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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. And, 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
Phillips is a registered trademark of Phillips Screw Company. The company name and the product name to be described in this manual are the registered trademarks or trademarks of each company.

Effective September 2014
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.

**FX3S-** M R /ES

<table>
<thead>
<tr>
<th>Model</th>
<th>Total No. Points</th>
<th>Input Points</th>
<th>Output Points</th>
<th>Input Type</th>
<th>Output Type</th>
<th>Connection</th>
</tr>
</thead>
<tbody>
<tr>
<td>FX3S-10MR/ES</td>
<td>10</td>
<td>6</td>
<td>4</td>
<td>24 VDC (sink/source)</td>
<td>Relay</td>
<td>Terminal Block</td>
</tr>
<tr>
<td>FX3S-14MR/ES</td>
<td>14</td>
<td>8</td>
<td>6</td>
<td>24 VDC (sink/source)</td>
<td>Relay</td>
<td>Terminal Block</td>
</tr>
<tr>
<td>FX3S-20MR/ES</td>
<td>20</td>
<td>12</td>
<td>8</td>
<td>Relay</td>
<td>Terminal Block</td>
<td></td>
</tr>
<tr>
<td>FX3S-30MR/ES</td>
<td>30</td>
<td>16</td>
<td>14</td>
<td>Relay</td>
<td>Terminal Block</td>
<td></td>
</tr>
</tbody>
</table>

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
- Before modifying or disrupting the program in operation or running the PLC, carefully read through this manual and the associated manuals and ensure the safety of the operation. An operation error may damage the machinery or cause accidents.

**CAUTION: STARTUP AND MAINTENANCE PRECAUTIONS**
- Do not disassemble or modify the PLC. Doing so may cause fire, equipment failures, or malfunctions.
- Turn off the power to the PLC before connecting or disconnecting any connection cable.

**CAUTION: DISPOSAL PRECAUTIONS**
Please contact a certified electronic waste disposal company for the environmentally safe recycling and disposal of your device.

**CAUTION: TRANSPORT AND STORAGE PRECAUTIONS**
- The PLC is a precision instrument. During transportation, avoid impacts larger than those specified in this manual by using dedicated packaging boxes and shock-absorbing palettes. Failure to do so may cause failures in the PLC. After transportation, verify operation of the PLC and check for damage of the mounting part, etc.

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

<table>
<thead>
<tr>
<th>Model</th>
<th>Item</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>FX3S-10MR/ES</td>
<td>Product</td>
<td>1 unit</td>
</tr>
<tr>
<td>FX3S-14MR/ES</td>
<td>Dust proof protection sheet</td>
<td>1 sheet</td>
</tr>
</tbody>
</table>
1.4 FRONT PANEL

**FACTORY DEFAULT CONFIGURATION (STANDARD)**

1. Top cover  Mount the expansion board under this cover.
2. Terminal names  The signal names for power supply, input and output terminals are shown.
3. Terminal block covers  The covers can be opened for wiring. Keep the covers closed while the PLC is running (the unit power is on).
4. Input display LEDs (red)  When an input terminal (X000 or more) is turned on, the corresponding LED lights.
5. Peripheral device connecting connector cover  The peripheral device connector, variable analog potentiometers, analog inputs and RUN/STOP switch are located under this cover.
6. 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.

<table>
<thead>
<tr>
<th>LED Name</th>
<th>Display Color</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>POW</td>
<td>Green</td>
<td>ON while power is on the PLC.</td>
</tr>
<tr>
<td>RUN</td>
<td>Green</td>
<td>ON while the PLC is running.</td>
</tr>
<tr>
<td>ERR</td>
<td>Red</td>
<td>Flashing when a program error occurs.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Lights when a CPU error occurs.</td>
</tr>
</tbody>
</table>

7. Output display LEDs (red)  When an output terminal (Y000 or more) is turned on, the corresponding LED lights.
8. The year and month of production  The year and month of production of the main unit is indicated.
9. Model name (abbreviation)  The model name of the main unit is indicated.
10. DIN rail mounting hooks  The main unit can be installed on DIN46277 rail (35 mm (1.38") wide).

