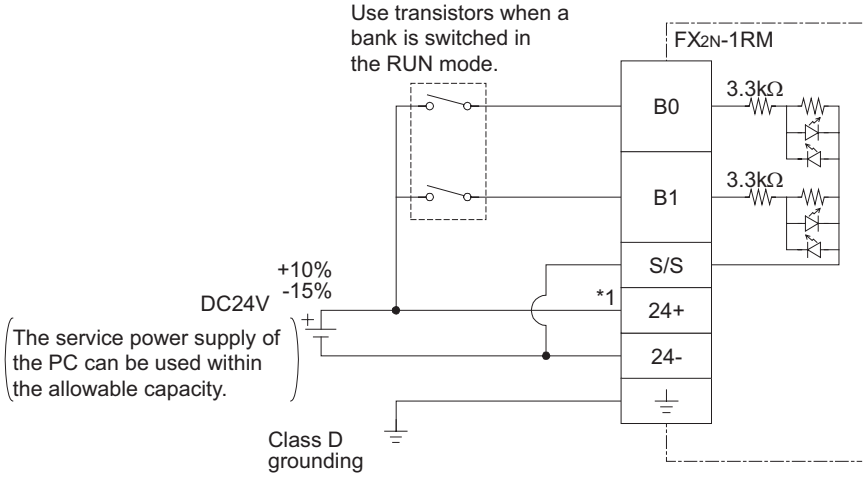
- Turn on or off simultaneously the power of the PLC and the power of the FX2N-1RM.
- Use an electric wire of 2 mm^2 or more as a power line so that voltage drop can be prevented.
- Even if an instantaneous power interruption of 5 ms or less has occurred, the FX2N-1RM continues its operation.
  If a considerably long power interruption or an abnormal voltage drop has occurred, the FX2N-1RM is stopped and the output is turned off. When the power is recovered, the FX2N-1RM automatically restarts operation
  (if the RUN/PRG selector switch is set to "RUN").

4.1 Wiring of the power supply and the input

<Sink input>

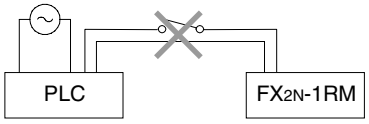


<Source input>



*1 It is recommended to use the 24V DC service power supply from the PLC main unit.
If two sources are required, follow the below guidelines:
- Supply power to the FX2N-1RM before or at the same time the PLC is powered.
- The power supplies may be cut the same time after ensuring system safety.

When using the service power supply of PLC as follows, do not power on the FX2N-1RM during the ON state of PLC power supply.
If the FX2N-1RM is powered on during the ON state of the PLC power supply, inrush current will power off the internal electrical power source of the PLC.



- For the capacity of the service power supply of the PLC main unit, refer to the Hardware Manual offered separately.

5. Extension Block Specifications and External Wiring

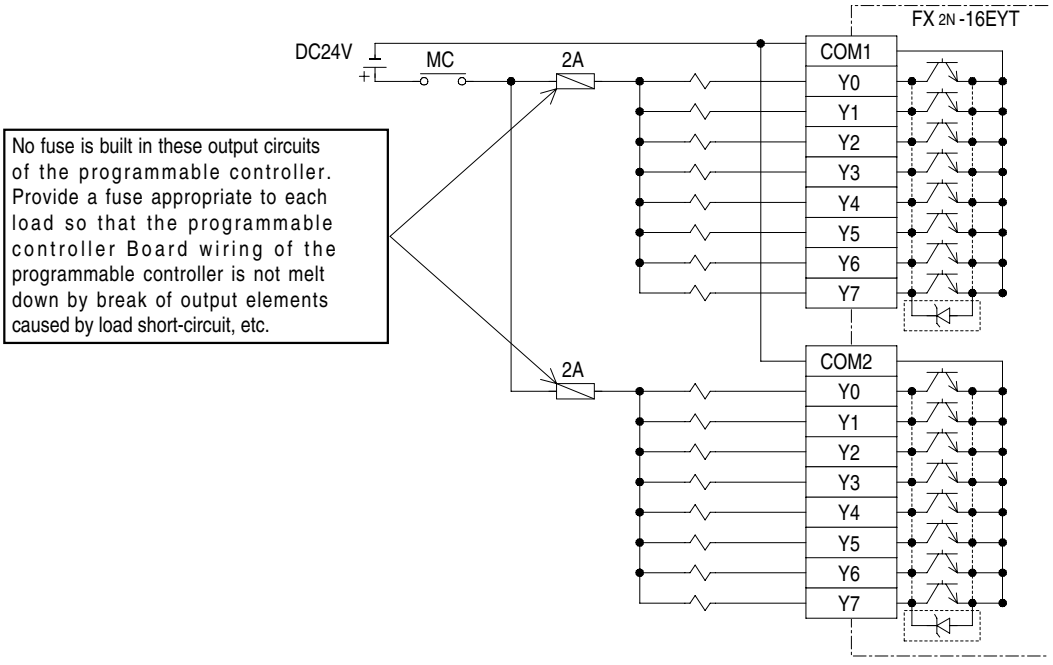
This section describes the specifications and the wiring of the FX2N-16EYT.
When other extension blocks dedicated to output are used, refer to the Hardware Manual of the FX2N Series PLC in accordance with the model used.

5.1 Extension block specifications (transistor output type)

External power supply		5 to 30 VDC
Circuit isolation		Photocoupler isolation
Maximum load	**Resistance load**	0.5 A/point, 0.8 A/4 points common, 1.6 A/8 points common
	Inductive load	12 W/24 VDC
	Ramp load	1.5 W/24 VDC
Open circuit leak current		0.1 mA/30 VDC
Response time	**OFF → ON**	0.2 ms or less (0.2 A or more)
	ON → OFF	0.2 ms or less (0.2 A or more)

- The general specifications are equivalent to those of the FX2N-1RM. (Refer to Paragraph 3.1.)

5.2 Output wiring (transistor output type)



Cautions on wiring

- Do not connect the AC power supply to DC I/O terminals or DC power terminals. If such connection is performed, the FX2N-1RM may burned out.
- Do not perform wiring from the outside to an unused terminal [·] of the main unit or an extension block.
  If such wiring is performed, the unit may be damaged.

6. Basic Setting

This section describes the basic setting of the FX2N-1RM including handling of the RUN and STOP modes, specification of the bank No., setting of the automatic angle advance function and setting of the reference angle.

Cautions on start-up and maintenance

- Do not touch any terminal while the power is supplied.
  If a terminal is touched, electrical shocks or malfunction may occur.
- Turn off the power before cleaning or tightening terminals.
  If cleaning or tightening is performed while the power is supplied, electrical shocks may occur.
- Read thoroughly the manual and confirm safety before modifying a program during operation, performing forced output, performing the RUN operation or performing the STOP operation.
  Erroneous operation may cause mechanical damages or accidents.

Cautions on start-up and maintenance

- Do not disassemble or modify the unit.
  Disassembly or modification may cause failures, malfunction or fires.
  * For repair, contact Mitsubishi Electric System Service
- Turn off the power before connecting or disconnecting connection cables such as extension cables.
  If such cables are connected or disconnected while the power is turned on, failures or malfunction may occur.

Cautions on Disposal

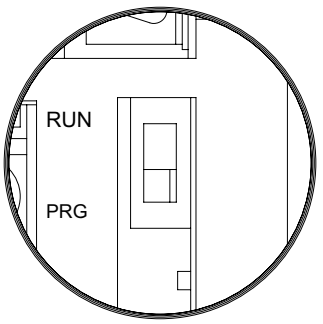
- Treat the unit as industrial waste when disposing of it.

6.1 Handling of the RUN and PRG modes

The FX2N-1RM offers two modes, RUN (operation) and PRG (program). These modes can be switched using the following procedure.
(In the PRG mode, the FX2N-1RM stops operation.)

< Built-in RUN/PRG selector switch >

The RUN mode and the PRG mode can be switched by manipulating the RUN/PRG selector switch built in the main unit.
When the switch is set to the RUN side, operation is performed.
When the switch is set to the PRG mode, operation is stopped and the download of programs is enabled.



< Changing over the RUN and PRG modes from the data setting panel >

The RUN mode and PRG mode can be switched by manipulating the keys provided on the data setting panel.
To select the RUN mode: [RUN] → [GO]
To select the PRG mode: [STOP] → [GO]
The RUN to PRG operation with data setting panel can be prohibited with BFM#0 b6 or the data setting panel.
This function is added from the product since V2.20.

< Changing over the RUN and PRG modes from the PLC >

The RUN mode and PRG mode can be switched by giving a TO instruction from the PLC.
The RUN/PRG command write destination is provided in b0 and b1 of BFM #3.

BFM #3
b0: Selects the RUN mode when set to ON from OFF (when the rising edge is detected).
b1: Selects the PRG mode when set to ON from OFF (when the rising edge is detected).
* b0 and b1 should not be set to ON from OFF at the same time.

- Change in the status is detected in any procedure to change-over the RUN mode and the PRG mode.
- When the power is turned on, the mode is set in accordance with the setting of the RUN/PRG selector switch built in the FX2N-1RM.
- The RUN LEDs on the FX2N-1RM and the data setting panel are lit while the RUN mode is selected.
  The RUN LEDs on the FX2N-1RM and the data setting panel are extinguished while the PRG mode is selected.
- When switching from PRG to RUN, FX2N-1RM does not output by the position where the resolver is stopped occasionally. (Dead zone)
  When the resolver starts rotating, FX2N-1RM is normally output.
  When switching from PRG to RUN, the product since V2.20 is normally output wherever the resolver has stopped.

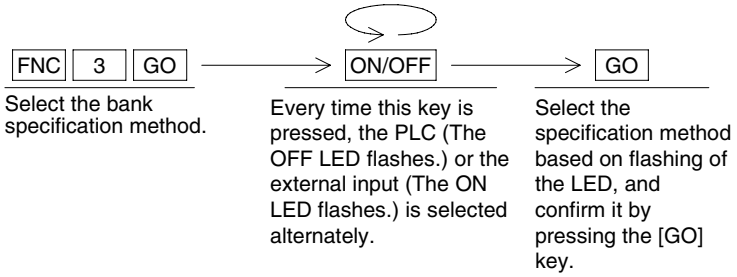
6.2 Specifying the bank

The FX2N-1RM can store two or more programs, and execute an arbitrary program in accordance with an external input to the FX2N-1RM or an instruction given by the PLC main unit.
Up to 4 banks are available for an external input. Up to 8 banks are available for an instruction by the PLC.

- **Setting the bank specification method**

  Set which one between the external input and the PLC is used to specify a bank.
  To select either one, give a TO instruction from the data setting panel or the PLC main unit.

  < Setting by the data setting panel >



  < Setting by the PLC >

  The bank specification method write destination is provided in b3 of BFM #0.

  BFM #0
  b3: OFF → A bank is specified by an external input.
  ON → A bank is specified by the PLC.

  Set to specify the Bank from the PLC without fail when you use the current angle transfer function.

- **Bank specification method**

  Specify the program No. to be executed using the method selected by the procedure described in "Setting the bank specification method" above (bank specification).

  < Bank specification by the external input >

  Specify an arbitrary program No. from the B0 and B1 terminals. (For the wiring, refer to "4.1 Power supply and input wiring".)
  To change-over the program No. to be executed while a program is running (RUN mode), use transistors.
  The input response time of the FX2N-1RM is approximately 3 ms. If relays or with-contact switches are used, a program other than the specified one may be executed while the bank change-over operation is being performed.

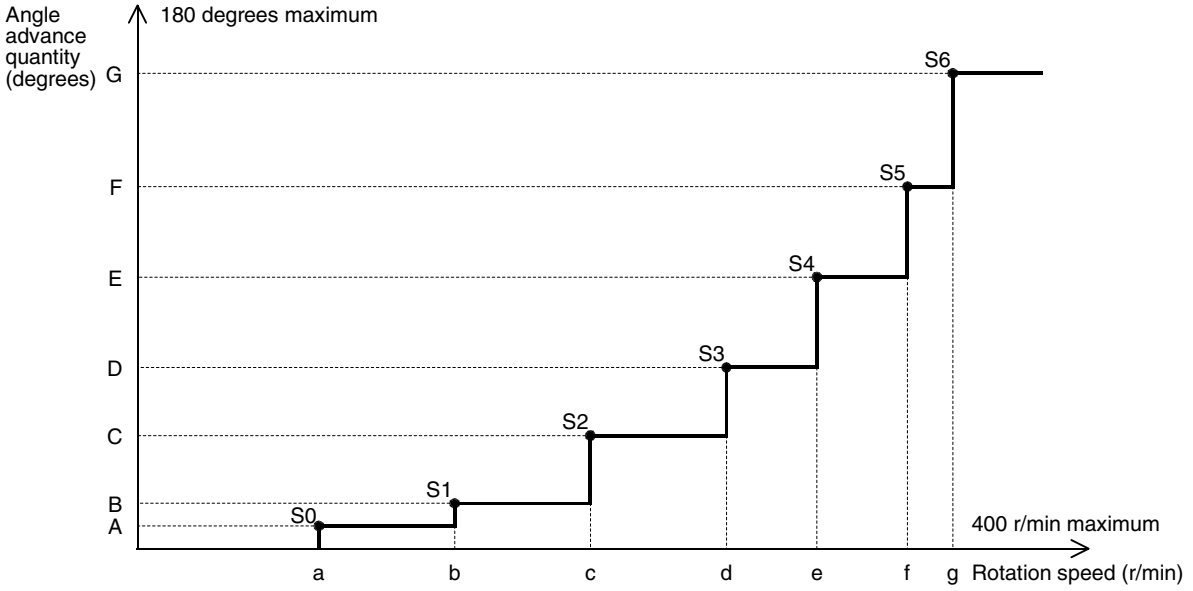
Specified program No.	B1	B0
0	OFF	OFF
1	OFF	ON
2	ON	OFF
3	ON	ON

  < Bank specification by the PLC >

  The bank specification write destination is provided in BFM #2. Write the program No. to be executed using a TO instruction.
  The effective values are 0 to 7.

6.3 Automatic angle advance function

The automatic angle advance function performs the output ON/OFF operation in advance by an arbitrary angle (angle advance quantity) in accordance with the rotation speed of the resolver.
By using this function, delay in the mechanical operation generated during rotation at high speed can be compensated.
The setting of this function becomes the common set point for the on angle and the off angle outputs Y00 to Y07 and Y10 to Y17.
The response speed can be used by 830 r/min (1 degree mode), 415 r/min (0.5 degrees mode).



The automatic angle advance function can be set in 7 steps from S0 to S6 as shown in the figure above. Enter the rotation speed (a to g) and the angle advance quantity (A to G) for each step from the data setting panel or the PLC main unit.
The smallest rotation speed should be set in S0 with the settings increasing in sequential order of speed. (S0<S1<S2< . . . <S6)
When the automatic angle advance function is used, the rotation speed should be 400 r/min or less and the angle advance quantity should be 180 degrees or less.
When the rotation speed is 0 (initial value), the angle advance quantity is treated as 0.
Whether or not the automatic angle advance function is used can be set from the data operation panel and the PLC main unit.

For the input procedure from the data setting panel, refer to Paragraph 8.3.5.
For the input destination from the main unit, refer to Paragraphs 7.1 and 7.2.
(Data is written to BFM #0 and BFM #13 to BFM #26 by a TO instruction.)

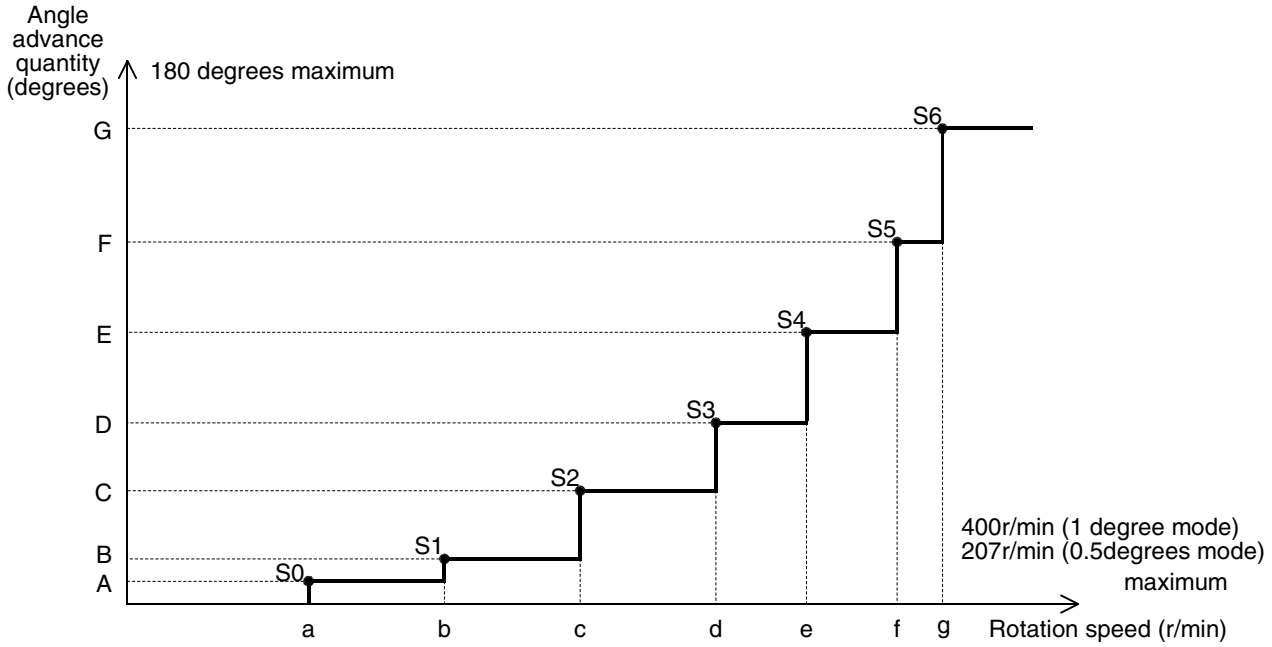
< Assignment of FNC Nos. and BFM Nos. >

		Input from data setting panel (FNC No.)	Input from main unit (BFM No.)
S0	Rotation angle a	FNC 13	BFM #13
	Angle advance quantity A	FNC 14	BFM #14
S1	Rotation angle b	FNC 15	BFM #15
	Angle advance quantity B	FNC 16	BFM #16
S2	Rotation angle c	FNC 17	BFM #17
	Angle advance quantity C	FNC 18	BFM #18
S3	Rotation angle d	FNC 19	BFM #19
	Angle advance quantity D	FNC 20	BFM #20
S4	Rotation angle e	FNC 21	BFM #21
	Angle advance quantity E	FNC 22	BFM #22
S5	Rotation angle f	FNC 23	BFM #23
	Angle advance quantity F	FNC 24	BFM #24
S6	Rotation angle g	FNC 25	BFM #25
	Angle advance quantity G	FNC 26	BFM #26

6.4 Individual automatic angle advance function

The automatic angle advance function performs the output ON/OFF operation in advance with an arbitrary angle (angle advance quantity) in accordance with the rotation speed of the resolver. This setting does an individual setting to the on angle and the off angle of output Y00 to Y03. The executed program number can be used from bank 0 to bank 6.
Bank 7 must not be used. (Bank 7 is used to store the data of the individual automatic angle advance function.)
The rotational speed response is as follows.

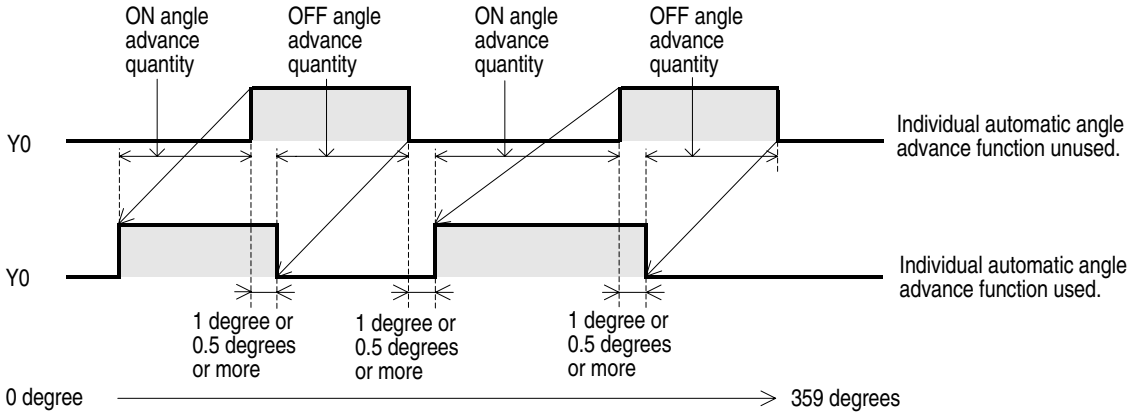
Response speed:1degree (360 degrees/revolution) mode . . . 415 r/min
0.5 degrees (720 degrees/revolution) mode . . . 207 r/min



- The individual automatic angle advance function can be set in 7steps from S0 to S6 as shown in the figure above. Setting the rotation speed (a to g) and the angle advance quantity (A to G) for each step.
- Please set the smallest rotation speed to S0 and increase the settings sequentially. (S0<S1< . . . <S6)
- The rotation speed should be 400 r/min or less (1 degree mode), 207 r/min or less (0.5 degrees mode) and the angle advance quantity should be 180 degrees or less.
- When the rotation speed is 0 (initial value), the angle advance quantity is treated as 0.

- Please separate angle advance quantity from previous ON/OFF 1 degree (1 degree mode) or 0.5 degrees (0.5 degrees mode) or more. (Refer to the figure 1 below)

  Figure 1



- Selection of use/do not use, input of the rotational speed, and angle advance quantity can be set by the data operation panel and the PLC main unit.

Use specification of individual automatic angle advance function

From the data setting panel : Set by FNC 05 → Refer to 8.3.6

From the PLC : Bit5 of BFM #0 is turned ON → Refer to 7.2

Setting of rotational speed and angle advance quantity

From the data setting panel : Set by FNC 90 → Refer to 8.3.6
Input by one time value

From the PLC : Input to BFM #6376 to #6459 → Refer to the next page
Input value equals advance angle (1 degree mode)
Input value equals twice the advance angle (0.5 degrees mode)

Please input the rotational speed and angle advance quantity after specifying the use of the function.
(When the use of the function is not specified, it becomes an error.)

When individual automatic angle advance function is used, addition of the crack of rotation speed and angle advance quantity to buffer memory (BFM) is as follows.

	BFM No.		
	Rotation speed	**ON angle advance quantity**	**OFF angle advance quantity**
Y0 S0	6376	6377	6378
S1	6379	6380	6381
S2	6382	6383	6384
S3	6385	6386	6387
S4	6388	6389	6390
S5	6391	6392	6393
S6	6394	6395	6396
Y1 S0	6397	6398	6399
S1	6400	6401	6402
S2	6403	6404	6405
S3	6406	6407	6408
S4	6409	6410	6411
S5	6412	6413	6414
S6	6415	6416	6417
Y2 S0	6418	6419	6420
S1	6421	6422	6423
S2	6424	6425	6426
S3	6427	6428	6429
S4	6430	6431	6432
S5	6433	6434	6435
S6	6436	6437	6438
Y3 S0	6439	6440	6441
S1	6442	6443	6444
S2	6445	6446	6447
S3	6448	6449	6450
S4	6451	6452	6453
S5	6454	6455	6456
S6	6457	6458	6459

- When the mode is selected 1 degree (360 degrees/ revolution), input equals advance angle value. When the mode is selected 0.5 degrees (720 degrees/ revolution), inputs equals twice the advance angle value. (input 10, advance angle=5)
- The executed program number can be used from

Caution on batch transfer of programs

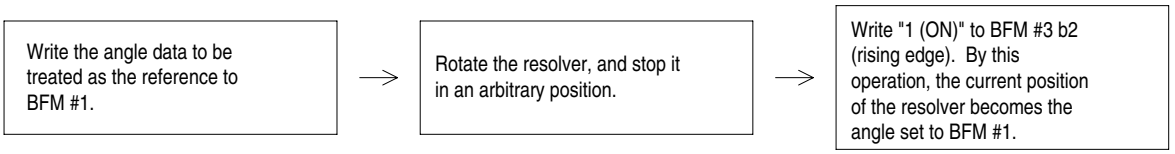
When the batch transfer of the program is done with the personal computer and FX-20P-E when the Individual automatic angle advance function is used, all the data of the rotational speed, the turning ON angle, and the turning OFF angle is treated by the twice value.

6.5 Setting the reference angle

Originally, the brushless resolver has an absolute reference angle. In addition, a reference angle in accordance with a machine can be set.
Each set angle of the FX2N-1RM performs its operation based on the reference angle set in accordance with the machine.
The reference angle can be set by the data setting panel or by a TO instruction given by the PLC main unit.

