



PROGRAMMABLE LOGIC CONTROLLER

MODEL

**FX3G**

QUICK START MANUAL



<b>1. INTRODUCTION</b> .....	3	<b>5. PROGRAMMING USING GX WORKS2</b> .....	14
1.1 AVAILABLE MODELS.....	3	5.1 SYSTEM CONFIGURATION.....	14
1.2 CAUTION.....	3	5.2 INSTALLING THE USB DRIVER.....	14
1.3 INCLUDED ITEMS.....	4	5.3 INSTALLING GX WORKS2.....	16
1.4 FRONT PANEL.....	4	5.4 STARTING AND EXITING GX WORKS2.....	17
<b>2. DIMENSIONS</b> .....	5	5.5 USING THE HELP FILES IN GX WORKS2.....	17
<b>3. INSTALLATION</b> .....	5	<b>6. OPERATION</b> .....	18
3.1 SPECIFICATIONS.....	5	<b>7. MAINTENANCE</b> .....	20
3.2 MOUNTING INSTRUCTIONS.....	6	<b>8. TROUBLESHOOTING</b> .....	21
3.3 TERMINAL BLOCK LAYOUT.....	7		
<b>4. SPECIFICATIONS AND WIRING</b> .....	8		
4.1 WIRING.....	9		
4.2 GROUNDING.....	9		
4.3 POWER SUPPLY SPECIFICATIONS AND WIRING DIAGRAM.....	9		
4.4 INPUT SPECIFICATIONS AND WIRING DIAGRAM.....	10		
4.5 PULSE CATCH (M8170 TO M8175).....	11		
4.6 PULSE WIDTH/PULSE PERIOD MEASUREMENT SPECIFICATIONS AND WIRING.....	11		
4.7 HIGH SPEED COUNTERS SPECIFICATIONS AND WIRING.....	12		
4.8 OUTPUT SPECIFICATIONS AND WIRING.....	13		

## 1. INTRODUCTION

This manual describes the part names, dimensions, mounting, cabling and specifications for the product. Before use, read this manual and manuals of relevant products fully to acquire proficiency in the handling and operating the product. Make sure to learn all the product information, safety information, and precautions.

Store this manual in a safe place so that you can take it out and read it whenever necessary. Always forward it to the end user.

### Registration

The company name and the product name to be described in this manual are the registered trademarks or trademarks of each company.

Effective December 2009

Specifications are subject to change without notice.

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### 1.1 AVAILABLE MODELS

The main unit incorporates a CPU, memory, input and output terminals and power supply.

FX3G-□□ M □ / □

Series Name

Total number of input and output points

Main Unit

Power supply, Input/output type: Connection on terminal block  
**R/ES:** AC power supply/24VDC (sink/source) input/relay output  
**T/DS:** DC power supply/24VDC (sink/source) input/Transistor (sink) output

Model	No. of Input/Output Points			Input Type	Output Type	Connection
	Total No. Points	Input Points	Output Points			
<b>AC Power Supply Common to 24VDC Sink and Source Input</b>						
FX3G-14MR/ES	14 (16) *1	8	6(8) *1	24VDC (sink/source)	Relay	Terminal block
FX3G-24MR/ES	24 (32) *1	14(16) *1	10(16) *1			
FX3G-40MR/ES	40	24	16			
FX3G-60MR/ES	60 (64) *1	36(40)*1	24			

Model	No. of Input/Output Points			Input Type	Output Type	Connection
	Total No. Points	Input Points	Output Points			
<b>DC Power Supply Common To 24V DC Sink and Source Input</b>						
FX3G-14MR/ES	14 (16) *1	8	6(8) *1	24VDC (sink/source)	Transistor sink	Terminal block
FX3G-24MR/ES	24 (32) *1	14(16) *1	10(16) *1			
FX3G-40MR/ES	40	24	16			
FX3G-60MR/ES	60 (64) *1	36(40)*1	24			

## 1.2 CAUTION

Safety Precaution (Read these precautions before use.) This manual classifies the safety precautions into two categories: **DANGER** and **CAUTION**.

-  **DANGER** Indicates that incorrect handling may cause hazardous conditions, resulting in death or severe injury.
-  **CAUTION** Indicates that incorrect handling may cause hazardous conditions, resulting in medium or slight personal injury or physical damage.

Depending on the circumstances, procedures indicated by **CAUTION** may also cause severe injury. It is important to follow all precautions for personal safety.

### DANGER STARTUP AND MAINTENANCE PRECAUTIONS

- Do not touch any terminal while the PLC's power is on. Doing so may cause electric shock or malfunctions.
- Before cleaning or retightening terminals externally cut off all phases of the power supply. Failure to do so may cause electric shock
- Use the battery for memory backup correctly as described in this manual.
  - ▶ Use the battery only for the specified purpose.
  - ▶ Connect the battery correctly.
  - ▶ Do not charge, disassemble, heat, put in fire, short-circuit, connect reversely, weld, swallow or burn the battery, or apply excessive forces (vibration, impact, drop, etc.) to the battery.
  - ▶ Do not store or use the battery at high temperatures or expose to direct sunlight.
  - ▶ Do not expose to water, bring near fire or touch liquid leakage or other contents directly.
  - ▶ Incorrect handling of the battery may cause heat excessive generation, bursting, ignition, liquid leakage or deformation, and lead to injury, fire or failures and malfunctions of facilities and other equipment.
- Before modifying or disrupting the program in operation or running the PLC, carefully read through this manual to ensure the safety of the operation. An operation error may damage the machinery or cause accidents.

### CAUTION DISPOSAL PRECAUTIONS

Please contact a certified electronic waste disposal company for the environmentally safe recycling and disposal of your device. When disposing of batteries, separate them from other waste according to local regulations.

### CAUTION TRANSPORT AND STORAGE PRECAUTIONS

- When transporting the FX3G Series PLC incorporating the optional battery, turn on the PLC before shipment, confirm that the battery mode is set using a parameter and the ALM LED is OFF, and check the battery life. If the PLC is transported with the ALM LED on or the battery exhausted, the battery-backed data may be unstable during transportation.
- The PLC is a precision instrument. During transportation, avoid impacts larger than those specified in Section 3.1. Failure to do so may cause failures in the PLC. After transportation, verify the operations of the PLC.
- When transporting lithium batteries, follow required transportation regulations.

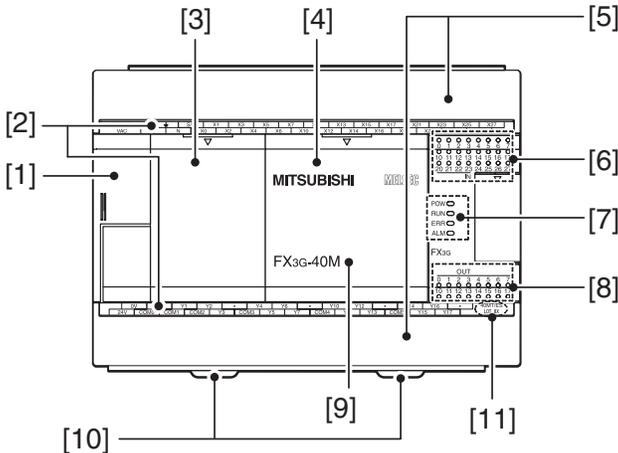
### 1.3 INCLUDED ITEMS

Check if the following product and items are included in the package:

MAIN UNITS		
FX3G-14M_ ~ FX3G-60M_	Product	1 unit
	Dust proof protection sheet	1 sheet
	Manuals [English version]	1 manual

### 1.4 FRONT PANEL

#### ■ FACTORY DEFAULT CONFIGURATION (STANDARD)



**[1] Peripheral device connecting connector cover.** The peripheral device connector, variable analog potentiometers and RUN/STOP switch are located under this cover.

**[2] Terminal names.** The signal names for power supply, input and output terminals are shown.

**[3] Top cover (S).** (40 points, 60 points type only) Mount the expansion board under this cover.

**[4] Top cover.** Mount the expansion board, display module and battery under this cover.

**[5] Terminal block covers.** The covers can be opened for wiring. Keep the covers closed while the PLC is running (the unit power is on).

**[6] Input display LEDs (red).** When an input terminal (X000 or more) is turned on, the corresponding LED lights.

**[7] Operation status display LEDs.** The operation status of the PLC can be checked with the LEDs. The LEDs turn off, light and flash according to the following table. For details on the operation status, refer to Section 7.

LED Name	Display Color	Description
POW	Green	On while power is on the PLC.
RUN	Green	On while the PLC is running.
ERR	Red	Flashing when a program error occurs.
		Lights when a CPU error occurs.
ALM	Red	Lights when the battery voltage drops. (When the optional battery is used)

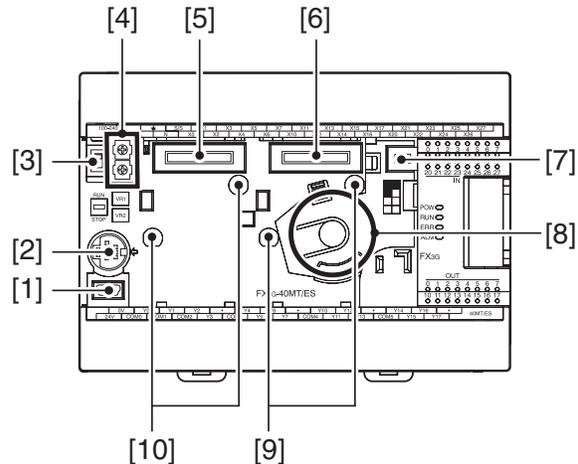
**[8] Output display LEDs (red).** When an output terminal (Y000 or more) is turned on, the corresponding LED lights.

**[9] Model name (abbreviation).** The model name of the main unit is indicated. Check the nameplate on the right side for the model name.

**[10] DIN rail mounting hooks.** The main unit can be installed on DIN46277 rail (35mm (1.38") wide).

**[11] The year and month of production.** The year and month of production of the main unit is indicated.

#### ■ WHEN THE TOP COVERS ARE OPEN



**[1] Peripheral device connecting connector (USB).** Connect a programming tool (PC) to program a sequence.

**[2] Peripheral device connecting connector (RS-422).** Connect a programming tool to program a sequence.

**[3] RUN/STOP switch.** To stop writing (batch) of the sequence program or operation, set the switch to STOP (slide it downward). To start operation (run the machine), set it to RUN (slide it upward).

**[4] Variable analog potentiometers.** Two variable analog potentiometers are built in. Upper side : VR1, Lower side : VR2

**[5] Optional equipment connector 1.** Connect the expansion board to the connector.

**[6] Optional equipment connector 2 (40 points, 60 points type only).** Connect the expansion board and display module to the connector.

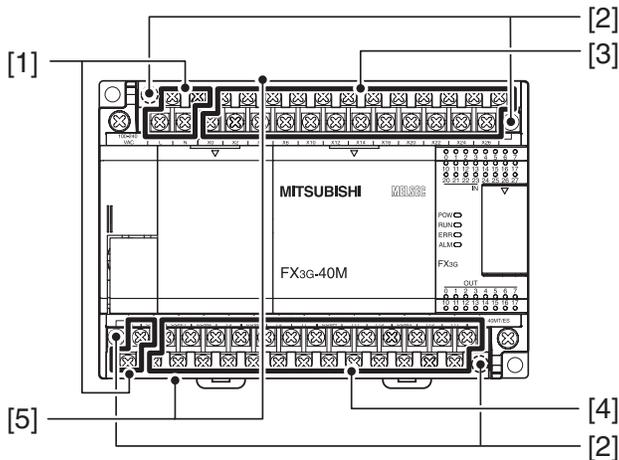
**[7] Battery connector.** Connect the optional battery to the connector.

**[8] Battery holder.** This holder accommodates the optional battery.

**[9] Optional equipment connecting screw holes 2 (2 places) (40 points, 60 points type only).** These holes are designed to secure the expansion board with screws.

**[10] Optional equipment connecting screw holes 1 (2 places).** These holes are designed to secure the expansion board with screws.