**WHEN THE TOP COVERS ARE OPEN**

1. Optional equipment connector  These holes are designed to secure the expansion board with screws.
2. 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).
3. Variable analog potentiometers  Two variable analog potentiometers are built in. Upper side: VR1, Lower side: VR2
4. Peripheral device connecting connector (USB)  Connect a programming tool (PC) to program a sequence.
5. Peripheral device connecting connector (RS-422)  Connect a programming tool to program a sequence.
6. Optional equipment connecting screw holes (2 places)  These holes are designed to secure the expansion board with screws.

**WHEN THE TERMINAL BLOCK COVERS ARE OPEN**

1. Power supply terminals  Connect the power supply to the main unit.
2. Input (X) terminals  Wire switches and sensors to the terminals.
3. Output (Y) terminals  Wire loads (contactors, solenoid valves, etc.) to be driven to the terminals.
4. 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.
[5] Service power supply terminals (only AC power type) Wire sensors or other external equipment to these terminals when the service power supply (24 VDC) is used for such equipment.

2. DIMENSIONS

<table>
<thead>
<tr>
<th>Model Number</th>
<th>W: mm (inches)</th>
<th>W1: mm (inches)</th>
<th>Weight: kg (lbs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>FX3S-10MR/ES</td>
<td>60 (2.37&quot;)</td>
<td>52 (2.05&quot;)</td>
<td>0.30 (0.66 lbs)</td>
</tr>
<tr>
<td>FX3S-14MR/ES</td>
<td>60 (2.37&quot;)</td>
<td>52 (2.05&quot;)</td>
<td>0.30 (0.66 lbs)</td>
</tr>
<tr>
<td>FX3S-20MR/ES</td>
<td>75 (2.96&quot;)</td>
<td>67 (2.64&quot;)</td>
<td>0.40 (0.88 lbs)</td>
</tr>
<tr>
<td>FX3S-30MR/ES</td>
<td>100 (3.94&quot;)</td>
<td>92 (3.63&quot;)</td>
<td>0.45 (0.99 lbs)</td>
</tr>
</tbody>
</table>

INSTALLATION: 35-mm-wide DIN rail or Direct (screw) mounting (M4x2)

3. INSTALLATION

CAUTION: INSTALLATION PRECAUTIONS
- Use the product within the generic environment specifications described in this manual. Never use the product in areas with excessive dust, oily smoke, conductive dusts, corrosive gas (salt air, C12, H2S, SO2 or NO2), flammable gas, vibration or impacts, or expose it 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. Doing so may cause device 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 do 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 peripheral device cables securely to their designated connectors.
- Loose connections may cause malfunctions.

NOTES
- When a dust proof sheet is supplied with units, keep the sheet applied to the ventilation slits during installation and wiring work.
- 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 this manual.
- Keep a space of 50 mm (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
- Make sure to cut off all phases of the power supply externally before attempting installation or wiring work. Failure to do so may cause electric shock or damage to the product.

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 FX3S series, FX3G series, FX3U series manufactured

From November 1st, 2008
FX3G-232-BD
FX3U-485-BD
FX3G-422-BD

From March 1st, 2013
FX3S- _ _ MR/ES
Where _ _ indicates 10, 14, 20, 30

From September 1st, 2013
FX3G-485-BD-RJ
Standard | REMARK
---|---
EN61131-2: 2007 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

## REQUIREMENT FOR COMPLIANCE WITH LVD 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 Low Voltage (2006/95/EC) when used as directed by the appropriate documentation.

Type: Programmable Controller (Open Type Equipment)
Models: MELSEC FX3S series manufactured

From March 1st, 2013
FX3S-_ _MR/ES
Where _ _ indicates: 10, 14, 20, 30

## CAUTION FOR COMPLIANCE WITH EC DIRECTIVE
Installation in Enclosure: Programmable logic controllers are open-type devices that must be installed and used within conductive control boxes. Please use the FX3S Series programmable logic controllers while installed in conductive shielded control boxes. Please secure the control box lid to the control box (for conduction). Installation within a control box greatly affects the safety of the system and aids in shielding noise from the programmable logic controller.