< Setting by the data setting panel >
For the setting procedure using the data setting panel, refer to Paragraph 8.2.10.

< Setting by the PLC >
The reference angle data is provided in BFM #1. The reference angle setting command is provided in BFM #3 b2.



Caution on batch transfer of programs

Even if programs are transferred at a time by a personal computer or the FX-20P-E, the reference angle image set is not transferred.
Accordingly, set the reference angle again after the FX2N-1RM or the resolver is replaced.

6.6 Handling the keyword

< Limitation of the function by the keyword >

When a keyword is registered, writing to the EEPROM is prohibited in the same way as the EEPROM protect function. When programs are read by a personal computer or the FX-20P-E, the registered keyword must be entered.

(Preventing theft of a program)
A keyword can be registered/deleted using the data setting panel, the personal computer software and the FX-20P-E.
At this time, a keyword in a personal computer or the FX-20P-E is treated as "BBBBB○○○" (○○○ indicates a numeric from 1 to 999.).
The writing of any data from the buffer memory to the EEPROM is prohibited. Only the operations shown in the table below are allowed to be set on the data setting panel.

< Operations enabled while a keyword is registered >

Operation by data setting panel	Operation by buffer memory (BFM)
Read	Writing from BFM to EEPROM is prohibited. Any modification of BFM is valid, and operation of FX2N-1RM can be modified.
Forced RUN/STOP	
Read of reference angle	
Write-protect of EEPROM	
Deletion of keyword	

When the registered keyword is deleted, all the functions become available again.
An unknown keyword can be deleted by the entire program deletion procedure (Refer to Paragraph 9.2.5.). Keep in mind that all other registered data is also deleted.

6.7 Current angle transfer function

The current angle transfer function to transfers the current angle of the resolver to BFM#106 via turning ON input terminal B1.
(This function has been included since V2.40)
The PLC is used together, and a highly accurate sampling by which an external input is made a trigger can be done.
The response speed becomes 207r/min/0.5degree or 415r/min/degree.
Set to specify the bank from the PLC without fail when you use the current angle transfer function.

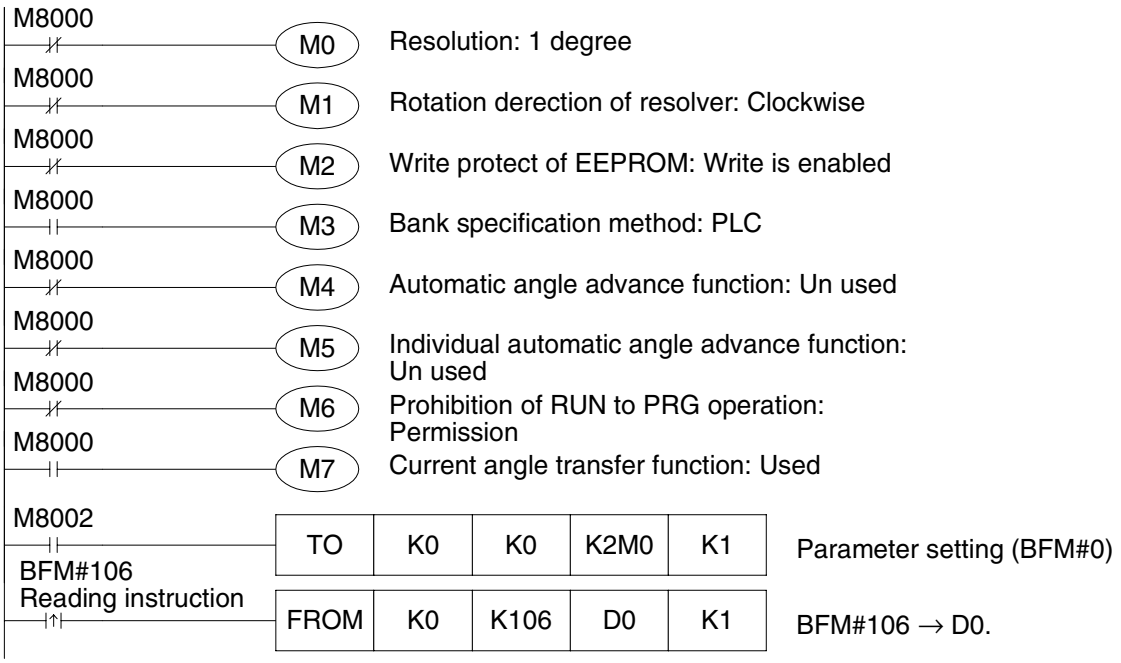
< Setting by the data setting panel >

- Set the method of specifying the bank by operating FNC3, "PLC".
  Refer to Paragraph 8.3.4
- Set the current angle transfer function by operating FNC7, "Effective".
  Refer to Paragraph 8.3.8

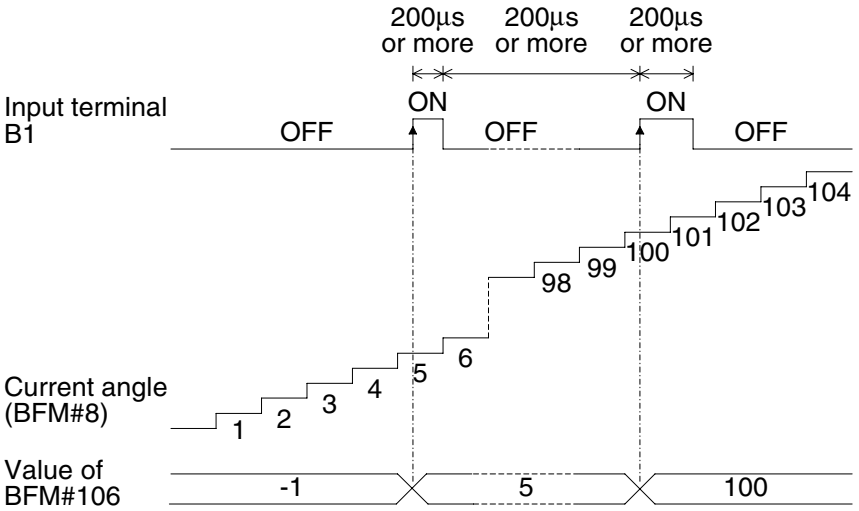
< Setting by the PLC >

- BFM#0 b3 is turned ON, and the method of specifying the bank selects "PLC".
- BFM#0 b7 is turned ON, and the Current Angle Transfer function is made effective.
  b7: OFF → Current angle transfer function is Invalidity.
  ON → Current angle transfer function is effective.

Program example



< Action of current angle transfer function>



- Transfer the current angle of the resolver to BFM#106 by turning ON input terminal B1.
- The input signal to input terminal B1 is necessary for both 200µS or more the turning ON time and the turning OFF time.
- When input terminal B1 turns ON the power supply of FX2N-1RM while turned ON, the data storage in BFM#106 is not executed.
  (When the terminal B1 is turned OFF once, and the terminal B1 is turned ON again, the data storage in BFM#106 is executed.)
- When neither turning ON the power supply nor the current angle transfer function are used, ”-1” is stored.

7. BFM Assignment

This section describes the buffer memory (BFM) of the FX2N-1RM.
When the FX2N Series PLC is connected to the FX2N-1RM, data can be read/written from/to the BFM by FROM/TO instructions. (Refer to Paragraph 7.3.)
When two or three FX2N-1RM units are connected, FROM/TO instructions are available in only the unit nearest to the PLC main unit.
The second and third FX2N-1RM units can write and read data from the PLC main unit via the first FX2N-1RM unit.

7.1 BFM list

BFM No.	Name	Initial value	Remarks R: For read W: For write K: Keep		File register assignment No.
#0	Initial setting	0	—	W, K	D7144
#1	Reference angle (ADJ)	0	×1 value (1 degree), ×2 value (0.5 degree) Refer to Paragraph 6.5.	W, K	D7145
#2 #8002 #9002 *1	Bank No. specification (00 to 07)	0	Valid when bank specification is set to PLC.	W	—
#3 #8003 #9003 *1	Command	0	—	W	—
#4	Output prohibition (Y00 to Y17)	0	Prohibits output when each bit is set to ON.	W	—
#5	Output prohibition (Y20 to Y37)	0	Prohibits output when each bit is set to ON.	W	—
#6	Output prohibition (Y40 to Y57)	0	Prohibits output when each bit is set to ON.	W	—
#7	Executed bank No.	—	—	W	—
#8 #8008 #9008 *1	Current angle (degrees)	—	×1 value (1 degree), ×2 value (0.5 degree)	R	—
#9 #8009 #9009 *1	Rotation angle (r/min)	—	—	R	—
#10 #8010 #9010 *1	Output status (Y00 to Y17)	—	Monitors output status when each bit is set to ON/OFF.	R	—
#11 #8011 #9011 *1	Output status (Y20 to Y37)	—	Monitors output status when each bit is set to ON/OFF.	R	—
#12 #8012 #9012 *1	Output status (Y40 to Y57)	—	Monitors output status when each bit is set to ON/OFF.	R	—
#13	Speed of automatic angle advance S0 (r/min)	0	—	W, K	D7146
#14	Angle advance quantity of automatic angle advance S0 (degrees)	0	×1 value (1 degree), ×2 value (0.5 degree)	W, K	D7147
#15	Speed of automatic angle advance S1 (r/min)	0	—	W, K	D7148
#16	Angle advance quantity of automatic angle advance S1 (degrees)	0	×1 value (1 degree), ×2 value (0.5 degree)	W, K	D7149

BFM No.	Name	Initial value	Remarks R: For read W: For write K: Keep		File register assignment No.
⋮	⋮	⋮	⋮	⋮	⋮
#25	Speed of automatic angle advance S6 (r/min)	0	—	W, K	D7158
#26	Angle advance quantity of automatic angle advance S6 (degrees)	0	×1 value (1 degree), ×2 value (0.5 degree)	W, K	D7159
#27	Undefined	—	—	—	—
#28 #8028 #9028 *1	Status	0	—	R	—
#29	Error code	0	—	R	—
#30	Model code	K5410	—	R	—
#31	Unusable	—	—	—	—
↓					
#100 *2	Written ON angle	—	×1 value (1 degree), ×2 value (0.5 degree)	W	—
#101 *2	Written OFF angle	—	×1 value (1 degree), ×2 value (0.5 degree)	W	—
#102 *2	Written BFM No.	—	Range of setting 1000 to 7142 (BFM number of output ON angle setting)	W	—
#103 *2	Reading BFM No.	—	Range of setting 1000 to 7142 (BFM number of output ON angle setting)	W	—
#104 *2	Reading ON angle	—	×1 value (1 degree), ×2 value (0.5 degree)	R	—
#105 *2	Reading OFF angle	—	×1 value (1 degree), ×2 value (0.5 degree)	R	—
#106 *3	Data transfer destination of current angle transfer function. Refer to paragraph 6.7	-1	×1 value (1 degree), ×2 value (0.5 degree)	R	—
↓					
#1000	ON angle of bank No. 0, Y00, step No. 0	FFFF	×1 value (1 degree), ×2 value (0.5 degree)	W, K	D1000
#1001	OFF angle of bank No. 0, Y00, step No. 0	FFFF	×1 value (1 degree), ×2 value (0.5 degree)	W, K	D1001
#1002	ON angle of bank No. 0, Y00, step No. 1	FFFF	×1 value (1 degree), ×2 value (0.5 degree)	W, K	D1002
#1003	OFF angle of bank No. 0, Y00, step No. 1	FFFF	×1 value (1 degree), ×2 value (0.5 degree)	W, K	D1003
⋮	⋮	BFM #1000 to BFM #7143 are offered to set an angle. The initial value is "FFFF" respectively. Data is written by ×1 value (1 degree) and ×2 value (0.5 degree), and the set values are kept in the EEPROM. When a program is transferred by a personal computer or the FX-20P-E, BFM #1000 to BFM #7143 are assigned to file registers D1000 to D7143. For the bank Nos., output Nos., step Nos., ON angle and OFF angle assigned to BFM #1000 to BFM #7143, refer to the BFM No. Quick Reference Table for Angle Setting provided at end of this manual.			
#1767	ON angle of bank No. 0, Y57, step No. 7				
#1768	OFF angle of bank No. 0, Y57, step No. 7				
#1769	ON angle of bank No. 0, Y00, step No. 0				
#1770	OFF angle of bank No. 0, Y00, step No. 0				
⋮	⋮				
#7142	ON angle of bank No. 0, Y57, step No. 7	FFFF	×1 value (1 degree), ×2 value (0.5 degree)	W, K	D7142
#7143	OFF angle of bank No. 0, Y57, step No. 7	FFFF	×1 value (1 degree), ×2 value (0.5 degree)	W,K	D7143

*1: When two or more FX2N-1RM units are connected to the PLC main unit, data is read from and written to each unit via the buffer memory of the unit nearest to the PLC main unit.
The relationship between the BFM Nos. and the units is shown below.

BFM Nos. of one or two digits: FX2N-1RM unit nearest to the PLC main unit
BFM Nos. of 8000 to 8999: Second FX2N-1RM unit
BFM Nos. of 9000 to 9999: Third FX2N-1RM unit

*2: BFM #100 to #105 has been included since version V2.00 (from 1998/2)

*3: BFM#106 has been included since version V2.40 (from 2002/1)

- All the buffer memories in the FX2N-1RM units accommodate 16-bit data. When using a FROM/TO instruction, use a 16-bit instruction.
- When two FX2N-1RM is connected, the monitor cycle of BFM #8002 to #8028 becomes about 12m seconds.
  When three is connected, the monitor cycle of BFM #8002 to #8028, #9002 to #9028 becomes about 27m seconds.
  However, the table is composed from PRG to RUN again at the switch and bank changing. Therefore, the time of 4 seconds or less is required. (Only at change)

7.2 Description on BFM

< BFM #0: Initial setting >

Bit	Description	Initial value	Remarks
b0	Resolution	0	1: 0.5 degree (720 degrees/rotation), 0: 1 degree (360 degrees / rotation) *1
b1	Rotation direction of resolver	0	1: Counterclockwise 0: Clockwise
b2	Write-protect of EEPROM	0	1: Write to EEPROM is disabled. 0: Write is enabled. (However, BFM #0 b2 can be modified.)
b3 *4	Bank specification method	0	1: PLC 0: FX2N-1RM external input Refer to Paragraph 6.2.
b4 *2	Automatic angle advance function	0	1: Used (Y00 to Y17) 0: Unused Refer to Paragraph 6.3
b5 *2	Individual automatic angle advance function	0	1: Used (Y00 to Y03) 0: Unused Refer to paragraph 6.4
b6 *3	Prohibition of RUN to PRG operation	0	1:Prohibition 0:Permission
b7 *4	Current angle transfer function	0	1: Used 0: Unused Refer to paragraph 6.7
b8~15	Unusable	—	—

*1: When selecting "0.5 degree" as the resolution, enter a value twice the actual angle as the set data to BFM #1000 and later. For example, when the actual angle is 45 degrees, enter "K90" as the set data.
(For setting from the data setting panel, refer to Paragraph 8.2.1.) (Set range: 0 to 719)

*2: When both b4 and b5 are turned on, b5 becomes effective.

*3: The RUN to PRG operation with data setting panel is prohibited.
The RUN to PRG switch by the RUN / PRG change switch and BFM#3 is effective.
(This function is added from the product since V2.20.)

*4: Set to specify the Bank from the PLC without fail when you use the current angle transfer function.
(This function has been included since V2.40)

< BFM #3: Command >

Bit	Description	Remarks
b0	RUN	Runs a program (on rising edge). Refer to Paragraph 7.1.
b1	PRG	Turns off output by PRG command (received on rising edge). Refer to Paragraph 7.1.
b2	ADJ	Sets reference angle on rising edge in PRG mode. Refer to Paragraph 7.4. *4
b3	Error reset	Resets error information (received on rising edge).
b4	Write instruction in RUN mode	Writes modification of program contents of bank currently executed to EEPROM (on rising edge). *5
b5	Initialization of BFM keep area	Initializes BFM keep area (on rising edge in PRG mode). This command has priority over program protection actuated by code No.
b6	Write instruction in PRG mode	Writes keep area contents to EEPROM in PRG mode (on rising edge).
b7~15	Unusable	—

*4: When an ADJ command is executed, the absolute value of the resolver is written to the EEPROM. Do not set the write-protect function of the EEPROM.

*5: BFM #13 to BFM #26 (setting of the automatic angle advance function) are also written at the same time.

- When two or more FX2N-1RM is connected and used for a main unit, the second command is allocated to BFM #8003, the third command is allocated to BFM #9003.
  It is similar to above-mentioned BFM #3 with the crack of each bit of BFM #8003, #9003.

< BFM #4 to BFM #6: Output prohibition >

Example of BFM #4

Bit	Description	Remarks
b0	Y00 output prohibition	1: Prohibits output., 0: Enables output.
b1	Y01 output prohibition	1: Prohibits output., 0: Enables output.
b2	Y02 output prohibition	1: Prohibits output., 0: Enables output.
b3	Y03 output prohibition	1: Prohibits output., 0: Enables output.
b4	Y04 output prohibition	1: Prohibits output., 0: Enables output.
b5	Y05 output prohibition	1: Prohibits output., 0: Enables output.
b6	Y06 output prohibition	1: Prohibits output., 0: Enables output.
b7	Y07 output prohibition	1: Prohibits output., 0: Enables output.
b8	Y10 output prohibition	1: Prohibits output., 0: Enables output.
b9	Y11 output prohibition	1: Prohibits output., 0: Enables output.
b10	Y12 output prohibition	1: Prohibits output., 0: Enables output.
b11	Y13 output prohibition	1: Prohibits output., 0: Enables output.
b12	Y14 output prohibition	1: Prohibits output., 0: Enables output.
b13	Y15 output prohibition	1: Prohibits output., 0: Enables output.
b14	Y16 output prohibition	1: Prohibits output., 0: Enables output.
b15	Y17 output prohibition	1: Prohibits output., 0: Enables output.

The bits b0 to b15 of BFM #4 correspond to Y00 to Y17. When each bit is set to 1 (ON), the output of the corresponding output No. is prohibited.
BFM #5 and BFM #6 correspond to Y20 to Y37 and Y40 to Y57 respectively in the same way, and the output can be prohibited for each point.

< BFM #10 to BFM #12: Output status >

Example of BFM #10

Bit	Description	Remarks
b0	Y00 output status	1: Y01 output ON operation, 0: Y01 output OFF operation
b1	Y01 output status	1: Y01 output ON operation, 0: Y01 output OFF operation
b2	Y02 output status	1: Y01 output ON operation, 0: Y01 output OFF operation
b3	Y03 output status	1: Y01 output ON operation, 0: Y01 output OFF operation
b4	Y04 output status	1: Y01 output ON operation, 0: Y01 output OFF operation
b5	Y05 output status	1: Y01 output ON operation, 0: Y01 output OFF operation
b6	Y06 output status	1: Y01 output ON operation, 0: Y01 output OFF operation
b7	Y07 output status	1: Y01 output ON operation, 0: Y01 output OFF operation
b8	Y10 output status	1: Y01 output ON operation, 0: Y01 output OFF operation
b9	Y11 output status	1: Y01 output ON operation, 0: Y01 output OFF operation
b10	Y12 output status	1: Y01 output ON operation, 0: Y01 output OFF operation
b11	Y13 output status	1: Y01 output ON operation, 0: Y01 output OFF operation
b12	Y14 output status	1: Y01 output ON operation, 0: Y01 output OFF operation
b13	Y15 output status	1: Y01 output ON operation, 0: Y01 output OFF operation
b14	Y16 output status	1: Y01 output ON operation, 0: Y01 output OFF operation
b15	Y17 output status	1: Y17 output ON operation, 0: Y17 output OFF operation

- The bits b0 to b15 of BFM #10 correspond to Y00 to Y17, and each of b0 to b15 is turned on or off in accordance with each output status. This output status can be read to the PLC main unit by FROM instructions.
- BFM #11 and BFM #12 correspond to Y20 to Y37 and Y40 to Y57 respectively in the same way, and the output status can be checked for each point.
- When two or more FX2N-1RM is connected used for a main unit, the second state of output is allocated to BFM #8010 to #8012 the third state of output is allocated to BFM #9010 to #9012.

< BFM #28: Status >

Bit	Description	Remarks
b0	Operating	Turned on while operation is normal in RUN mode (Functions in same way as RUN LED.).
b1	Rotating clockwise	Turned on while rotating in RUN mode with BFM #0 b1 set to 0.
b2	Rotating counterclockwise	Turned on while rotating in RUN mode with BFM #0 b1 set to 1.
b3	Error occurred	Turns off output. Turned off when error is reset (Functions in same way as ERROR LED.).
b4	Writing in RUN mode	Turned on while contents of program of bank currently executed are written to EEPROM. Never modify program of same bank while this bit is turned on.
b5	Keep area being initialized	Never modify program in keep area while keep area is initialized.
b6	Two or more FX2N-1RM units connected	When two FX2N-1RM units are connected, b6 is turned on and b7 is turned off. When three.FX2N-1RM units are connected, both b6 and b7 are turned on.
b7	Three FX2N-1RM units connected	
b8	FX2N-1RM communication error	When it is not possible to communicate with the right FX2N-1RM where two or more FX2N-1RM are connected, b8 turns on.
b9~15	Unusable	—

When two or more FX2N-1RM is connected and used for a PLC main unit, the second status is allocated to BFM #8028, the third status is allocated to BFM #9028.
It is similar to above-mentioned BFM #28 with the crack of each bit of BFM #8028, #9028.

< BFM #29: Error code >

Code No.	Description
20	Data setting error (out of range)
21	Bank setting error (out of range)
22	Memory error (Data cannot be written to EEPROM.)
23	Resolver disconnection error

<BFM #100: Written on angle, BFM #101: Written off angle, BFM #102: Written BFM No>

The data of the turning on angle and the turning off angle can be indirectly set from a PLC main unit to two or more outputs of FX2N-1RM.
(It is a function added from version V2.00)
After the turning on angle and the turning off angle data are written in BFM #100, #101, the BFM number which wants to be written is written BFM #102. The turning on angle data of BFM #100 is written in the BFM number specified by BFM #102 by this work. The off angle data of BFM #101 is written in the old number which continues to the specified number.
(Give setting BFM #102 as a number allocated to output on angle setting of BFM #1000 to #7142. Refer to BFM No. Quick Reference Table for Angle setting in the end of a book.)
When the to instruction to BFM #102 is executed, the turning on angle and the turning off angle are written.

<BFM #103:Reading BFM No., BFM #104: Reading on angle, BFM #105: Reading off angle>

The data of the turning on angle and the turning off angle can be indirectly read from a PLC main unit to two or more outputs of FX2N-1RM.
(It is a function added from version V2.00)
The BFM number which wants to be read to BFM #103 is written.
Then, output on angle data of the specified BFM number is read to BFM #104.
The turning off angle data allocated to BFM of the old number which continues to the specified number is read to BFM #105.
(Give setting BFM #103 as a number allocated to output on angle setting of BFM #1000 to #7142. Refer to BFM No. Quick Reference Table for Angle setting in the end of a book.)
When the to instruction to BFM #103 is executed, the angle data is read to BFM #104, #105.

<BFM #106:Data transfer destination of current angle transfer function>

When the current angle transfer function is used, the current angle of the resolver is transferred to BFM#106 via turning ON (OFF Æ ON) input terminal B1.
When neither turning ON the power supply nor the current angle transfer function are used, “-1” is stored. (Function has been included since version V2.40)

< Application operation (FNC function) >

When using a function with FNC (FNC 70 to 75, 90), write the FNC No. to be used added to 1000 (K1070 for FNC 70, for example) to the bank No., STEP0 of the output No. and the BFM No. (BFM #1000, BFM #1016, BFM #6376, etc.) of the ON angle to be used.

< Timing at which a program is saved to the EEPROM >

1) While the data setting panel is manipulated
Every time a program is modified using the data setting panel, the modified data is written to both the buffer memory and the EEPROM.

2) While the RUN mode is selected
When the bank is switched, the contents of a new bank are saved in the EEPROM.
When a write command in RUN mode (BFM #3 b4) is written from the PLC main unit to the FX2N-1RM (on the rising edge), the modified contents of the program of the bank currently executed are saved in the EEPROM. (At the same time, the modified contents of the automatic angle advance are also saved.)

3) While the PRG mode is selected
When a write command in PRG mode (BFM #3 b6) is written from the PLC main unit to the FX2N-1RM (on the rising edge), the contents of the BFM keep area are saved in the EEPROM.

4) When the mode is switched from PRG to RUN
When a RUN command (BFM #3 b0) is written from the PLC main unit to the FX2N-1RM (on the rising edge), the contents of the BFM keep area are saved in the EEPROM.