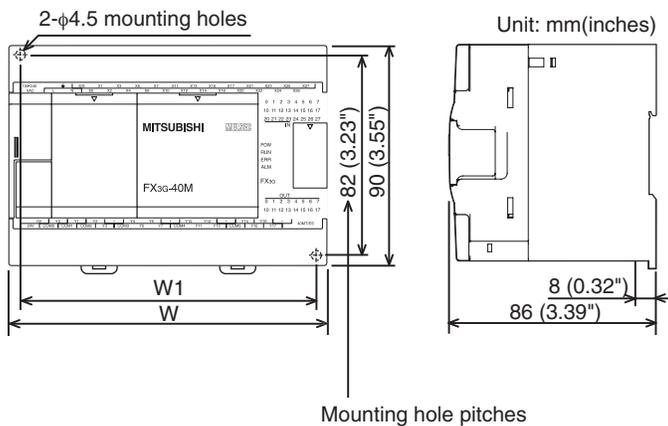
■ WHEN THE TERMINAL BLOCK COVERS ARE OPEN



- [1] **Power supply terminal.** Connect the power supply to the main unit.
- [2] **Terminal block mounting screws.** If the main unit must be replaced, loosen the screws (slightly loosen the left and right screws), and the upper part of the terminal block can be removed.
- [3] **Input (X) terminals.** Wire switches and sensors to the terminals.
- [4] **Output (Y) terminals.** Wire loads (contactors, solenoid valves, etc.) to be driven to the terminals.
- [5] **Terminal cover.** A protective terminal cover (refer to the following drawing) is fitted to the lower stage of each terminal block. The cover prevents fingers from touching terminals, thereby improving safety.



2. DIMENSIONS



Model Number	W: mm (inches)	W1: mm (inches) Direct mounting hole pitches	Weight: kg (lbs)
FX3G-14M_	90 (3.55")	82 (3.23")	0.50 (1.10 lbs.)
FX3G-24M_	90 (3.55")	82 (3.23")	0.55 (1.21 lbs.)
FX3G-40M_	130 (5.12")	122 (4.81")	0.70 (1.54 lbs.)
FX3G-60M_	175 (6.89")	167 (6.58")	0.85 (1.87 lbs.)

3. INSTALLATION

CAUTION INSTALLATION PRECAUTIONS

- Use the product within the generic environment specifications described in Section 3.1 of this manual. Never use the product in areas with excessive dust, oily smoke, conductive dusts, corrosive gas (salt air, Cl<sub>2</sub>, H<sub>2</sub>S, SO<sub>2</sub> or NO<sub>2</sub>), flammable gas, vibration or impacts, or exposed to high temperature, condensation, or rain and wind. If the product is used in such conditions, electric shock, fire, malfunctions, deterioration or damage may occur.
- Do not touch the conductive parts of the product directly to avoid failure or malfunctions.
- Install the product securely using a DIN rail or mounting screws.
- Install the product on a flat surface. If the mounting surface is rough, undue force will be applied to the PC board, thereby causing nonconformities.
- When drilling screw holes or wiring, make sure cutting or wire debris does not enter the ventilation slits. Failure to do so may cause fire, equipment failures or malfunctions.
- Be sure to remove the dust proof sheet from the PLC's ventilation port when installation work is completed. Failure to do so may cause fire, equipment failures or malfunctions.
- Connect the extension cables, peripheral device cables, input/output cables and battery connecting cable securely to their designated connectors. Unsecured connection may cause malfunctions.
- Turn off the power before attaching or detaching the following devices. Failure to do so may cause device failures or malfunctions.
  - ▶ Battery
- To prevent temperature rise, do not install the PLC on a floor, a ceiling or a vertical surface. Install it horizontally on a wall as shown in Section 3.2.
- Keep a space of 50mm (1.97") or more between the unit main body and another device or structure (part A). Install the unit as far away as possible from high-voltage lines, high-voltage devices and power equipment.

DANGER WIRING PRECAUTIONS

- Cut off all phases of the power supply externally before installation or wiring work in order to avoid damage to the product or electric shock.

3.1 SPECIFICATIONS

■ COMPLIANCE WITH EC DIRECTIVE (CE MARKING)

This document does not guarantee that a mechanical system including this product will comply with the following standards. Compliance to EMC directive and LVD directive of the entire mechanical system should be checked by the user / manufacturer. For more details please contact Mitsubishi Electric at Amzsupport@meau.com.

■ REQUIREMENT FOR COMPLIANCE WITH EMC DIRECTIVE

The following products have shown compliance through direct testing (of the identified standards below) and design analysis (through the creation of a technical construction file) to the European Directive for Electromagnetic Compatibility (2004/108/EC) when used as directed by the appropriate documentation.

**ATTENTION**

- This product is designed for use in industrial applications.
- Manufactured by:  
Mitsubishi Electric Corporation  
2-7-3 Marunouchi, Chiyoda-ku, Tokyo, 100-8310 Japan
- Manufactured at:  
Mitsubishi Electric Corporation Himeji Works  
840 Chiyoda-machi, Himeji, Hyogo, 670-8677 Japan
- Authorized Representative in the European Community:  
Mitsubishi Electric Europe B.V.  
Gothaer Str. 8, 40880 Ratingen, Germany

**Type: Programmable Controller (Open Type Equipment)**  
**Models: MELSEC FX3G series manufactured**

From November 1st, 2008  
FX3G-232-BD  
FX3G-422-BD  
FX3G-485-BD

From December 1st, 2008  
FX3G-\_\_MR/ES(-A)  
Where \_\_ indicates:14, 24, 40, 60

From December 1st, 2009  
FX3G-\_\_MT/DS  
Where \_\_ indicates:14, 24

Terminal	Dielectric Strength	Insulation Resistance
<b>Main Units</b>		
Between power supply terminal (AC power) and ground terminal	1.5 kVAC for one minute	5MΩ or more by 500VDC megger
Between power supply terminal (DC power) and ground terminal	500VAC for one minute	
Between input terminal (24V DC) and ground terminal	500VAC for one minute	
Between input terminal (100V AC) and ground terminal	1.5 kVAC for one minute	
Between output terminal (relay) and ground terminal	1.5 kVAC for one minute	
Between output terminal (transistor) and ground terminal	500VAC for one minute	

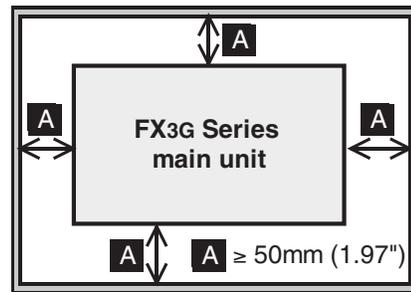
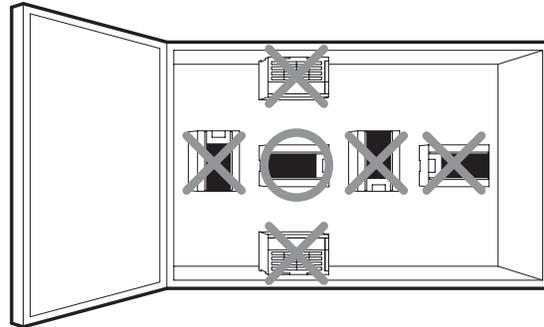
1. The criterion is shown in IEC61131-2.
2. Dielectric withstand voltage and insulation resistance are shown above.
3. For common grounding, refer to Section 4.2.
4. The PLC cannot be used at a pressure higher than the atmospheric pressure to avoid damage.

**3.2 MOUNTING INSTRUCTIONS**

**■ INSTALLATION LOCATION**

Install the PLC in an environment conforming to the generic specifications, installation precautions and notes.

**Installation location in enclosure**



**■ AFFIXING THE DUST PROOF SHEET**

The dust proof sheet should be affixed to the ventilation port before beginning the installation and wiring work. **For the affixing procedure, refer to the instructions on the dust proof sheet.** Be sure to remove the dust proof sheet when the installation and wiring work is completed.

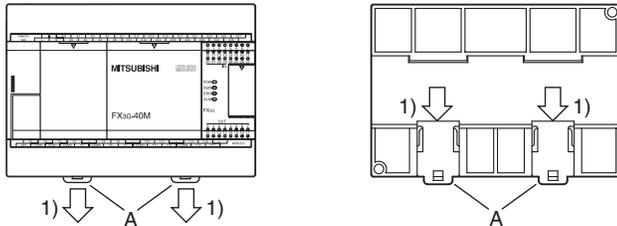
Standard	Remark
EN61131-2:2003 Programmable controllers - Equipment requirements and tests	Compliance with all relevant aspects of the standard. EMI • Radiated Emissions • Conducted Emissions EMS • Radiated electromagnetic field • Fast transient burst • Electrostatic discharge • High-energy surge • Voltage drops and interruptions • Conducted RF • Power frequency magnetic field

Item	Specification			
<b>Ambient Temperature</b>	0 to 55°C (32 to 131°F) when operating and -25 to 75°C (-13 to 167°F) when stored			
<b>Ambient Humidity</b>	5 to 95%RH (no condensation) when operating			
<b>Vibration Resistance *1</b>	Frequency (Hz)	Acceleration (m/s <sup>2</sup> )	Half amplitude (mm)	Sweep Count for X, Y, Z: 10 times (80 min in each direction)
	When installed on DIN rail	10 to 57	-	0.035
		57 to 150	4.9	-
	When installed directly	10 to 57	-	0.075
	57 to 150	9.8	-	
<b>Shock Resistance *1</b>	147m/s <sup>2</sup> Acceleration, Action time: 11ms, 3 times by half-sine pulse in each direction X, Y, and Z			
<b>Noise Resistance</b>	By noise simulator at noise voltage of 1,000Vp-p, noise width of 1μs, rise time of 1ns and period of 30 to 100Hz			
<b>Dielectric Withstand Voltage *2</b>	1.5kVAC for one minute	Between each terminals *2 and ground terminal		
	500VAC for one minute			
<b>Insulation Resistance *2</b>	5MΩ or more by 500VDC megger			
<b>Grounding</b>	Class D grounding (grounding resistance: 100Ω or less) <Common grounding with a heavy electrical system is not allowed.> *3			
<b>Working Atmosphere</b>	Free from corrosive or flammable gas and excessive conductive dusts			
<b>Working Altitude</b>	<2000m *4			

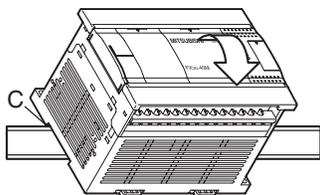
**PROCEDURES FOR INSTALLING TO AND DETACHING FROM DIN RAIL**

The products can be installed on a DIN46277 rail [35mm (1.38") wide].

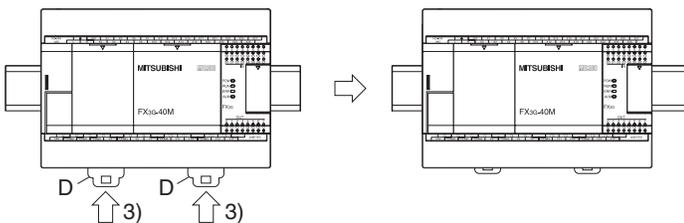
1) Push out all DIN rail mounting hooks (below fig.A).



2) Fit the upper edge of the DIN rail mounting groove (right fig.C) onto the DIN rail.



3) Lock the DIN rail mounting hooks (below fig.D) while pressing the PLC against the DIN rail.

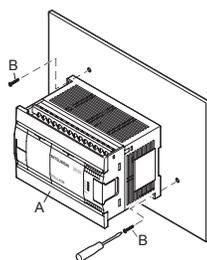


**PROCEDURES FOR MOUNTING WITH M4 SCREWS**

**MOUNTING HOLE PITCHES**

Refer to the External Dimensions (Section 2) for the product's mounting hole pitch information

**INSTALLATION**



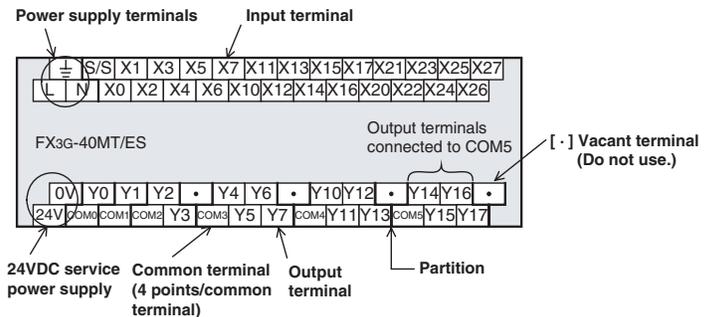
1) Make mounting holes in the mounting surface referring to the external dimensions diagram.

