FX3U SERIES PROGRAMMABLE CONTROLLERS

HARDWARE MANUAL

Manual Number JY997D18801
Revision C
Date November 2008

This manual describes the part names, dimensions, mounting, cabling and specifications for the product. This manual is extracted from FX3U Series User’s Manual - Hardware Edition. Refer to FX3U Series User’s Manual for more details. 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

The company name and the product name to be described in this manual are the registered trademarks or trademarks of each company. Effective Nov. 2008 Specifications are subject to change without notice. © 2005 Mitsubishi Electric Corporation

Safety Precaution (read these precautions before use.)

This manual classifies the safety precautions into two categories:

1. Safety Precaution, which describes things you should not do. (Caution)
2. Safety Precaution, which describes things you should do. (Danger)

Safety Precaution (read these precautions before use.)

This manual classifies the safety precautions into two categories:

1. Safety Precaution, which describes things you should not do. (Caution)
2. Safety Precaution, which describes things you should do. (Danger)

Disposal of the Equipment

- Please contact a certified electronic waste disposal company for the environmentally safe recycling and disposal of your device.

Transport and Maintenance Precautions

- Before transporting the PLC, turn on the power to the PLC to check that the BATT LED is off. If the PLC is transported with the BATT LED 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 2.1. Failure to do so may cause failures in the PLC.
- After transportation, verify the operations of the PLC.

Marine standard

Please consult with Mitsubishi Electric for the information on marine standard practices and the corresponding types of equipment.

2.

Certification of UL, cUL standards

FX3U main units and input/output extension units/boards supporting UL, cUL standards are as follows:

UL, cUL file number : E95239

Models : MELSEC FX3U series manufactured

FX3U-** MR/ESS(-A) FX3U-** MT/ESS

Where ** indicates: 16,32,48,64,80,128

For more details please contact the local Mitsubishi Electric sales site.

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 system should be checked by the user/manufacturer.
- For more details please contact the local Mitsubishi Electric sales site.

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 (89/336/EEC) when used as directed by the appropriate documentation.

Type : Programmable Controller (Open Type Equipment)

Models : MELSEC FX3U series manufactured

from May 1st, 2005

FX3U-** MR/ESS(-A)

Where ** indicates: 16,32,48,64,80

FX3U-** 4HSX-ADP

FX3U-** 485-BD

FX3U-** 485-ADP

FX3U-** 485-TC-ADP

FX3U-** 485-TC-ADP

from June 1st, 2005

FX3U-485-ADP

FX3U-485-TC-ADP

FX3U-485-ADP

FX3U-485-TC-ADP

FX3U-485-ADP

from November 1st, 2005

FX3U-** MT/ESS(-A)

Where ** indicates: 16,32,48,64,80

From February 1st, 2006 FX3U-128MR/ES(-A) FX3U-128MT/ES(-A)

FX3U-128MT/ES

FX3U-** MR/DS

FX3U-** MT/DS

Where ** indicates: 16,32,48,64,80

Standard

EN61131-2-2003

Programmable controllers

Equipment requirements and tests

Compliance with all relevant aspects of the standard.

- Radiated Emissions
- Mains Terminal Voltage Emissions
- RF immunity
- Fast Transients
- ESD
- Surge
- Voltage drops and interruptions
- Conducted
- Power magnetic fields

Models : MELSEC FX3N series manufactured

from July 1st, 1997 FX3N-** MR/ESS(-A) FX3N-** ET-ESS(-A)

Where ** indicates: 32,48

FX3N-** 485-ADP

FX3N-** 485-TC-ADP

FX3N-** 485-ADP

FX3N-** 485-TC-ADP

FX3N-** 485-ADP

from April 1st, 1998 FX3N-** 485-ADP

FX3N-** 485-TC-ADP

from August 1st, 1998 FX3N-** 485-ADP

FX3N-** 485-TC-ADP

For the products above, PLCs manufactured before March 31st, 2002 are compliant with EN50081-2 (EN61000-6-2) and EN60068-2 from April 1st, 2002 to April 30th, 2006 are compliant with EN50081-2 (EN61000-6-4) and EN61131-2-1994/A11:1996/A12:2000 after May 1st, 2006 are compliant with EN61131-2-2003

Standard

EN61000-6-4:2001

- Generic emission standard Industrial environment

EN61000-6-4:1995

- Electromagnetic compatibility

EN61000-6-4:2008

- Electromagnetic compatibility

EN61131-2:1995

- Generic immunity standard Industrial environment

EN61131-2:1998

- Generic immunity standard Industrial environment

EN61131-2:1999

- Generic immunity standard Industrial environment

Compliance with all relevant aspects of the standard.