< Timing at which the ON/OFF table is created >

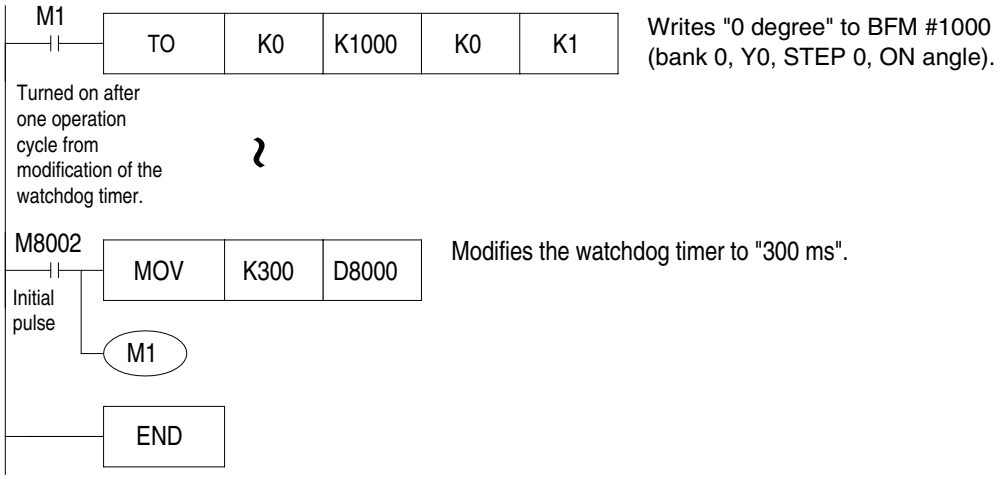
1) On the rising edge when the mode is switched from PRG to RUN

2) While the RUN mode is selected
When the bank is switched
When a command to write a program to the EEPROM is given (When data is not required to be written to the EEPROM, set the write-protect function of the EEPROM.)

- Even if a BFM program is modified in the RUN mode from the PLC, such modification is not reflected on the ON/OFF table.
The modified program is reflected when a command to write data to the EEPROM is given.
The contents of the setting of the automatic angle advance function are immediately reflected on the ON/OFF table when data is written to the buffer memory.
The contents of the setting are saved when a command to write data to the EEPROM is given.

7.3 Cautions on creation of a sequence program

When the ON/OFF angle of the FX2N-1RM is set using a program in the PLC main unit, a watchdog timer error may occur if many settings are performed at a time.
When a large value is written to D8000 while setting is performed using the initial pulse, a watchdog timer error may also occur because such a written value becomes valid only when an END instruction is given.
It is recommended to write the ON/OFF angle data after one operation cycle from the initial pulse as shown in the program below.



All the buffer memories (BFM) of the FX2N-1RM accommodate 16-bit data.
When reading or writing data from the PLC main unit, use 16-bit FROM/TO instructions.
(If 32-bit instructions ([D] FROM/[D] TO) are used, instructions are executed using 32-bit data for the specified BFM No. and the consecutive BFM No.)

7.4 Program example

7.4.1 Program example which uses FROM/TO instruction

A program example using FROM/TO instructions is shown below.
In this program, the FX2N-1RM is switched to the RUN mode by input to X000 in the PLC main unit, and switched to the PRG mode by input to X001.
When actual conditions differ from those in the program shown below, change the program to suit the application accordingly.

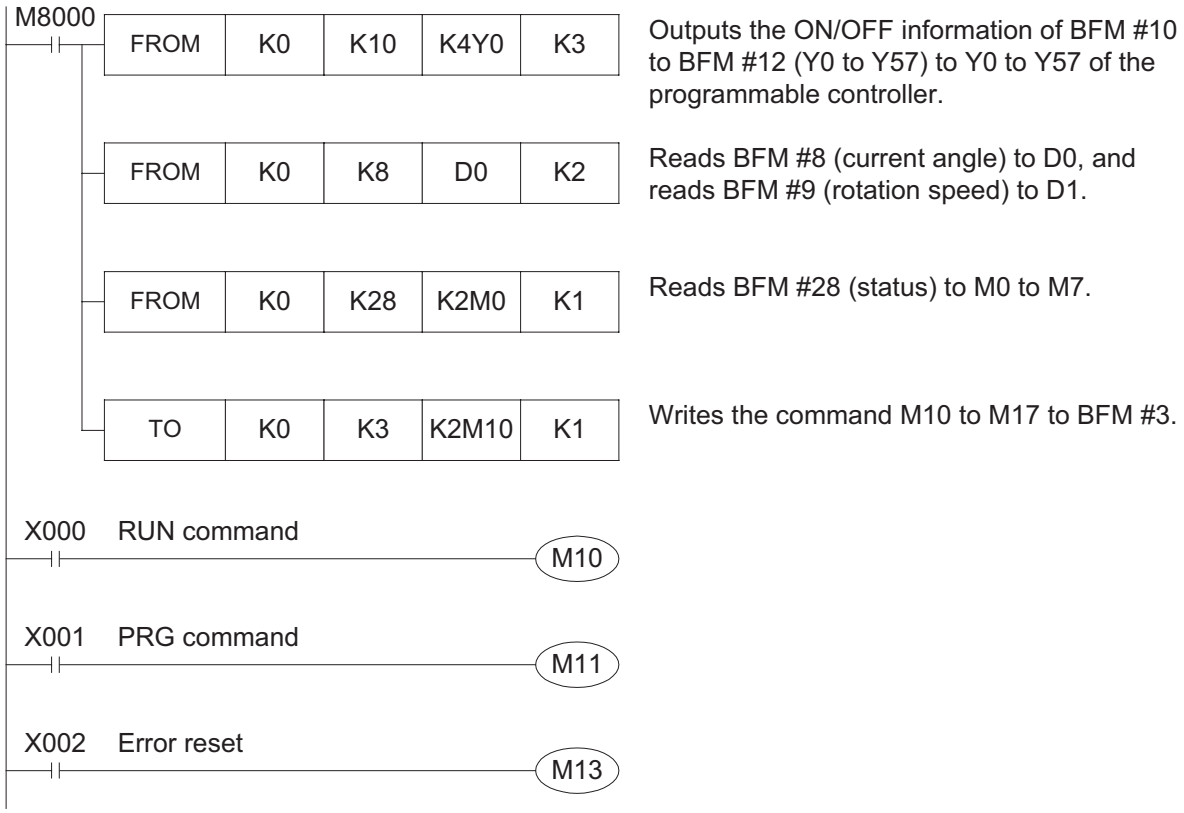
<Description>

Data is output to the PLC main unit, each data is read, and commands are written.
(Data and each statuses are read only.)

<Device assignment>

D0: BFM #8 (current angle)
D1: BFM #9 (rotation speed (rpm))

<Program>



Use the program example shown below when the resolver rotation speed is low at startup, stop, etc. and the current angle and output status are unstable.

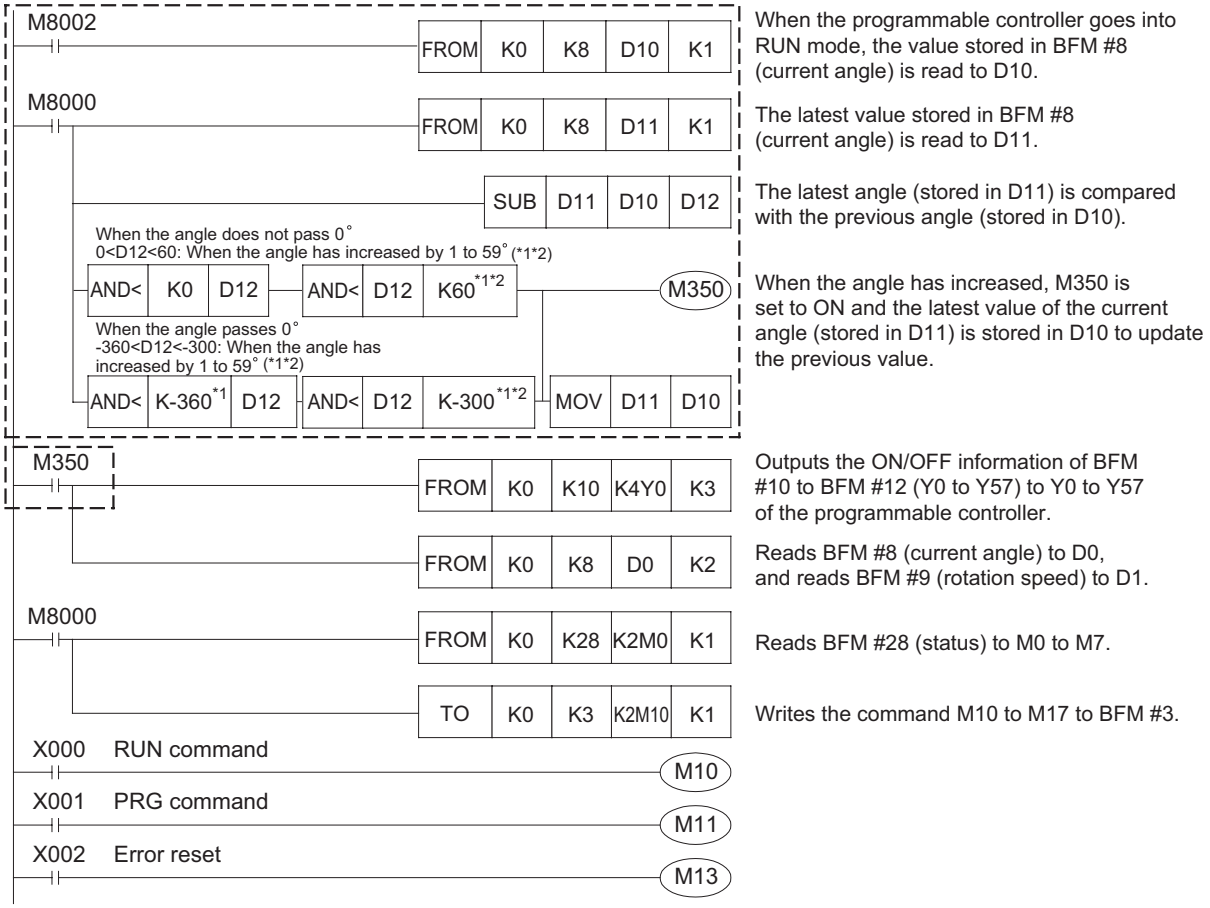
<Description>

Rotation direction: Clockwise only
Angle: Single angle
Angle proceeded in 1 scan: 1 to 59°

<Device assignment>

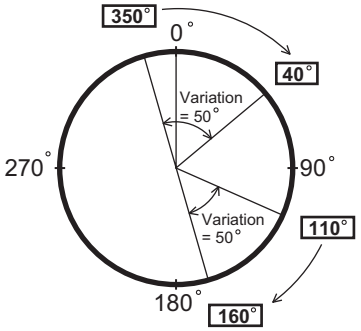
D0: BFM #8 (current angle)
D1: BFM #9 (rotation speed (rpm))
D10: Previous value of current angle
D11: Latest value of current angle
M350: FX2N-1RM output status stability confirmation flag

<Program>



*1: Double the value in the case of double angle.

*2: The figure below shows the variation of the rotation angle. Set a value larger than the angle proceeded in 1 scan.



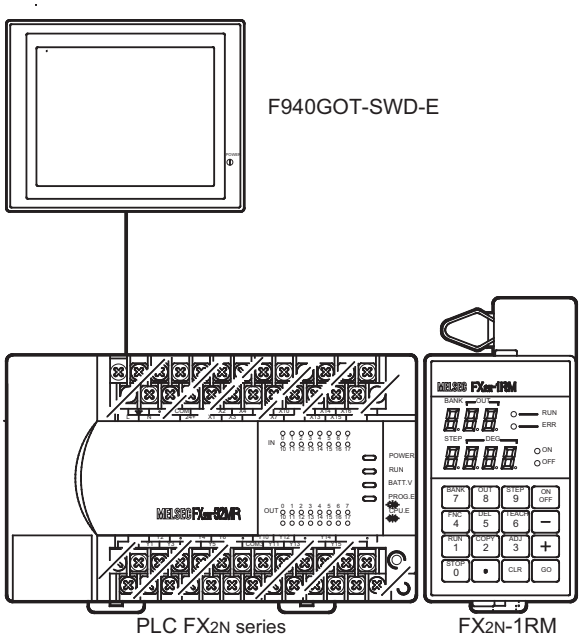
<Example>

- 110° → 160° (when the angle does not pass 0°)
  160 - 110 = 50
- 350° → 40° (when the angle passes 0°)
  40 - 350 = -310

7.4.2 Program example which uses indirect specification (BFM #100 to #105)

The bank number and the output number are specified with Graphic Operation Terminal GOT-F900 series connected with a PLC.
And, writing and reading are done to the ON/OFF angle of all patterns. (step 0 to step 7)
Writing and reading the ON/OFF angle are indirectly done. (BFM #100 to #105 is used.)

<System configuration>



<Device assignment>

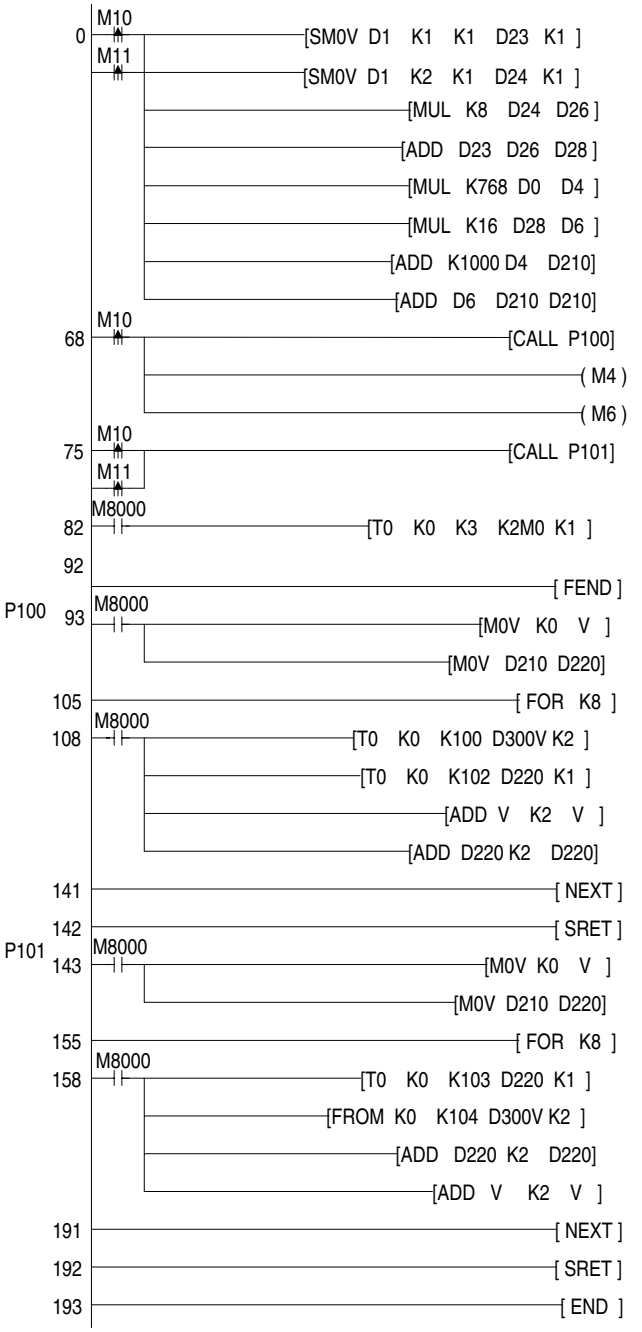
The device writes all data by F940GOT-SWD-E

D0 : Bank number specification 0 to 7
D1 : Output number specification 0 to 57(octal number)
D300 to D315 : ON/OFF angle input

	Step 0	Step 1	Step 2	Step 3	Step 4	Step 5	Step 6	Step 7
ON angle	D300	D302	D304	D306	D308	D310	D312	D314
OFF angle	D301	D303	D305	D307	D309	D311	D313	D315

M10 : Writing instruction
M11 : Reading instruction

<Program>



- The BFM number is specified based on output number specification(D1: 0 to 57)
  Octal number→decimal number...
  place of 10 × 8 + place of 1
- Bank specification BFM number (D210)
  = 768 × bank specification number(D0) + 1000
  Output specification BFM number (D210)
  = 16 × specification of output number of decimal number(D28) + bank specification number(D210)
- Writing instruction to EEPROM (RUN mode)
- Writing instruction to EEPROM (PRG mode)
- Writing of command
- Initialization of index register
- Shelter of data
- FOR to NEXT is repeated 8 times.
- Writing of turning on angle and turning off angle of specified step
- Writing address
- Change in step number data and writing address (increases by two)
- Initialization of index register
- Shelter of data
- FOR to NEXT is repeated 8 times.
- Reading address
- Reading of turning on angle and turning off angle of specified step
- Change in step number data and reading address (increases by two)

Memo

8. Program Operating Procedures

This section describes the program operating procedures in the FX2N-1RM using the data setting panel.

8.1 Functions offered by the data setting panel

< Data setting panel function list >

In addition to the following list. There is a monitor mode (refer to 9.1) and a test mode (refer to 10.1)

Item	Function	Mode	Description page
Read	Reads a program.	PRG	8-3
Write	Writes and modifies a program.	PRG	8-4
Insertion	Inserts a program.	PRG	8-5
Deletion	Deletes a program.	PRG	8-6
Bank copy	Copies contents of existing bank to specified bank.	PRG	8-8
Output copy	Copies contents of existing output to specified output of same bank.	PRG	8-8
Teaching modification	Treats current position of resolver as set value.	PRG	8-9
Teaching insertion	Inserts current position of resolver as set value.	PRG	8-10
Forced RUN/PRG	Changes over mode between RUN (operation) and PRG (stop/program) from data setting panel to FX2N-1RM.	PRG	8-11
Read of reference angle	Reads and displays reference angle.	PRG	8-12
Setting of reference angle	Modifies reference angle.	PRG	8-12
Specification of resolution	Specifies resolution (0.5 degree or 1 degree).	PRG	8-13
Specification of rotation direction	Specifies rotation direction of resolver (counterclockwise or clockwise).	PRG	8-13
Write-protect of EEPROM	Specifies availability of write to EEPROM (prohibited or enabled).	PRG	8-14
Setting of bank specification method	Specifies bank specification method (external input or PLC).	PRG	8-14
Setting of automatic angle advance function	Specifies use of automatic angle advance function, and sets rotation speed and angle advance quantity.	PRG	8-15
Individual automatic angle advance function	The output number, rotational speed, and angle advance quantity of individual automatic angle advance function is set.	PRG	8-17
Prohibition of RUN to PRG operation	The RUN to PRG operation with data setting panel is prohibited.	PRG	8-21
Current angle transfer function	Current angle of the resolver is transferred to BFM#106 via turning ON input terminal B1.	PRG	8-21
Reverse of output pattern	Reverses output pattern of existing program.	PRG	8-22
Batch addition of output set angle	Adds specified angle to set angle of specified output pattern at a time.	PRG	8-23
Batch subtraction of output set angle	Subtracts specified angle from set angle of specified output pattern at a time.	PRG	8-23
Batch addition of ON output set angle	Adds specified angle to ON set angle of specified output at a time.	PRG	8-24
Batch subtraction of ON output set angle	Subtracts specified angle from ON set angle of specified output at a time.	PRG	8-24

Item	Function	Mode	Description page
Batch addition of OFF output set angle	Adds specified angle to OFF set angle of specified output at a time.	PRG	8-25
Batch subtraction of OFF output set angle	Subtracts specified angle from OFF set angle of specified output at a time.	PRG	8-25
BCD output (negative logic)	Outputs current angle as BCD from a certain output No. (negative logic).	PRG	8-26
BCD reverse output (positive logic)	Outputs current angle as BCD from a certain output No. (positive logic).	PRG	8-26
One-phase pulse output (180 pulses/rotation)	Outputs a pulse string from an arbitrary output No. (One-phase, 180 pulses/rotation).	PRG	8-27
Two-phase pulse output (90 pulses/rotation)	Outputs a pulse string from an arbitrary output No. (Two-phase, 90 pulses/rotation).	PRG	8-27
RUN output	Always outputs ON from an arbitrary output No. in RUN mode.	PRG	8-28
One-phase pulse output (60 pulses/rotation)	Outputs a pulse string from an arbitrary output No. (One-phase, 60 pulses/rotation).	PRG	8-28
Keyword registration	Registers keyword to prevent write to EEPROM and theft of a program.	PRG	8-30
Keyword deletion	Deletes keyword.	PRG	8-30

8.2 Basic operating procedures

8.2.1 Common items

- When the power is turned on, the following initial screen is displayed on the data setting panel.

  < When the PRG mode is selected >

BANK	OUT	STEP	DEG	ON LED	OFF LED
0	0	0	Blank*1	Lit	Exting-uished

  *1: When an angle is already set to the output Y0, that ON angle is displayed.

  < When the RUN mode is selected >

  The display mode just before the power is turned off or just before the mode is switched to the PRG mode is displayed. (Refer to Paragraph 9.1.)

- When setting the ON/OFF angle of an output or the angle advance quantity of the automatic angle advance function from the data setting panel, use the [·] key to enter "0.5 degree". (For setting from the buffer memory, refer to Paragraph 6.2.)

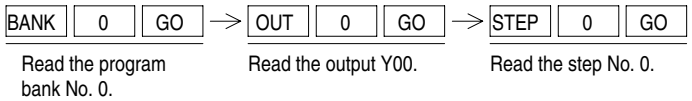
  Example: When setting "90.5 degree"
  Press the [9], [0] and [·] keys. A decimal point is also displayed on the DEG display. (Refer to Paragraph 8.3.5.)

- In the FX2N-1RM, modification of a program can be prohibited by registering a keyword or setting the write-protect function of the built-in EEPROM.
  When "Prt" is displayed while a program is modified, delete the registered keyword or reset the write-protect function of the built-in EEPROM, then modify the program again.
- Handling of the [CLR] key
  1) After having performed an erroneous operation or erroneous input, the last operation can be undone by pressing the [CLR] key.
  2) The error indication can be cleared by pressing the [CLR] key. When the [CLR] key is pressed, the error indication currently displayed is cleared, and "STEP0" is displayed.
  3) When the [CLR] key is pressed after a read operation was performed and while an angle is displayed on the DEG display, the insertion mode is selected and the DEG display becomes blank.
- Timing to save a program to the EEPROM

  While the data setting panel is manipulated, data is written to both the buffer memory and the EEPROM when the [GO] key is pressed.

8.2.2 Read **[Power ON][PRG mode]**

Read the specified program bank, the specified output and the specified step No.



When the [-] key is pressed, the item is moved in the order of "OFF angle of the previous step" and "ON angle of the previous step" (, then stops at the step No. 0).
When the [+] key is pressed, the item is moved in the order of "OFF angle of the same step" and "ON angle of the next step" (, then stops at the step No. 7).
When the [+] key is pressed and held for 0.3 sec or more, the next item is displayed in turn.
When the [-] key is pressed and held for 0.3 sec or more, the previous item is displayed in turn.

8.2.3 Write and modification [Power ON] [PRG mode]

Read the step No. to be written or modified, then set the ON/OFF angle of the output.
When writing new data, perform the write operation in the order of "ON angle" and "OFF angle".
When modifying the existing data, the ON angle or the OFF angle can be modified separately.

< Key operation >

BANK 0 GO	Read the program bank No. 0.
↓	
OUT 0 GO	Read the output Y00.
↓	
STEP 0 GO	Read the step No. 0.
↓	
ON OFF	Start to set ON/OFF of the output Y00.
↓	
1 2 3	Enter the ON angle of the output Y00.
↓	
ON OFF or GO	Determine the ON angle. When data is newly written or the [ON OFF] key is pressed, the process proceeds to setting of the OFF angle. When the existing data is modified, the contents of modification are written to the EEPROM when the [GO] key is pressed.
↓	
1 3 5	Enter the OFF angle of the output Y00.
↓	
GO	Determine the OFF angle. The ON/OFF set angle of the output Y00 entered is written to the built-in EEPROM.

●When the data entered is equivalent to (overlaps) the existing ON/OFF angle, the error indication "E02" is displayed. At this time, the data entered is not written.

●When the [GO] key is pressed at the end of the OFF angle setting operation for the step No. 7, the step 0 of the same bank is displayed.

< Display >

BANK	OUT	STEP	DEG	ON LED	OFF LED
0	0	0	Blank*1	Lit	Exting-uished

*1 When a modification operation is performed, the ON angle of the output Y00 already registered is displayed.

On the DEG , "0" is displayed or an angle already registered flashes.
The ON LED is lit to indicate that the ON angle setting operation is being performed.

"123" flashes on the DEG.

The OFF LED is lit to indicate that the process has proceeded to the OFF angle setting operation of the same step.

"135" flashes on the DEG.

The data setting operation proceeds to the next step, and the data setting panel becomes the following status.