---

### Item | Specification
---|---
Ambient Temperature | 0 to 55°C (32 to 131°F) when operating and -25 to 75°C (-13 to 167°F) when stored
Ambient Humidity | 5 to 95%RH (no condensation) when operating
Vibration Resistance | When installed on DIN rail: Frequency (Hz): 10 to 57; Acceleration (m/s²): 4.9; Half amplitude (mm): 0.035
| When installed directly: Frequency (Hz): 10 to 57; Acceleration (m/s²): 9.8; Half amplitude (mm): 0.075
Shock Resistance | 147m/s² acceleration, Action time: 11ms, 3 times by half-sine pulse in each direction X, Y, Z
Noise Resistance | By noise simulator at noise voltage of 1,000Vp-p, noise width of 1μs, rise time of 1ns and period of 30 to 100Hz
Dielectric Withstand Voltage | 1.5kVAC for one minute
Insulation Resistance | Between power supply terminal (AC power) and ground terminal: 500VAC for one minute
Grounding | Class D grounding (grounding resistance: 100Ω or less) <Common grounding with a heavy electrical system is not allowed.>
Working Atmosphere | Free from corrosive or flammable gas and excessive conductive dusts
Working Altitude | ≤2000m

---

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.

**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. B) onto the DIN rail.

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

### PROCEDURES FOR MOUNTING WITH M4 SCREWS
The product can be installed directly on the panel (with 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).

### 3.3 TERMINAL BLOCK LAYOUT

#### EXPLANATION OF TERMINAL BLOCK LAYOUT
- **Power supply terminals**
- **Input terminals**
- **Output terminals**
- **24 V DC service power supply**
- **Common terminal (4 points/common terminal)**
- **Partition**
- **[•] Vacant terminal (Do not use.)**

**Indication of power supply terminals**
The AC power supply type has [L] and [N] 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. [•] represents vacant terminals. Do not connect with vacant terminals. For external wiring, make sure to read the power supply wiring described later.

**Indication of input terminal**
For external wiring, make sure to read the input wiring described later.

**Indication of output terminals connected to common terminal**
One common terminal covers 1 or 4 output points. The output numbers (Y) connected to a common terminal are enclosed with heavy partition lines.
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.
  - If an overload of the 24 V DC service power supply occurs, the voltage automatically drops, inputs in the PLC are disabled, and all outputs are turned off. 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 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.

CAUTION: DESIGN PRECAUTIONS

- 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 100 mm (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 peripheral device connectors. Failure to do so may result in wire damage/breakage or PLC failure.
- Make sure to properly wire to the main unit in accordance with the rated voltage, current, and frequency of each terminal.
- The disposal size of the cable end should follow the dimensions described in the manual.
- Tightening torque should follow the specifications in the manual.
- Tighten the screws using a Phillips-head screwdriver No.2 (shaft diameter 6mm (0.24”) or less). Make sure that the screwdriver does not touch the partition part of the terminal block.

NOTES:
- Input/output wiring 50 to 100 m (164’1” to 328’1”) long will cause almost no problems of noise, but, generally, the wiring length should be less than 20 m (65’7”) to ensure the safety.

4.1 WIRING

CABLE END TREATMENT AND TIGHTENING TORQUE

- For the terminals of FX3S 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 outside the above-mentioned range. Failure to do so may cause equipment failures or malfunctions.

WHEN ONE WIRE IS CONNECTED TO ONE TERMINAL

<table>
<thead>
<tr>
<th>Terminal Manufacturer</th>
<th>Type No.</th>
<th>Certification</th>
<th>Pressure Bonding Tool</th>
</tr>
</thead>
<tbody>
<tr>
<td>JAPAN SOLDERLESS TERMINAL MFG CO LTD (JST)</td>
<td>FV125-B3A</td>
<td>UL Listed</td>
<td>YA-1(JST)</td>
</tr>
<tr>
<td></td>
<td>FV2-MS3</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

WHEN TWO WIRES ARE CONNECTED TO ONE TERMINAL

<table>
<thead>
<tr>
<th>Terminal Manufacturer</th>
<th>Type No.</th>
<th>Certification</th>
<th>Pressure Bonding Tool</th>
</tr>
</thead>
<tbody>
<tr>
<td>JAPAN SOLDERLESS TERMINAL MFG CO LTD (JST)</td>
<td>FV125-B3A</td>
<td>UL Listed</td>
<td>YA-1(JST)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
4.2 GROUNDING

Ground the PLC as stated below.