- RF immunity
- Fast Transients
- ESD
- Conducted
- Power magnetic fields

From February 1st, 2006 FX3U-128MR/ES(-A) FX3U-128MT/ES(-A)

FX3U-128MT/ES

FX3U-** MR/DS

FX3U-** MT/DS

Where ** indicates: 16,32,48,64,80

Compliance with all relevant aspects of the standard.

- Radiated Emissions
- Mains Terminal Voltage Emissions
- RF immunity
- Fast Transients
- ESD
- Surge
- Voltage drops and interruptions
- Conducted
- Power magnetic fields
Requirement for Compliance with EC 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 (73/23/EEC) when used as directed by the appropriate documentation.

Type: Programmable Controller (Open Type Equipment) Models: MELSEC FX3U series manufactured from May 1st, 2005 FX3U-** MT/ESS(A) Where ** indicates:16,32,48,64,80 from November 1st, 2005 FX3U-** MT/ES from January 1st, 2006 FX3U-12MTR/ES(A) FX3U-12MTR/ESS Where ** indicates:16,32,48,64,80 from February 1st, 2006 FX3U-12MTR/ES(A) FX3U-12MTR/ESS FX3U-** MR/DS Where ** indicates:16,32,48,64,80

Caution for Analog Products in use

The analog special adapters have been found to be compliant to the European standards in the aforementioned manual and directive. However, for the very best performance from what are in fact delicate measuring and controlled output device Mitsubishi Electric would like to make the following points:

As analog devices are sensitive by nature, their use should be considered carefully. For users of proprietary cables (integral with sensors or actuators), these users should follow those manufacturers installation requirements.

Mitsubishi Electric recommends that shielded cables should be used. If no other EMC protection is provided, then users may experience temporary induced errors not exceeding +10%/-10% in very heavy industrial areas.

However, Mitsubishi Electric suggest that if adequate EMC precautions are followed with general good EMC practice for the users complete control system, users should expect normal errors as specified in this manual.

- Sensitive analog cable should not be laid in the same trunking or cable conduit as high voltage cabling. Where possible users should run analog cables separately.
- Good cable shielding should be used. When terminating the shield at Earth - ensure that no earth loops are accidentally created.
- When reading analog values, EMC induced errors can be smoothed out by averaging the readings. This can be achieved either through functions on the analog special adapter block or through a users program in the FX3U Series PLC main unit.

Associated manuals

FX3U Series PLC (main unit) comes with this document (hardware manual). For a detailed explanation of the FX3U Series hardware and information on instructions for PLC programming and special extension unit/block, refer to the relevant documents.

Caution for compliance with EC Directive

Installation in Enclosure

Programmable logic controllers are open-type devices that must be installed and used within conducive control boxes. Please use the FX3U Series programmable logic controllers while installed in conducive 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.

How to obtain manuals

For the necessary product manuals or documents, consult with the Mitsubishi Electric dealer from where you purchase your product.

Incorporated Items

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

- Product Manual
- Dust proof sheet (1 sheet)

1. Outline

1.1 Part names

1.2 External dimensions and weight

1.2 (a) Terminal cover open

With terminal cover open

Plan view

Explains FX 3U Series and FX 3UC Series PLC.

3U / FX3UC Series Programming procedures

- Basic and Applied Programming Manual


Programmable Controllers

- Equipment requirements and tests

Programmable Controllers

- Equipment requirements and tests

Standard

Remark

EN61131-2:2003 Programmable controllers - Equipment requirements and tests

The equipment has been assessed as a component for fitting in a suitable enclosure which meets the requirements of EN61131-2:2003


Standard

Remark

IEC1010-1:1990 - 1992 Safety requirements for electrical equipment for measurement, control, and laboratory use - General requirements


The equipment has been assessed as a component for fitting in a suitable enclosure which meets the requirements of EN61131-2: 1994+A1:1996+A12:2000. 2003

Manual name

Manual No.