BANK	OUT	STEP	DEG	ON LED	OFF LED
0	0	1	Blank*2	Lit	Exting-uished

*2 When a modification operation is performed, the ON angle of the next step already registered is displayed.

- When setting the ON/OFF angle of an output or the angle advance quantity of the automatic angle advance function from the data setting panel, use the [·] key to enter "0.5 degree".
  Example: When setting "90.5 degree"
  Press the [9], [0] and [·] keys. A decimal point is also displayed on the DEG display.

8.2.4 Insertion

[Power ON] [PRG mode]

Insertion is performed to the steps Nos. 0 to 6 of the same bank and the same output No. When data is inserted into an arbitrary step, the steps after the specified step are shifted backward by 1 step respectively, and the set value is written. At this time, if a set value is already written to the step No. 7, shift backward is disabled and the error E06 occurs.
Read the head of a program at first, then insert the ON/OFF angle of the output.

< Key operation >

BANK 0 GO	Read the program bank No. 0.
↓	
OUT 0 GO	Read the output Y00.
↓	
STEP 0 GO	Read the step No. 0.
↓	
CLR	Select the insertion mode.
↓	
ON OFF	Start to set ON/OFF of the output Y00.
↓	
2 4 6	Enter the ON angle of the output Y00.
↓	
ON OFF or GO	Determine the ON angle. Then, the process proceeds to setting of the OFF angle.
↓	
3 4 5	Enter the OFF angle of the output Y00.
↓	
GO	Determine the OFF angle. The existing set values of the step No. 0 and later are shifted backward by 1 step respectively, and the ON/OFF set angle of the output Y00 entered is written to the built-in EEPROM

When the data entered is equivalent to (overlaps) the existing ON/OFF angle, the error indication "E02" is displayed. At this time, the data entered is not inserted.
When data is already present in the step No. 7, the error indication "E06" is displayed. At this time, the data entered is not inserted either.

< Display >

BANK	OUT	STEP	DEG	ON LED	OFF LED
0	0	0	# # # *1	Lit	Exting-uished

*1 The ON angle of the output Y00 already registered is displayed.

Nothing is displayed on the DEG to indicate that the insertion mode is selected.

"0" flashes on the DEG.
The ON LED is lit to indicate that the ON angle setting operation is being performed.

"246" flashes on the DEG.

The OFF LED is lit to indicate that the process has proceeded to the OFF angle setting operation of the same step.
At this time, "0" flashes on the DEG.

"345" flashes on the DEG.

The data setting operation proceeds to the next step, and the data setting panel becomes the following status.

BANK	OUT	STEP	DEG	ON LED	OFF LED
0	0	1	000 *2	Lit	Exting-uished

*2 The step No. 1 (former step No. 0) shifted backward by insertion is displayed.

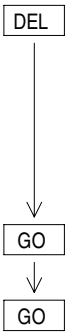
8.2.5 Deletion

[Power ON] [PRG mode]

Delete the entire program, the bank data, the output data or the step data (ON/OFF).
The entire program contains the bank data, the output data, the step data and the keyword.

Deleting the entire program

< Key operation >



< Display >

BANK	OUT	STEP	DEG	ON LED	OFF LED
"0" flashes	"0" flashes	"0" flashes	"# # #" flashes*1	Exting-uished	Exting-uished

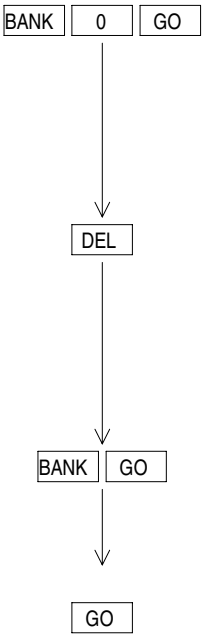
*1 The ON angle of the output Y00 already registered flashes.

"dEL" flashes on the DEG.

BANK	OUT	STEP	DEG	ON LED	OFF LED
0	0	0	Blank	Lit	Exting-uished

Deleting a specified bank

< Key operation >



< Display >

BANK	OUT	STEP	DEG	ON LED	OFF LED
0	0	0	# # # *1	Lit	Exting-uished

*1 The ON angle of the output Y00 already registered is displayed.

BANK	OUT	STEP	DEG	ON LED	OFF LED
"0" flashes	"0" flashes	"0" flashes	# # # flashes*2	Lit	Exting-uished

*2 The ON angle of the output Y00 already registered flashes.

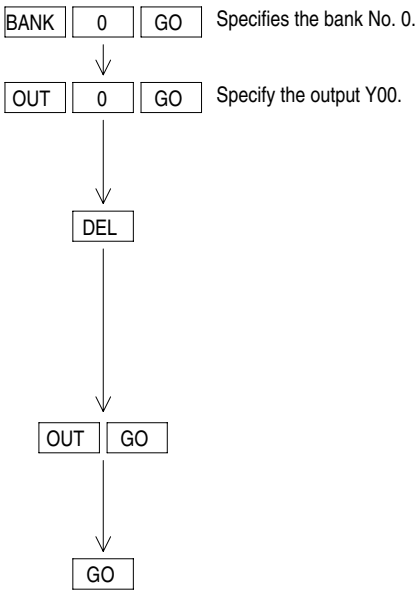
When the [BANK] key is pressed, only the BANK "0" flashes.

When the [GO] key is pressed, "dEL" flashes on the DEG.

BANK	OUT	STEP	DEG	ON LED	OFF LED
0	0	0	Blank	Lit	Exting-uished

Deleting a specified output

< Key operation >



< Display >

BANK	OUT	STEP	DEG	ON LED	OFF LED
0	0	0	# # # *1	Lit	Exting-uished

*1 The ON angle of the output Y00 already registered is displayed.

BANK	OUT	STEP	DEG	ON LED	OFF LED
"0" flashes	"0" flashes	"0" flashes	# # # flashes*2	Exting-uished	Exting-uished

*2 The ON angle of the output Y00 already registered flashes.

When the [OUT] key is pressed, only the OUT "0" flashes.

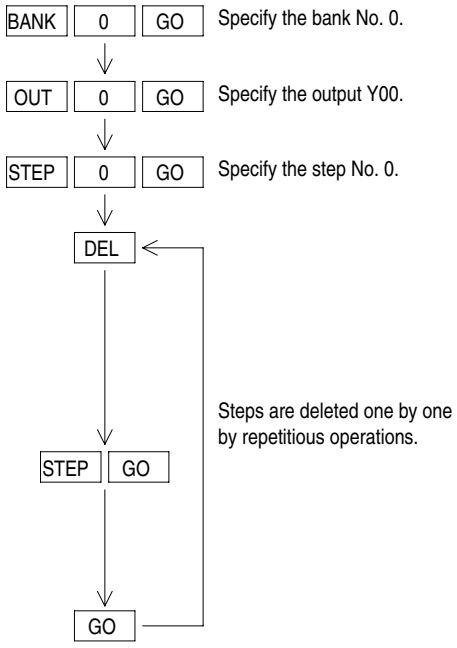
(The BANK "0" is displayed.)

When the [GO] key is pressed, "dEL" flashes on the DEG.

BANK	OUT	STEP	DEG	ON LED	OFF LED
0	0	0	Blank	Lit	Exting-uished

Deleting the ON/OFF data of a specified step

< Key operation >



The ON/OFF data of the specified step is deleted, and the ON/OFF data of the step after the specified step and later is shifted forward respectively.

< Display >

BANK	OUT	STEP	DEG	ON LED	OFF LED
0	0	0	# # # *1	Lit	Exting-uished

*1 The ON angle of the output Y00 already registered is displayed.

BANK	OUT	STEP	DEG	ON LED	OFF LED
"0" flashes	"0" flashes	"0" flashes	# # # flashes*2	Exting-uished	Exting-uished

*2 The ON angle of the output Y00 already registered is displayed.

When the [STEP] key is pressed, only the STEP "0" flashes.
(The BANK "0" and the OUT "0" are displayed.)

When the [GO] key is pressed, "dEL" flashes on the DEG.

BANK	OUT	STEP	DEG	ON LED	OFF LED
0	0	0	# # # *3	Lit	Exting-uished

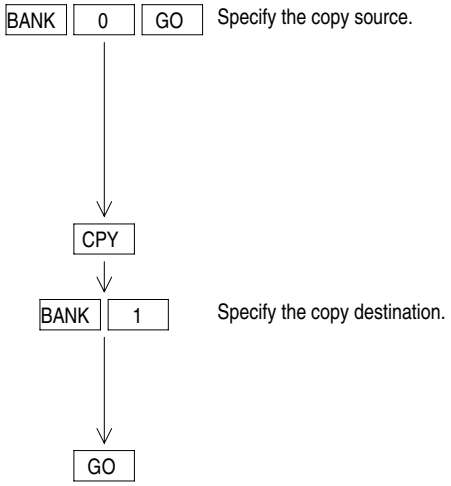
The step No. 0 (former step No. 1) shifted forward by deletion is displayed.

8.2.6 Copy [Power ON] [PRG mode]

Copy the contents of an existing bank to a specified bank. Copy the contents of an existing output to a specified output of the same bank.

Copying a bank

< Key operation >



The error indication "E07" is displayed when the bank No. specified as source is equivalent to the bank No. specified as destination. At this time, copy is not executed.

< Display >

BANK	OUT	STEP	DEG	ON LED	OFF LED
0	0	0	# # # *1	Lit	Exting-uished

*1 The ON angle of the output Y00 already registered is displayed.

"CPY" flashes on the DEG.

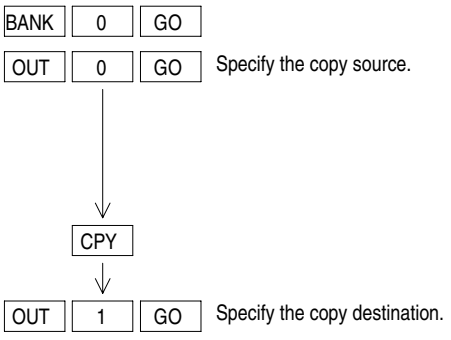
When the [BANK] and [1] keys are pressed, the BANK "1" and "cpy" flash.

BANK	OUT	STEP	DEG	ON LED	OFF LED
1	0	0	# # # *2	Lit	Exting-uished

*2 The ON angle of the output Y00 of the copy destination bank is displayed.

Copying an output

< Key operation >



The error indication "E05" is displayed when the output No. specified as source is equivalent to the output No. specified as destination. At this time, copy is not executed.

< Display >

BANK	OUT	STEP	DEG	ON LED	OFF LED
0	0	0	# # # *1	Lit	Exting-uished

*1 The ON angle of the output Y00 already registered is displayed.

"CPY" flashes on the DEG.

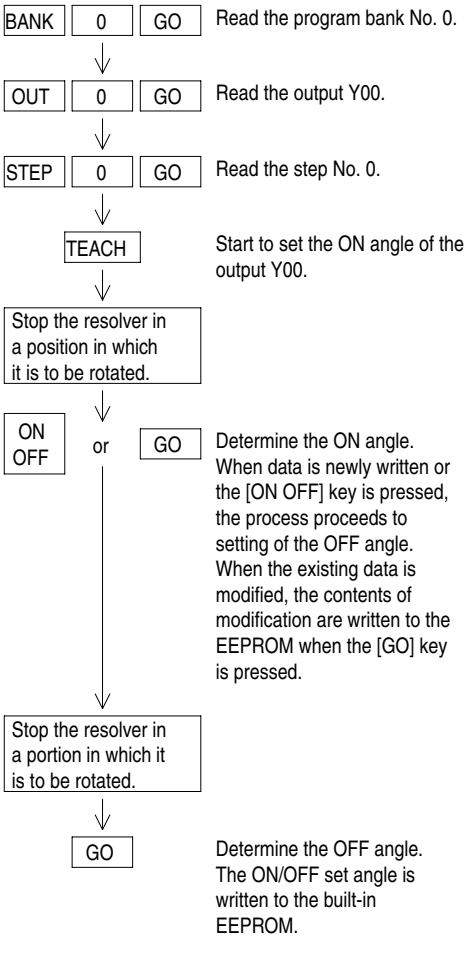
BANK	OUT	STEP	DEG	ON LED	OFF LED
0	1	0	# # # *2	Lit	Exting-uished

*2 The ON angle of the output Y00 of the copy destination output is displayed.

8.2.7 Write and modification of teaching [Power ON] [PRG mode]

Treat the current position of the resolver as the set value.
Connect the resolver to the FX2N-1RM before turning on the power.

< Key operation >



< Display >

BANK	OUT	STEP	DEG	ON LED	OFF LED
0	0	0	Blank*1	Lit	Exting-uished

*1 When a modification operation is performed, the ON angle of the output Y00 already registered is displayed.

The angle in the current position flashes on the DEG .
The OFF LED is lit to indicate that the process has proceeded to setting of the OFF angle of the same step.

BANK	OUT	STEP	DEG	ON LED	OFF LED
0	0	0	# # # *2	Exting-uished	Lit

*2 When the [GO] key is pressed while modification is performed, the OFF angle of the same step is displayed.
When the [ON OFF] or [GO] key is pressed while data is newly written or when the [ON OFF] key is pressed while the existing data is modified, the current angle flashes.

BANK	OUT	STEP	DEG	ON LED	OFF LED
0	0	1	Blank*3	Lit	Exting-uished

*3 When a modification operation is performed, the ON angle of the next step already registered is displayed.

8.2.8 Insertion of teaching [Power ON][PRG mode]

Insert the current position of the resolver as the set value.
Connect the resolver to the FX2N-1RM before turning on the power.

< Key operation >

BANK 0 GO — Read the program bank No. 0.

↓

OUT 0 GO — Read the output Y00.

↓

STEP 0 GO — Read the step No. 0.

↓

CLR — Select the insertion mode.

↓

TEACH — Start to set the ON angle of the output Y00.

↓

Rotate the resolver, and stop it in a position in which it is to be turned on.

↓

ON OFF or GO — Determine the ON angle. Starts to set OFF of the output Y00.

↓

Rotate the resolver, and stop it in a position in which it is to be turned on.

↓

GO — Determines the OFF angle.

< Display >

BANK	OUT	STEP	DEG	ON LED	OFF LED
0	0	0	Blank*1	Lit	Exting-uished

*1 The ON angle of the output Y00 already registered is displayed.

Nothing is displayed on the DEG to indicate that the insertion mode is selected.

The angle in the current position flashes on the DEG.

BANK	OUT	STEP	DEG	ON LED	OFF LED
0	0	0	# # # flashes*2	Exting-uished	Lit

*2 The current angle flashes.

The OFF LED is lit to indicate that the process has proceeded to setting of the OFF angle of the same step.

BANK	OUT	STEP	DEG	ON LED	OFF LED
0	0	1	# # # *3	Lit	Exting-uished

*3 The step No. 1 (former step No. 0) shifted downward by insertion is displayed.

8.2.9 Changing over the mode between RUN and PRG [Power ON] [RUN/ PRG mode]

Change-over the mode between RUN and PRG from the data setting panel.

RUN

< Key operation >

< Display >

BANK	OUT	STEP	DEG
0	0	0	"RUN" flashes

Example of current value display

BANK	OUT	STEP	DEG	RUN LED
0	Blank	Blank	### *1	Lit

*1 The current value is displayed.

When the mode is switched in the way "RUN → PRG → RUN", the monitor status just before the mode is switched from RUN to PRG is displayed.
(Refer to Paragraph 9.1)

PRG

< Key operation >

< Display >

BANK	OUT	STEP	DEG
0	Blank	Blank	"StP" flashes

BANK	OUT	STEP	DEG	ON LED
0	0	0	### *1	Lit

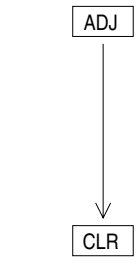
*1 The set value is displayed.

8.2.10 Reading/setting the reference angle [Power ON][PRG mode]

Set the current position of the resolver as the reference angle.
The reference angle is used as common in all the banks.
Connect the resolver to the FX2N-1RM before turning on the power.

Read procedure

< Key operation >



Display the reference angle.

Return the display to the previous status.

< Display >

BANK	OUT	STEP	DEG	ON LED	OFF LED
b	Ad	Blank	### flashes *1	Exting-uished	Exting-uished

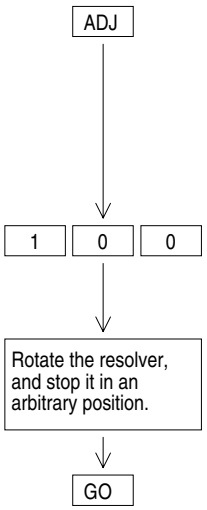
*1 The reference angle already registered flashes. The initial value is 0.

BANK	OUT	STEP	DEG	ON LED	OFF LED
0	0	0	### *2	Lit	Exting-uished

*2 The ON angle of the output Y00 already registered is displayed.

Setting procedure

< Key operation >



Display the reference angle.

Enter a numeric to be treated as reference.

< Display >

BANK	OUT	STEP	DEG	ON LED	OFF LED
b	Ad	Blank	### flashes *1	Lit	Exting-uished

*1 The reference angle already registered flashes. The initial

The numeric "100" entered flashes on the DEG.

The current position in which the resolver is stopped is treated as set value.

BANK	OUT	STEP	DEG	ON LED	OFF LED
0	0	0	###*2	Lit	Exting-uished

*2 The ON angle of the output Y00 already registered is displayed.

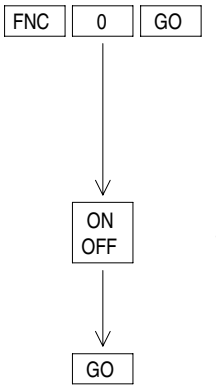
8.3 Application operating procedures

An application operating procedure indicates a monitor operating procedure, a test operating procedure or an operating procedure using the [FNC] key. The contents when the [FNC] key is used vary depending on the FNC No. entered after the [FNC] key.
The FNC Nos. available are 0 to 6, 13 to 26, 50, 60 to 65, 70 to 75, 80, 84 and 90.

8.3.1 Specifying the resolution [FNC0] [Power ON] [PRG mode]

Specify the resolution.
The resolution can be selected between 1 degree (initial vale) and 0.5 degree.

< Key operation >



Confirm the setting by referring to the ON/OFF LED status.

The contents of the previous and later FNC Nos. can be displayed and confirmed in turn using the [-] and [+] keys. (FNC0 to FNC4)

< Display >

BANK	OUT	STEP	DEG	ON LED	OFF LED
0	0	0	F00	Exting-uished	Lit*1

*1 Initial value (resolution = 1 degree)

BANK	OUT	STEP	DEG	ON LED	OFF LED
0	0	0	F00	Flashes	Exting-uished

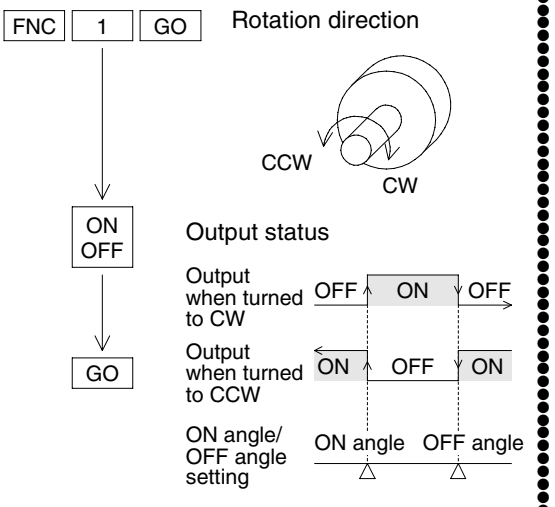
When setting is finished, the contents of the next FNC No. (FNC1) are displayed.

While the OFF LED is lit: Resolution = 1 degree
While the ON LED is lit: Resolution = 0.5 degree

8.3.2 Specifying the rotation direction of the resolver [FNC1] [Power ON] [PRG mode]

Select the rotation direction of the resolver. When turned to the other direction, the ON/OFF angle is changed and output status is reversed.

< Key operation >



< Display >

BANK	OUT	STEP	DEG	ON LED	OFF LED
0	0	0	F01	Exting-uished	Lit*1

*1 Initial value (rotation direction = clockwise)

BANK	OUT	STEP	DEG	ON LED	OFF LED
0	0	0	F01	Flashes	Exting-uished

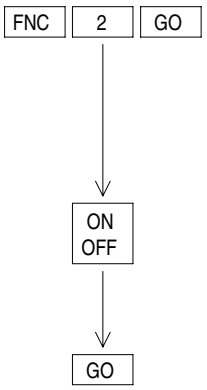
When setting is finished, the contents of the next FNC No. (FNC2) are displayed.

While the OFF LED is lit: Rotation direction = CW
While the ON LED is lit: Rotation direction = CCW

8.3.3 Write-protect function of the EEPROM [FNC2] [Power ON] [PRG mode]

Enable or prohibit write of data to the EEPROM built in the FX2N-1RM.

< Key operation >



< Display >

BANK	OUT	STEP	DEG	ON LED	OFF LED
0	0	0	F02	Exting-uished	Lit*1

*1 Initial value (write enabled).

BANK	OUT	STEP	DEG	ON LED	OFF LED
0	0	0	F02	Flashes	Exting-uished

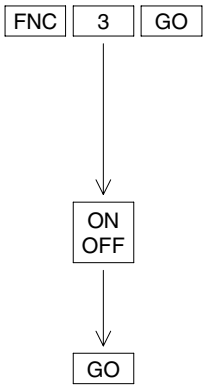
When setting is finished, the contents of the next FNC No. (FNC3) are displayed.

While the OFF LED is lit: Write enabled
While the ON LED is lit: Write prohibited

8.3.4 Bank specification method [FNC3] [Power ON] [PRG mode]

Select the program bank specification method.

< Key operation >



< Display >

BANK	OUT	STEP	DEG	ON LED	OFF LED
0	0	0	F03	Exting-uished	Lit *1

*1 Initial value (specifies by an external input of FX2N-1RM).

BANK	OUT	STEP	DEG	ON LED	OFF LED
0	0	0	F03	Flashes	Exting-uished

When setting is finished, the contents of the next FNC No. (FNC4) are displayed.

While the OFF LED is lit: Specifies by an external input of FX2N-1RM
While the ON LED is lit : Specificat ion from programmable controller

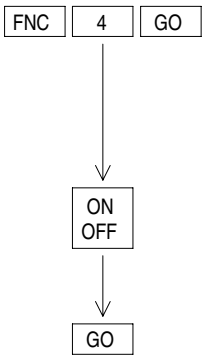
Set to specify the bank from the PLC without fail when you use the current angle transfer function.

8.3.5 Setting the automatic angle advance function [FNC4, 13 to 26] [Power ON] [PRG mode]

Set use of the automatic angle advance angle, the rotation speed and the angle advance quantity.

Specifying the automatic angle advance function [FNC4]

< Key operation >



Confirm the setting by referring to the ON/OFF LED status.

< Display >

BANK	OUT	STEP	DEG	ON LED	OFF LED
0	0	0	F04	Exting-uished	Lit*1

*1 Initial value (invalid)

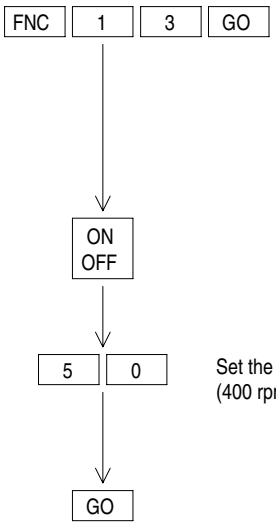
BANK	OUT	STEP	DEG	ON LED	OFF LED
0	0	0	F04	Flashes	Exting-uished

When setting is finished, the contents of the FNC5 are displayed.

While the OFF LED is lit: Invalid
While the ON LED is lit: Valid

Rotation speed (rpm) of S0 [FNC13]

< Key operation >



Set the rotation speed (400 rpm maximum).

The contents of the previous and later FNC Nos. can be displayed and confirmed in turn using the [+] and [-] keys. (FNC13 to FNC26)

< Display >

BANK	OUT	STEP	DEG
S	Pd	0 *1	"0" is displayed .*2

*1 It indicates that S0 is being set.
*2 The existing value is displayed.

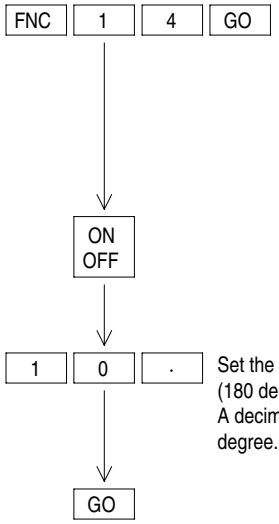
Data flashes on the DEG to indicate that setting is ready.

BANK	OUT	STEP	DEG
S	Pd	0	"50" flashes*1

When setting is finished, the contents of the next FNC No. (FNC14) are displayed.