- Perform class D grounding. (Grounding resistance: 100Ω 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 mm²).
- 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

<table>
<thead>
<tr>
<th>Item</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply Voltage</td>
<td>100 to 240VAC</td>
</tr>
<tr>
<td>Allowable Supply Voltage Range</td>
<td>85 to 264VAC</td>
</tr>
<tr>
<td>Rated Frequency</td>
<td>50/60Hz</td>
</tr>
<tr>
<td>Allowable Instantaneous Power</td>
<td>Operation can be started upon occurrence of instantaneous power failure for 10 ms or less.</td>
</tr>
<tr>
<td>Failure Time</td>
<td></td>
</tr>
<tr>
<td>Power Fuse</td>
<td>250V 1A</td>
</tr>
<tr>
<td>Rush Current</td>
<td>15 A max. 5 ms or less/100 VAC</td>
</tr>
<tr>
<td></td>
<td>28 A max. 5 ms or less/200 VAC</td>
</tr>
<tr>
<td>Power Consumption *1</td>
<td>FX3S-10MR/ES 19W</td>
</tr>
<tr>
<td></td>
<td>FX3S-14MR/ES 19W</td>
</tr>
<tr>
<td></td>
<td>FX3S-20MR/ES 20W</td>
</tr>
<tr>
<td></td>
<td>FX3S-30MR/ES 21W</td>
</tr>
<tr>
<td>24VDC Service Power Supply</td>
<td>Main Unit 400mA</td>
</tr>
<tr>
<td>Output Impedance</td>
<td>FX3S-10MR/ES 3.3kΩ</td>
</tr>
<tr>
<td></td>
<td>FX3S-20MR/ES 4.3kΩ</td>
</tr>
<tr>
<td>Input Impedance</td>
<td>X000 to X007 7mA/24VDC</td>
</tr>
<tr>
<td>Input Signal Voltage</td>
<td>X010 or X017 5mA/24VDC</td>
</tr>
<tr>
<td>Input Current</td>
<td>X000 to X007 4.5mA or more</td>
</tr>
<tr>
<td></td>
<td>X010 or X017 3.5mA or more</td>
</tr>
<tr>
<td>OFF Input Sensitivity Current</td>
<td>1.5mA or less</td>
</tr>
</tbody>
</table>

*1 This item shows values when all 24 VDC service power supplies are used in the maximum configuration connectable to the main unit, and includes the input current (5 or 7 mA per point).

■ EXAMPLE OF EXTERNAL WIRING (AC POWER TYPE)

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

4.4 INPUT SPECIFICATIONS AND WIRING DIAGRAM

■ 24VDC INPUT (SINK/SOURCE)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Input Points</td>
<td>6 points</td>
<td>8 points</td>
<td>12 points</td>
<td>16 points</td>
</tr>
<tr>
<td>Input Connecting Type</td>
<td>Fixed terminal block (M3 screw)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Input Form</td>
<td>Sink/source</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Input Signal Voltage</td>
<td>AC power supply type: 24V DC ±10%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Input Impedance</td>
<td>X000 to X007 3.3kΩ</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>X010 or X017 4.3kΩ</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Input Signal Voltage</td>
<td>X000 to X007 7mA/24VDC</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>X010 or X017 5mA/24VDC</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>On Input Sensitivity Current</td>
<td>X000 to X007 4.5mA or more</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>X010 or X017 3.5mA or more</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OFF Input Sensitivity Current</td>
<td>1.5mA or less</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Input Response Time</td>
<td>Approx. 10ms</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Input Signal Form</td>
<td>Sink Input</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>No-voltage contact input</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>NPN open collector transistor</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Source Input</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>No-voltage contact input</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>PNP open collector transistor</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Input Circuit Insulation</td>
<td>Photocoupler insulation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Input Operation Display</td>
<td>LED on panel lights when photocoupler is driven</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

INPUT CIRCUIT CONFIGURATION

AC Power Type.

