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# JY997D18801K(ENGLISH)

Changes for the Better

MITSUBISHI
PROGRAMMABLE CONTROLLERS
MELSEC-F

## FX3U SERIES PROGRAMMABLE CONTROLLERS

## HARDWARE MANUAL

FX3U

| | |
|---|---|
| Manual Number | JY997D18801 |
| Revision | K |
| Date | May 2011 |

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 - Hardware Edition 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 May 2011
Specifications are subject to change without notice.


## 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.

**STARTUP AND MAINTENANCE PRECAUTIONS** ⚠DANGER

- 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.

**STARTUP AND MAINTENANCE PRECAUTIONS** ⚠DANGER

- Use the battery for memory backup correctly in FX3U Series User's Manual - Hardware Edition.
  - 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 and the associated manuals and ensure the safety of the operation.
  An operation error may damage the machinery or cause accidents.

**STARTUP AND MAINTENANCE PRECAUTIONS** ⚠CAUTION

- Turn off the power to the PLC before attaching or detaching the memory cassette. If the memory cassette is attached or detached while the PLC's power is on, the data in the memory may be destroyed, or the memory cassette may be damaged.
- Do not disassemble or modify the PLC.
  Doing so may cause fire, equipment failures, or malfunctions.
  For repair, contact your local Mitsubishi Electric distributor.
- Turn off the power to the PLC before connecting or disconnecting any extension cable.
  Failure to do so may cause equipment failures or malfunctions.
- Turn off the power to the PLC before attaching or detaching the following devices.
  Failure to do so may cause equipment failures or malfunctions.
  - Display module, peripheral devices, expansion boards, and special adapters
  - Connector conversion adapter, extension blocks, and FX Series terminal blocks
  - Battery and memory cassette

**DISPOSAL PRECAUTIONS** ⚠CAUTION

- 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.
  (For details of the Battery Directive in EU countries, refer to FX3U Series User's Manual - Hardware Edition.)

**TRANSPORTATION AND STORAGE PRECAUTIONS** ⚠CAUTION

- 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 on or the battery exhausted, the battery-backed data may be unstable during transportation.

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**TRANSPORTATION AND STORAGE PRECAUTIONS** ⚠CAUTION

- 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.
- When transporting lithium batteries, follow required transportation regulations.
  (For details of the regulated products, refer to FX3U Series User's Manual - Hardware Edition.)

## Marine standard

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

## Certification of UL, cUL standards

FX3U series main units, FX3U series special adapters and FX2N series input/output extension units/blocks supporting UL, cUL standards are as follows:

**UL, cUL file number :E95239**

**Models : MELSEC FX3U series manufactured**

FX3U-★★MR/ES(-A) FX3U-★★MT/ES(-A)
FX3U-★★MT/ESS
Where ★★ indicates:16,32,48,64,80,128
FX3U-★★MR/DS FX3U-★★MT/DS
FX3U-★★MT/DSS
Where ★★ indicates:16,32,48,64,80
FX3U-★★MR/UA1 FX3U-★★MS/ES
Where ★★ indicates:32,64
FX3U-232ADP(-MB) FX3U-485ADP(-MB)
FX3U-4AD-ADP FX3U-4DA-ADP
FX3U-3A-ADP FX3U-4AD-PT-ADP
FX3U-4AD-PTW-ADP FX3U-4AD-PNK-ADP
FX3U-4AD-TC-ADP
FX3U-4HSX-ADP FX3U-2HSY-ADP
FX3U-CF-ADP

**Models : MELSEC FX2N series manufactured**

FX2N-★★ER-ES/UL FX2N-★★ET-ESS/UL
Where ★★ indicates:32,48
FX2N-48ER-DS FX2N-48ET-DSS
FX2N-48ER-UA1/UL
FX2N-8ER-ES/UL FX2N-8EX-ES/UL
FX2N-8EYR-ES/UL FX2N-8EYR-S-ES/UL
FX2N-8EYT-ESS/UL FX2N-8EX-UA1/UL
FX2N-16EX-ES/UL FX2N-16EYR-ES/UL
FX2N-16EYT-ESS/UL FX2N-16EYS

## 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 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 (2004/108/EC) when used as directed by the appropriate documentation.