Angle advance quantity (degrees) of S0 [FNC14]

< Key operation >



Set the angle advance quantity (180 degrees maximum). A decimal point indicates 0.5 degree.

< Display >

BANK	OUT	STEP	DEG
d	EG	0 *1	"0" is displayed *2

*1 It indicates that S0 is being set.
*2 The existing value is displayed.

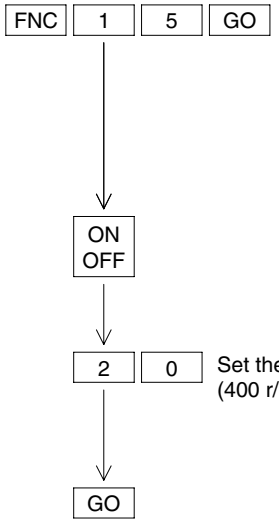
BANK	OUT	STEP	DEG
d	EG	0	"10 ·" flashes*3

When setting is finished, the contents of the next FNC No. (FNC15) are displayed.

*3 " · " (decimal point) indicates 0.5 degree.

Rotation speed (rpm) of S1 [FNC15]

< Key operation >



Set the rotation speed (400 r/min maximum).

< Display >

BANK	OUT	STEP	DEG
S	Pd	1 *1	"0" is displayed *2

*1 It indicates that S1 is being set.
*2 The existing value is displayed.

BANK	OUT	STEP	DEG
S	Pd	1	"20" flashes*3

When setting is finished, the contents of the next FNC No. are displayed.

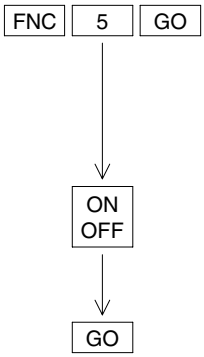
Manipulate FNC16 to FNC26 in the same way as FNC13 to FNC15.
The operating procedures for the FNC16 to the FNC26 are omitted here.

8.3.6 Individual automatic angle advance function [FNC5,90] [Power ON] [PRG mode]

The use of individual automatic angle advance function is specified and the rotational speed and angle advance quantity are set.
Please make the specification of “use” before setting the rotational speed and angle advance quantity by the undermentioned operation.

The specification of use [FNC5]

< Key operation >



Confirm the setting by referring to the ON/OFF LED status.

< Display >

BANK	OUT	STEP	DEG	ON LED	OFF LED
0	0	0	F05	Exting-uished	Lit*1

*1 Initial value (invalid)

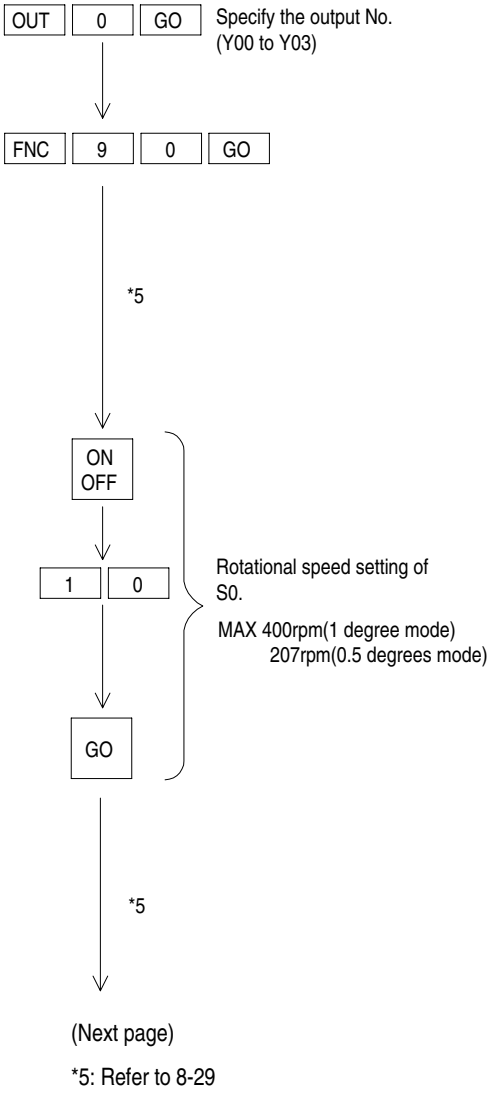
BANK	OUT	STEP	DEG	ON LED	OFF LED
0	0	0	F05	Flashes	Exting-uished

When setting is finished, the contents of the FNC6 are displayed.

While the OFF LED is lit: Invalid
While the ON LED is lit: Valid

Setting of rotational speed and angle advance quantity [FNC90]

< Key operation >



(Next page)

*5: Refer to 8-29

< Display >

BANK	OUT	STEP	DEG	ON LED	OFF LED
0	0	0	0	Lit	Exting-uished

The rotational speed setting of S0 is displayed by the operation recorded left.

BANK	OUT	STEP	DEG	ON LED	OFF LED
S	Pd	0	0 Lit *1	Exting-uished	Exting-uished

*1: An existing value is displayed.

It is displayed that DEG display part becomes a blinking display when the [ON OFF] key is pushed, and setting is possible.

BANK	OUT	STEP	DEG	ON LED	OFF LED
S	Pd	0	"10" flashes	Exting-uished	Exting-uished

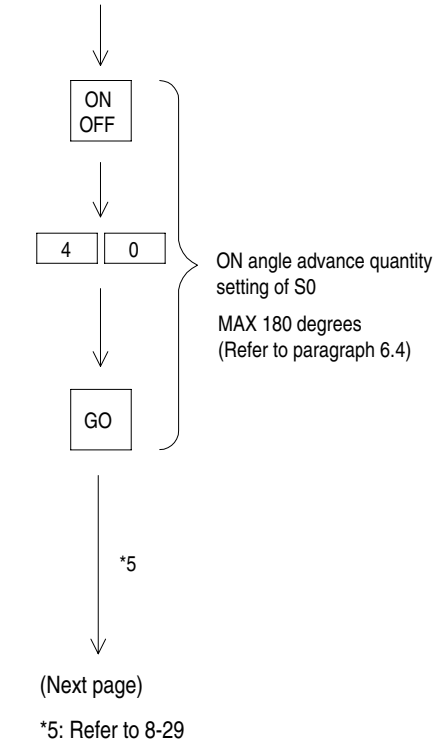
When the [GO] key is pushed, the ON angle advance quantity setting of S0 is displayed.

BANK	OUT	STEP	DEG	ON LED	OFF LED
d	EC	0	0 Lit *2	Lit	Exting-uished

*2 ON angle advance quantity existing set value of S0 is displayed.

< Key operation >

(From previous page)



(Next page)

*5: Refer to 8-29

< Display >

It is displayed that DEG display part becomes a blinking display when [ON OFF] key is pushed, and setting is possible.

BANK	OUT	STEP	DEG	ON LED	OFF LED
d	EC	0	"40" flashes	Lit	Exting-uished

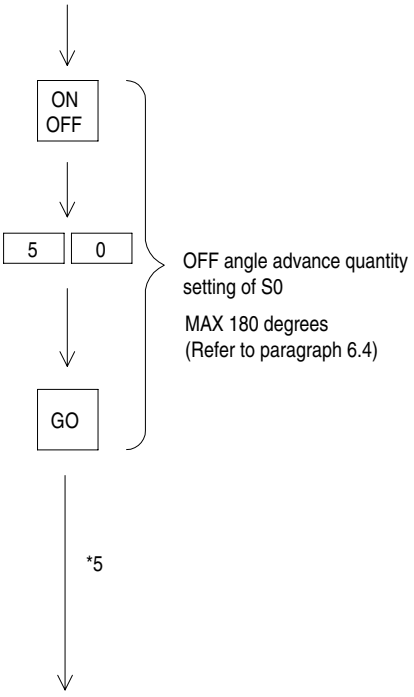
When the [GO] key is pushed, the OFF angle advance quantity setting of S0 is displayed.

BANK	OUT	STEP	DEG	ON LED	OFF LED
d	EC	0	0 Lit *3	Exting-uished	Lit

*3: OFF angle advance quantity existing set value of S0 is displayed.

< Key operation >

(From previous page)



The rotational speed and angle advance quantity of S1 to S6 are set one by one as well as S0.

*5: The existing contents of S0 through S6 can be displayed by using the [+] / [-] key.

[+] key : The content of the following item setting is displayed.
(S0 →S1 . . . →S6)

[-] key : The content of the previous item setting is displayed.
(S6 →S5 . . . →S0)

< Display >

The DEG display becomes a blinking display when the [ON OFF] key is pushed, and setting is possible.

BANK	OUT	STEP	DEG	ON LED	OFF LED
d	EC	0	"50" flashes	Exting-uished	Lit

When the [GO] key is pushed, the rotational speed setting of S1 is displayed.

BANK	OUT	STEP	DEG	ON LED	OFF LED
d	EC	1	0 Lit *4	Exting-uished	Exting-uished

*4: Rotational speed existing set value of S1 is displayed.

Returns to the display of the rotational speed setting about S0 when OFF angle advance quantity set operation of S6 ends.

8.3.7 Prohibition of RUN to PRG operation [FNC6] [Power ON] [PRG mode]

The RUN to PRG operation with data setting panel is prohibited.
The RUN to PRG switch by the RUN/PRG change switch and BFM#3 is effective.
(This function is added from the product since V2.20.).

Prohibition of RUN to PRG operathion [FNC6]

< Key operation >

FNC 6 GO

↓

ON OFF

Confirm the setting by referring to the ON/OFF LED status.

↓

GO

< Display >

BANK	OUT	STEP	DEG	ON LED	OFF LED
0	0	0	F06	Exting-uished	Lit*1

*1 Initial value (Permission)

BANK	OUT	STEP	DEG	ON LED	OFF LED
0	0	0	F06	Flashes	Exting-uished

When setting is finished, the contents of the FNC0 are displayed.

While the OFF LED is lit: Permission
While the ON LED is lit: Prohibition

8.3.8 Current angle transfer function [FNC7] [Power ON] [PRG mode]

Current angle of the resolver is transferred to BFM#106 via turning ON input terminal B1.
Set to specify the Bank from the PLC without fail when you use the current angle transfer function. (Function has been included since version V2.40)

< Key operation >

FNC 7 GO

↓

ON OFF

Confirm the setting by referring to the ON/OFF LED status.

↓

GO

< Display >

BANK	OUT	STEP	DEG	ON LED	OFF LED
0	0	0	F07	Exting-uished	Lit*1

*1 Initial value (Permission)

BANK	OUT	STEP	DEG	ON LED	OFF LED
0	0	0	F07	Flashes	Exting-uished

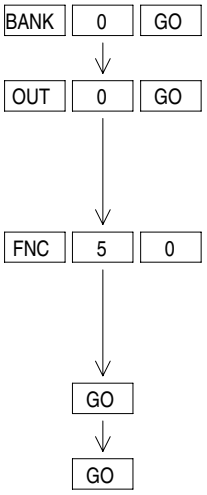
When setting is finished, the contents of the FNC0 are displayed.

While the OFF LED is lit: Permission
While the ON LED is lit: Prohibition

8.3.9 Inverting the output pattern [FNC50] [Power ON] [PRG mode]

Invert the output pattern of an existing program except the fixed output patterns automatically generated by FNC70 to FNC75.
Outputs which are not set in a program cannot be inverted. (The error code "E03" is displayed.)

< Key operation >



< Display >

BANK	OUT	STEP	DEG	ON LED	OFF LED
0	0	0	# # # *1	Lit	Exting-uished

*1 The angle of the output Y00 already registered is displayed.

BANK	OUT	STEP	DEG	ON LED	OFF LED
0	0	0	"F50" flashes	Exting-uished	Exting-uished

"rEv" flashes on the DEG.

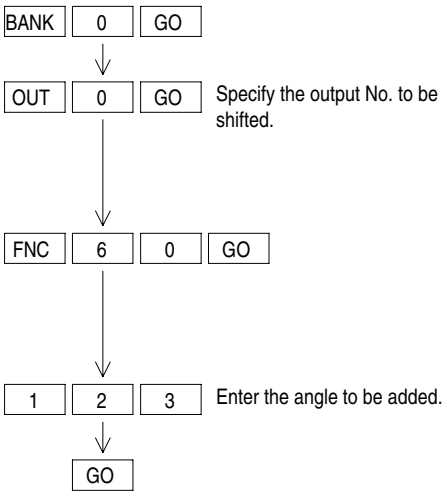
When setting is finished, flashing of "rEv" is changed into display of the set angle after invert.

8.3.10 Batch addition/subtraction of the output set angle [FNC60, 61] [Power ON] [PRG mode]

Add or subtract a specified angle to/from all the steps of a specified output at a time (ON angle and OFF angle) except the fixed output patterns automatically generated by FNC70 to FNC75.

Batch addition [FNC60]

< Key operation >



< Display >

BANK	OUT	STEP	DEG	ON LED	OFF LED
0	0	0	# # # *1	Lit	Exting-uished

*1 The ON angle of the output Y00 already registered is displayed.

BANK	OUT	STEP	DEG	ON LED	OFF LED
A	dd	0	"000" flashes	Exting-uished	Exting-uished

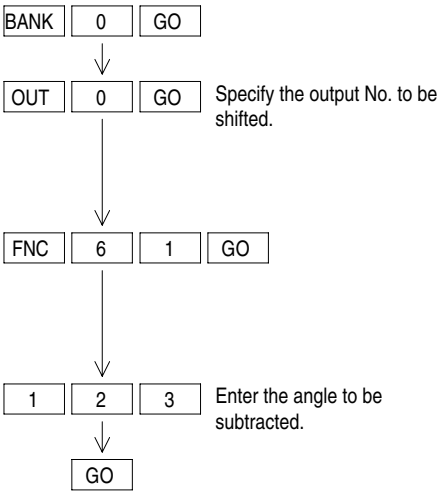
"123" flashes on the DEG.

BANK	OUT	STEP	DEG	ON LED	OFF LED
0	0	0	# # # *2	Lit	Exting-uished

*2 When setting is finished, flashing of data on the DEG is changed into display of a value shifted.

Batch subtraction [FNC61]

< Key operation >



< Display >

BANK	OUT	STEP	DEG	ON LED	OFF LED
0	0	0	# # # *1	Lit	Exting-uished

*1 The ON angle of the output Y00 already registered is displayed.

BANK	OUT	STEP	DEG	ON LED	OFF LED
S	ub	0	"000" flashes	Exting-uished	Exting-uished

"123" flashes on the DEG.

BANK	OUT	STEP	DEG	ON LED	OFF LED
0	0	0	# # # *2	Lit	Exting-uished

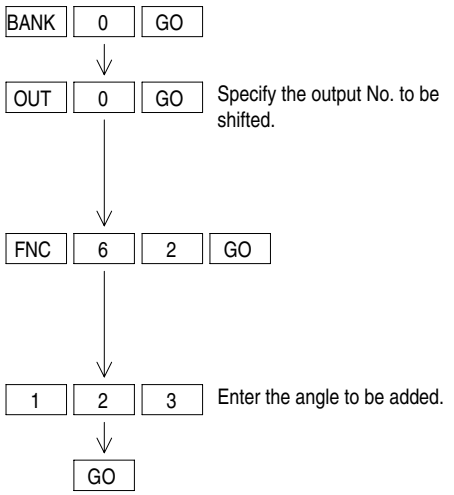
*2 When setting is finished, flashing of data on the DEG is changed into display of a value shifted.

8.3.11 Batch addition/subtraction of the ON output set angle[FNC62, 63] [Power ON][PRG mode]

Add or subtract a specified angle to/from the ON set angle of a specified output at a time (only the ON angle) except the fixed output patterns automatically generated by FNC70 to FNC75.
If the ON/OFF width becomes 0 by the setting entered, the error code "E08" is displayed.

Batch addition [FNC62]

< Key operation >



< Display >

BANK	OUT	STEP	DEG	ON LED	OFF LED
0	0	0	# # # *1	Lit	Exting-uished

*1 The ON angle of the output Y00 already registered is displayed.

BANK	OUT	STEP	DEG	ON LED	OFF LED
o	nP	0	"000" flashes	Exting-uished	Exting-uished

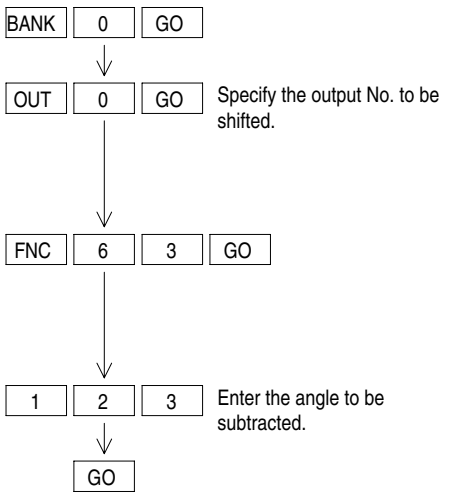
"123" flashes on the DEG.

BANK	OUT	STEP	DEG	ON LED	OFF LED
0	0	0	# # # *2	Lit	Exting-uished

*2 When setting is finished, flashing of data on the DEG is changed into display of a value shifted.

Batch subtraction [FNC63]

< Key operation >



< Display >

BANK	OUT	STEP	DEG	ON LED	OFF LED
0	0	0	# # # *1	Lit	Exting-uished

*1 The ON angle of the output Y00 already registered is displayed.

BANK	OUT	STEP	DEG	ON LED	OFF LED
o	nn̄	0	"000" flashes	Exting-uished	Exting-uished

"123" flashes on the DEG.

BANK	OUT	STEP	DEG	ON LED	OFF LED
0	0	0	# # # *2	Lit	Exting-uished

*2 When setting is finished, flashing of data on the DEG is changed into display of a value shifted.

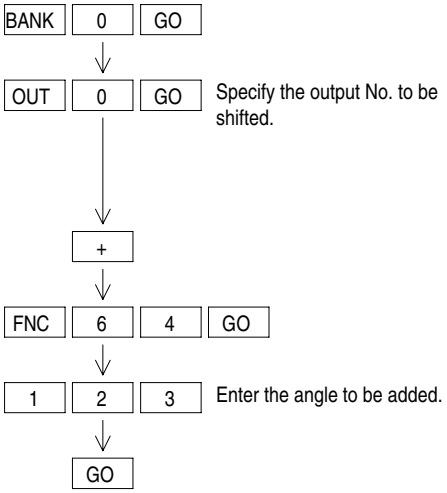
8.3.12 Batch addition/subtraction of the OFF output set angle [FNC64, 65]

[Power ON] [PRG mode]

Add or subtract a specified angle to/from the OFF set angle of a specified output at a time (only the OFF angle) except the fixed output patterns automatically generated by FNC70 to FNC75. If the ON/OFF width becomes 0 by the setting entered, the error code "E08" is displayed.

Batch addition [FNC64]

< Key operation >



< Display >

BANK	OUT	STEP	DEG	ON LED	OFF LED
0	0	0	# # # *1	Exting-uished	Lit

*1 The ON angle of the output Y00 already registered is displayed.

BANK	OUT	STEP	DEG	ON LED	OFF LED
o	FP	0	"000" flashes	Exting-uished	Exting-uished

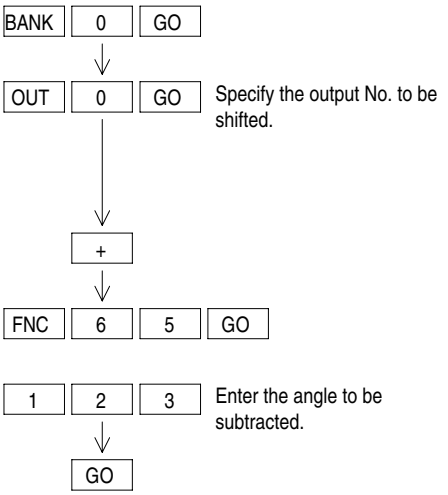
"123" flashes on the DEG.

BANK	OUT	STEP	DEG	ON LED	OFF LED
0	0	0	# # # *2	Exting-uished	Lit

*2 When setting is finished, flashing of data on the DEG is changed into display of a value shifted.

Batch subtraction [FNC65]

< Key operation >



< Display >

BANK	OUT	STEP	DEG	ON LED	OFF LED
0	0	0	# # # *1	Exting-uished	Lit

*1 The ON angle of the output Y00 already registered is displayed.

BANK	OUT	STEP	DEG	ON LED	OFF LED
o	$\overline{Fn}$	0	"000" flashes	Exting-uished	Exting-uished

"123" flashes on the DEG.

BANK	OUT	STEP	DEG	ON LED	OFF LED
0	0	0	# # # *2	Exting-uished	Lit

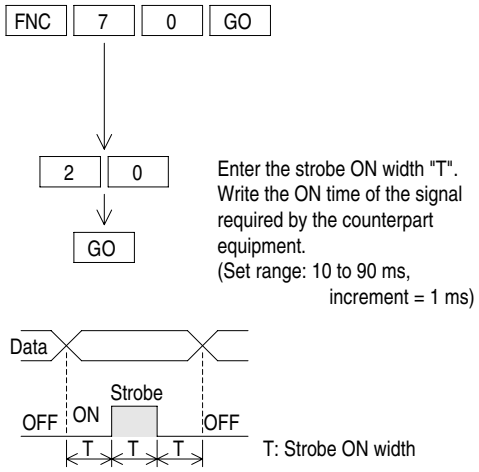
*2 When setting is finished, flashing of data on the DEG is changed into display of a value shifted.

8.3.13 Outputting the BCD current angle [FNC70, 71] [Power ON] [PRG mode]

Output the BCD current angle. The portion after the decimal point is ignored.
The output Nos. of the current angle are Y00 to Y11 (three digits.) The strobe signal is fixed to Y12. (The strobe signal Y12 is used as a signal shared by the three digits.)
Only extension blocks dedicated to output can be connected to the FX2N-1RM.
When a program to set the ON/OFF angle is present in Y00 to Y12, output operations by that program are ignored.

BCD output [FNC70]

< Key operation >



< Display >

BANK	OUT	STEP	DEG	ON LED	OFF LED
b	cd	0	"000" flashes	Exting-uished	Exting-uished

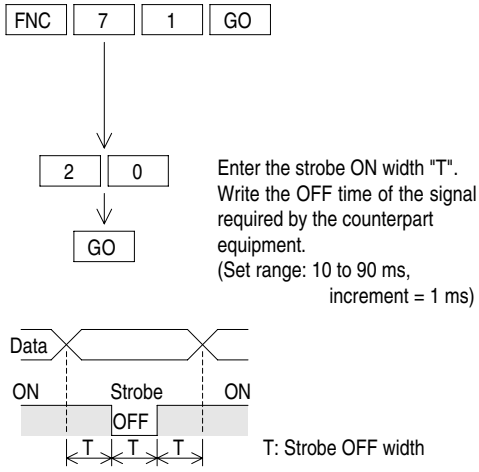
"20" flashes on the DEG.

BANK	OUT	STEP	DEG	ON LED	OFF LED
0	13	0	# # # *1	Lit	Exting-uished

*1 When setting is finished, flashing of data on the DEG is changed into display of the ON output set angle of Y13.

BCD invert output [FNC71] * FNC71 offers the same function as FNC70 except that ON and OFF are inverted both in the data output and the strobe output.

< Key operation >



< Display >

BANK	OUT	STEP	DEG	ON LED	OFF LED
b	cd	0	"000" flashes	Exting-uished	Exting-uished

"20" flashes on the DEG.

BANK	OUT	STEP	DEG	ON LED	OFF LED
0	13	0	# # # *1	Lit	Exting-uished

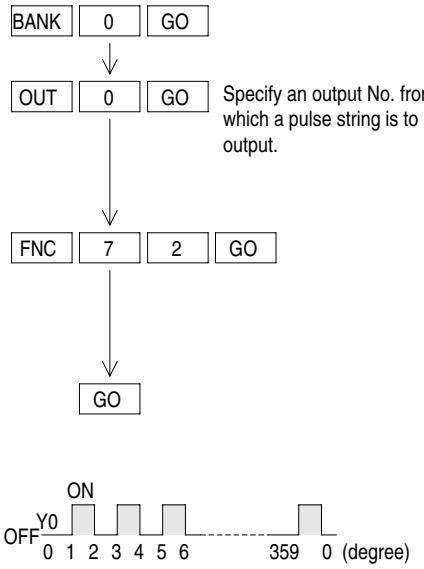
*1 When setting is finished, flashing of data on the DEG is changed into display of the ON output set angle of Y13.

8.3.14 Outputting the pulse string [FNC72, 73] [Power ON] [PRG mode]

Output a one- or two-phase pulse string from an arbitrary output No.
The number of pulses output is 180 pulses/rotation (for one-phase) or 90 pulses/rotation (for two-phase). The rotation speed is determined by the resolution selected.
(When 1 degree is selected: 830 r/min, when 0.5 degree is selected: 415 r/min)

One-phase pulse output: 180 pulses/rotation [FNC72]

< Key operation >



< Display >

BANK	OUT	STEP	DEG	ON LED	OFF LED
0	0	0	# # # *1	Lit	Exting-uished

*1 The ON angle of the output Y00 already registered is displayed.