Sink input wiring

![Sink input wiring diagram]

Source input wiring

![Source input wiring diagram]

1. Input impedance.
2. 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 7 mA/24 V DC. (5 mA/24 VDC in X010 or later). Use input devices applicable to this minute current. If no-voltage contacts (switches) for large current are used, contact failure may occur.

<table>
<thead>
<tr>
<th>Input Number</th>
<th>Input Current</th>
</tr>
</thead>
<tbody>
<tr>
<td>X000 to X007</td>
<td>7 mA/24 VDC</td>
</tr>
<tr>
<td>X010 to X017</td>
<td>5 mA/24 VDC</td>
</tr>
</tbody>
</table>

In the case of input device with built-in series diode:
The voltage drop of the series diode should be approx. 4 V 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.

In the case of input device with built-in parallel resistance:
Use a device having a parallel resistance, Rp, of 15 kΩ or more. If the resistance is less than 15 kΩ, connect a bleeder resistance, Rb (kΩ), obtained by the following formula as shown in the following figure.

\[ R_b (k\Omega) \leq \frac{4R_p}{15-R_p} \]

In the case of 2-wire proximity switch:
Use a two-wire proximity switch whose leakage current, I_r, is 1.5 mA or less when the switch is off. When the current is larger than 1.5 mA, connect a bleeder resistance, Rb (kΩ), determined by the following formula:

\[ R_b (k\Omega) \leq \frac{6}{I_r-1.5} \]

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 menu in GX Works2.

<table>
<thead>
<tr>
<th>Input Number</th>
<th>Contact on Sequence Program</th>
<th>ON Duration of Input Signal</th>
</tr>
</thead>
<tbody>
<tr>
<td>X000</td>
<td>M8170</td>
<td>10µs or more</td>
</tr>
<tr>
<td>X001</td>
<td>M8171</td>
<td></td>
</tr>
<tr>
<td>X002</td>
<td>M8172</td>
<td></td>
</tr>
<tr>
<td>X003</td>
<td>M8173</td>
<td>50µs or more</td>
</tr>
<tr>
<td>X004</td>
<td>M8174</td>
<td></td>
</tr>
<tr>
<td>X005</td>
<td>M8175</td>
<td></td>
</tr>
</tbody>
</table>

CAUTIONS FOR PULSE CATCH

Non-overlap of input numbers: The input terminals X000 to X005 can be used for high-speed counter, input interruption, pulse catch, SPD instruction, ZRN instruction, DSZR instruction and general-purpose inputs. Take care not to overlap the input numbers.

Cautions 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.
4.6 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 menu 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.

NPN open collector transistor output rotary encoder

1. The grounding resistance should be 100Ω or less.

2. 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.