2) Fit the main unit (A in the above figure) based on the holes, and secure it with M4 screws (B in the right figure). The mounting hole pitches and number of screws depend on the product. Refer to the external dimensions diagram (Section 2).

**3.3 TERMINAL BLOCK LAYOUT**

The terminal layout in the main unit is shown below.

**EXPLANATION OF TERMINAL BLOCK LAYOUT**



**Indication of Power supply terminals**

The AC power supply type has [L] and [N] terminals. The DC power supply type has [+ ] and [- ] terminals. For external wiring, make sure to read the power supply wiring described later.

**Indication of 24VDC service power supply**

The AC power supply type has [0V] and [24V] terminals, whereas the DC power supply type shows [•] since the DC power supply type does not have the service power supply. Do not connect with [•] terminals.

**Indication of Input terminal**

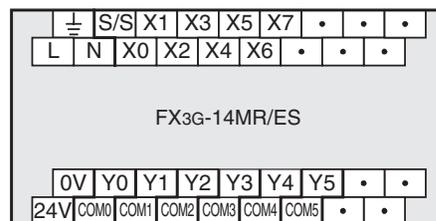
Both AC and DC power supply type have the same input terminals, however, the external input wiring differs from each other.

**Indication of output terminals connected to common terminal**

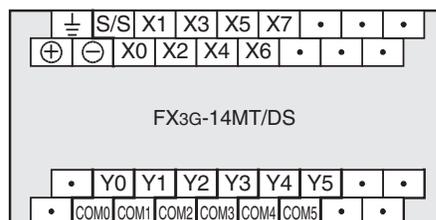
One common terminal covers 1, 2, 3 or 4 output points. The output numbers (Y) connected to a common terminal are enclosed with heavy partition lines. For transistor output (source) type, [COM□] is [+V□].

**FX3G-14M\_**

AC Power Supply Type

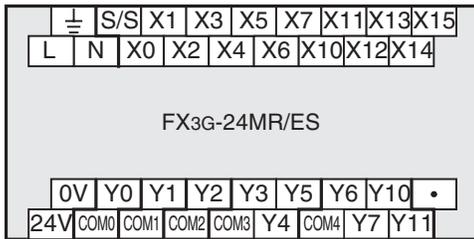


DC Power Supply Type



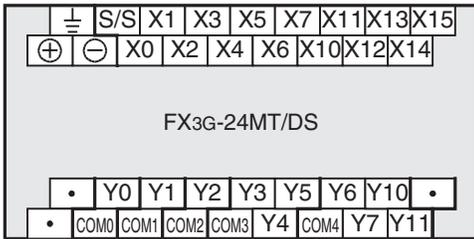
**FX3G-24M\_**

AC Power Supply Type



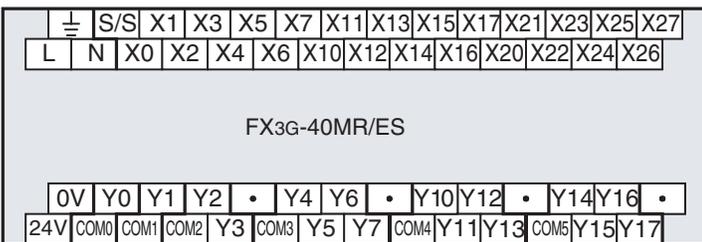
**FX3G-24M\_**

DC Power Supply Type



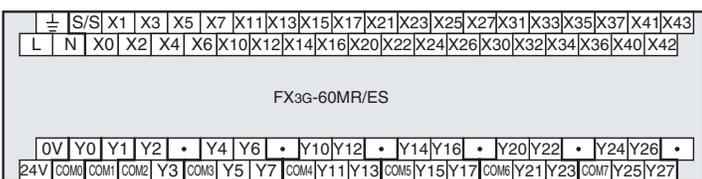
**FX3G-40MR/ES**

AC Power Supply Type



**FX3G-60MR/ES**

AC Power Supply Type



## 4. SPECIFICATIONS AND WIRING

### DANGER DESIGN PRECAUTIONS

- Make sure to have the following safety circuits outside of the PLC to ensure safe system operation even during external power supply problems or PLC failure. Otherwise, malfunctions may cause serious accidents.
  - ▶ Most importantly, have the following: an emergency stop circuit, a protection circuit, an interlock circuit for opposite movements (such as normal vs. reverse rotation), and an interlock circuit (to prevent damage to the equipment at the upper and lower positioning limits).
  - ▶ Note that when the PLC CPU detects an error, such as a watchdog timer error, during self-diagnosis, all outputs are turned off. Also, when an error that cannot be detected by the PLC CPU occurs in an input/output control block, output control may be disabled. External circuits and mechanisms should be designed to ensure safe machinery operation in such a case.
  - ▶ Note that when an error occurs in a relay, triac or transistor output device, the output could be held either on or off. For output signals that may lead to serious accidents, external circuits and mechanisms should be designed to ensure safe machinery operation in such a case.
- Do not bundle the control line together with or lay it close to the main circuit or power line. As a guideline, lay the control line at least 100mm (3.94") or more away from the main circuit or power line. Noise may cause malfunctions.
- Install module so that excessive force will not be applied to the built-in programming connectors, power connectors or I/O connectors. Failure to do so may result in wire damage/breakage or PLC failure.
- Even if the AC power supply causes an instantaneous power failure for less than 10 ms, the PLC can continue to operate.
- Even if the DC power supply causes an instantaneous power failure for less than 5 ms, the PLC can continue to operate.
- If a long-time power failure or an abnormal voltage drop occurs, the PLC stops, and output is turned off. When the power supply is restored, it will automatically restart (when the RUN input is on).

### DANGER WIRING PRECAUTIONS

- Cut off all phases of the power supply externally before installation or wiring work in order to avoid damage to the product or electric shock.

### CAUTION WIRING PRECAUTIONS

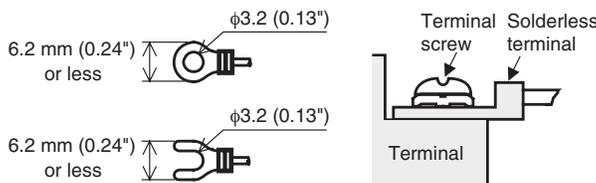
- Connect the AC power supply to the dedicated terminals specified in this manual. If an AC power supply is connected to a DC input/output terminal or DC power supply terminal, the PLC will burn out.
- Do not wire vacant terminals externally. Doing so may damage the product.
- Use class D grounding (grounding resistance of 100Ω or less) with a wire of 2mm<sup>2</sup> or thicker on the grounding terminal of the FX3G Series main unit. However, do not connect the ground terminal at the same point as a heavy electrical system.
- When drilling screw holes or wiring, make sure cutting or wire debris does not enter the ventilation slits. Failure to do so may cause fire, equipment failures or malfunctions.
- Input/output wiring 50 to 100m (164'1" to 328'1") long will cause almost no problems of noise, but, generally, the wiring length should be less than 20m (65'7") to ensure the safety.

## 4.1 WIRING

### ■ CABLE END TREATMENT AND TIGHTENING TORQUE

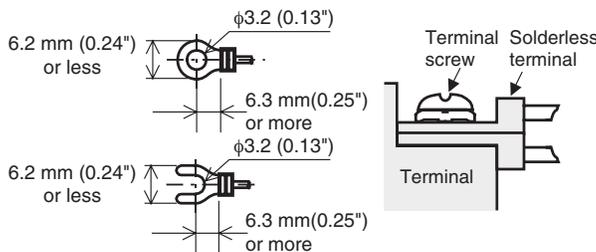
- For the terminals of FX3G series PLC, M3 screws are used. The electric wire ends should be treated as shown below.
- Tighten the screws to a torque of 0.5 to 0.8 N•m.
- Do not tighten terminal screws with a torque exceeding the regulation torque.
- Failure to do so may cause equipment failures or malfunctions.

### ■ WHEN ONE WIRE IS CONNECTED TO ONE TERMINAL



Terminal Manufacturer	Type No.	Certification	Pressure Bonding Tool
JAPAN SOLDERLESS TERMINAL MFG CO LTD (JST)	FV1.25-B3A	UL Listed	YA-1(JST)
	FV2-MS3		

### ■ WHEN TWO WIRES ARE CONNECTED TO ONE TERMINAL



Terminal Manufacturer	Type No.	Certification	Pressure Bonding Tool
JAPAN SOLDERLESS TERMINAL MFG CO LTD (JST)	FV1.25-B3A	UL Listed	YA-1(JST)

### ■ REMOVAL AND INSTALLATION OF QUICK-RELEASE TERMINAL BLOCK

**REMOVAL** Unscrew the terminal block mounting screw [both right and left screws] evenly, and remove the terminal block.

**INSTALLATION** Place the terminal block in the specified position, and tighten the terminal block mounting screw evenly [both right and left screws]. Tightening torque 0.4 to 0.5 N • m

Do not tighten the terminal block mounting screws with a torque exceeding the regulation torque.

Failure to do so may cause equipment failures or malfunctions.

\* Pay attention so that the center of the terminal block is not lifted.

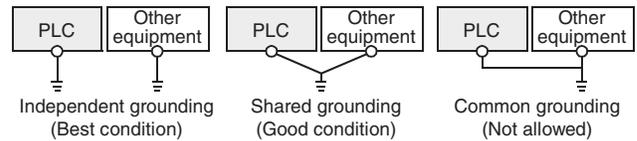
## 4.2 GROUNDING

Ground the PLC as stated below.

- Perform class D grounding. (Grounding resistance: 100 Ω or less)
- Ground the PLC independently if possible.

If it cannot be grounded independently, ground it jointly as shown below.

- Use ground wires thicker than AWG14 (2 mm<sup>2</sup>).



- Position the grounding point as close to the PLC as possible to decrease the length of the ground wire.

## 4.3 POWER SUPPLY SPECIFICATIONS AND WIRING DIAGRAM

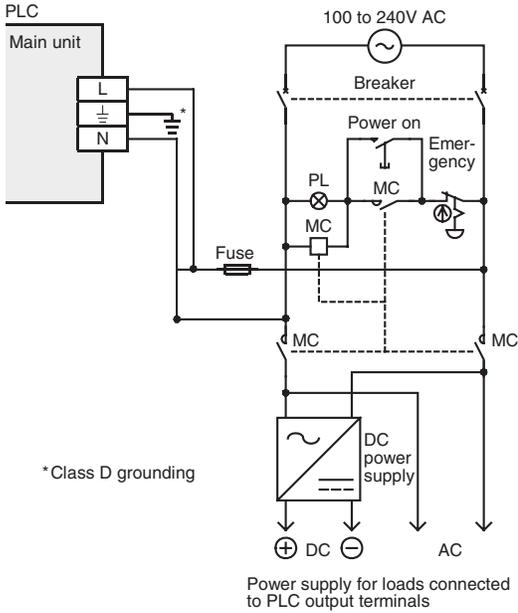
### ■ POWER SUPPLY SPECIFICATIONS

Item	Specification		
	AC Power Type	DC Power Type	
Supply Voltage	100 to 240VAC	24VDC	
Allowable Supply Voltage Range	85 to 264VAC	20.4 to 28.8VDC	
Rated Frequency	50/60Hz	-	
Allowable Instantaneous Power Failure Time	Operation can be continued upon occurrence of instantaneous power failure for 10 ms or less.	Operation can be continued upon occurrence of instantaneous power failure for 5 ms or less.	
Power Fuse	FX3G-14M_	250V 1A	125V 2.5A
	FX3G-24M_		
	FX3G-40M_	250V 3.15A	125V 3.15A
Rush Current	Main unit	30A max. 5ms or less/100 VAC 50A max. 5ms or less/200 VAC	30A max. 1ms or less/ 24 VDC
Power Consumption *1	FX3G-14M_	31W	19W
	FX3G-24M_	32W	21W
	FX3G-40M_	37W	25W
	FX3G-60M_	40W	29W
24VDC Service Power Supply	Main Unit	400mA	-

\*1 This item shows values when all 24V DC service power supplies are used in the maximum configuration connectable to the main unit or input/output extension units (The DC power type main unit does not have a 24V DC service power supply.)