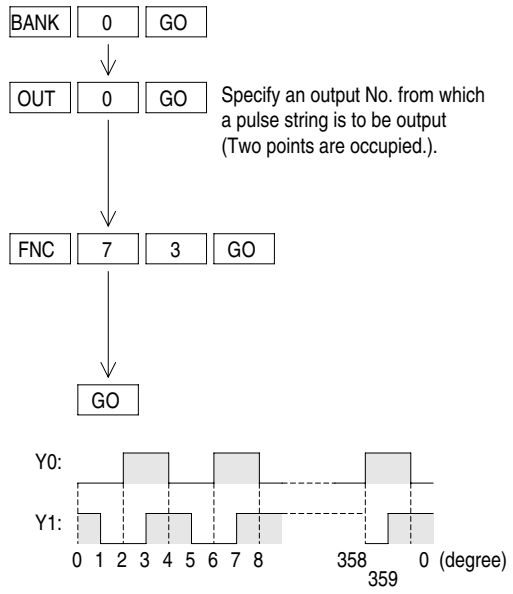
BANK	OUT	STEP	DEG	ON LED	OFF LED
0	0	0	"F72" flashes	Exting-uished	Exting-uished

BANK	OUT	STEP	DEG	ON LED	OFF LED
0	1	0	# # # *2	Lit	Exting-uished

*2 The ON angle of the output Y01 already registered is displayed.

Two-phase pulse output: 90 pulses/rotation [FNC73]

< Key operation >



< Display >

BANK	OUT	STEP	DEG	ON LED	OFF LED
0	0	0	# # # *1	Lit	Exting-uished

*1 The ON angle of the output Y00 already registered is displayed.

BANK	OUT	STEP	DEG	ON LED	OFF LED
0	0	0	"F73" flashes	Exting-uished	Exting-uished

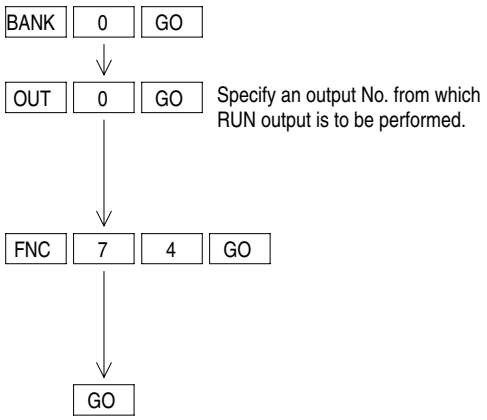
BANK	OUT	STEP	DEG	ON LED	OFF LED
0	2	0	# # # *2	Lit	Exting-uished

*2 The ON angle of the output Y01 already registered is displayed.

8.3.15 RUN output [FNC74] [Power ON] [PRG mode]

Output always the ON signal from an arbitrary output No. in the RUN mode.

< Key operation >



< Display >

BANK	OUT	STEP	DEG	ON LED	OFF LED
0	0	0	# # # *1	Lit	Exting-uished

*1 The ON angle of the output Y00 already registered is displayed.

BANK	OUT	STEP	DEG	ON LED	OFF LED
0	0	0	"F74" flashes	Lit	Exting-uished

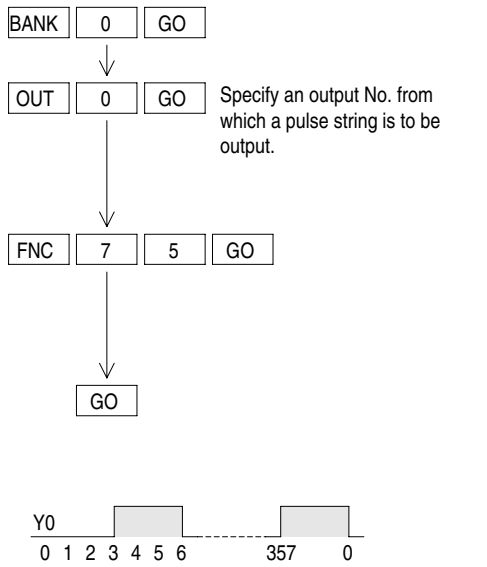
BANK	OUT	STEP	DEG	ON LED	OFF LED
0	1	0	# # # *2	Lit	Exting-uished

*2 The ON angle of the output Y01 already registered is displayed.

8.3.16 Outputting the one-phase pulse string [FNC75] [Power ON] [PRG mode]

Output a one-phase pulse string from an arbitrary output No.
The number of pulses output is 60 pulses/rotation. The rotation speed is determined by the resolution selected. (When 1 degree is selected: 830 r/min, when 0.5 degree is selected: 415 r/min)

< Key operation >



< Display >

BANK	OUT	STEP	DEG	ON LED	OFF LED
0	0	0	# # # *1	Lit	Exting-uished

*1 The ON angle of the output Y00 already registered is displayed.

BANK	OUT	STEP	DEG	ON LED	OFF LED
0	0	0	"F75" flashes	Lit	Exting-uished

BANK	OUT	STEP	DEG	ON LED	OFF LED
0	1	0	# # # *2	Lit	Exting-uished

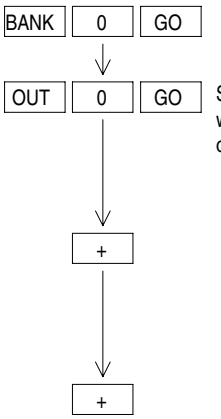
*2 The ON angle of the output Y01 already registered is displayed.

8.3.17 Confirming and deleting the setting [Power ON] [PRG mode]

When FNC70 to FNC75 are already set, the existing setting can be displayed or deleted using a usual read/deletion operation.

Displaying the existing setting [FNC70 to FNC75]

< Key operation > (Example of [FNC70])



Specify an output No. from which the current value is to be output.

< Display >

BANK	OUT	STEP	DEG	ON LED	OFF LED
0	0	0	F70 *1	Lit	Exting-uished

*1 The FNC No. to set the BCD current value already registered is displayed.

BANK	OUT	STEP	DEG	ON LED	OFF LED
0	0	0	20 *2	Exting-uished	Lit

*2 Existing strobe width set value

BANK	OUT	STEP	DEG	ON LED	OFF LED
0	0	1	Blank	Lit	Exting-uished

Deleting the existing setting [FNC70 to FNC75]

< Key operation >

By performing the procedure described in "8.2.5 Deletion", the output setting related to each of FNC70 to FNC75 is deleted.

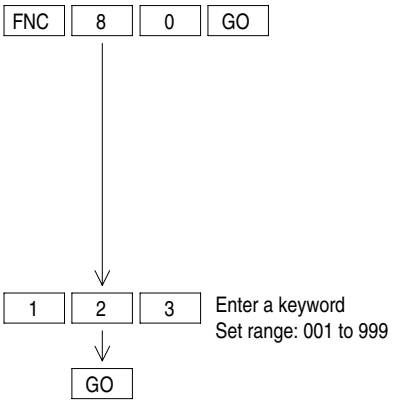
8.3.18 Prohibiting write to the EEPROM and preventing theft of a program

[Power ON] [PRG mode]

Prohibit write to the EEPROM and prevent theft of a program using a keyword.
Reset the write-protect function of the built-in EEPROM (so that write is enabled).

Registering a keyword [FNC80]

< Key operation >



< Display >

BANK	OUT	STEP	DEG
S	Et	0	"000" flashes*1

*1 When a keyword is already registered or the write-protect function of the EEPROM is set (so that write is disabled), "Prt" is displayed.

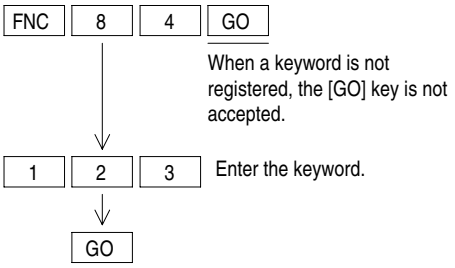
"123" flashes on the DEG.

BANK	OUT	STEP	DEG	ON LED	OFF LED
0	0	0	# # # *2	Lit	Exting-uished

*2 The ON angle of the output Y00 already registered is displayed.

Deleting the registered keyword [FNC84]

< Key operation >



< Display >

BANK	OUT	STEP	DEG
d	EL	0	"0" flashes*1

"123" flashes on the DEG.

BANK	OUT	STEP	DEG	ON LED	OFF LED
0	0	0	# # # *2	Lit	Exting-uished

*2 The ON angle of the output Y00 already registered is displayed.

If a keyword is entered incorrectly while manipulating FNC80 or FNC84, "Err" is displayed and no input is accepted. In such a case, clear the error indication, and perform the setting procedure again.

9. Monitor

The display on the data setting panel can be switched among the current value, the status and the rotation speed.
This section describes the display change-over procedure and the contents of display.

9.1 Changing over the monitor display **[Power ON] [PRG mode]**

By pressing the [ON OFF] key, the monitor display is switched in the way "current value display → output/status display → rotation speed display".

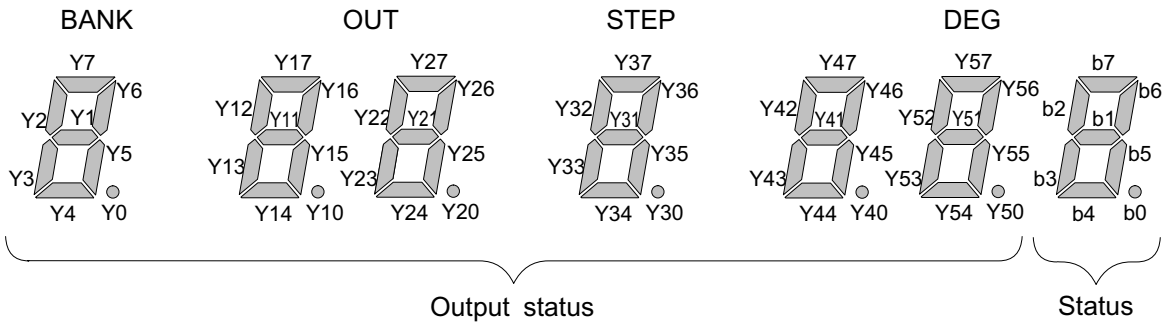
< Initial display in the RUN mode >

When the power is turned on again, the screen displayed just before the power was turned off is displayed.
When the mode is switched in the way "RUN → PRG → RUN", the screen displayed just before the mode was switched from RUN to PRG is displayed.

BANK	OUT	STEP	DEG	RUN
Executed bank No.	Blank	Blank	Current value	Lit

●●●●●●● Press the [ON OFF] key to change over the screen. ●●●●●●●●●●●●●●●●●●●●●●●●●●●●●●●●●●●●

< Output/status ON/OFF indication >



While LED is lit: The output/status bits are turned on.
While LED is extinguished: The output/status bits are turned off.

●●●●●●● Press the [ON OFF] key to change over the screen. ●●●●●●●●●●●●●●●●●●●●●●●●●●●●●●●●●●●●

< Rotation speed display >

BANK	OUT	STEP	DEG	RUN
Executed bank No.	rP	n	Rotation speed (r/min)	Lit

●●●●●●● Press the [ON OFF] key to change over the screen. ●●●●●●●●●●●●●●●●●●●●●●●●●●●●●●●●●●●●

The initial screen is displayed again.

Memo

10. Test

This section describes the procedure to modify the set data while the FX2N-1RM is in the RUN mode.

10.1 Operating procedure of the test mode

The set data in a program can be modified in the test mode even if the FX2N-1RM is in the RUN mode. However, a program cannot be added or deleted.
The set data can be modified in the increment of 0.5 degree using the [+] and [-] keys. (Operations are in accordance with the resolution selected.) Numerics cannot be entered.

Changing over to the test mode

After executing a bank whose data is to be modified, change over to the test mode using the following procedure.

< Key operation >

BANK + GO Press these keys at the same time.

< Display >

BANK	OUT	STEP	DEG	ON LED	RUN LED
Executed bank No.	"0" is displayed	"0" is displayed	Set value is displayed	Lit	Lit

BANK: Displays the bank No. monitored.
OUT: Displays "00".
STEP: Displays "0".
DEG: Displays the existing set value.
ON LED: Lit.
RUN LED: Lit.

Selecting an output No/step No. to be modified

< Key operation >

OUT 0 GO Select the output No.

↓

STEP 0 GO Select the step No.

\+ / - Display the ON/OFF angle to be modified using the [+] and [-] keys.

If an output No. for which a program is not present is specified, the error code "E15" is displayed.
When an output No. for which a fixed output pattern automatically generated by FNC70 to FNC75 is selected, the error code "E01" is displayed.

Modifying either the ON angle or the OFF angle

< Key operation >

	< Display >
ON OFF	While the ON LED is lit: The ON angle is modified. While the OFF LED is lit: The OFF angle is modified.
↓	
+ The angle is increased by 0.5 degree every time the [+] key is pressed.	A value flashes on the DEG, and the value is changed.
- The angle is decreased by 0.5 degree every time the [-] key is pressed.	
↓	
GO Determine the modified angle. The set value is written to the EEPROM, and the output is changed.	A new value is displayed on the DEG. When modification of the ON angle is finished, the OFF angle of the same step is displayed. When modification of the OFF angle is finished, the ON angle of the next step is displayed.

Modifying the ON angle and the OFF angle consecutively

< Key operation >

	< Display >
ON OFF	While the ON LED is lit: The ON angle is modified.
↓	
+ The angle is increased by 0.5 degree every time the [+] key is pressed.	A value flashes on the DEG, and the value is changed.
- The angle is decreased by 0.5 degree every time the [-] key is pressed.	
↓	
ON OFF	While the OFF LED is lit: The OFF angle is modified.
↓	
+ The angle is increased by 0.5 degree every time the [+] key is pressed.	A value flashes on the DEG, and the value is changed.
- The angle is decreased by 0.5 degree every time the [-] key is pressed.	
↓	
GO Determine the modified angle. The set value is written to the EEPROM, and the output is changed.	A new value is displayed on the DEG. When modification is finished, the ON angle of the next step is displayed.

Cautions on modification of the ON/OFF angle

- The angle can be modified by up to +10 degrees at a time.
  If the angle entered is to become consecutive to a set angle in another program, the [+] or [-] key is not accepted just before the angle entered becomes consecutive.

Modifying the rotation speed of the automatic angle advance function

< Key operation >

FNC 1 3 GO — Set the FNC No. (odd No. among FNC13 to FNC26)

After that, the contents of the FNC No. to be modified can be confirmed using the [+] and [-] keys.

ON OFF

\+ — The rotation speed is increased by 1 r/min every time the [+] key is pressed.

\- — The rotation speed is decreased by 1 r/min every time the [-] key is pressed. (Any numeric cannot be entered.)

GO — Determine the rotation speed modified. The set value is written to the EEPROM, and the output is changed.

< Display >

BANK	OUT	STEP	DEG
S	Pd	0	# # # *1

*1 The rotation speed (rpm) already registered is displayed.

When the [ON OFF] key is pressed, data flashes on the DEG.

BANK	OUT	STEP	DEG
d	EG	0	# # # *2

*2 The angle advance quantity (degrees) already registered is displayed.

The next angle advance quantity set value is displayed.

Modifying the angle advance quantity of the automatic angle advance function

< Key operation >

FNC 1 4 GO — Set the FNC No. (even No. among FNC13 to FNC26)

After that, the contents of the FNC No. to be modified can be confirmed using the [+] and [-] keys.

ON OFF

\+ — The angle advance quantity is increased by 0.5 degree every time the [+] key is pressed.

\- — The angle advance quantity is decreased by 0.5 degree every time the [-] key is pressed.(Any numeric cannot be entered)

GO — Determine the angle advance quantity modified. The set value is written to the EEPROM, and the output is changed.

< Display >

BANK	OUT	STEP	DEG
d	EG	0	# # # *1

*1 The angle advance quantity (degrees) already registered is displayed.

When the [ON OFF] key is pressed, data flashes on the DEG.

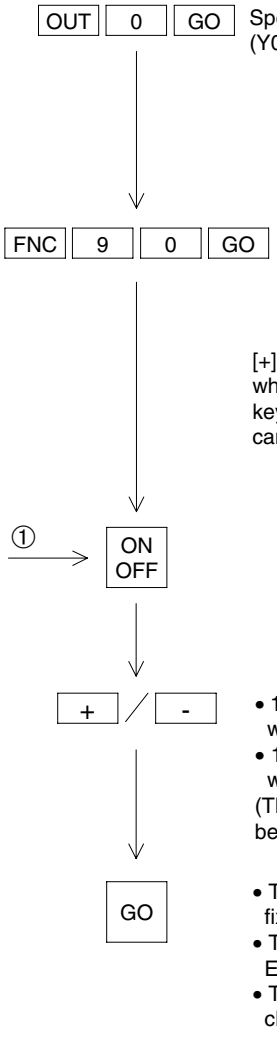
BANK	OUT	STEP	DEG
S	Pd	1	# # # *2

*2 The rotation speed (r/min) already registered is displayed.

The next rotation speed set value is displayed.

Change in individual automatic angle advance function

< Key operation >



To change the setting of the next item, the operation is repeated from step 1.
An item can be selected with [+] / [-] key.

< Display >

BANK	OUT	STEP	DEG	ON LED	OFF LED
0	0	0	### *1	Lit	Exting-uished

*1: The output set value which has already been resistered is displayed.

The rotational speed setting of S0 is displayed by the operation recorded left.

BANK	OUT	STEP	DEG	ON LED	OFF LED
S	Pd	0	### *2	Exting-uished	Exting-uished

*2: An existing value is displayed.

The DEG display becomes a blinking display when the [ON OFF] key is pushed, and setting is possible.

1 r/min or 1 degree increase whenever [+] key is pushed.
1 r/min or 1 degree decrease whenever [-] key is pushed.

When the [GO] key is pushed, the next set item is displayed.

Cautions on modification of the set value of the automatic angle advance function

- The allowable modification range of the rotation speed is 1 to 400 r/min. If the value entered is to overlap the previous or next set value during modification, the [+] or [-] key is not accepted just before the value entered overlaps the previous or next set value.
- When the set value of the rotation speed is 0 (initial value), the angle advance quantity is treated as 0.
  When an FNC No. for which a program is not present is specified, the error code "E15" is displayed.
- The allowable modification range of the angle advance quantity is 0 to 180 degrees.

Confirming the contents of FNC0 to FNC5

< Key operation >

FNC | 0 | GO — Set the FNC No. (FNC0 to FNC5)

< Display >

After that, the contents of the FNC No. specified can be confirmed using the [+] and [-] keys.

Terminating the test mode

< Key operation >

BANK + CLR

Press these keys at the same time.

< Display >

BANK	OUT	STEP	DEG
Executed bank No.	Blank	Blank	Displays current value*1

The display status returns to the status before the test mode is selected.

*1 Example of the current value display

11. Diagnostics

This section describes the error indication, the causes and the countermeasures.
Errors are classified into ones displayed on the data setting panel and the others written to the BFM #29.

11.1 Indication and causes of errors

< Errors displayed o the data setting panel >

The errors shown in the table below are displayed on the data setting panel.
These errors are indicated so that erroneous settings entered using the data setting panel can be detected and displayed, and are different from the errors (BFM #29 error code) stored in the FX2N-1RM main body.

Error indication	Causes	Countermeasures
E01	Fixed output patterns had been already generated by FNC70 to FNC75, and the data of the corresponding output No. was to be modified or copied.	Delete the fixed output patterns. Or stop the copy operation.
E02	When an ON/OFF angle was entered for new setting or modification, the value entered overlapped the existing ON/OFF angle. The same value was entered in the ON angle and the OFF angle. The ON/OFF angle data set by an BFM exceeded the set range. (When data is entered from the data setting panel, any data outside the set range is not accepted.)	Enter a correct ON/OFF angle.
E03	When the ON/OFF output was inverted using FNC50, the ON/OFF data of the corresponding output had not been set.	Data not created cannot be inverted.
E05	The same output No. was specified for source and destination while the output was to be copied.	The same output cannot be copied within the same bank.
E06	A program was inserted while data was already present in the step No. 7.	Programs of 8 steps or more are not available. If required, output data to a different output No., and set "wired OR" outside.
E07	The same bank No. was specified for source and destination in the batch copy operation for a bank.	The same bank cannot be copied.
E08	The ON/OFF width became 0 by manipulating FNC62 to FNC65 (batch addition/subtraction of angle).	Add or subtract a smaller value. Or delete or modify the existing data.
E09	Data could not be written to the EEPROM due to an abnormality in the memory.	Replace the unit.
E13	The resolver was not connected while teaching was performed or the reference angle was set. Or something was wrong with the cable (disconnection, etc.).	Turn off the power, and connect the resolver. Or replace the cable.
E14	An FNC No. not defined yet was entered.	Enter a correct numeric.
E15	An output No. for which a program was not present was specified while the program was modified in the RUN mode.	Specify an output No. for which a program is present.

< Errors written to BFM #29 >

The errors shown in the table below are written to BFM #29.
Each of these errors is written as an error code to BFM #29 in the FX2N-1RM, and can be read from the PLC main body using a FROM instruction.
The same error code is also displayed on the data setting panel.

Error indication	Causes	Countermeasures	Target BFM
E20	Data outside the allowable range was set.	Reset the error status, and enter correct data.	BFM#1 BFM#1000~7144
E21	Any bank No. other than 0 to 7 was specified.	Reset the error status, and enter a correct bank No.	BFM#2
E22	Data was not able to be written to the EEPROM due to an abnormality in the memory.	The memory may be destroyed. Replace the unit. Or contact Mitsubishi Electric System Service	—
E23	The resolver was not connected while teaching was performed or the reference angle was set. Or something was wrong with the cable (disconnection, etc.).	Turn off the power, and connect the resolver. Or replace the cable.	—

< Output status when an error has occurred >

RUN LED : Extinguished
ERR LED : Lit
"Operating" flag (BFM #28 b0) : OFF
Output : OFF
"Error" flag (BFM #28 b3) : ON
Error indication on data setting panel : Each error code is displayed in accordance with the contents of the error occurred.

< Resetting an error >

The following three methods are available to reset an error.

1) Press the [CLR] key on the data setting panel.
2) Turn on the error reset (BFM #28 b3) by giving a TO instruction from the PLC main unit.
3) Turn off the power, then turn it on again.