4.7 OUTPUT SPECIFICATIONS AND WIRING

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Output Points</td>
<td>4 points</td>
<td>6 points</td>
<td>8 points</td>
<td>14 points</td>
</tr>
<tr>
<td>Connecting Type</td>
<td>Fixed terminal block (M3 screw)</td>
<td>Fixed terminal block (M3 screw)</td>
<td>Fixed terminal block (M3 screw)</td>
<td>Fixed terminal block (M3 screw)</td>
</tr>
<tr>
<td>Output Type</td>
<td>Relay</td>
<td>Relay</td>
<td>Relay</td>
<td>Relay</td>
</tr>
<tr>
<td>External Power Supply</td>
<td>30 VDC or less, 240 VAC or less (250 VAC or less when the unit does not comply with CE, UL or cUL standards.)</td>
<td>30 VDC or less, 240 VAC or less (250 VAC or less when the unit does not comply with CE, UL or cUL standards.)</td>
<td>30 VDC or less, 240 VAC or less (250 VAC or less when the unit does not comply with CE, UL or cUL standards.)</td>
<td>30 VDC or less, 240 VAC or less (250 VAC or less when the unit does not comply with CE, UL or cUL standards.)</td>
</tr>
<tr>
<td>Maximum Load</td>
<td>2 A/point The total load current of resistance loads per common terminal should be the following value. • 1 output point/common terminal: 2 A or less • 4 output points/common terminal: 8 A or less</td>
<td>2 A/point The total load current of resistance loads per common terminal should be the following value. • 1 output point/common terminal: 2 A or less • 4 output points/common terminal: 8 A or less</td>
<td>2 A/point The total load current of resistance loads per common terminal should be the following value. • 1 output point/common terminal: 2 A or less • 4 output points/common terminal: 8 A or less</td>
<td>2 A/point The total load current of resistance loads per common terminal should be the following value. • 1 output point/common terminal: 2 A or less • 4 output points/common terminal: 8 A or less</td>
</tr>
<tr>
<td>Inductive Load</td>
<td>80 VA (UL and cUL standards approved at 120 and 240 VAC)</td>
<td>80 VA (UL and cUL standards approved at 120 and 240 VAC)</td>
<td>80 VA (UL and cUL standards approved at 120 and 240 VAC)</td>
<td>80 VA (UL and cUL standards approved at 120 and 240 VAC)</td>
</tr>
<tr>
<td>Min. Load</td>
<td>5VDC, 2mA (reference value)</td>
<td>5VDC, 2mA (reference value)</td>
<td>5VDC, 2mA (reference value)</td>
<td>5VDC, 2mA (reference value)</td>
</tr>
<tr>
<td>Open Circuit Leakage Current</td>
<td>.</td>
<td>.</td>
<td>.</td>
<td>.</td>
</tr>
<tr>
<td>Response Time</td>
<td>OFF – ON: Approx. 10ms</td>
<td>OFF – ON: Approx. 10ms</td>
<td>OFF – ON: Approx. 10ms</td>
<td>OFF – ON: Approx. 10ms</td>
</tr>
<tr>
<td>Input Circuit Insulation</td>
<td>Mechanical insulation</td>
<td>Mechanical insulation</td>
<td>Mechanical insulation</td>
<td>Mechanical insulation</td>
</tr>
<tr>
<td>Input Operation Display</td>
<td>LED on panel lights when power is applied to relay coil</td>
<td>LED on panel lights when power is applied to relay coil</td>
<td>LED on panel lights when power is applied to relay coil</td>
<td>LED on panel lights when power is applied to relay coil</td>
</tr>
</tbody>
</table>
OUTPUT CIRCUIT CONFIGURATION

<table>
<thead>
<tr>
<th>Load Circuit Configuration</th>
</tr>
</thead>
<tbody>
<tr>
<td>DC power supply</td>
</tr>
<tr>
<td>Y</td>
</tr>
<tr>
<td>COM</td>
</tr>
<tr>
<td>Fuse</td>
</tr>
<tr>
<td>AC power supply</td>
</tr>
<tr>
<td>Y</td>
</tr>
<tr>
<td>COM</td>
</tr>
<tr>
<td>Fuse</td>
</tr>
</tbody>
</table>

A common number applies to the [COM].

LIFE OF RELAY CONTACT

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 20 VA.

The following table shows the approximate life of a relay based on the results of an operation life test.

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

<table>
<thead>
<tr>
<th>Load Capacity</th>
<th>Contact Life</th>
</tr>
</thead>
<tbody>
<tr>
<td>20VA</td>
<td>0.2A/100VAC 3 million times</td>
</tr>
<tr>
<td></td>
<td>0.1A/200VAC 3 million times</td>
</tr>
<tr>
<td>35VA</td>
<td>0.35A/100VAC 1 million times</td>
</tr>
<tr>
<td></td>
<td>0.17A/200VAC 1 million times</td>
</tr>
<tr>
<td>80VA</td>
<td>0.8A/100VAC 2 hundred thousand times</td>
</tr>
<tr>
<td></td>
<td>0.4A/200VAC 2 hundred thousand times</td>
</tr>
</tbody>
</table>

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.

CAUTIONS IN EXTERNAL WIRING

Protection circuit for load short-circuiting
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.

Contact protection circuit for inductive loads
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.

DC CIRCUIT

Connect a diode in parallel with the load. The diode (for commutation) must comply with the following specifications:

<table>
<thead>
<tr>
<th>Item</th>
<th>Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reverse voltage</td>
<td>5 to 10 times the load voltage</td>
</tr>
<tr>
<td>Forward current</td>
<td>Load current or more</td>
</tr>
</tbody>
</table>

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 a surge absorber that is suitable for the load being used. Refer to the table below for other specifications.