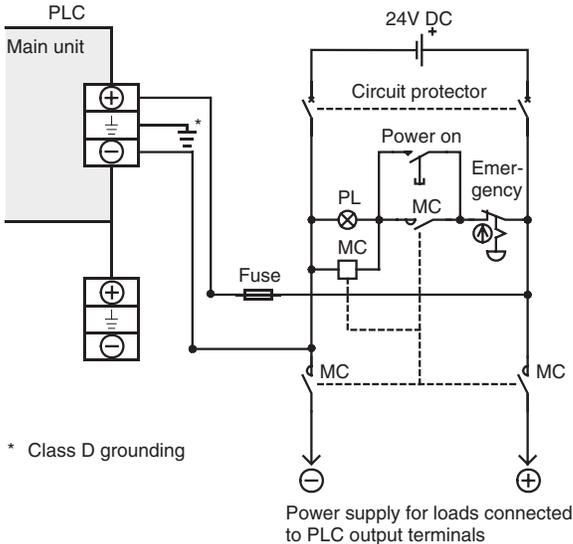
**EXAMPLE OF EXTERNAL WIRING (AC POWER TYPE)**

100 to 240VAC power is supplied to the main unit and input/output extension unit.



**EXAMPLE OF EXTERNAL WIRING (DC POWER TYPE)**

24VDC power is supplied to the main unit and input/output extension unit.



**4.4 INPUT SPECIFICATIONS AND WIRING DIAGRAM**

**24VDC INPUT (SINK/SOURCE)**

The input numbers in the table indicate the main unit terminal numbers. "X010 or more" means the numbers from X010 to the largest number that the main unit has. (The input numbers for FX3G-14M\_ are X000 to X007.)

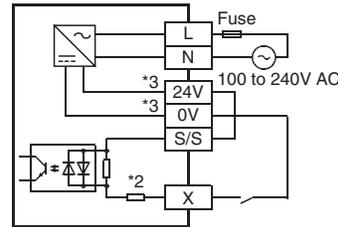
Item	FX3G-14M_	FX3G-24M_	FX3G-40M_	FX3G-60M_
Number of Input Points	8 points	14 points (16) *1	24 points	36 points (40) *1
Input Connecting Type	Removable terminal block (M3 screw)			
Input Form	sink/source			
Input Signal Voltage	AC power supply type: 24V DC ±10% DC power supply type: 20.4V to 28.8V DC			
Input Impedance	X000 to X007	3.3kΩ		
	X010 or More	-	4.3kΩ	
Input Signal Current	X000 to X007	7mA/24VDC		
	X010 or More	-	5mA/24VDC	
ON Input Sensitivity Current	X000 to X007	4.5mA or more		
	X010 or More	-	3.5mA or more	
OFF Input Sensitivity Current	1.5mA or less			
Input Response Time	Approx. 10ms			
Input Signal Form	No-voltage contact input Sink input: NPN open collector transistor Source input: PNP open collector transistor			
Input Circuit Insulation	Photocoupler insulation			
Input Operation Display	LED on panel lights when photocoupler is driven			

**INPUT CIRCUIT CONFIGURATION**

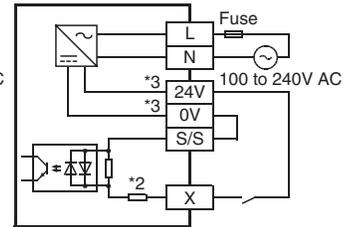
1. Each value inside ( ) indicates the number of occupied points.

**AC power supply type**

Sink input wiring

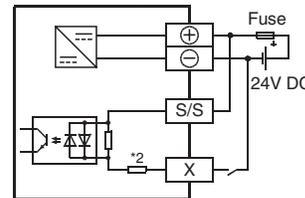


Source input wiring

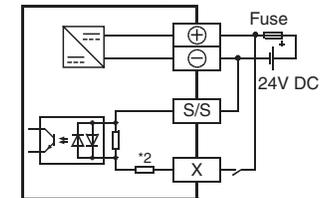


**DC power supply type**

Sink input wiring



Source input wiring



2. Input impedance
3. The "24V" and "0V" terminals are located on the output terminal side.

**INSTRUCTIONS FOR CONNECTING INPUT DEVICES**

**1. In the case of no-voltage contact:**

The input current of this PLC is 5 to 7mA/24VDC. Use input devices applicable to this current. If no-voltage contacts (switches) for large current are used, contact failure may occur.

**2. In the case of input device with built-in series diode:**

The voltage drop of the series diode should be approx. 4V or less.

When lead switches with a series LED are used, up to two switches can be connected in series. Also make sure that the input current is over the input-sensing level while the switches are ON.

3. **In the case of input device with built-in parallel resistance:**  
Use a device with a parallel resistance of 15kΩ or more. When the resistance is less than 15kΩ, connect a bleeder resistance.
4. **In the case of 2-wire proximity switch:**  
Use a two-wire proximity switch whose leakage current is 1.5mA or less when the switch is off. When the current is 1.5mA or more, connect a bleeder resistance.

#### 4.5 PULSE CATCH (M8170 TO M8175)

The PLC (main unit) is provided with a pulse catch function and has 6 pulse catch input points.

For details on programming, refer to the HELP section in GX Works2.

##### ■ CAUTIONS FOR PULSE CATCH

1. **Non-overlap of input numbers**  
The input terminals X000 to X005 can be used for high-speed counter, input interruption, pulse catch, speed detection (SPD) instructions and general-purpose input. Take care not to overlap the input numbers.
2. **Caution in wiring**  
It is recommended to use shielded twisted-pair cables for connection cables.

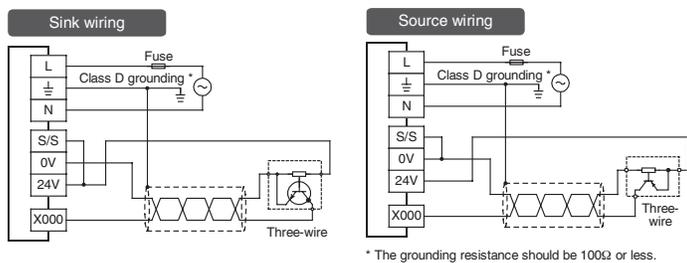
##### ■ EXAMPLES OF EXTERNAL WIRING

It is recommended to use shielded twisted-pair cables for connection cables. Ground the shield of each shielded cable only on the PLC side.

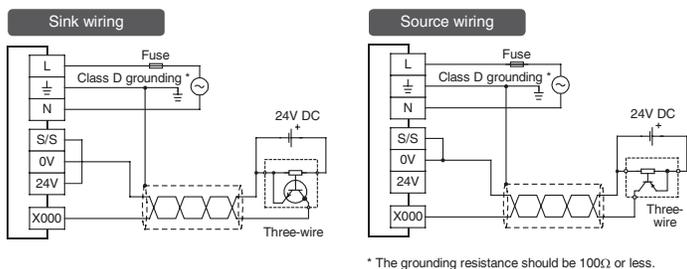
##### ■ EXAMPLES OF PULSE CATCH (M8170) WIRING USING X000

When another input terminal is used, wire it according to the following diagrams.

###### 1) When 24VDC service power supply is used



###### 2) When 24VDC external power supply is used



#### 4.6 PULSE WIDTH/PULSE PERIOD MEASUREMENT SPECIFICATIONS AND WIRING

Four input points in the PLC (main unit) can be used for the pulse width/period measurement function which enables measurement of the pulse width or pulse frequency in units of 10 s.

For details on programming, refer to the HELP section in GX Works2.

##### ■ CAUTIONS FOR PULSE WIDTH/PERIOD MEASUREMENT FUNCTION

1. **Non-overlap of input numbers**  
The input terminals X000, X001, X003 and X004 can be used for high-speed counter, input interruption, pulse catch, speed detection (SPD) instructions and general-purpose input. Take care not to overlap the input numbers. However, overlap of input numbers is allowed for input interruptions.
2. When the pulse width/period measurement function and high-speed counters are used together, the overall frequency of high-speed counters is affected.
3. Make sure that the total frequency of four input channels is 50 kHz or less when using the pulse width/period measurement function. For details on programming, refer to the HELP section in GX Works2.
4. **Caution in wiring**  
It is recommended to use shielded twisted-pair cables for connection cables.

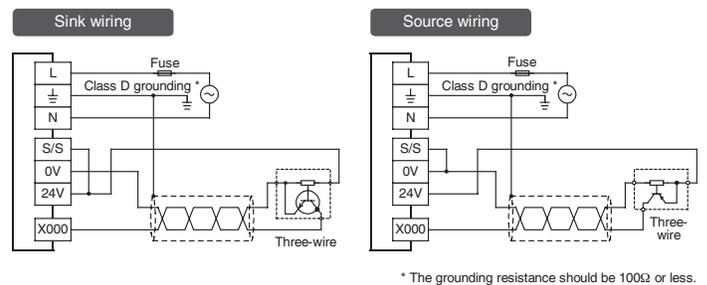
##### ■ EXAMPLES OF EXTERNAL WIRING

It is recommended to use shielded twisted-pair cables for connection cables. Ground the shield of each shielded cable only on the PLC side.

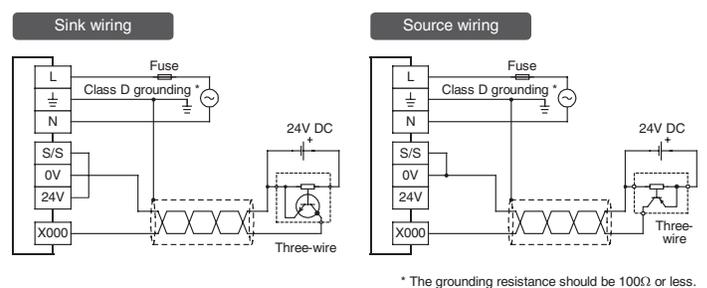
##### ■ EXAMPLES OF PULSE WIDTH MEASUREMENT WIRING USING X000

When another input terminal is used, wire it according to the following diagrams.

###### 1) When 24V DC service power supply is used



###### 2) When 24V DC external power supply is used



## 4.7 HIGH SPEED COUNTERS SPECIFICATIONS AND WIRING

High-speed counters use input terminals X000 to X007 of the main unit for inputs, and offer counting up to 60kHz (1 phase).

Input terminals not used for high-speed counters are available for general-purpose inputs.

For details on programming, refer to the HELP section of GX Works2.

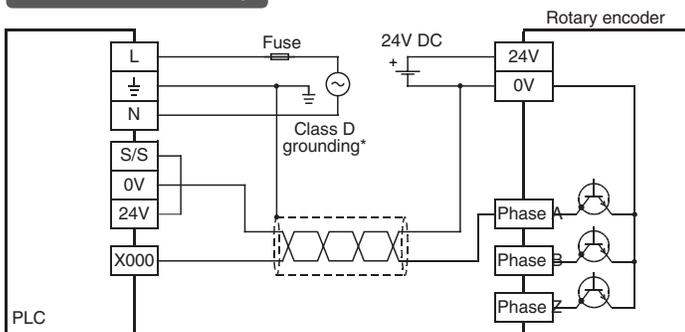
### EXAMPLES OF EXTERNAL WIRING (ROTARY ENCODER)

#### 1-phase 1-input [C235 to C245]

The following examples of wiring apply to the cases where C235 is used. When another high-speed counter number is used, wire the counter referring to the following diagrams. It is recommended to use shielded twisted-pair cables for connection cables. Ground the shield of each shielded cable only on the PLC side.