BFM No. Quick Reference Table for Angle Setting

< Bank 0 >

Output No.	BFM No.															
	STEP0 ON	STEP0 OFF	STEP1 ON	STEP1 OFF	STEP2 ON	STEP2 OFF	STEP3 ON	STEP3 OFF	STEP4 ON	STEP4 OFF	STEP5 ON	STEP5 OFF	STEP6 ON	STEP6 OFF	STEP7 ON	STEP7 OFF
Y00	1000	1001	1002	1003	1004	1005	1006	1007	1008	1009	1010	1011	1012	1013	1014	1015
Y01	1016	1017	1018	1019	1020	1021	1022	1023	1024	1025	1026	1027	1028	1029	1030	1031
Y02	1032	1033	1034	1035	1036	1037	1038	1039	1040	1041	1042	1043	1044	1045	1046	1047
Y03	1048	1049	1050	1051	1052	1053	1054	1055	1056	1057	1058	1059	1060	1061	1062	1063
Y04	1064	1065	1066	1067	1068	1069	1070	1071	1072	1073	1074	1075	1076	1077	1078	1079
Y05	1080	1081	1082	1083	1084	1085	1086	1087	1088	1089	1090	1091	1092	1093	1094	1095
Y06	1096	1097	1098	1099	1100	1101	1102	1103	1104	1105	1106	1107	1108	1109	1110	1111
Y07	1112	1113	1114	1115	1116	1117	1118	1119	1120	1121	1122	1123	1124	1125	1126	1127
Y10	1128	1129	1130	1131	1132	1133	1134	1135	1136	1137	1138	1139	1140	1141	1142	1143
Y11	1144	1145	1146	1147	1148	1149	1150	1151	1152	1153	1154	1155	1156	1157	1158	1159
Y12	1160	1161	1162	1163	1164	1165	1166	1167	1168	1169	1170	1171	1172	1173	1174	1175
Y13	1176	1177	1178	1179	1180	1181	1182	1183	1184	1185	1186	1187	1188	1189	1190	1191
Y14	1192	1193	1194	1195	1196	1197	1198	1199	1200	1201	1202	1203	1204	1205	1206	1207
Y15	1208	1209	1210	1211	1212	1213	1214	1215	1216	1217	1218	1219	1220	1221	1222	1223
Y16	1224	1225	1226	1227	1228	1229	1230	1231	1232	1233	1234	1235	1236	1237	1238	1239
Y17	1240	1241	1242	1243	1244	1245	1246	1247	1248	1249	1250	1251	1252	1253	1254	1255
Y20	1256	1257	1258	1259	1260	1261	1262	1263	1264	1265	1266	1267	1268	1269	1270	1271
Y21	1272	1273	1274	1275	1276	1277	1278	1279	1280	1281	1282	1283	1284	1285	1286	1287
Y22	1288	1289	1290	1291	1292	1293	1294	1295	1296	1297	1298	1299	1300	1301	1302	1303
Y23	1304	1305	1306	1307	1308	1309	1310	1311	1312	1313	1314	1315	1316	1317	1318	1319
Y24	1320	1321	1322	1323	1324	1325	1326	1327	1328	1329	1330	1331	1332	1333	1334	1335
Y25	1336	1337	1338	1339	1340	1341	1342	1343	1344	1345	1346	1347	1348	1349	1350	1351
Y26	1352	1353	1354	1355	1356	1357	1358	1359	1360	1361	1362	1363	1364	1365	1366	1367
Y27	1368	1369	1370	1371	1372	1373	1374	1375	1376	1377	1378	1379	1380	1381	1382	1383
Y30	1384	1385	1386	1387	1388	1389	1390	1391	1392	1393	1394	1395	1396	1397	1398	1399
Y31	1400	1401	1402	1403	1404	1405	1406	1407	1408	1409	1410	1411	1412	1413	1414	1415
Y32	1416	1417	1418	1419	1420	1421	1422	1423	1424	1425	1426	1427	1428	1429	1430	1431
Y33	1432	1433	1434	1435	1436	1437	1438	1439	1440	1441	1442	1443	1444	1445	1446	1447
Y34	1448	1449	1450	1451	1452	1453	1454	1455	1456	1457	1458	1459	1460	1461	1462	1463
Y35	1464	1465	1466	1467	1468	1469	1470	1471	1472	1473	1474	1475	1476	1477	1478	1479
Y36	1480	1481	1482	1483	1484	1485	1486	1487	1488	1489	1490	1491	1492	1493	1494	1495
Y37	1496	1497	1498	1499	1500	1501	1502	1503	1504	1505	1506	1507	1508	1509	1510	1511
Y40	1512	1513	1514	1515	1516	1517	1518	1519	1520	1521	1522	1523	1524	1525	1526	1527
Y41	1528	1529	1530	1531	1532	1533	1534	1535	1536	1537	1538	1539	1540	1541	1542	1543
Y42	1544	1545	1546	1547	1548	1549	1550	1551	1552	1553	1554	1555	1556	1557	1558	1559
Y43	1560	1561	1562	1563	1564	1565	1566	1567	1568	1569	1570	1571	1572	1573	1574	1575
Y44	1576	1577	1578	1579	1580	1581	1582	1583	1584	1585	1586	1587	1588	1589	1590	1591
Y45	1592	1593	1594	1595	1596	1597	1598	1599	1600	1601	1602	1603	1604	1605	1606	1607
Y46	1608	1609	1610	1611	1612	1613	1614	1615	1616	1617	1618	1619	1620	1621	1622	1623
Y47	1624	1625	1626	1627	1628	1629	1630	1631	1632	1633	1634	1635	1636	1637	1638	1639
Y50	1640	1641	1642	1643	1644	1645	1646	1647	1648	1649	1650	1651	1652	1653	1654	1655
Y51	1656	1657	1658	1659	1660	1661	1662	1663	1664	1665	1666	1667	1668	1669	1670	1671
Y52	1672	1673	1674	1675	1676	1677	1678	1679	1680	1681	1682	1683	1684	1685	1686	1687
Y53	1688	1689	1690	1691	1692	1693	1694	1695	1696	1697	1698	1699	1700	1701	1702	1703
Y54	1704	1705	1706	1707	1708	1709	1710	1711	1712	1713	1714	1715	1716	1717	1718	1719
Y55	1720	1721	1722	1723	1724	1725	1726	1727	1728	1729	1730	1731	1732	1733	1734	1735
Y56	1736	1737	1738	1739	1740	1741	1742	1743	1744	1745	1746	1747	1748	1749	1750	1751
Y57	1752	1753	1754	1755	1756	1757	1758	1759	1760	1761	1762	1763	1764	1765	1766	1767

BFM No. Quick Reference Table for Angle Setting

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Output No.	BFM No.															
	STEP0 ON	STEP0 OFF	STEP1 ON	STEP1 OFF	STEP2 ON	STEP2 OFF	STEP3 ON	STEP3 OFF	STEP4 ON	STEP4 OFF	STEP5 ON	STEP5 OFF	STEP6 ON	STEP6 OFF	STEP7 ON	STEP7 OFF
Y00	1768	1769	1770	1771	1772	1773	1774	1775	1776	1777	1778	1779	1780	1781	1782	1783
Y01	1784	1785	1786	1787	1788	1789	1790	1791	1792	1793	1794	1795	1796	1797	1798	1799
Y02	1800	1801	1802	1803	1804	1805	1806	1807	1808	1809	1810	1811	1812	1813	1814	1815
Y03	1816	1817	1818	1819	1820	1821	1822	1823	1824	1825	1826	1827	1828	1829	1830	1831
Y04	1832	1833	1834	1835	1836	1837	1838	1839	1840	1841	1842	1843	1844	1845	1846	1847
Y05	1848	1849	1850	1851	1852	1853	1854	1855	1856	1857	1858	1859	1860	1861	1862	1863
Y06	1864	1865	1866	1867	1868	1869	1870	1871	1872	1873	1874	1875	1876	1877	1878	1879
Y07	1880	1881	1882	1883	1884	1885	1886	1887	1888	1889	1890	1891	1892	1893	1894	1895
Y10	1896	1897	1898	1899	1900	1901	1902	1903	1904	1905	1906	1907	1908	1909	1910	1911
Y11	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922	1923	1924	1925	1926	1927
Y12	1928	1929	1930	1931	1932	1933	1934	1935	1936	1937	1938	1939	1940	1941	1942	1943
Y13	1944	1945	1946	1947	1948	1949	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959
Y14	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975
Y15	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
Y16	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Y17	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Y20	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039
Y21	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055
Y22	2056	2057	2058	2059	2060	2061	2062	2063	2064	2065	2066	2067	2068	2069	2070	2071
Y23	2072	2073	2074	2075	2076	2077	2078	2079	2080	2081	2082	2083	2084	2085	2086	2087
Y24	2088	2089	2090	2091	2092	2093	2094	2095	2096	2097	2098	2099	2100	2101	2102	2103
Y25	2104	2105	2106	2107	2108	2109	2110	2111	2112	2113	2114	2115	2116	2117	2118	2119
Y26	2120	2121	2122	2123	2124	2125	2126	2127	2128	2129	2130	2131	2132	2133	2134	2135
Y27	2136	2137	2138	2139	2140	2141	2142	2143	2144	2145	2146	2147	2148	2149	2150	2151
Y30	2152	2153	2154	2155	2156	2157	2158	2159	2160	2161	2162	2163	2164	2165	2166	2167
Y31	2168	2169	2170	2171	2172	2173	2174	2175	2176	2177	2178	2179	2180	2181	2182	2183
Y32	2184	2185	2186	2187	2188	2189	2190	2191	2192	2193	2194	2195	2196	2197	2198	2199
Y33	2200	2201	2202	2203	2204	2205	2206	2207	2208	2209	2210	2211	2212	2213	2214	2215
Y34	2216	2217	2218	2219	2220	2221	2222	2223	2224	2225	2226	2227	2228	2229	2230	2231
Y35	2232	2233	2234	2235	2236	2237	2238	2239	2240	2241	2242	2243	2244	2245	2246	2247
Y36	2248	2249	2250	2251	2252	2253	2254	2255	2256	2257	2258	2259	2260	2261	2262	2263
Y37	2264	2265	2266	2267	2268	2269	2270	2271	2272	2273	2274	2275	2276	2277	2278	2279
Y40	2280	2281	2282	2283	2284	2285	2286	2287	2288	2289	2290	2291	2292	2293	2294	2295
Y41	2296	2297	2298	2299	2300	2301	2302	2303	2304	2305	2306	2307	2308	2309	2310	2311
Y42	2312	2313	2314	2315	2316	2317	2318	2319	2320	2321	2322	2323	2324	2325	2326	2327
Y43	2328	2329	2330	2331	2332	2333	2334	2335	2336	2337	2338	2339	2340	2341	2342	2343
Y44	2344	2345	2346	2347	2348	2349	2350	2351	2352	2353	2354	2355	2356	2357	2358	2359
Y45	2360	2361	2362	2363	2364	2365	2366	2367	2368	2369	2370	2371	2372	2373	2374	2375
Y46	2376	2377	2378	2379	2380	2381	2382	2383	2384	2385	2386	2387	2388	2389	2390	2391
Y47	2392	2393	2394	2395	2396	2397	2398	2399	2400	2401	2402	2403	2404	2405	2406	2407
Y50	2408	2409	2410	2411	2412	2413	2414	2415	2416	2417	2418	2419	2420	2421	2422	2423
Y51	2424	2425	2426	2427	2428	2429	2430	2431	2432	2433	2434	2435	2436	2437	2438	2439
Y52	2440	2441	2442	2443	2444	2445	2446	2447	2448	2449	2450	2451	2452	2453	2454	2455
Y53	2456	2457	2458	2459	2460	2461	2462	2463	2464	2465	2466	2467	2468	2469	2470	2471
Y54	2472	2473	2474	2475	2476	2477	2478	2479	2480	2481	2482	2483	2484	2485	2486	2487
Y55	2488	2489	2490	2491	2492	2493	2494	2495	2496	2497	2498	2499	2500	2501	2502	2503
Y56	2504	2505	2506	2507	2508	2509	2510	2511	2512	2513	2514	2515	2516	2517	2518	2519
Y57	2520	2521	2522	2523	2524	2525	2526	2527	2528	2529	2530	2531	2532	2533	2534	2535

BFM No. Quick Reference Table for Angle Setting

< Bank 2 >

Output No.	BFM No.															
	STEP0 ON	STEP0 OFF	STEP1 ON	STEP1 OFF	STEP2 ON	STEP2 OFF	STEP3 ON	STEP3 OFF	STEP4 ON	STEP4 OFF	STEP5 ON	STEP5 OFF	STEP6 ON	STEP6 OFF	STEP7 ON	STEP7 OFF
Y00	2536	2537	2538	2539	2540	2541	2542	2543	2544	2545	2546	2547	2548	2549	2550	2551
Y01	2552	2553	2554	2555	2556	2557	2558	2559	2560	2561	2562	2563	2564	2565	2566	2567
Y02	2568	2569	2570	2571	2572	2573	2574	2575	2576	2577	2578	2579	2580	2581	2582	2583
Y03	2584	2585	2586	2587	2588	2589	2590	2591	2592	2593	2594	2595	2596	2597	2598	2599
Y04	2600	2601	2602	2603	2604	2605	2606	2607	2608	2609	2610	2611	2612	2613	2614	2615
Y05	2616	2617	2618	2619	2620	2621	2622	2623	2624	2625	2626	2627	2628	2629	2630	2631
Y06	2632	2633	2634	2635	2636	2637	2638	2639	2640	2641	2642	2643	2644	2645	2646	2647
Y07	2648	2649	2650	2651	2652	2653	2654	2655	2656	2657	2658	2659	2660	2661	2662	2663
Y10	2664	2665	2666	2667	2668	2669	2670	2671	2672	2673	2674	2675	2676	2677	2678	2679
Y11	2680	2681	2682	2683	2684	2685	2686	2687	2688	2689	2690	2691	2692	2693	2694	2695
Y12	2696	2697	2698	2699	2700	2701	2702	2703	2704	2705	2706	2707	2708	2709	2710	2711
Y13	2712	2713	2714	2715	2716	2717	2718	2719	2720	2721	2722	2723	2724	2725	2726	2727
Y14	2728	2729	2730	2731	2732	2733	2734	2735	2736	2737	2738	2739	2740	2741	2742	2743
Y15	2744	2745	2746	2747	2748	2749	2750	2751	2752	2753	2754	2755	2756	2757	2758	2759
Y16	2760	2761	2762	2763	2764	2765	2766	2767	2768	2769	2770	2771	2772	2773	2774	2775
Y17	2776	2777	2778	2779	2780	2781	2782	2783	2784	2785	2786	2787	2788	2789	2790	2791
Y20	2792	2793	2794	2795	2796	2797	2798	2799	2800	2801	2802	2803	2804	2805	2806	2807
Y21	2808	2809	2810	2811	2812	2813	2814	2815	2816	2817	2818	2819	2820	2821	2822	2823
Y22	2824	2825	2826	2827	2828	2829	2830	2831	2832	2833	2834	2835	2836	2837	2838	2839
Y23	2840	2841	2842	2843	2844	2845	2846	2847	2848	2849	2850	2851	2852	2853	2854	2855
Y24	2856	2857	2858	2859	2860	2861	2862	2863	2864	2865	2866	2867	2868	2869	2870	2871
Y25	2872	2873	2874	2875	2876	2877	2878	2879	2880	2881	2882	2883	2884	2885	2886	2887
Y26	2888	2889	2890	2891	2892	2893	2894	2895	2896	2897	2898	2899	2900	2901	2902	2903
Y27	2904	2905	2906	2907	2908	2909	2910	2911	2912	2913	2914	2915	2916	2917	2918	2919
Y30	2920	2921	2922	2923	2924	2925	2926	2927	2928	2929	2930	2931	2932	2933	2934	2935
Y31	2936	2937	2938	2939	2940	2941	2942	2943	2944	2945	2946	2947	2948	2949	2950	2951
Y32	2952	2953	2954	2955	2956	2957	2958	2959	2960	2961	2962	2963	2964	2965	2966	2967
Y33	2968	2969	2970	2971	2972	2973	2974	2975	2976	2977	2978	2979	2980	2981	2982	2983
Y34	2984	2985	2986	2987	2988	2989	2990	2991	2992	2993	2994	2995	2996	2997	2998	2999
Y35	3000	3001	3002	3003	3004	3005	3006	3007	3008	3009	3010	3011	3012	3013	3014	3015
Y36	3016	3017	3018	3019	3020	3021	3022	3023	3024	3025	3026	3027	3028	3029	3030	3031
Y37	3032	3033	3034	3035	3036	3037	3038	3039	3040	3041	3042	3043	3044	3045	3046	3047
Y40	3048	3049	3050	3051	3052	3053	3054	3055	3056	3057	3058	3059	3060	3061	3062	3063
Y41	3064	3065	3066	3067	3068	3069	3070	3071	3072	3073	3074	3075	3076	3077	3078	3079
Y42	3080	3081	3082	3083	3084	3085	3086	3087	3088	3089	3090	3091	3092	3093	3094	3095
Y43	3096	3097	3098	3099	3100	3101	3102	3103	3104	3105	3106	3107	3108	3109	3110	3111
Y44	3112	3113	3114	3115	3116	3117	3118	3119	3120	3121	3122	3123	3124	3125	3126	3127
Y45	3128	3129	3130	3131	3132	3133	3134	3135	3136	3137	3138	3139	3140	3141	3142	3143
Y46	3144	3145	3146	3147	3148	3149	3150	3151	3152	3153	3154	3155	3156	3157	3158	3159
Y47	3160	3161	3162	3163	3164	3165	3166	3167	3168	3169	3170	3171	3172	3173	3174	3175
Y50	3176	3177	3178	3179	3180	3181	3182	3183	3184	3185	3186	3187	3188	3189	3190	3191
Y51	3192	3193	3194	3195	3196	3197	3198	3199	3200	3201	3202	3203	3204	3205	3206	3207
Y52	3208	3209	3210	3211	3212	3213	3214	3215	3216	3217	3218	3219	3220	3221	3222	3223
Y53	3224	3225	3226	3227	3228	3229	3230	3231	3232	3233	3234	3235	3236	3237	3238	3239
Y54	3240	3241	3242	3243	3244	3245	3246	3247	3248	3249	3250	3251	3252	3253	3254	3255
Y55	3256	3257	3258	3259	3260	3261	3262	3263	3264	3265	3266	3267	3268	3269	3270	3271
Y56	3272	3273	3274	3275	3276	3277	3278	3279	3280	3281	3282	3283	3284	3285	3286	3287
Y57	3288	3289	3290	3291	3292	3293	3294	3295	3296	3297	3298	3299	3300	3301	3302	3303

BFM No. Quick Reference Table for Angle Setting

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Output No.	BFM No.															
	STEP0 ON	STEP0 OFF	STEP1 ON	STEP1 OFF	STEP2 ON	STEP2 OFF	STEP3 ON	STEP3 OFF	STEP4 ON	STEP4 OFF	STEP5 ON	STEP5 OFF	STEP6 ON	STEP6 OFF	STEP7 ON	STEP7 OFF
Y00	3304	3305	3306	3307	3308	3309	3310	3311	3312	3313	3314	3315	3316	3317	3318	3319
Y01	3320	3321	3322	3323	3324	3325	3326	3327	3328	3329	3330	3331	3332	3333	3334	3335
Y02	3336	3337	3338	3339	3340	3341	3342	3343	3344	3345	3346	3347	3348	3349	3350	3351
Y03	3352	3353	3354	3355	3356	3357	3358	3359	3360	3361	3362	3363	3364	3365	3366	3367
Y04	3368	3369	3370	3371	3372	3373	3374	3375	3376	3377	3378	3379	3380	3381	3382	3383
Y05	3384	3385	3386	3387	3388	3389	3390	3391	3392	3393	3394	3395	3396	3397	3398	3399
Y06	3400	3401	3402	3403	3404	3405	3406	3407	3408	3409	3410	3411	3412	3413	3414	3415
Y07	3416	3417	3418	3419	3420	3421	3422	3423	3424	3425	3426	3427	3428	3429	3430	3431
Y10	3432	3433	3434	3435	3436	3437	3438	3439	3440	3441	3442	3443	3444	3445	3446	3447
Y11	3448	3449	3450	3451	3452	3453	3454	3455	3456	3457	3458	3459	3460	3461	3462	3463
Y12	3464	3465	3466	3467	3468	3469	3470	3471	3472	3473	3474	3475	3476	3477	3478	3479
Y13	3480	3481	3482	3483	3484	3485	3486	3487	3488	3489	3490	3491	3492	3493	3494	3495
Y14	3496	3497	3498	3499	3500	3501	3502	3503	3504	3505	3506	3507	3508	3509	3510	3511
Y15	3512	3513	3514	3515	3516	3517	3518	3519	3520	3521	3522	3523	3524	3525	3526	3527
Y16	3528	3529	3530	3531	3532	3533	3534	3535	3536	3537	3538	3539	3540	3541	3542	3543
Y17	3544	3545	3546	3547	3548	3549	3550	3551	3552	3553	3554	3555	3556	3557	3558	3559
Y20	3560	3561	3562	3563	3564	3565	3566	3567	3568	3569	3570	3571	3572	3573	3574	3575
Y21	3576	3577	3578	3579	3580	3581	3582	3583	3584	3585	3586	3587	3588	3589	3590	3591
Y22	3592	3593	3594	3595	3596	3597	3598	3599	3600	3601	3602	3603	3604	3605	3606	3607
Y23	3608	3609	3610	3611	3612	3613	3614	3615	3616	3617	3618	3619	3620	3621	3622	3623
Y24	3624	3625	3626	3627	3628	3629	3630	3631	3632	3633	3634	3635	3636	3637	3638	3639
Y25	3640	3641	3642	3643	3644	3645	3646	3647	3648	3649	3650	3651	3652	3653	3654	3655
Y26	3656	3657	3658	3659	3660	3661	3662	3663	3664	3665	3666	3667	3668	3669	3670	3671
Y27	3672	3673	3674	3675	3676	3677	3678	3679	3680	3681	3682	3683	3684	3685	3686	3687
Y30	3688	3689	3690	3691	3692	3693	3694	3695	3696	3697	3698	3699	3700	3701	3702	3703
Y31	3704	3705	3706	3707	3708	3709	3710	3711	3712	3713	3714	3715	3716	3717	3718	3719
Y32	3720	3721	3722	3723	3724	3725	3726	3727	3728	3729	3730	3731	3732	3733	3734	3735
Y33	3736	3737	3738	3739	3740	3741	3742	3743	3744	3745	3746	3747	3748	3749	3750	3751
Y34	3752	3753	3754	3755	3756	3757	3758	3759	3760	3761	3762	3763	3764	3765	3766	3767
Y35	3768	3769	3770	3771	3772	3773	3774	3775	3776	3777	3778	3779	3780	3781	3782	3783
Y36	3784	3785	3786	3787	3788	3789	3790	3791	3792	3793	3794	3795	3796	3797	3798	3799
Y37	3800	3801	3802	3803	3804	3805	3806	3807	3808	3809	3810	3811	3812	3813	3814	3815
Y40	3816	3817	3818	3819	3820	3821	3822	3823	3824	3825	3826	3827	3828	3829	3830	3831
Y41	3832	3833	3834	3835	3836	3837	3838	3839	3840	3841	3842	3843	3844	3845	3846	3847
Y42	3848	3849	3850	3851	3852	3853	3854	3855	3856	3857	3858	3859	3860	3861	3862	3863
Y43	3864	3865	3866	3867	3868	3869	3870	3871	3872	3873	3874	3875	3876	3877	3878	3879
Y44	3880	3881	3882	3883	3884	3885	3886	3887	3888	3889	3890	3891	3892	3893	3894	3895
Y45	3896	3897	3898	3899	3900	3901	3902	3903	3904	3905	3906	3907	3908	3909	3910	3911
Y46	3912	3913	3914	3915	3916	3917	3918	3919	3920	3921	3922	3923	3924	3925	3926	3927
Y47	3928	3929	3930	3931	3932	3933	3934	3935	3936	3937	3938	3939	3940	3941	3942	3943
Y50	3944	3945	3946	3947	3948	3949	3950	3951	3952	3953	3954	3955	3956	3957	3958	3959
Y51	3960	3961	3962	3963	3964	3965	3966	3967	3968	3969	3970	3971	3972	3973	3974	3975
Y52	3976	3977	3978	3979	3980	3981	3982	3983	3984	3985	3986	3987	3988	3989	3990	3991
Y53	3992	3993	3994	3995	3996	3997	3998	3999	4000	4001	4002	4003	4004	4005	4006	4007
Y54	4008	4009	4010	4011	4012	4013	4014	4015	4016	4017	4018	4019	4020	4021	4022	4023
Y55	4024	4025	4026	4027	4028	4029	4030	4031	4032	4033	4034	4035	4036	4037	4038	4039
Y56	4040	4041	4042	4043	4044	4045	4046	4047	4048	4049	4050	4051	4052	4053	4054	4055
Y57	4056	4057	4058	4059	4060	4061	4062	4063	4064	4065	4066	4067	4068	4069	4070	4071