<table>
<thead>
<tr>
<th>Item</th>
<th>Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electrostatic capacity</td>
<td>Approx. 0.1μF</td>
</tr>
<tr>
<td>Resistance value</td>
<td>Approx. 100 to 200Ω</td>
</tr>
</tbody>
</table>

INTERLOCK

For loads such as forward/reverse contactors, etc., where a hazardous condition could result if switched ON simultaneously, an external interlock should be provided for interlocking the PLC’s internal programs.

IN-PHASE

PLC output contacts (*) should be used in an “in-phase” manner.

5. PROGRAMMING USING GX WORKS2

The software package GX Works2 is a programming tool designed to be used with FX3S 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

- RS-232C/RS-422 cable
- Connection cabling
- Connection cabling for extension devices

Expansion board

FX3G-232-BD

USB
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.

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”.

3. 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

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 screen is displayed. Select “Locate and install driver software (recommended)”.


4. 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

[Image of Update Driver Software - Unknown Device]

1. Connect the personal computer and the programmable controller CPU with a USB cable, and then turn on the programmable controller CPU.
2. From Windows Control Panel, select [System and Security] [Device Manager]. Right-click “Unknown device” and click “Update Driver Software”.
3. The Update Driver Software screen is displayed. Select “Browse my computer for driver software” and specify “EasysocketUSBdrivers” 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

[Image of Update Driver Software - Unknown Device]

1. Connect the personal computer and the programmable controller CPU with a USB cable, and then turn on the programmable controller CPU.
2. From Windows Control Panel, select [System and Security] [Device Manager]. Right-click “Unknown device” and click “Update Driver Software”.
3. The Update Driver Software screen is displayed. Select “Browse my computer for driver software” and specify “EasysocketUSBdrivers” 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-GWX2-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.

1. Insert the CD-ROM (Disc 1) to the CD-ROM drive. Double click the “setup.exe” file on the CD-ROM (Disc 1).
2. 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

<table>
<thead>
<tr>
<th>Item</th>
<th>Contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personal Computer</td>
<td>Windows® supported personal computer</td>
</tr>
<tr>
<td>CPU</td>
<td>Intel® Core™2 Duo Processor 2GHz or more recommended</td>
</tr>
<tr>
<td>Required Memory</td>
<td>1GB or more recommended</td>
</tr>
<tr>
<td>Available Hard Disk Capacity</td>
<td>When installing GX Works2: HDD available capacity is 2.5GB or more. When operating GX Works2: Virtual memory available capacity is 512MB or more.</td>
</tr>
<tr>
<td>Disk Drive</td>
<td>CD-ROM supported disk drive</td>
</tr>
<tr>
<td>Monitor</td>
<td>Resolution 1024 x 768 pixels or higher</td>
</tr>
</tbody>
</table>

OS (English Version)

- Microsoft® Windows® 8.1 Operating System
- Microsoft® Windows® 8.1 Pro Operating System
- Microsoft® Windows® 8 Enterprise Operating System
- Microsoft® Windows® 8 Operating System
- Microsoft® Windows® 8 Pro Operating System
- Microsoft® Windows® 8 Enterprise Operating System
- Microsoft® Windows® 8 Ultimate Operating System
- Microsoft® Windows® 7 Home Basic Operating System
- Microsoft® Windows® 7 Home Premium Operating System
- Microsoft® Windows® 7 Professional Operating System
- Microsoft® Windows® 7 Ultimate 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

1. 64-bit version is not supported.
2. 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.

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

**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.

1. For Windows Vista®, select [Start] → [Control Panel] → [Ease of Access] → [Ease of Access Center].
2. For Windows® 7, select [Start] → [Control Panel] → [Ease of Access Center].
3. 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”.
3. 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
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 1 min (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.

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
FX3S 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.

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.
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 X005 in FX3S-10M/ES, X006 to X007 in FX3S-14M/ES, and X008 to X013 in FX3S-20M/ES.

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.

3. Starting and stopping by remote control from programming tool
The programming tool 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 tool, see below.

■ USE OF SEVERAL RUNNING/STOPPING METHODS

When the built-in RUN/STOP switch and the general-purpose RUN terminal are used (without remote running/stop operation from the programming tool), the RUN/STOP status of the PLC is determined by the conditions shown in the following table.