**Attention**

- This product is designed for use in industrial applications.

**Note**

- 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 FX3U series manufactured**

| | | |
|---|---|---|
| from May 1st, 2005 | FX3U-★★MR/ES(-A) | |
| | Where ★★ indicates:16,32,48,64,80 | |
| | FX3U-4HSX-ADP | FX3U-2HSY-ADP |
| | FX3U-FLROM-16 | FX3U-FLROM-64L |
| | FX3U-7DM | |
| from June 1st, 2005 | FX3U-232ADP | FX3U-485ADP |
| | FX3U-4AD-ADP | FX3U-4DA-ADP |
| | FX3U-4AD-PT-ADP | FX3U-4AD-TC-ADP |
| | FX3U-232-BD | FX3U-422-BD |
| | FX3U-485-BD | FX3U-USB-BD |
| | FX3U-FLROM-64 | FX3U-CNV-BD |
| from November 1st, 2005 | FX3U-★★MT/ES(-A) | |
| | FX3U-★★MT/ESS | |
| | Where ★★ indicates:16,32,48,64,80 | |
| from February 1st, 2006 | FX3U-128MR/ES(-A) | FX3U-128MT/ES(-A) |
| | FX3U-128MT/ESS | |
| | FX3U-★★MR/DS | FX3U-★★MT/DS |
| | FX3U-★★MT/DSS | |
| | Where ★★ indicates:16,32,48,64,80 | |
| from April 1st, 2007 | FX3U-232ADP-MB | FX3U-485ADP-MB |
| from December 1st, 2007 | FX3U-4AD-PTW-ADP | |
| | FX3U-4AD-PNK-ADP | |
| from June 1st, 2009 | FX3U-3A-ADP | FX3U-CF-ADP |
| from August 1st, 2010 | FX3U-8AV-BD | |
| from September 1st, 2010 | FX3U-★★MR/UA1 | FX3U-★★MS/ES |
| | Where ★★ indicates:32,64 | |
| from May 1st, 2011 | FX3U-FLROM-1M | |

| Standard | Remark |
|---|---|
| EN61131-2:2007<br>Programmable controllers<br>- Equipment requirements and tests | Compliance with all relevant aspects of the standard.<br>EMI<br>• Radiated Emission<br>• Conducted Emission<br>EMS<br>• Radiated electromagnetic field<br>• Fast Transient burst<br>• Electrostatic discharge<br>• High-energy surge<br>• Voltage drops and interruptions<br>• Conducted RF<br>• Power frequency magnetic field |

**Models : MELSEC FX2N series manufactured**

| | | |
|---|---|---|
| from July 1st, 1997 | FX2N-★★ER-ES/UL | FX2N-★★ET-ESS/UL |
| | Where ★★ indicates:32,48 | |
| | FX2N-16EX-ES/UL | FX2N-16EYR-ES/UL |
| | FX2N-16EYT-ESS/UL | |
| from April 1st, 1998 | FX2N-48ER-DS | FX2N-48ET-DSS |
| from August 1st, 1998 | FX2N-48ER-UA1/UL | |
| from August 1st, 2005 | FX2N-8ER-ES/UL | FX2N-8EX-ES/UL |
| | FX2N-8EYR-ES/UL | FX2N-8EYT-ESS/UL |
| from September 1st, 2010 | FX2N-8EYR-S-ES/UL | |