BFM No. Quick Reference Table for Angle Setting

< Bank 4>

Output No.	BFM No.															
	STEP0 ON	STEP0 OFF	STEP1 ON	STEP1 OFF	STEP2 ON	STEP2 OFF	STEP3 ON	STEP3 OFF	STEP4 ON	STEP4 OFF	STEP5 ON	STEP5 OFF	STEP6 ON	STEP6 OFF	STEP7 ON	STEP7 OFF
Y00	4072	4073	4074	4075	4076	4077	4078	4079	4080	4081	4082	4083	4084	4085	4086	4087
Y01	4088	4089	4090	4091	4092	4093	4094	4095	4096	4097	4098	4099	4100	4101	4102	4103
Y02	4104	4105	4106	4107	4108	4109	4110	4111	4112	4113	4114	4115	4116	4117	4118	4119
Y03	4120	4121	4122	4123	4124	4125	4126	4127	4128	4129	4130	4131	4132	4133	4134	4135
Y04	4136	4137	4138	4139	4140	4141	4142	4143	4144	4145	4146	4147	4148	4149	4150	4151
Y05	4152	4153	4154	4155	4156	4157	4158	4159	4160	4161	4162	4163	4164	4165	4166	4167
Y06	4168	4169	4170	4171	4172	4173	4174	4175	4176	4177	4178	4179	4180	4181	4182	4183
Y07	4184	4185	4186	4187	4188	4189	4190	4191	4192	4193	4194	4195	4196	4197	4198	4199
Y10	4200	4201	4202	4203	4204	4205	4206	4207	4208	4209	4210	4211	4212	4213	4214	4215
Y11	4216	4217	4218	4219	4220	4221	4222	4223	4224	4225	4226	4227	4228	4229	4230	4231
Y12	4232	4233	4234	4235	4236	4237	4238	4239	4240	4241	4242	4243	4244	4245	4246	4247
Y13	4248	4249	4250	4251	4252	4253	4254	4255	4256	4257	4258	4259	4260	4261	4262	4263
Y14	4264	4265	4266	4267	4268	4269	4270	4271	4272	4273	4274	4275	4276	4277	4278	4279
Y15	4280	4281	4282	4283	4284	4285	4286	4287	4288	4289	4290	4291	4292	4293	4294	4295
Y16	4296	4297	4298	4299	4300	4301	4302	4303	4304	4305	4306	4307	4308	4309	4310	4311
Y17	4312	4313	4314	4315	4316	4317	4318	4319	4320	4321	4322	4323	4324	4325	4326	4327
Y20	4328	4329	4330	4331	4332	4333	4334	4335	4336	4337	4338	4339	4340	4341	4342	4343
Y21	4344	4345	4346	4347	4348	4349	4350	4351	4352	4353	4354	4355	4356	4357	4358	4359
Y22	4360	4361	4362	4363	4364	4365	4366	4367	4368	4369	4370	4371	4372	4373	4374	4375
Y23	4376	4377	4378	4379	4380	4381	4382	4383	4384	4385	4386	4387	4388	4389	4390	4391
Y24	4392	4393	4394	4395	4396	4397	4398	4399	4400	4401	4402	4403	4404	4405	4406	4407
Y25	4408	4409	4410	4411	4412	4413	4414	4415	4416	4417	4418	4419	4420	4421	4422	4423
Y26	4424	4425	4426	4427	4428	4429	4430	4431	4432	4433	4434	4435	4436	4437	4438	4439
Y27	4440	4441	4442	4443	4444	4445	4446	4447	4448	4449	4450	4451	4452	4453	4454	4455
Y30	4456	4457	4458	4459	4460	4461	4462	4463	4464	4465	4466	4467	4468	4469	4470	4471
Y31	4472	4473	4474	4475	4476	4477	4478	4479	4480	4481	4482	4483	4484	4485	4486	4487
Y32	4488	4489	4490	4491	4492	4493	4494	4495	4496	4497	4498	4499	4500	4501	4502	4503
Y33	4504	4505	4506	4507	4508	4509	4510	4511	4512	4513	4514	4515	4516	4517	4518	4519
Y34	4520	4521	4522	4523	4524	4525	4526	4527	4528	4529	4530	4531	4532	4533	4534	4535
Y35	4536	4537	4538	4539	4540	4541	4542	4543	4544	4545	4546	4547	4548	4549	4550	4551
Y36	4552	4553	4554	4555	4556	4557	4558	4559	4560	4561	4562	4563	4564	4565	4566	4567
Y37	4568	4569	4570	4571	4572	4573	4574	4575	4576	4577	4578	4579	4580	4581	4582	4583
Y40	4584	4585	4586	4587	4588	4589	4590	4591	4592	4593	4594	4595	4596	4597	4598	4599
Y41	4600	4601	4602	4603	4604	4605	4606	4607	4608	4609	4610	4611	4612	4613	4614	4615
Y42	4616	4617	4618	4619	4620	4621	4622	4623	4624	4625	4626	4627	4628	4629	4630	4631
Y43	4632	4633	4634	4635	4636	4637	4638	4639	4640	4641	4642	4643	4644	4645	4646	4647
Y44	4648	4649	4650	4651	4652	4653	4654	4655	4656	4657	4658	4659	4660	4661	4662	4663
Y45	4664	4665	4666	4667	4668	4669	4670	4671	4672	4673	4674	4675	4676	4677	4678	4679
Y46	4680	4681	4682	4683	4684	4685	4686	4687	4688	4689	4690	4691	4692	4693	4694	4695
Y47	4696	4697	4698	4699	4700	4701	4702	4703	4704	4705	4706	4707	4708	4709	4710	4711
Y50	4712	4713	4714	4715	4716	4717	4718	4719	4720	4721	4722	4723	4724	4725	4726	4727
Y51	4728	4729	4730	4731	4732	4733	4734	4735	4736	4737	4738	4739	4740	4741	4742	4743
Y52	4744	4745	4746	4747	4748	4749	4750	4751	4752	4753	4754	4755	4756	4757	4758	4759
Y53	4760	4761	4762	4763	4764	4765	4766	4767	4768	4769	4770	4771	4772	4773	4774	4775
Y54	4776	4777	4778	4779	4780	4781	4782	4783	4784	4785	4786	4787	4788	4789	4790	4791
Y55	4792	4793	4794	4795	4796	4797	4798	4799	4800	4801	4802	4803	4804	4805	4806	4807
Y56	4808	4809	4810	4811	4812	4813	4814	4815	4816	4817	4818	4819	4820	4821	4822	4823
Y57	4824	4825	4826	4827	4828	4829	4830	4831	4832	4833	4834	4835	4836	4837	4838	4839

BFM No. Quick Reference Table for Angle Setting

< Bank 5 >

Output No.	BFM No.															
	STEP0 ON	STEP0 OFF	STEP1 ON	STEP1 OFF	STEP2 ON	STEP2 OFF	STEP3 ON	STEP3 OFF	STEP4 ON	STEP4 OFF	STEP5 ON	STEP5 OFF	STEP6 ON	STEP6 OFF	STEP7 ON	STEP7 OFF
Y00	4840	4841	4842	4843	4844	4845	4846	4847	4848	4849	4850	4851	4852	4853	4854	4855
Y01	4856	4857	4858	4859	4860	4861	4862	4863	4864	4865	4866	4867	4868	4869	4870	4871
Y02	4872	4873	4874	4875	4876	4877	4878	4879	4880	4881	4882	4883	4884	4885	4886	4887
Y03	4888	4889	4890	4891	4892	4893	4894	4895	4896	4897	4898	4899	4900	4901	4902	4903
Y04	4904	4905	4906	4907	4908	4909	4910	4911	4912	4913	4914	4915	4916	4917	4918	4919
Y05	4920	4921	4922	4923	4924	4925	4926	4927	4928	4929	4930	4931	4932	4933	4934	4935
Y06	4936	4937	4938	4939	4940	4941	4942	4943	4944	4945	4946	4947	4948	4949	4950	4951
Y07	4952	4953	4954	4955	4956	4957	4958	4959	4960	4961	4962	4963	4964	4965	4966	4967
Y10	4968	4969	4970	4971	4972	4973	4974	4975	4976	4977	4978	4979	4980	4981	4982	4983
Y11	4984	4985	4986	4987	4988	4989	4990	4991	4992	4993	4994	4995	4996	4997	4998	4999
Y12	5000	5001	5002	5003	5004	5005	5006	5007	5008	5009	5010	5011	5012	5013	5014	5015
Y13	5016	5017	5018	5019	5020	5021	5022	5023	5024	5025	5026	5027	5028	5029	5030	5031
Y14	5032	5033	5034	5035	5036	5037	5038	5039	5040	5041	5042	5043	5044	5045	5046	5047
Y15	5048	5049	5050	5051	5052	5053	5054	5055	5056	5057	5058	5059	5060	5061	5062	5063
Y16	5064	5065	5066	5067	5068	5069	5070	5071	5072	5073	5074	5075	5076	5077	5078	5079
Y17	5080	5081	5082	5083	5084	5085	5086	5087	5088	5089	5090	5091	5092	5093	5094	5095
Y20	5096	5097	5098	5099	5100	5101	5102	5103	5104	5105	5106	5107	5108	5109	5110	5111
Y21	5112	5113	5114	5115	5116	5117	5118	5119	5120	5121	5122	5123	5124	5125	5126	5127
Y22	5128	5129	5130	5131	5132	5133	5134	5135	5136	5137	5138	5139	5140	5141	5142	5143
Y23	5144	5145	5146	5147	5148	5149	5150	5151	5152	5153	5154	5155	5156	5157	5158	5159
Y24	5160	5161	5162	5163	5164	5165	5166	5167	5168	5169	5170	5171	5172	5173	5174	5175
Y25	5176	5177	5178	5179	5180	5181	5182	5183	5184	5185	5186	5187	5188	5189	5190	5191
Y26	5192	5193	5194	5195	5196	5197	5198	5199	5200	5201	5202	5203	5204	5205	5206	5207
Y27	5208	5209	5210	5211	5212	5213	5214	5215	5216	5217	5218	5219	5220	5221	5222	5223
Y30	5224	5225	5226	5227	5228	5229	5230	5231	5232	5233	5234	5235	5236	5237	5238	5239
Y31	5240	5241	5242	5243	5244	5245	5246	5247	5248	5249	5250	5251	5252	5253	5254	5255
Y32	5256	5257	5258	5259	5260	5261	5262	5263	5264	5265	5266	5267	5268	5269	5270	5271
Y33	5272	5273	5274	5275	5276	5277	5278	5279	5280	5281	5282	5283	5284	5285	5286	5287
Y34	5288	5289	5290	5291	5292	5293	5294	5295	5296	5297	5298	5299	5300	5301	5302	5303
Y35	5304	5305	5306	5307	5308	5309	5310	5311	5312	5313	5314	5315	5316	5317	5318	5319
Y36	5320	5321	5322	5323	5324	5325	5326	5327	5328	5329	5330	5331	5332	5333	5334	5335
Y37	5336	5337	5338	5339	5340	5341	5342	5343	5344	5345	5346	5347	5348	5349	5350	5351
Y40	5352	5353	5354	5355	5356	5357	5358	5359	5360	5361	5362	5363	5364	5365	5366	5367
Y41	5368	5369	5370	5371	5372	5373	5374	5375	5376	5377	5378	5379	5380	5381	5382	5383
Y42	5384	5385	5386	5387	5388	5389	5390	5391	5392	5393	5394	5395	5396	5397	5398	5399
Y43	5400	5401	5402	5403	5404	5405	5406	5407	5408	5409	5410	5411	5412	5413	5414	5415
Y44	5416	5417	5418	5419	5420	5421	5422	5423	5424	5425	5426	5427	5428	5429	5430	5431
Y45	5432	5433	5434	5435	5436	5437	5438	5439	5440	5441	5442	5443	5444	5445	5446	5447
Y46	5448	5449	5450	5451	5452	5453	5454	5455	5456	5457	5458	5459	5460	5461	5462	5463
Y47	5464	5465	5466	5467	5468	5469	5470	5471	5472	5473	5474	5475	5476	5477	5478	5479
Y50	5480	5481	5482	5483	5484	5485	5486	5487	5488	5489	5490	5491	5492	5493	5494	5495
Y51	5496	5497	5498	5499	5500	5501	5502	5503	5504	5505	5506	5507	5508	5509	5510	5511
Y52	5512	5513	5514	5515	5516	5517	5518	5519	5520	5521	5522	5523	5524	5525	5526	5527
Y53	5528	5529	5530	5531	5532	5533	5534	5535	5536	5537	5538	5539	5540	5541	5542	5543
Y54	5544	5545	5546	5547	5548	5549	5550	5551	5552	5553	5554	5555	5556	5557	5558	5559
Y55	5560	5561	5562	5563	5564	5565	5566	5567	5568	5569	5570	5571	5572	5573	5574	5575
Y56	5576	5577	5578	5579	5580	5581	5582	5583	5584	5585	5586	5587	5588	5589	5590	5591
Y57	5592	5593	5594	5595	5596	5597	5598	5599	5600	5601	5602	5603	5604	5605	5606	5607

BFM No. Quick Reference Table for Angle Setting

< Bank 6 >

Output No.	BFM No.															
	STEP0 ON	STEP0 OFF	STEP1 ON	STEP1 OFF	STEP2 ON	STEP2 OFF	STEP3 ON	STEP3 OFF	STEP4 ON	STEP4 OFF	STEP5 ON	STEP5 OFF	STEP6 ON	STEP6 OFF	STEP7 ON	STEP7 OFF
Y00	5608	5609	5610	5611	5612	5613	5614	5615	5616	5617	5618	5619	5620	5621	5622	5623
Y01	5624	5625	5626	5627	5628	5629	5630	5631	5632	5633	5634	5635	5636	5637	5638	5639
Y02	5640	5641	5642	5643	5644	5645	5646	5647	5648	5649	5650	5651	5652	5653	5654	5655
Y03	5656	5657	5658	5659	5660	5661	5662	5663	5664	5665	5666	5667	5668	5669	5670	5671
Y04	5672	5673	5674	5675	5676	5677	5678	5679	5680	5681	5682	5683	5684	5685	5686	5687
Y05	5688	5689	5690	5691	5692	5693	5694	5695	5696	5697	5698	5699	5700	5701	5702	5703
Y06	5704	5705	5706	5707	5708	5709	5710	5711	5712	5713	5714	5715	5716	5717	5718	5719
Y07	5720	5721	5722	5723	5724	5725	5726	5727	5728	5729	5730	5731	5732	5733	5734	5735
Y10	5736	5737	5738	5739	5740	5741	5742	5743	5744	5745	5746	5747	5748	5749	5750	5751
Y11	5752	5753	5754	5755	5756	5757	5758	5759	5760	5761	5762	5763	5764	5765	5766	5767
Y12	5768	5769	5770	5771	5772	5773	5774	5775	5776	5777	5778	5779	5780	5781	5782	5783
Y13	5784	5785	5786	5787	5788	5789	5790	5791	5792	5793	5794	5795	5796	5797	5798	5799
Y14	5800	5801	5802	5803	5804	5805	5806	5807	5808	5809	5810	5811	5812	5813	5814	5815
Y15	5816	5817	5818	5819	5820	5821	5822	5823	5824	5825	5826	5827	5828	5829	5830	5831
Y16	5832	5833	5834	5835	5836	5837	5838	5839	5840	5841	5842	5843	5844	5845	5846	5847
Y17	5848	5849	5850	5851	5852	5853	5854	5855	5856	5857	5858	5859	5860	5861	5862	5863
Y20	5864	5865	5866	5867	5868	5869	5870	5871	5872	5873	5874	5875	5876	5877	5878	5879
Y21	5880	5881	5882	5883	5884	5885	5886	5887	5888	5889	5890	5891	5892	5893	5894	5895
Y22	5896	5897	5898	5899	5900	5901	5902	5903	5904	5905	5906	5907	5908	5909	5910	5911
Y23	5912	5913	5914	5915	5916	5917	5918	5919	5920	5921	5922	5923	5924	5925	5926	5927
Y24	5928	5929	5930	5931	5932	5933	5934	5935	5936	5937	5938	5939	5940	5941	5942	5943
Y25	5944	5945	5946	5947	5948	5949	5950	5951	5952	5953	5954	5955	5956	5957	5958	5959
Y26	5960	5961	5962	5963	5964	5965	5966	5967	5968	5969	5970	5971	5972	5973	5974	5975
Y27	5976	5977	5978	5979	5980	5981	5982	5983	5984	5985	5986	5987	5988	5989	5990	5991
Y30	5992	5993	5994	5995	5996	5997	5998	5999	6000	6001	6002	6003	6004	6005	6006	6007
Y31	6008	6009	6010	6011	6012	6013	6014	6015	6016	6017	6018	6019	6020	6021	6022	6023
Y32	6024	6025	6026	6027	6028	6029	6030	6031	6032	6033	6034	6035	6036	6037	6038	6039
Y33	6040	6041	6042	6043	6044	6045	6046	6047	6048	6049	6050	6051	6052	6053	6054	6055
Y34	6056	6057	6058	6059	6060	6061	6062	6063	6064	6065	6066	6067	6068	6069	6070	6071
Y35	6072	6073	6074	6075	6076	6077	6078	6079	6080	6081	6082	6083	6084	6085	6086	6087
Y36	6088	6089	6090	6091	6092	6093	6094	6095	6096	6097	6098	6099	6100	6101	6102	6103
Y37	6104	6105	6106	6107	6108	6109	6110	6111	6112	6113	6114	6115	6116	6117	6118	6119
Y40	6120	6121	6122	6123	6124	6125	6126	6127	6128	6129	6130	6131	6132	6133	6134	6135
Y41	6136	6137	6138	6139	6140	6141	6142	6143	6144	6145	6146	6147	6148	6149	6150	6151
Y42	6152	6153	6154	6155	6156	6157	6158	6159	6160	6161	6162	6163	6164	6165	6166	6167
Y43	6168	6169	6170	6171	6172	6173	6174	6175	6176	6177	6178	6179	6180	6181	6182	6183
Y44	6184	6185	6186	6187	6188	6189	6190	6191	6192	6193	6194	6195	6196	6197	6198	6199
Y45	6200	6201	6202	6203	6204	6205	6206	6207	6208	6209	6210	6211	6212	6213	6214	6215
Y46	6216	6217	6218	6219	6220	6221	6222	6223	6224	6225	6226	6227	6228	6229	6230	6231
Y47	6232	6233	6234	6235	6236	6237	6238	6239	6240	6241	6242	6243	6244	6245	6246	6247
Y50	6248	6249	6250	6251	6252	6253	6254	6255	6256	6257	6258	6259	6260	6261	6262	6263
Y51	6264	6265	6266	6267	6268	6269	6270	6271	6272	6273	6274	6275	6276	6277	6278	6279
Y52	6280	6281	6282	6283	6284	6285	6286	6287	6288	6289	6290	6291	6292	6293	6294	6295
Y53	6296	6297	6298	6299	6300	6301	6302	6303	6304	6305	6306	6307	6308	6309	6310	6311
Y54	6312	6313	6314	6315	6316	6317	6318	6319	6320	6321	6322	6323	6324	6325	6326	6327
Y55	6328	6329	6330	6331	6332	6333	6334	6335	6336	6337	6338	6339	6340	6341	6342	6343
Y56	6344	6345	6346	6347	6348	6349	6350	6351	6352	6353	6354	6355	6356	6357	6358	6359
Y57	6360	6361	6362	6363	6364	6365	6366	6367	6368	6369	6370	6371	6372	6373	6374	6375

BFM No. Quick Reference Table for Angle Setting

< Bank 7 >

Output No.	BFM No.															
	STEP0 ON	STEP0 OFF	STEP1 ON	STEP1 OFF	STEP2 ON	STEP2 OFF	STEP3 ON	STEP3 OFF	STEP4 ON	STEP4 OFF	STEP5 ON	STEP5 OFF	STEP6 ON	STEP6 OFF	STEP7 ON	STEP7 OFF
Y00	6376	6377	6378	6379	6380	6381	6382	6383	6384	6385	6386	6387	6388	6389	6390	6391
Y01	6392	6393	6394	6395	6396	6397	6398	6399	6400	6401	6402	6403	6404	6405	6406	6407
Y02	6408	6409	6410	6411	6412	6413	6414	6415	6416	6417	6418	6419	6420	6421	6422	6423
Y03	6424	6425	6426	6427	6428	6429	6430	6431	6432	6433	6434	6435	6436	6437	6438	6439
Y04	6440	6441	6442	6443	6444	6445	6446	6447	6448	6449	6450	6451	6452	6453	6454	6455
Y05	6456	6457	6458	6459	6460	6461	6462	6463	6464	6465	6466	6467	6468	6469	6470	6471
Y06	6472	6473	6474	6475	6476	6477	6478	6479	6480	6481	6482	6483	6484	6485	6486	6487
Y07	6488	6489	6490	6491	6492	6493	6494	6495	6496	6497	6498	6499	6500	6501	6502	6503
Y10	6504	6505	6506	6507	6508	6509	6510	6511	6512	6513	6514	6515	6516	6517	6518	6519
Y11	6520	6521	6522	6523	6524	6525	6526	6527	6528	6529	6530	6531	6532	6533	6534	6535
Y12	6536	6537	6538	6539	6540	6541	6542	6543	6544	6545	6546	6547	6548	6549	6550	6551
Y13	6552	6553	6554	6555	6556	6557	6558	6559	6560	6561	6562	6563	6564	6565	6566	6567
Y14	6568	6569	6570	6571	6572	6573	6574	6575	6576	6577	6578	6579	6580	6581	6582	6583
Y15	6584	6585	6586	6587	6588	6589	6590	6591	6592	6593	6594	6595	6596	6597	6598	6599
Y16	6600	6601	6602	6603	6604	6605	6606	6607	6608	6609	6610	6611	6612	6613	6614	6615
Y17	6616	6617	6618	6619	6620	6621	6622	6623	6624	6625	6626	6627	6628	6629	6630	6631
Y20	6632	6633	6634	6635	6636	6637	6638	6639	6640	6641	6642	6643	6644	6645	6646	6647
Y21	6648	6649	6650	6651	6652	6653	6654	6655	6656	6657	6658	6659	6660	6661	6662	6663
Y22	6664	6665	6666	6667	6668	6669	6670	6671	6672	6673	6674	6675	6676	6677	6678	6679
Y23	6680	6681	6682	6683	6684	6685	6686	6687	6688	6689	6690	6691	6692	6693	6694	6695
Y24	6696	6697	6698	6699	6700	6701	6702	6703	6704	6705	6706	6707	6708	6709	6710	6711
Y25	6712	6713	6714	6715	6716	6717	6718	6719	6720	6721	6722	6723	6724	6725	6726	6727
Y26	6728	6729	6730	6731	6732	6733	6734	6735	6736	6737	6738	6739	6740	6741	6742	6743
Y27	6744	6745	6746	6747	6748	6749	6750	6751	6752	6753	6754	6755	6756	6757	6758	6759
Y30	6760	6761	6762	6763	6764	6765	6766	6767	6768	6769	6770	6771	6772	6773	6774	6775
Y31	6776	6777	6778	6779	6780	6781	6782	6783	6784	6785	6786	6787	6788	6789	6790	6791
Y32	6792	6793	6794	6795	6796	6797	6798	6799	6800	6801	6802	6803	6804	6805	6806	6807
Y33	6808	6809	6810	6811	6812	6813	6814	6815	6816	6817	6818	6819	6820	6821	6822	6823
Y34	6824	6825	6826	6827	6828	6829	6830	6831	6832	6833	6834	6835	6836	6837	6838	6839
Y35	6840	6841	6842	6843	6844	6845	6846	6847	6848	6849	6850	6851	6852	6853	6854	6855
Y36	6856	6857	6858	6859	6860	6861	6862	6863	6864	6865	6866	6867	6868	6869	6870	6871
Y37	6872	6873	6874	6875	6876	6877	6878	6879	6880	6881	6882	6883	6884	6885	6886	6887
Y40	6888	6889	6890	6891	6892	6893	6894	6895	6896	6897	6898	6899	6900	6901	6902	6903
Y41	6904	6905	6906	6907	6908	6909	6910	6911	6912	6913	6914	6915	6916	6917	6918	6919
Y42	6920	6921	6922	6923	6924	6925	6926	6927	6928	6929	6930	6931	6932	6933	6934	6935
Y43	6936	6937	6938	6939	6940	6941	6942	6943	6944	6945	6946	6947	6948	6949	6950	6951
Y44	6952	6953	6954	6955	6956	6957	6958	6959	6960	6961	6962	6963	6964	6965	6966	6967
Y45	6968	6969	6970	6971	6972	6973	6974	6975	6976	6977	6978	6979	6980	6981	6982	6983
Y46	6984	6985	6986	6987	6988	6989	6990	6991	6992	6993	6994	6995	6996	6997	6998	6999
Y47	7000	7001	7002	7003	7004	7005	7006	7007	7008	7009	7010	7011	7012	7013	7014	7015
Y50	7016	7017	7018	7019	7020	7021	7022	7023	7024	7025	7026	7027	7028	7029	7030	7031
Y51	7032	7033	7034	7035	7036	7037	7038	7039	7040	7041	7042	7043	7044	7045	7046	7047
Y52	7048	7049	7050	7051	7052	7053	7054	7055	7056	7057	7058	7059	7060	7061	7062	7063
Y53	7064	7065	7066	7067	7068	7069	7070	7071	7072	7073	7074	7075	7076	7077	7078	7079
Y54	7080	7081	7082	7083	7084	7085	7086	7087	7088	7089	7090	7091	7092	7093	7094	7095
Y55	7096	7097	7098	7099	7100	7101	7102	7103	7104	7105	7106	7107	7108	7109	7110	7111
Y56	7112	7113	7114	7115	7116	7117	7118	7119	7120	7121	7122	7123	7124	7125	7126	7127
Y57	7128	7129	7130	7131	7132	7133	7134	7135	7136	7137	7138	7139	7140	7141	7142	7143

BFM No. Quick Reference Table for Angle Setting

< Please use this page as a allocation table>

Output No.	BFM No.															
	STEP0 ON	STEP0 OFF	STEP1 ON	STEP1 OFF	STEP2 ON	STEP2 OFF	STEP3 ON	STEP3 OFF	STEP4 ON	STEP4 OFF	STEP5 ON	STEP5 OFF	STEP6 ON	STEP6 OFF	STEP7 ON	STEP7 OFF
Y00																
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USER'S MANUAL

FX2N-1RM-E-SET PROGRAMMABLE CAM SWITCH

MITSUBISHI ELECTRIC CORPORATION

HEAD OFFICE: TOKYO BUILDING, 2-7-3 MARUNOUCHI, CHIYODA-KU, TOKYO 100-8310, JAPAN

MODEL	FX2N1RM-H-E
MODEL CODE	09R614

JY992D71101L
(MEE)

Effective April 2015
Specification are subject to change without notice.