#### 1) NPN open collector transistor output rotary encoder

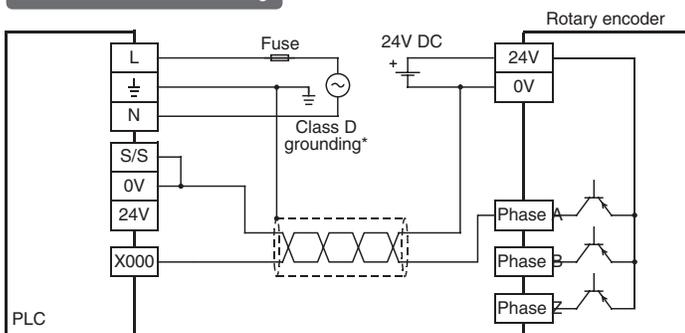
In the case of sink wiring



\* The grounding resistance should be 100Ω or less.

#### 2) PNP open collector transistor output rotary encoder

In the case of source wiring



\* The grounding resistance should be 100Ω or less.

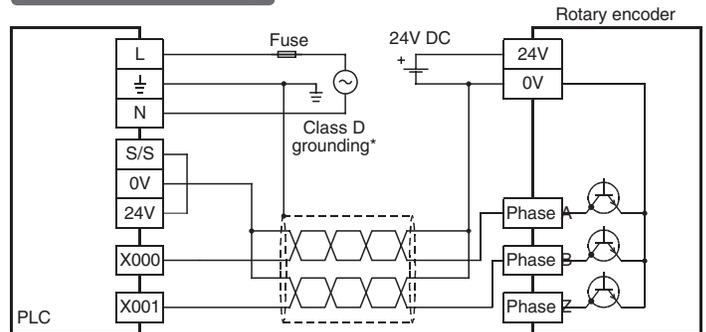
#### 2-phase 2-input [C251 to C255]

The following examples of wiring apply to the cases where C251 is used. When another high-speed counter number is used, wire the counter referring to the following diagrams.

It is recommended to use shielded twisted-pair cables for connection cables. Ground the shield of each shielded cable only on the PLC side.

#### 1) NPN open collector transistor output rotary encoder

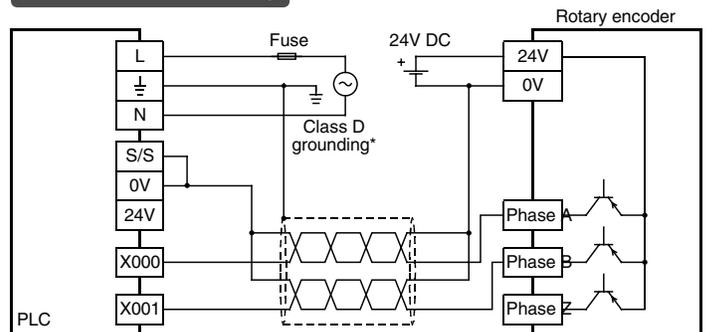
In the case of sink wiring



\* The grounding resistance should be 100Ω or less.

#### 2) PNP open collector transistor output rotary encoder

In the case of source wiring



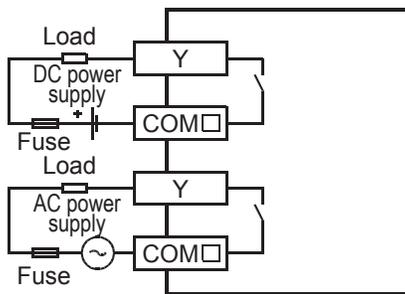
\* The grounding resistance should be 100Ω or less.

## 4.8 OUTPUT SPECIFICATIONS AND WIRING

### Relay output

Item	FX3G-14MR/_	FX3G-24MR/_	FX3G-40MR/_	FX3G-60MR/_
Number of Output Points	6 points (8) *1	10 points (16) *1	16 points	24 points
Connecting Type	Removable terminal block (M3 screw)			
Output Type	Relay			
External Power Supply	30VDC or less 240VAC or less(250VAC or less when the unit does not comply with CE, UL or cUL standards)			
Maximum Load	Resistance Load	2A/point The total load current of resistance loads per common terminal should be the following value. • 1 output point/common terminal: 2A or less • 4 output points/common terminal: 8A or less		
	Inductive Load	80VA		
Min. Load	5V DC, 2mA (reference value)			
Open Circuit Leakage Current	-			
Response Time	OFF – ON	Approx. 10ms		
	ON – OFF	Approx. 10ms		
Input Circuit Insulation	Mechanical insulation			
Input Operation Display	LED on panel lights when power is applied to relay coil			

### ■ OUTPUT CIRCUIT CONFIGURATION



A common number applies to the □ of [COM □].

1. Each value inside ( ) indicates the number of occupied points.

### ■ LIFE OF RELAY CONTACT

The product life of relay contacts considerably varies depending on the load type used. Take care that loads generating reverse electromotive force or rush current may cause poor contact or deposition of contacts which may lead to considerable reduction of the contact product life.

#### 1) Inductive load

Inductive loads generate large reverse electromotive force between contacts at shutdown may cause arcing. At a fixed current consumption, as the power factor (phase between current and voltage) gets smaller, the arc energy gets larger. The standard life of the contact used for inductive loads, such as contactors and solenoid valves, is 500 thousand operations at 20VA. The following table shows the approximate life of the relay based on the results of our operation life test.

**Test condition: 1 sec. ON / 1 sec. OFF.**

Load Capacity	Contact Life	
20VA	0.2A/100VAC	3 million times
	0.1A/200VAC	
35VA	0.35A/100VAC	1 million times
	0.17A/200VAC	
80VA	0.8A/100VAC	2 hundred thousand times
	0.4A/200VAC	

The product life of relay contacts becomes considerably shorter than the above conditions when the rush overcurrent is shut down.

Some types of inductive loads generate rush current 5 to 15 times the stationary current at activation. Make sure that the rush current does not exceed the current corresponding to the maximum specified resistance load.

#### 2) Lamp load

Lamp loads generally generate rush current 10 to 15 times the stationary current. Make sure that the rush current does not exceed the current corresponding to the maximum specified resistance load.

#### 3) Capacitive load

Capacitive loads can generate rush current 20 to 40 times the stationary current. Make sure that the rush current does not exceed the current corresponding to the maximum specified resistance load. Capacitive loads such as capacitors may be present in electronic circuit loads including inverters.

### ■ CAUTIONS IN EXTERNAL WIRING

#### Protection circuit for load short-circuiting

When a load connected to the output terminal short-circuits, the printed circuit board may be burnt out. Fit a protective fuse on the output circuit.

#### Protection circuit of contact when inductive load is used

An internal protection circuit for the relays is not provided for the relay output circuit in this product. It is recommended to use inductive loads with built-in protection circuits. When using loads without built-in protection circuits, insert an external contact protection circuit, etc. to reduce noise and extend the product life.

#### 1) DC circuit

Connect a diode in parallel with the load. Use a diode (for commutation) having the following specifications:

Item	Standard
Reverse voltage	5 to 10 times the load voltage
Forward current	Load current or more

#### 2) AC circuit

Connect the surge absorber (combined CR components such as a surge killer and spark killer, etc.) parallel to the load. Select the rated voltage of the surge absorber suitable to the output used. Refer to the table below for other specifications.

Item	Standard
Electrostatic capacity	Approx. 0.1μF
Resistance value	Approx. 100 to 200Ω

#### Interlock

Loads, such as contactors for normal and reverse rotations, that must not be turned on simultaneously should have an interlock in the PLC program and an external interlock.

#### Common mode

Use output contacts of the PLC in the common mode.

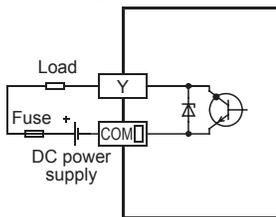
**Transistor output**

Item	FX3G-14MT/_	FX3G-24MT/_	FX3G-40MT/_	FX3G-60MT/_
<b>Number of Output Points</b>	6 points (8) *1	10 points (16) *1	16 points	24 points
<b>Connecting Type</b>	Removable terminal block (M3 screw)			
<b>Output Type/Form</b>	Transistor/sink output (FX3G- MT/_S) Transistor/source output (FX3G- MT/_SS)			
<b>External Power Supply</b>	5 to 30VDC			
<b>Maximum Load</b>	<b>Resistance Load</b>	0.5A/point The total load current of resistance loads per common terminal should be the following value. • 1 output point/common terminal: 0.5A or less • 4 output points/common terminal: 0.8A or less		
	<b>Inductive Load</b>	12W/24VDC The total of inductive loads per common terminal should be the following value. • 1 output point/common terminal: 12W or less/24VDC • 4 output points/common terminal: 19.2W or less/24VDC		
<b>Open Circuit Leakage Current</b>	0.1mA or less/30VDC			
<b>ON Voltage</b>	1.5 V or less			
<b>Response Time</b>	<b>OFF – ON</b>	Y000, Y001:5µs or less/10mA or more (5 to 24VDC) Y002 or more:0.2ms or less/200mA or more (at 24VDC)	Y000 to Y002:5µs or less/10mA or more (5 to 24VDC) Y003 or more:0.2ms or less/200mA or more (at 24VDC)	
	<b>ON – OFF</b>	Y000, Y001:5µs or less/10mA or more (5 to 24VDC) Y002 or more:0.2ms or less/200mA or more (at 24VDC)	Y000 to Y002:5µs or less/10mA or more (5 to 24VDC) Y003 or more:0.2ms or less/200mA or more (at 24VDC)	
<b>Input Circuit Insulation</b>	Photocoupler insulation			
<b>Input Operation Display</b>	LED on panel lights when photocoupler is driven			

**OUTPUT CIRCUIT CONFIGURATION**

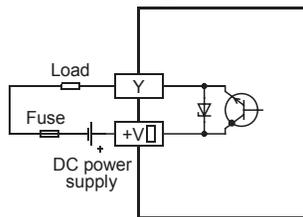
1. Each value inside ( ) indicates the number of occupied points.

Sink output wiring



A common number applies to the [ ] of [COM].

Source output wiring



A common number applies to the [ ] of [+V].

**PROTECTION CIRCUIT FOR LOAD SHORT-CIRCUITS**

A short-circuit at a load connected to an output terminal could cause burnout at the output element or the PCB. To prevent this, a protection fuse should be inserted at the output. Use a load power supply capacity that is at least 2 times larger than the total rated fuse capacity.

**CONTACT PROTECTION CIRCUIT FOR INDUCTIVE LOADS**

When an inductive load is connected, connect a diode (for commutation) in parallel with the load as necessary. The diode (for commutation) must comply with the following specifications.

Item	Guide
Reverse voltage	5 to 10 times of the load voltage
Forward current	Load current or more

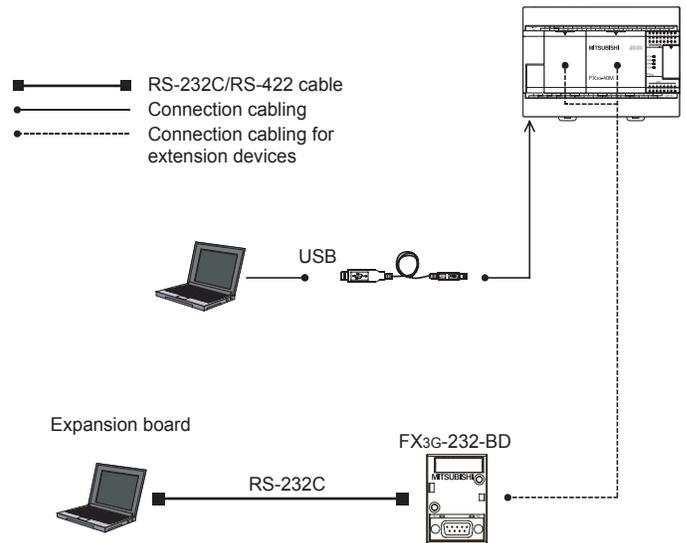
**INTERLOCK**

Loads, such as contactors for normal and reverse rotations, that must not be turned on simultaneously should have an interlock in the PLC program and an external interlock.