Description


JY9970-16001 MODELE CODE: 09R516

Explains FX3U Series PLC specification details for I/O, wiring, installation, and maintenance.


JY9970-16601 MODELE CODE: 09R517

Describes PLC programming for basic/applied instructions STL/SFC programming and devices.


JY9970-16601 MODELE CODE: 09R517

Explains N-link, parallel link, computer link, no protocol communication by RS instructions/FX3N-220IF.

FXU / FXUC Series Programming Manual - Analog Control Edition

JY9970-16701 MODELE CODE: 09R619

Describes specifications for analog control and programming methods for FXU / FXUC Series PLC.


JY9970-16801 MODELE CODE: 09R620

Explains the specifications for positioning control of FXU / FXUC Series and positioning procedures
2. Installation (general specifications)


INSTALLATION PRECAUTIONS

- Use the product within the generic environment specifications described in section 2.1 of this manual.
- Never use the product in areas with excessive dust, oily smoke, conductive dusts, corrosive gas (salt air, C2H5, SO2 or NO2), 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 silts.
- 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.
- Unsupported 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. - Peripheral devices, display modules, expansion boards and special adapters - Extension units/blocks and the FX Series terminal block
- Battery and memory cassette

Notes

- When a dust proof sheet is supplied with an extension unit/block, keep the sheet applied to the ventilation silts 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 section 2.2.
- 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.

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.

2.1 Generic specifications [Main unit]

<table>
<thead>
<tr>
<th>Item</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ambient temperature</td>
<td>0 to 55°C (32 to 131°F) when operating and -25 to 75°C (-13 to 167°F) when stored</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Item</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ambient humidity</td>
<td>5 to 95%RH (no condensation) when operating</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Frequency (Hz)</th>
<th>Acceleration (ms²)</th>
<th>Half amplitude (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>When installed on DIN rail</td>
<td>10 to 57</td>
<td>0.035</td>
</tr>
<tr>
<td>When installed directly</td>
<td>57 to 150</td>
<td>4.9</td>
</tr>
</tbody>
</table>

2.3 Procedures for installing to and detaching from DIN rail

The main unit can be installed on a DIN46227 rail [35 mm (1.38") wide].

2.3.1 Installation

1) Connect the expansion boards and special adapters to the main unit.
2) Push out all DIN rail mounting hooks (below fig.A).
3) Fit the upper edge of the DIN rail mounting groove (right fig.C) onto the DIN rail.
4) Lock the DIN rail mounting hooks (below fig.D) while pressing the PLC against the DIN rail.

2.4 Procedures for installing directly (with M4 screws)

The product can be installed directly on the panel (with screws).

2.4.1 Mounting hole pitches

Refer to the External Dimensions (section 1.2) for the product's mounting hole pitch information.

As for the details of the mounting hole pitches for extension unit/block and special adapters, refer to the following manual.


2.4.2 Installation

1) Make mounting holes in the mounting surface referring to the external dimensions diagram.
2) Fit the main unit (A in the right 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.
3. Power supply/input/output specifications and examples of external wiring

As for the details of the power supply wiring and input/output wiring, refer to FX3U Series User’s Manual - Hardware Edition.

**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.
  1) 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).
  2) 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 occurs in the 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.
  3) 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.

**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 100mm (3.94") or more away from the main circuit or power line.
- Noise may cause malfunction.
- Even if the power supply causes an instantaneous power failure for less than 10 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).
- 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.

---

### WIRING PRECAUTIONS

**CAUTION**
- 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 or use class D grounding (grounding resistance of 100 or less).
- Whenever drilling screw holes or wiring, make sure cutting or wire damage does not enter the ventilation slits. Failure to do so may cause fire, equipment failures or malfunctions.

### 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") to ensure the safety.
- Extension cables are easily affected by noises. Lay the cables at a distance of at least 30 to 50 mm (1.19" to 1.97") away from the PLC output and other power lines.

#### 3.1 Wiring

**3.1.1 Cable end treatment and tightening torque**

For the terminals of FX3U 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 N·m to 0.8 N·m.