For the products above, PLCs manufactured
before March 31st, 2002 are compliant with EN50081-2 (EN61000-6-4) and EN50082-2
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 EN61131-2:2007

| Standard | Remark |
|---|---|
| EN61000-6-4:2007<br>- Generic emission standard<br>Industrial environment<br>EN50081-2:1993<br>Electromagnetic compatibility | Compliance with all relevant aspects of the standard.<br>• Emission-Enclosure port<br>• Emission-Low voltage AC mains port<br>• Emission-Telecommunications/ network port |
| EN50082-2:1995<br>Electromagnetic compatibility<br>- Generic immunity standard<br>Industrial environment | Compliance with all relevant aspects of the standard.<br>• RF immunity<br>• Fast Transients<br>• ESD<br>• Conducted<br>• Power magnetic fields |
| EN61131-2:1994<br>/A11:1996<br>/A12:2000<br>Programmable controllers<br>- Equipment requirements and tests | Compliance with all relevant aspects of the standard.<br>• Radiated electromagnetic field<br>• Fast transient burst<br>• Electrostatic discharge<br>• Damped oscillatory wave |
| EN61131-2:2007<br>Programmable controllers<br>- Equipment requirements and tests | Compliance with all relevant aspects of the standard.<br>EMI<br>• Radiated Emission<br>• Conducted Emission<br>EMS<br>• Radiated electromagnetic field<br>• Fast Transient burst<br>• Electrostatic discharge<br>• High-energy surge<br>• Voltage drops and interruptions<br>• Conducted RF<br>• 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 FX3U series manufactured**

from May 1st, 2005 FX3U-★★MR/ES(-A)
Where ★★ indicates:16,32,48,64,80
from November 1st, 2005 FX3U-★★MT/ES(-A)
FX3U-★★MT/ESS
Where ★★ indicates:16,32,48,64,80
from February 1st, 2006 FX3U-128MR/ES(-A)
FX3U-128MT/ES(-A)
FX3U-128MT/ESS
FX3U-★★MR/DS
Where ★★ indicates:16,32,48,64,80
from September 1st, 2010 FX3U-★★MR/UA1
FX3U-★★MS/ES
Where ★★ indicates:32,64

| Standard | Remark |
|---|---|
| EN61131-2:2007<br>Programmable controllers<br>- Equipment requirements and tests | The equipment has been assessed as a component for fitting in a suitable enclosure which meets the requirements of EN61131-2:2007 |

**Models :MELSEC FX2N series manufactured**

from July 1st, 1997 FX2N-★★ER-ES/UL FX2N-★★ET-ESS/UL
Where ★★ indicates:32,48
FX2N-16EYR-ES/UL
from April 1st, 1998 FX2N-48ER-DS
from August 1st, 1998 FX2N-48ER-UA1/UL
from August 1st, 2005 FX2N-8ER-ES/UL FX2N-8EYR-ES/UL
from September 1st, 2010 FX2N-8EYR-S-ES/UL

For the products above, PLCs manufactured
before March 31st, 2002 are compliant with IEC1010-1
from April 1st, 2002 to April 30th, 2006 are compliant with EN61131-2:1994+A11:1996+A12:2000
after May 1st, 2006 are compliant with EN61131-2:2007

| Standard | Remark |
|---|---|
| IEC1010-1:1990<br>/A1:1992<br>Safety requirements for electrical equipment for measurement, control, and laboratory use<br>- General requirements | The equipment has been assessed as a component for fitting in a suitable enclosure which meets the requirements of IEC 1010-1: 1990+A1:1992 |
| EN61131-2:1994 :2007<br>/A12:2000<br>/A11:1996<br>Programmable controllers<br>- 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: 1994+A11:1996+A12:2000, :2007 |

## 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 FX3U 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.

**Caution for Analog Products in use**

The analog special adapters have been found to be compliant to the European standards in the aforesaid 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 recommend 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.