<table>
<thead>
<tr>
<th>Condition of Built-in RUN/STOP Switch</th>
<th>Condition of General-Purpose Input Terminal Specified as RUN Terminal by Parameter</th>
<th>Status of PLC</th>
</tr>
</thead>
<tbody>
<tr>
<td>RUN</td>
<td>OFF</td>
<td>RUN</td>
</tr>
<tr>
<td>STOP</td>
<td>OFF</td>
<td>STOP</td>
</tr>
</tbody>
</table>

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.)

When the remote running/stop 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 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

<table>
<thead>
<tr>
<th>Item</th>
<th>In Running Status</th>
<th>In Stopped Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forcible ON/OFF *1</td>
<td>Devices in program: O *1</td>
<td>X *1</td>
</tr>
<tr>
<td>Change of current values of timers, counters, data registers, and file registers *3</td>
<td>Devices in program: O *2</td>
<td>X</td>
</tr>
<tr>
<td>Change of settings of timers and counters *4</td>
<td>When the program memory is the built-in EEPROM: X</td>
<td>X</td>
</tr>
</tbody>
</table>

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).
   - 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 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.)

2. 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.

3. The current values of the file registers stored in the program memory cannot be monitored or tested on the display module.

4. 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.

<table>
<thead>
<tr>
<th>Item</th>
<th>In Running Status</th>
<th>In Stopped Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Batch Writing of File Registers (D)</td>
<td>X</td>
<td>–</td>
</tr>
<tr>
<td>Writing of Program to PLC</td>
<td>–</td>
<td>X</td>
</tr>
<tr>
<td>Partial Modification of Program</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Modification of whole Program</td>
<td>X</td>
<td>–</td>
</tr>
<tr>
<td>(Batch Writing)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Writing of Parameters to PLC</td>
<td>–</td>
<td>X</td>
</tr>
<tr>
<td>Writing of Comments to PLC</td>
<td>–</td>
<td>X</td>
</tr>
</tbody>
</table>

### PERIODIC INSPECTION

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.

## MAINTENANCE

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

## TROUBLESHOOTING

### TROUBLESHOOTING WITH LEDS

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

<table>
<thead>
<tr>
<th>State of LED</th>
<th>State of PLC</th>
<th>Remedies</th>
</tr>
</thead>
<tbody>
<tr>
<td>On</td>
<td>Power of the specified voltage is being correctly supplied to the power supply terminal.</td>
<td>The power supply is normal.</td>
</tr>
</tbody>
</table>
| Flashing     | One of the following problems may have occurred.  
• Power of the specified voltage and current is not being supplied to the power supply terminal.  
• External wiring is incorrect.  
• Internal error of PLC | Check the supply voltage.  
• 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. |
| Off          | One of the following problems may have occurred.  
• The power supply is off.  
• External wiring is incorrect.  
• Power of the specified voltage is not being supplied to the power supply terminal.  
• The power cable is broken. | 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.  
• 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. |

### ERR LED [ON/FLASHING/OFF]

<table>
<thead>
<tr>
<th>State of LED</th>
<th>State of PLC</th>
<th>Remedies</th>
</tr>
</thead>
</table>
| On           | A watchdog timer error may have occurred, or the hardware of the PLC may be damaged. | 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.  
• Review the program. The maximum value (D8012) of the scan time should not exceed the setting (D8000) of the watchdog timer.  
• Check that the input used for input interruption or pulse catch is not being abnormally turned on and off in one scan.  
• Check that the frequency of the pulse (duty of 50%) input to the high-speed counter does not exceed the specified range.  
• Add the WDT instructions to the program, and reset the watchdog timer several times in one scan.  
• 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).  
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.  
• Check the ground wiring, and reexamine the wiring route and installation location.  
• Fit a noise filter onto the power supply line.  
3. If the ERR LED does not go off even after the measures stated in (1) and (2) are taken, contact Mitsubishi Electric at Amzsupport@meau.com. |
| Flashing     | One of the following errors has occurred in the PLC.  
• Parameter error  
• Syntax error  
• Ladder error | 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. |