**5. PROGRAMMING USING GX WORKS2**

The software package GX Works2 is a programming tool designed to be used with FX3G programmable controller. GX Works2 runs on Microsoft® Windows® 95, Windows® 98, Windows® Me, WindowsNT® Workstation 4.0, Windows® 2000, Windows® XP, Windows Vista®, Windows® 7, and Windows® 8 (hereafter referred to collectively as Windows®). The software has been designed to be both powerful and user friendly. While many of the software features can be learned intuitively, a detailed help file has been incorporated into the software to assist users in finding answers to their questions.

**5.1 SYSTEM CONFIGURATION**

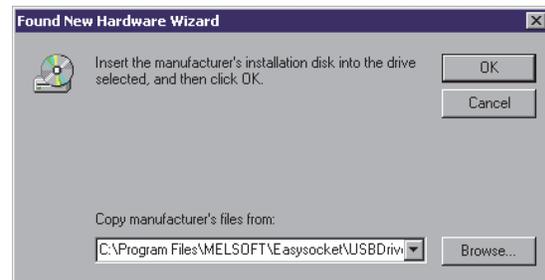


**5.2 INSTALLING THE USB DRIVER**

In order to communicate with a programmable controller CPU via USB, a USB driver needs to be installed.

The following explains the procedure of USB driver installation.

**WHEN USING WINDOWS® 2000 PROFESSIONAL**



**OPERATING PROCEDURE**

1. Connect the personal computer and the programmable controller CPU with a USB cable, and then turn on the programmable controller CPU.
2. The *Found New Hardware Wizard* screen is displayed. Select "Specify a location".

- Click the BROWSE button and set "Easysocket\USBdrivers" in the folder where GX Works2 has been installed to "Copy manufacturer's files from.;" and then click the OK button. If multiple MELSOFT products are installed previously, refer to their installed location.

**POINT**

Considerations when installing USB driver:

If the USB driver cannot be installed, confirm the following Windows® settings.

- If "Block - Prevent installation of unsigned files" is selected under [Control Panel] → [System] → [Hardware] → [Driver Subscription], the USB driver may not be installed.
- Select "Ignore - Install all files, regardless of file signature," or "Warn - Display a message before installing an unsigned files" in [Driver Subscription], and execute the USB driver installation.

**WHEN USING WINDOWS® XP**



**OPERATING PROCEDURE**

- Connect the personal computer and the programmable controller CPU with a USB cable, and then turn on the programmable controller CPU.
- The Found New Hardware Wizard screen is displayed. Select "Install from a list or specific location (Advanced)":
- Select "Search for the best driver in these locations" on the displayed screen. Select "Include this location in the search," and then set "Easysocket\USBdrivers" in the folder where GX Works2 has been installed. If multiple MELSOFT products are installed previously, refer to their installed location.

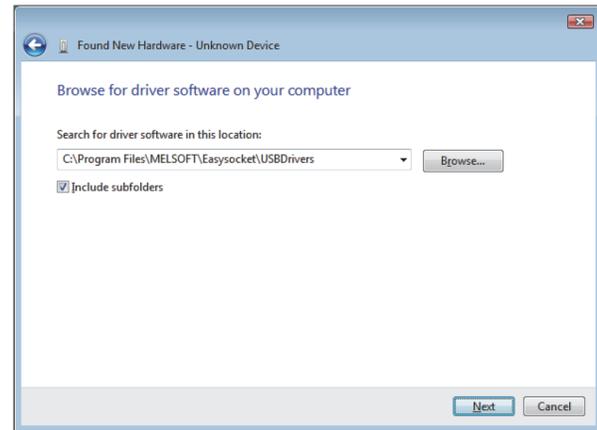
**POINT**

Considerations when installing USB driver:

If the USB driver cannot be installed, confirm the following Windows® settings.

- If "Block - Never install unsigned driver software" is selected under [Control Panel] → [System] → [Hardware] → [Driver Signing], the USB driver may not be installed.
- Select "Ignore - Install the software anyway and don't ask for my approval" or "Warn - Prompt me each time to choose an action" in [Driver Signing], and execute the USB driver installation.

**WHEN USING WINDOWS VISTA®**



**OPERATING PROCEDURE**

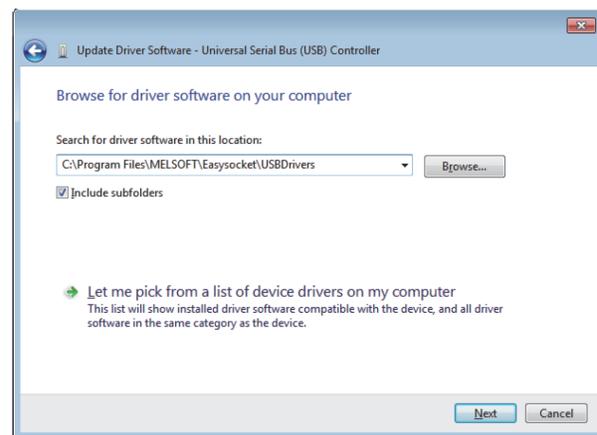
- Connect the personal computer and the programmable controller CPU with a USB cable, and then turn on the programmable controller CPU.
- The Found New Hardware screen is displayed. Select "Locate and install driver software (recommended)":
- Select "Browse my computer for driver software (advanced)" on the Found New Hardware screen.
- Specify "Easysocket\USBdrivers" in the folder where GX Works2 has been installed on the displayed screen. If multiple MELSOFT products are installed previously, refer to their installed location. Select "Include subfolders"

**POINT**

Considerations when installing USB driver:

When the Windows can't verify the publisher of this driver software screen is displayed during the installation, select "Install this driver software anyway".

**WHEN USING WINDOWS® 7**



**OPERATING PROCEDURE**

- Connect the personal computer and the programmable controller CPU with a USB cable, and then turn on the programmable controller CPU.
- From Windows® Control Panel, select [System and Security] - [Device Manager]. Right-click "Unknown device" and click "Update

Driver Software”.

- The Update Driver Software screen is displayed. Select “Browse my computer for driver software” and specify “Easysocket\USBdrivers” in the folder where GX Works2 has been installed on the displayed screen. If multiple MELSOFT products are installed previously, refer to their installed location.

**WHEN USING WINDOWS® 8 OR WINDOWS® 8.1**



**OPERATING PROCEDURE**

- Connect the personal computer and the programmable controller CPU with a USB cable, and then turn on the programmable controller CPU.
- From Windows® Control Panel, select [System and Security] - [Device Manager]. Right-click “Unknown device” and click “Update Driver Software”.
- The Update Driver Software screen is displayed. Select “Browse my computer for driver software” and specify “Easysocket\USBdrivers” in the folder where GX Works2 has been installed on the displayed screen. If multiple MELSOFT products are installed previously, refer to their installed location.

**5.3 INSTALLING GX WORKS2**

This section explains how to install and uninstall GX Works2 (SW1DNC-GXW2-E ). Please read carefully before installing the product to your personal computer.

Notice: Reprinting or reproducing the part or all of the contents of this document in any form for any purpose without the permission of Mitsubishi Electric Corporation is strictly forbidden.

- Although we have made the utmost effort to follow the revisions of the software and hardware, in some cases, unsynchronized matter may occur.

The information in this document may be subject to change without notice.

**■ INSTALLATION**

Install GX Works2 to the personal computer.

**Confirm before installation**

- Log on to the personal computer as an administrator.
  - Close all the applications running under Microsoft® Windows® Operating System before installation. If the product is installed while other applications are running, it may not operate normally.
- Insert the CD-ROM (Disc 1) to the CD-ROM drive. Double click the “setup.exe” file on the CD-ROM (Disc 1).
  - Following the on-screen instructions, select or enter the necessary information.

**POINT**

Product ID is written on the “License certificate” included with the product. Enter the 12-digit number divided into 3 and 9 digits.

**■ OPERATING ENVIRONMENT**

Item	Contents
Personal Computer	Windows® supported personal computer
CPU	Intel®Core™2 Duo Processor 2GHz or more recommended
Required Memory	1GB or more recommended
Available Hard Disk Capacity	When installing GX Works2: HDD available capacity is 2.5GB or more. When operating GX Works2: Virtual memory available capacity is 512MB or more.
Disk Drive	CD-ROM supported disk drive
Monitor	Resolution 1024 x 768 pixels or higher
OS (English Version)	Microsoft® Windows® 8.1 Operating System Microsoft® Windows® 8.1 Pro Operating System Microsoft® Windows® 8.1 Enterprise Operating System Microsoft® Windows® 8 Operating System Microsoft® Windows® 8 Pro Operating System Microsoft® Windows® 8 Enterprise Operating System Microsoft® Windows® 7 Starter Operating System Microsoft® Windows® 7 Home Premium Operating System Microsoft® Windows® 7 Professional Operating System Microsoft® Windows® 7 Ultimate Operating System Microsoft® Windows® 7 Enterprise Operating System Microsoft® Windows Vista® Home Basic Operating System *1 Microsoft® Windows Vista® Home Premium Operating System *1 Microsoft® Windows Vista® Business Operating System *1 Microsoft® Windows Vista® Ultimate Operating System *1 Microsoft® Windows Vista® Enterprise Operating System *1 Microsoft® Windows® XP Professional, Service Pack 2 or later *1 Microsoft® Windows® XP Home Edition, Service Pack 2 or later Microsoft® Windows® 2000 Professional, Service Pack 4 or later
Communication Interface *2	RS-232 port USB port Ethernet port

- 64-bit version is not supported.
- When a programmable controller CPU is directly connected.

**PRECAUTIONS**

- If .NET Framework 2.0 and Windows Installer 3.0 are not installed to the personal computer to which GX Works2 is to be installed, approximately 350MB of memory is required in the system drive to install them.
- For Windows® 8 and Windows® 8.1, if .NET Framework 3.5 (including .NET 2.0 and 3.0) is invalid on the personal computer to which GX Works2 is to be installed, it needs to be valid.
- The following functions cannot be used when the computer is running under Windows® XP, Windows Vista®, Windows® 7, Windows® 8, or Windows® 8.1. This product may not perform properly, when these functions are used.

- Activating the application with Windows® compatible mode.
- Simplified user switch-over
- Remote desktop
- Large font size (Advanced setting of Display Properties)
- DPI setting other than 100% (set the size of text and illustration other than [smaller-100%])
- Windows XP Mode
- Windows Touch or Touch
- Modern UI
- Client Hyper-V
- Use the product as a user having a privilege higher than 'Standard user' or 'Administrator' for Windows Vista®, Windows® 7, Windows® 8, and Windows® 8.1.
- The screens of this product may not perform properly when multi-display is set on Display Properties.
- For a personal computer with less than 1GB of memory, the startup speed of GX Works2 may be improved by increasing the memory to more than 1GB.
- The operations on the screen of this product may not be executed properly when the screen resolution is changed while the product is being activated.

### 5.4 STARTING AND EXITING GX WORKS2

#### Starting GX Works2

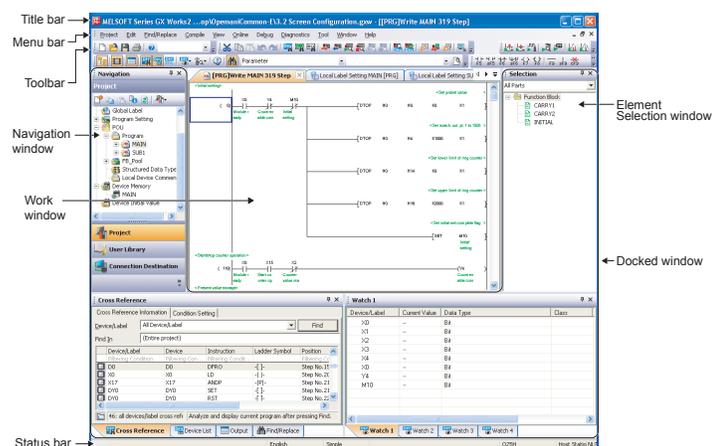
Select [Start] → [All Programs] → [MELSOFT Application] → [GX Works2] → [GX Works2].