- When one wire is connected to one terminal
  - 6.2 mm (0.24") or less:
    - Ignored, this terminal block mounting screw [both right and left screws] is already closed. Place the terminal block in the specified position, and tighten the terminal block mounting screw [both right and left screws]. Tightening torque 0.4 to 0.5 N·m
  - 6.2 mm (0.24") or more:
    - 6.3 mm (0.25") or more:
      - Solderless terminal:
        - Terminal screw: 0.13")
        - Solderless terminal:
          - Terminal screw: 0.13")

- When two wires are connected to one terminal
  - 6.2 mm (0.24") or less:
    - 6.3 mm (0.25") or more:
      - Solderless terminal:
        - Terminal screw: 0.13")

**3.1.2 Removal and installation of quick-release terminal block**

**Removal**

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

**Installation**

Place the terminal block in the specified position, and tighten the terminal block mounting screw [both right and left screws].

Tightening torque 0.4 to 0.5 N·m

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

---

### 3.2 Power supply specifications and example of external wiring

#### 3.2.1 Power supply specifications

The specifications for the power supply of the main unit are shown in the following table.

<table>
<thead>
<tr>
<th>Item</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power supply type</td>
<td>DC power type*7</td>
</tr>
<tr>
<td>Supply voltage</td>
<td>100 - 240V AC</td>
</tr>
<tr>
<td>Allowable supply voltage range</td>
<td>85 - 264V AC</td>
</tr>
<tr>
<td>Rated Frequency</td>
<td>50/60Hz</td>
</tr>
<tr>
<td>Allowable instantaneous power failure time</td>
<td>Operation can be continued upon occurrence of instantaneous power failure for 10 ms or less.</td>
</tr>
<tr>
<td>Power fuse</td>
<td>FX3U-16M/12M</td>
</tr>
<tr>
<td></td>
<td>FX3U-48M/32M</td>
</tr>
<tr>
<td></td>
<td>FX3U-80M</td>
</tr>
<tr>
<td>Power consumption</td>
<td>30W 25W</td>
</tr>
<tr>
<td></td>
<td>40W 35W</td>
</tr>
<tr>
<td></td>
<td>45W 40W</td>
</tr>
<tr>
<td></td>
<td>50W 40W</td>
</tr>
<tr>
<td></td>
<td>65W 35W</td>
</tr>
<tr>
<td></td>
<td>400 mA or less</td>
</tr>
<tr>
<td></td>
<td>600 mA or less</td>
</tr>
<tr>
<td>5V DC built-in power supply*3</td>
<td>500 mA or less</td>
</tr>
</tbody>
</table>

*1 Does not include the power consumption of extension units / special extension units, and of the extension blocks / special extension blocks connected to those units.

*2 When input/output extension blocks are connected, the 24V DC service power supply is consumed by the blocks, and the current value to be used by the main unit is reduced.

*3 Cannot be used to supply power to an external destination. The power is supplied to input/output extension blocks, special extension blocks, special adapters and expansion boards.

*4 When the supply voltage is 200 V AC, the time can be changed to 10 to 100 ms by using the user program.

*5 FX3U-128MC does not have DC power supply.

*6 When supply voltage is DC 16.8-19.2V, the connectable extension equipment decreases. The following manual shows further information.

---

* When attaching high-speed input/output special adapter (FX3U-4HSX-ADP, FX3U-2HSY-ADP) and special function block (FX3U-3A, FX3U-2AD, FX3U-2DA), the number of connectable modules to the main unit is limited, due to the current consumption (internal 24V DC) at startup. The following manual shows further information.

**→ Refer to FX3U Series User’s Manual - Hardware Edition.**

---

**→ Refer to FX3U Series User’s Manual - Hardware Edition.**

---

*7 100 to 240V AC power is supplied to the main unit. For the details of wiring work, refer to section 3.1.

---

**3.2.2 Example of external wiring (AC power type)**

24V DC power is supplied to the main unit. For the details of wiring work, refer to section 3.1.

---

**3.2.3 Example of external wiring (DC power type)**

24V DC power is supplied to the main unit. For the details of wiring work, refer to section 3.1.
### 3.4 Input specifications and external wiring

#### 3.4.1 Input specifications

<table>
<thead>
<tr>
<th>Number of input points</th>
<th>Input connecting type</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>FX3U-16M-□</td>
<td>Removable terminal block (M3 screw)</td>
<td>8 points</td>
</tr>
<tr>
<td>FX3U-32M-□</td>
<td>Removable terminal block (M3 screw)</td>
<td>16 points</td>
</tr>
<tr>
<td>FX3U-48M-□</td>
<td>Removable terminal block (M3 screw)</td>
<td>24 points</td>
</tr>
<tr>
<td>FX3U-64M-□</td>
<td>Removable terminal block (M3 screw)</td>
<td>32 points</td>
</tr>
<tr>
<td>FX3U-80M-□</td>
<td>Removable terminal block (M3 screw)</td>
<td>40 points</td>
</tr>
<tr>
<td>FX3U-128M-□</td>
<td>Removable terminal block (M3 screw)</td>
<td>64 points</td>
</tr>
</tbody>
</table>

- **Input form:** Sink/source
- **Input signal voltage:** 24V DC +10% to -10%
- **Input impedance:**
  - X000 to X005: 3.9kΩ
  - X006, X007: 3.3kΩ
  - X010 or more: 4.3kΩ (Does not apply to FX3U-16M-□)
- **Input signal current:**
  - X000 to X005: 6mA±24V DC
  - X006, X007: 7mA±24V DC
  - X010 or more: 5mA±24V DC (Does not apply to FX3U-16M-□)
- **ON input sensitivity current:**
  - X000 to X005: 3.5 mA or more
  - X006, X007: 4.5 mA or more
  - X010 or more: 3.5 mA or more (Does not apply to FX3U-16M-□)
- **OFF input sensitivity current:** 1.5 mA or less
- **Input response time:** Approx. 10 ms

#### 3.4.2 Examples of input wiring [AC power type]

1. **Sink input**
   - Fuse L N S/S 100 to 240V AC
   - X000 to X005 3.9kΩ
   - 3-wire type sensor
   - X006, X007 6mA/24V DC
   - X010 or more 4.5mA/24V DC
   - X010 or more (Does not apply to FX3U-16M-□)

2. **Source input**
   - Fuse L N S/S 100 to 240V AC
   - X000 to X005 3.9kΩ
   - 3-wire type sensor
   - X006, X007 7mA/24V DC
   - X010 or more 15kΩ or more

#### 3.4.3 Examples of input wiring [DC power type]

1. **Sink input**
   - Fuse L N S/S 24V DC
   - X000 to X005 3.9kΩ
   - 3-wire type sensor
   - X006, X007 4.5 mA or more
   - X010 or more 15kΩ or more

2. **Source input**
   - Fuse L N S/S 24V DC
   - X000 to X005 3.9kΩ
   - 3-wire type sensor
   - X006, X007 4.5 mA or more
   - X010 or more 15kΩ or more

#### 3.4.4 Instructions for connecting input devices

1. **In the case of no-voltage contact:**
   - The input current of this PLC is 5 to 7 mA/24V DC. Use input devices applicable to this minute current. If no-voltage contacts (switches) for large current are used, contact failure may occur.
   - *Example Products of OMRON:
     - Microswitch Models 2, 3, and 205V
     - Operation switch Model A3P
     - Proximity switch Model TL
     - Photoelectric switch Model E3S

2. **In the case of input device with built-in series diode:**
   - Use a two-wire proximity switch whose leakage current, I_s, is 1.5 mA or less when the switch is off.
   - *Formula:
     
     \[ R_b = \frac{6}{I_s} \]  

3. **In the case of 2-wire proximity switch:**
   - Use a two-wire proximity switch whose leakage current, I_s, is 1.5 mA or less when the switch is off.
   - *Formula:
     
     \[ R_b = \frac{6}{I_s} \]  