#### Exiting GX Works2

Select [Project] → [Exit].

### MAIN FRAME CONFIGURATION

The following screen shows a main frame configuration on which a work window and docked windows are displayed.



Name	Description
Title Bar	Display a project name
Menu Bar	Display menu options for executing each function
Toolbar	Display tool buttons for executing each function
Work window	A main screen used for operations such as programming, parameter setting, and monitoring
Docking window	A sub screen to support operations performed on a work window
Navigation	Display contents of a project in tree format
Element Selection	Display a list of functions (such as function blocks) used for programming
Output	Display compilation and check results (errors and warnings)
Cross Reference	Display cross reference results
Device List	Display the device list
Watch 1 to 4	A screen used for monitoring and changing current device values.
Intelligent Function Module Monitor 1 to 10	Screens used for monitoring intelligent function modules
Find/Replace	A screen used for searching and replacing character strings in the project
Debug	A screen used for setting the debug which uses the simulation function
Status bar	Display information about a project being edited

#### POINT

Focus point indication in Windows Vista®, Windows® 7, Windows® 8, or Windows® 8.1. When using Windows Vista®, Windows® 7, Windows® 8, or Windows® 8.1, the focus point may not be indicated on the screen.

To display the focus point, set the following setting.

For Windows Vista®, select [Start] → [Control Panel] → [Ease of Access] → [Ease of Access Center].  
 For Windows® 7, select [Start] → [Control Panel] → [Ease of Access Center].  
 For Windows® 8 and Windows® 8.1, select the windows key + [X] [Control Panel] → [Ease of Access Center].

3. Select "Make the keyboard easier to use"
4. Select "Underline keyboard shortcuts and access keys"

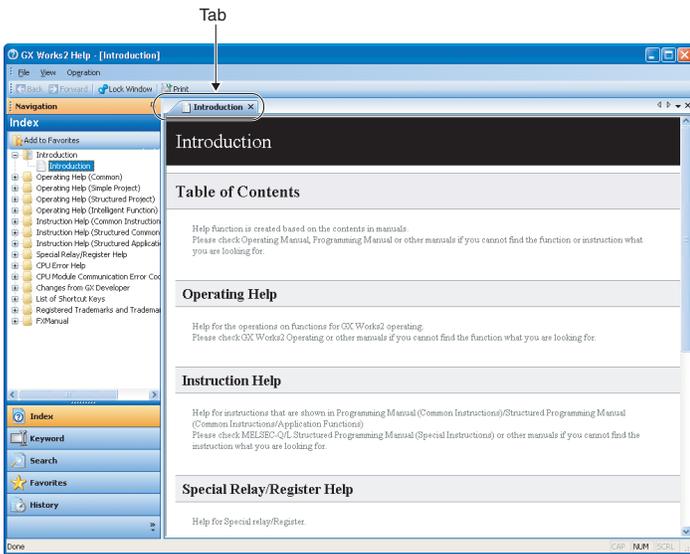
### 5.5 USING THE HELP FILES IN GX WORKS2

Use the GX Works2 help function to learn GX Works2 operations, understand functions, and check error codes of programmable controller CPU.

The following items can be checked with the GX Works2 help function.

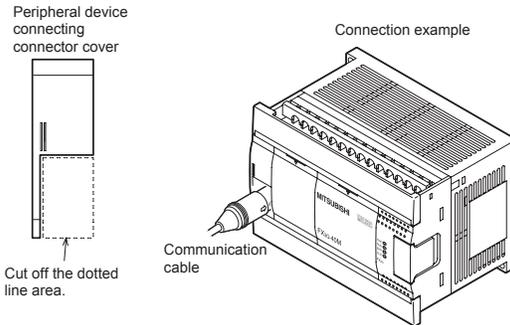
- Help for operations
- Help for instructions
- Help for special relays/special registers
- Help for CPU errors
- Error codes for CPU module communication
- Changes from GX Developer
- List of shortcut keys
- Registered Trademarks and Trademarks
- FX manuals

Select [Help] → [GX Works2 Help] (?)



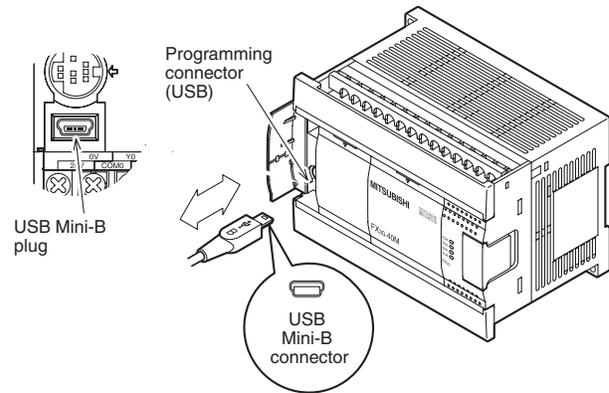
■ FOR CONTINUOUS USE OF A PERIPHERAL DEVICE (SUCH AS GOT)

- Cut off the area shown in the left figure below of the peripheral device connector cover (main unit) using a nipper, etc., and connect the peripheral device as shown in the right figure below.



■ CONNECTION TO BUILT-IN PROGRAMMING CONNECTOR (USB)

Connect and disconnect the communication cable for the peripheral device (personal computer). At connection, confirm the cable and connector shape.



6. OPERATION

■ PRELIMINARY INSPECTION [POWER OFF]

Incorrect connection of the power supply terminal, contact of the DC input wire and power supply wire, or short-circuiting of output wires may result in serious damage. Before applying power, check that the power supply and ground terminals are connected correctly and input/output devices are wired properly.

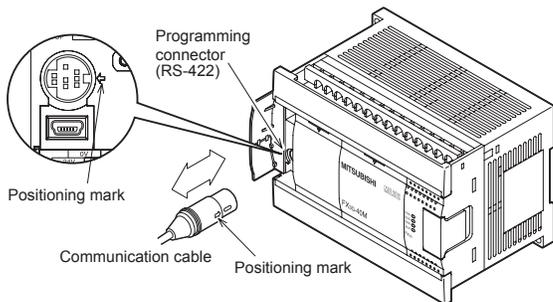
**NOTES** The dielectric withstand voltage and insulation resistance test of the PLC should be measured in accordance with the following procedures.

1. Remove all input/output wires and power supply wires from the PLC.
2. Connect a crossing wire to each of the PLC terminals (power supply terminal, input terminals and output terminals) except the ground terminal.
3. For the dielectric withstand voltage test of each terminal, refer to the generic specifications for the product.  
Measure the dielectric withstand voltage and insulation resistance between each terminal and the ground terminal. Dielectric withstand voltage: 1.5kV AC or 500V for 1min (The terminals vary in dielectric withstand voltage.) Insulation resistance: 500V DC/5M or more.

■ CONNECTION TO BUILT-IN PROGRAMMING CONNECTOR (RS-422)

• When connecting a peripheral device

Connect and disconnect the communication cable for the peripheral device. At connection, align the “positioning mark” between the cable and the main unit.



■ WRITING OF PROGRAM AND PROGRAM CHECK [POWER ON AND PLC STOPPED]

1. Turn on the PLC power.  
Make sure that the RUN/STOP switch of the PLC is set to STOP, and turn the power on.
2. Check the program.  
Check for circuit errors and grammatical errors with the program check function of the programming tool.
3. Transfer the sequence program.  
Write the program to the PLC with the programming tool.
4. Verify the sequence program.  
Verify that the program has been correctly written to the PLC.
5. Execute PLC diagnosis.  
Check for errors in the PLC main body with the PLC diagnostic function of the programming tool.

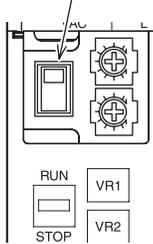
■ METHODS OF RUNNING AND STOPPING

FX3G PLCs can be started or stopped by any of the following three methods. Two of the methods can be combined. The RUN/STOP switch is located under the peripheral device connector cover.

**1. Operation with built-in RUN/STOP switch**

Operate the RUN/STOP switch on the front panel of the main unit to start and stop the PLC (refer to the right figure). Turn the switch to RUN, and the PLC will start. Turn it to STOP, and the PLC will stop.

RUN/STOP switch

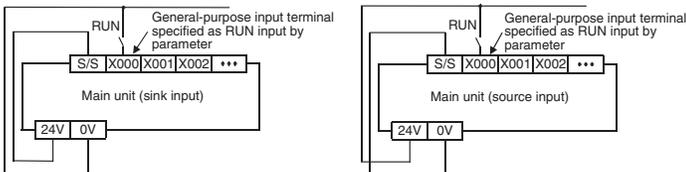


**2. Running and stopping with general-purpose input (RUN terminal)** Operation with one switch (RUN)

One of the input terminals X000 to X017 \*1 of the main unit can be used as a RUN input terminal by a parameter setting (refer to the figure below). When the specified input terminal is turned on, the PLC starts. When it is turned off, the PLC is started or stopped depending on the state of the built-in RUN/STOP switch.

\*1. X000 to X007 in 14-point type main units, and X000 to X015 in 24-point type main units.

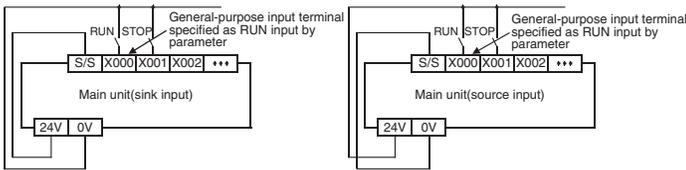
For details, refer to the HELP menu in GX Works2.



**Operation with two switches (RUN and STOP)**

The PLC can be started and stopped with individual RUN and STOP pushbutton switches. For this operation, a sequence program using M8035 to M8037 is necessary.

For details, refer to the HELP menu in GX Works2.



**3. Starting and stopping by remote control from programming software**

The programming software has a function to forcibly start and stop the PLC by remote control (remote RUN/STOP function). However, when power is reapplied, the remote RUN/STOP function is disabled. The RUN/STOP status is then determined by the RUN/STOP switch or RUN terminal.

For details on the start and stop procedures with remote control from programming software, see below.

**■ USE OF SEVERAL RUNNING/STOPPING METHODS**

1. When the built-in RUN/STOP switch and the general-purpose RUN terminal are used

(without remote running/stopping operation from the programming software) The RUN/STOP status of the PLC is determined by the conditions shown in the following table.

Condition of Built-in RUN/STOP Switch	Condition of General-Purpose Input Terminal Specified as RUN Terminal by Parameter	Status of PLC
RUN	OFF	RUN
	ON	RUN
STOP	OFF	STOP
	ON	RUN

Use either built-in RUN/STOP switch or the general input specified as RUN terminal. (When specifying the general-purpose terminal as the RUN terminal, always set the built-in RUN/STOP switch to STOP.)

**2. When the remote running/stopping operation from the programming software is performed**

For this operation, keep both the built-in RUN/STOP switch and the general-purpose input RUN terminal in the STOP position. If the stop command is given from the programming software after the PLC is started by either the built-in RUN/STOP switch or the general-purpose input RUN terminal, the PLC will be restored to the running status by giving the RUN command from the programming software. This can also be accomplished by setting the built-in RUN/STOP switch or the general-purpose input RUN terminal to STOP and then to RUN.

**■ OPERATION AND TEST [POWER ON AND PLC RUNNING]**

**SELF-DIAGNOSTIC FUNCTION**

When the PLC's power is turned on, its self-diagnostic function starts automatically. If there are no problems with the hardware, parameters or program, the PLC will start and the RUN command (refer to Section 14.2) is given (RUN LED is lit). If any problems are found, the "ERR" LED flashes or lights.

**TEST FUNCTIONS**

Functions of the programming tool to turn on/off the PLC devices and change the current values/settings are effective or ineffective depending on the PLC status as shown below.

X: Effective O: Conditionally Effective - : Ineffective

Item	In Running Status	In Stopped Status
<b>Forcible ON/OFF *1</b>	Devices used in program	O *1
	Devices not in use	X
<b>Change of current values of timers, counters, data registers, extension registers, extension file registers and file registers *4</b>	Devices used in program	O *2, *3
	Devices not in use	X *3
<b>Change of settings of timers and counters *5</b>	When the program memory is the built-in EEPROM	X
	When the program memory is in the memory cassette and the PROTECT switch is on	-
	When the program memory is in the memory cassette and the PROTECT switch is off	X

1. Forcible ON/OFF  
 - The forcible ON/OFF function is effective on the input relays (X), output relays (Y), auxiliary relays (M), state (S), timers (T) and counters (C). On the display module, the function cannot be operated for the input relays (X).  
 - The forcible ON/OFF function can turn on or off the devices only for one scan. While the PLC is running, the function is substantially effective in clearing the current values of the timers (T), counters (C), data registers (D), index registers (Z and V) and extension registers (R) and in controlling the SET/RST circuit and self-retaining circuit. (The operation to forcibly turn on timers is effective only when

the timers are driven by the program.)

- The results of forcible ON/OFF operation performed while the PLC in the stopped state or performed for devices not used in the program are retained. However, the results of the operation performed for the input relays (X) are not retained because the relays refresh input even while the PLC is in the stopped state. (They are updated according to the input terminal conditions.)

- Since the current values may be changed according to MOV instruction in the program and the operation results, the most recently obtained values are retained.
- Only display modules can change the current value by the extension file register test function.
- The current values of the file registers stored in the program memory cannot be monitored or tested on the display module.
- Change of timer and counter settings. The settings of the timers (T) and counters (C) can be changed only when the timers are driven by the program.

**PROGRAM MODIFICATION FUNCTION**

The sequence program can be transferred while the PLC is running or in the stopped state as shown below.

X: Effective - : Ineffective

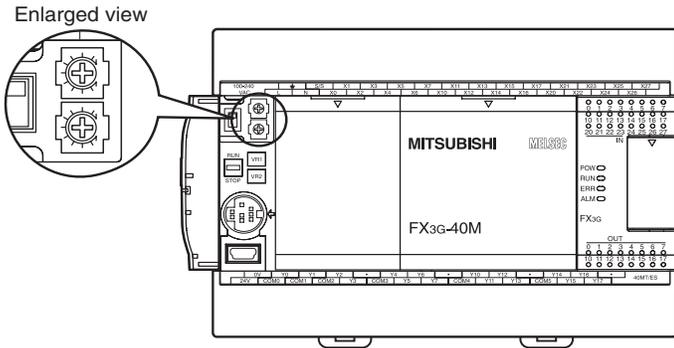
Item		In Running Status	In Stopped Status
<b>Batch Writing of File Registers (D) and Extension File Registers (ER)</b>			
		-	X
<b>Writing of Program to PLC</b>	Partial Modification of Program	X	X
	Modification of whole Program (Batch Writing)	-	X
<b>Writing of Parameters to PLC</b>		-	X
<b>Writing of Comments to PLC</b>		-	X

- Since the writing function is used during running, the programming tool must support the write during RUN function, such as GX Works2.

**BUILT-IN VARIABLE ANALOG POTENTIOMETER FUNCTION**

The main unit has two built-in variable analog potentiometers (shown in the figure below). The current value increases from 0 to 255 when a variable analog potentiometer is turned clockwise.

The current value of each variable analog potentiometer is stored in special data registers shown below.

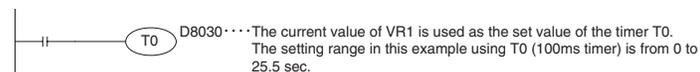


Volume	Data Register to Store Current Value
VR1 : variable analog potentiometer1	D8030 (Integer from 0 to 255)
VR2 : variable analog potentiometer2	D8031 (Integer from 0 to 255)

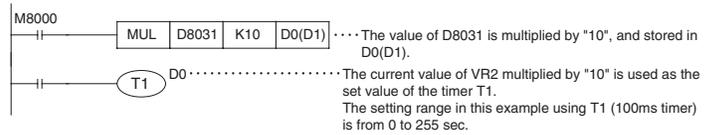
**Use example 1 of variable analog potentiometer**

The current value of VR1 is used as the set value of a timer.

**Use example 2 of variable analog potentiometer**



The current value of VR2 multiplied by “10” is used as the set value of a timer.



**7. MAINTENANCE**

This PLC does not incorporate consumable parts that are factors in the reduction of service life. However, the output relays (points of contact) and batteries (option) have a limited life expectancy.

**PERIODIC INSPECTION - BATTERY LIFE, ETC.**

**1. BATTERY**

Model FX3U-32BL battery: Standard life: 5 years (at ambient temperature of 25°C (77°F))

**2. OTHER DEVICES**

When inspecting the battery, check the following points.

- ▶ Check that the temperature in the panel is not abnormally increased by other heat generating bodies or direct sunlight.
- ▶ Check that dust or conductive dust has not entered the panel.
- ▶ Check for loosening of wiring and other abnormalities.

**3. BATTERY REPLACEMENT**

When the battery voltage drops while the PLC power is on, the “ALM” LED on the panel is lit in red, and M8005 and M8006 (latch) are turned on. The memory can be retained for about one month after the lamps turn on. However, the operators may not immediately find the lamps to be on. Prepare a new battery promptly, and replace the battery with the new one.

**MAINTENANCE – PRODUCT LIFE OF RELAY CONTACTS**

The product life of relay contacts varies considerably depending on the load type used. Take care that loads generating reverse electromotive force or rush current may cause poor contact or deposition of contacts which may lead to considerable reduction of the contact product life.

**INDUCTIVE LOAD**

Inductive loads generate large reverse electromotive force between contacts at shutdown, which may cause arcing. At a fixed current consumption, as the power factor (phase between current and voltage) gets smaller, the arc energy gets larger.

The standard life of contacts used for Inductive loads, such as contactors and solenoid valves, is 500,000 operations at 20VA. The following table shows the approximate life of a relay based on the results of an operation life test.

Load Capacity	Contact Life	
20VA	0.2A/100VAC	3,000,000 times
	0.1A/200VAC	
35VA	0.35A/100VAC	1,000,000 times
	0.17A/200VAC	
80VA	0.8A/100VAC	200,000 times
	0.4A/200VAC	

The product life of relay contacts becomes considerably shorter than the above conditions when the rush overcurrent is shut down.

Some types of inductive loads generate rush current 5 to 15 times

the stationary current at activation. Make sure that the rush current does not exceed the current corresponding to the maximum specified resistance load.

**LAMP LOAD**

Lamp loads generally generate rush current 10 to 15 times the stationary current. Make sure that the rush current does not exceed the current corresponding to the maximum specified resistance load.

**CAPACITIVE LOAD**

Capacitive loads can generate rush current 20 to 40 times the stationary current. Make sure that the rush current does not exceed the current corresponding to the maximum specified resistance load. Capacitive loads such as capacitors may be present in electronic circuit loads including inverters.

**8. TROUBLESHOOTING**

**■ TROUBLESHOOTING WITH LEDs**

When trouble occurs, check the LEDs on the PLC to identify the problem with the PLC.

State of LED	State of PLC	Remedies
On	Power of the specified voltage is being correctly supplied to the power supply terminal.	The power supply is normal.
Flashing	One of the following problems may have occurred. <ul style="list-style-type: none"> <li>• Power of the specified voltage and current is not being supplied to the power supply terminal.</li> <li>• External wiring is incorrect.</li> <li>• Internal error of PLC</li> </ul>	Check the supply voltage. <ul style="list-style-type: none"> <li>• After disconnecting the cables other than the power cable, re-apply power to the PLC, and check for changes in the state. If the problem persists, consult your local Mitsubishi Electric representative.</li> </ul>
Off	One of the following problems may have occurred. <ul style="list-style-type: none"> <li>• The power supply is off.</li> <li>• External wiring is incorrect.</li> <li>• Power of the specified voltage is not being supplied to the power supply terminal.</li> <li>• The power cable is broken.</li> </ul>	<ul style="list-style-type: none"> <li>• If the power is not off, check the power supply and the power supply route. If power is being supplied correctly, consult your local Mitsubishi Electric representative.</li> <li>• After disconnecting the cables other than the power cable, re-apply power to the PLC, and check for changes in the state. If the problem persists, consult your local Mitsubishi Electric representative.</li> </ul>

**■ ALM LED [ON/OFF]**

This LED is valid when the optional battery is installed and the battery mode is selected using a parameter.

State of LED	State of PLC	Remedies
On	The battery voltage is low.	Immediately replace the battery.
Off	The battery voltage is higher than the value set with D8006.	Normal

**■ ERR LED [ON/FLASHING/OFF]**

State of LED	State of PLC	Remedies
On	A watchdog timer error may have occurred, or the hardware of the PLC may be damaged.	<ol style="list-style-type: none"> <li>1. Stop the PLC, and re-apply power. If ERR LED goes off, a watchdog timer error may have occurred. Take any of the following measures.                             <ul style="list-style-type: none"> <li>• Review the program. The maximum value (D8012) of the scan time should not exceed</li> <li>• the setting (D8000) of the watchdog timer.</li> <li>• Check that the input used for input interruption or pulse catch is not being abnormally turned on and off in one scan.</li> <li>• Check that the frequency of the pulse (duty of 50%) input to the high-speed counter does not exceed the specified range.</li> <li>• Add the WDT instructions. Add some WDT instructions to the program, and reset the watchdog timer several times in one scan.</li> <li>• Change the setting of the watchdog timer. Change the watchdog timer setting (D8000) in the program so that the setting is larger than the maximum value of the scan time (D8012).</li> </ul> </li> <li>2. Remove the PLC and supply power to it from another power supply on a desk. If the ERR LED goes off, noise may have affected the PLC. Take the following measures.                             <ul style="list-style-type: none"> <li>• Check the ground wiring, and reexamine the wiring route and installation location.</li> <li>• Fit a noise filter onto the power supply line.</li> </ul> </li> <li>3. If the ERR LED does not go off even after the measures stated in (1) and (2) are taken, consult your local Mitsubishi Electric representative.</li> </ol>
Flashing	One of the following errors has occurred in the PLC. <ul style="list-style-type: none"> <li>• Parameter error</li> <li>• Syntax error</li> <li>• Ladder error</li> </ul>	Perform PLC diagnosis and program check with the programming tool.
Off	No errors that stop the PLC have occurred.	If the operations of the PLC are abnormal, perform PLC diagnosis and program check with the programming tool. An I/O error, Comms error or Runtime error may have occurred.

**■ OUTPUT DOES NOT OPERATE**

**1. Output does not turn on.**

Stop the PLC, and forcibly turn the inoperable output on then off with a peripheral device or the display module to check its operation. Check for troubles with external wiring.

- When the output operates  
The output may be turned off unintentionally in the program. Reexamine the program. (Duplicate coil or RST instructions)

- When the output does not operate  
Check the configuration of the connected devices and the connection of the extension cables. If the configuration of the external wiring and connected devices and the connection of the extension cables are acceptable, the output circuit may be damaged. Consult your local Mitsubishi Electric representative.

**2. Output does not turn off.**

Stop the PLC, and check that the output turns off. Check for trouble with external wiring.

- When the output turns off  
The output may be turned on unintentionally in the program. Check that there are no duplicate coils in the program.
- When the output does not turn off  
The output circuit may be damaged. Consult your local Mitsubishi Electric representative.

■ 24VDC INPUT DOES NOT OPERATE

1. Input does not turn on.

Disconnect the external wiring and connect the S/S terminal and the 0V terminal or the 24V terminal. Short-circuit the 0V terminal or 24V terminal not connected to the S/S terminal and the input terminal, then check the input display LED or a peripheral device to confirm that the input turns on.

	Measures
When input turns on	Check that the input device does not have a built-in diode or parallel resistance. .
When input does not turn on	Measure the voltage between the 0V terminal or 24V terminal not connected to the S/S terminal and the input terminal with a tester to confirm that the voltage is 24VDC. • Check the configuration of the external wiring and connected devices and the connection of the extension cables.

2. Input does not turn off.

Check for leakage current from input devices.  
If the leakage current is larger than 1.5mA, it is necessary to connect a bleeder resistance.

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