### 3.5 Relay output specifications and example of external wiring

#### 3.5.1 Relay output specifications

<table>
<thead>
<tr>
<th>Number of output points</th>
<th>Output connecting type</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>FX3U-16MR-□</td>
<td>Removable terminal block (M3 screw)</td>
<td>8 points</td>
</tr>
<tr>
<td>FX3U-32MR-□</td>
<td>Removable terminal block (M3 screw)</td>
<td>16 points</td>
</tr>
<tr>
<td>FX3U-48MR-□</td>
<td>Removable terminal block (M3 screw)</td>
<td>24 points</td>
</tr>
<tr>
<td>FX3U-64MR-□</td>
<td>Removable terminal block (M3 screw)</td>
<td>32 points</td>
</tr>
<tr>
<td>FX3U-80MR-□</td>
<td>Removable terminal block (M3 screw)</td>
<td>40 points</td>
</tr>
<tr>
<td>FX3U-128MR/ES</td>
<td>Removable terminal block (M3 screw)</td>
<td>64 points</td>
</tr>
</tbody>
</table>

- **Output form:** Relay
- **External power supply:** 30V DC or less (240V AC or less if not a CE, UL, cUL compliant item)
- **Max. load:** 2 A (2 point)
- **Inductive load:** 80VA
- **Min. load:** 5V DC, 2 mA (reference value)
- **Response time:** OFF → ON Approx. 10 ms
- **Circuit insulation:** Mechanical insulation
- **Display of output operation:** LED lights when power is applied to relay coil.

1. **FX3U-128M-□ does not have DC power supply**
2. **FX3U-16M-□ terminal block cannot be installed/removed**
3.5.4 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.

![Diagram of circuit protection](image)

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.

<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>

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 load. 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. 0.1 μF</td>
</tr>
<tr>
<td>Resistance value</td>
<td>Approx. 100 to 2000 Ω</td>
</tr>
</tbody>
</table>

Reference

Manufacturer: Okaya Electric Industries Co., Ltd.
Model name: CR-10201

Rubycom Corporation
Model name: 250MCRA104100M B9325

3.6 Transistor output specifications and example of external wiring


<table>
<thead>
<tr>
<th>Item</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of output points</td>
<td>FXU-16MT/SS 8 points</td>
</tr>
<tr>
<td>FXU-32MT/SS 16 points</td>
<td></td>
</tr>
<tr>
<td>FXU-48MT/SS 24 points</td>
<td></td>
</tr>
<tr>
<td>FXU-64MT/SS 32 points</td>
<td></td>
</tr>
<tr>
<td>FXU-80MT/SS 40 points</td>
<td></td>
</tr>
<tr>
<td>FXU-128MT/SS 64 points</td>
<td></td>
</tr>
<tr>
<td>Output connecting type</td>
<td>Removable terminal block (M3 screw)²</td>
</tr>
<tr>
<td>Output form</td>
<td>FXU-16MT/SS (Sink) Transistor(Sink)</td>
</tr>
<tr>
<td>FXU-16MT/SS (Source)</td>
<td></td>
</tr>
<tr>
<td>External power supply</td>
<td>5 to 30V DC</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Item</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. load</td>
<td>The total load current of resistance loads per common terminal should be the following value or less.</td>
</tr>
<tr>
<td></td>
<td>1 output point/common terminal: 0.5 A</td>
</tr>
<tr>
<td></td>
<td>4 output point/common terminal: 0.5A</td>
</tr>
<tr>
<td></td>
<td>8 output point/common terminal: 1.6A</td>
</tr>
<tr>
<td>Inductive load</td>
<td>12 W/24V DC</td>
</tr>
<tr>
<td>Min. load</td>
<td>0.1 mA or less/30V DC</td>
</tr>
<tr>
<td>ON voltage</td>
<td>1.5 V or less</td>
</tr>
</tbody>
</table>

3.6.1 External Wiring of Transistor Output

1. External Wiring of Sink Output Type

![Diagram of external wiring](image)

2. External Wiring of Source Output Type

![Diagram of external wiring](image)
3.6.2 Cautions in external wiring

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.

1. External Wiring of Sink Output Type

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 as shown below.

2. External Wiring of Source Output Type

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.

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

1. External Wiring of Sink Output Type

2. External Wiring of Source Output Type


4. Terminal block layouts

FX3U-16MR/ES(-A)

FX3U-16MT/ES(-A)

FX3U-32M/ES(-A)

FX3U-48M/ES(-A)

FX3U-80M/ES(-A)

FX3U-128M/ES(-A)*1

*1 FX3U-128 M/ES(-A) does not have DC power supply.
*2 FX3u-128MT/ESS does not have DC power supply.