| Manual name | Manual No. | Description |
|---|---|---|
| FX3U Series User's Manual - Hardware Edition | JY997D16501 MODEL CODE: 09R516 | Explains FX3U Series PLC specification details for I/O, wiring, installation, and maintenance. |
| FX3G/FX3U/ FX3UC Series Programming Manual - Basic & Applied Instruction Edition | JY997D16601 MODEL CODE: 09R517 | Describes PLC programming for basic/ applied instructions STL/ SFC programming and devices. |
| MELSEC-Q/L/F Structured Programming Manual (Fundamentals) | SH-080782 MODEL CODE: 13JW06 | Programming methods, specifications, functions, etc. required to create structured programs. |
| FXCPU Structured Programming Manual [Device & Common] | JY997D26001 MODEL CODE: 09R925 | Devices, parameters, etc. provided in structured projects of GX Works2. |
| FXCPU Structured Programming Manual [Basic & Applied Instruction] | JY997D34701 MODEL CODE: 09R926 | Sequence instructions provided in structured projects of GX Works2. |
| FXCPU Structured Programming Manual [Application Functions] | JY997D34801 MODEL CODE: 09R927 | Application functions provided in structured projects of GX Works2. |
| FX Series User's Manual - Data Communication Edition | JY997D16901 MODEL CODE: 09R715 | Explains N:N link, parallel link, computer link, no protocol communication by RS instructions/FX2N-232IF. |
| FX3G/FX3U/ FX3UC Series User's Manual - Analog Control Edition | JY997D16701 MODEL CODE: 09R619 | Describes specifications for analog control and programming methods for FX3G/FX3U/FX3UC Series PLC. |
| FX3G/FX3U/ FX3UC Series User's Manual - Positioning Control Edition | JY997D16801 MODEL CODE: 09R620 | Explains the specifications for positioning control of FX3G/FX3U/FX3UC Series and programming procedures |

**How to obtain manuals**

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

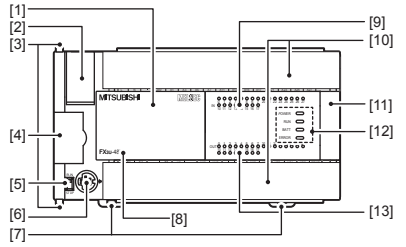
## Incorporated Items

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

| | Included Items | |
|---|---|---|
| **Main units** | | |
| FX3U-16M□ to FX3U-128M□ | Product | 1 unit |
| | Dust proof protection sheet | 1 sheet |
| | Manuals [Japanese version, English version] | 1 manual each |
| **Input/output extension units** | | |
| FX2N-32E□, FX2N-48E□ | Product | 1 unit |
| | Extension cable | 1 cable |
| | Input/output number label | 1 sheet |
| **Input/output extension blocks** | | |
| FX2N-8E□, FX2N-16E□ | Product | 1 unit |
| | Input/output number label | 1 sheet |

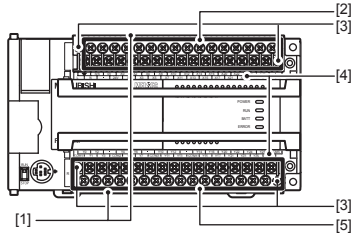
# 1. Outline

## 1.1 Part names



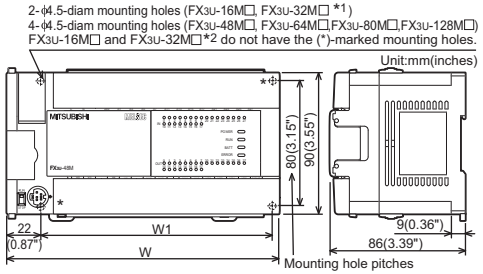

| No. | Name | | |
|---|---|---|---|
| [1] | Top cover | | |
| [2] | Battery cover | | |
| [3] | Special adapter connecting hooks (2 places) | | |
| [4] | Expansion board dummy cover | | |
| [5] | RUN/STOP switch | | |
| [6] | Peripheral device connecting connector | | |
| [7] | DIN rail mounting hooks | | |
| [8] | Model name (abbreviation) | | |
| [9] | Input display LEDs (Red) | | |
| [10] | Terminal block covers | | |
| [11] | Extension device connecting connector cover | | |
| [12] | Operation status display LEDs | | |
| | POWER | Green | On while power is on the PLC. |
| | RUN | Green | On while the PLC is running. |
| | BATT | Red | Lights when the battery voltage drops. |
| | ERROR | Red | Flashing when a program error occurs. |
| | | Red | Lights when a CPU error occurs. |
| [13] | Output display LEDs (Red) | | |

**With terminal cover open**




| No. | Name |
|---|---|
| [1] | Protective terminal covers (FX3U-□M□/□-A is excluded) |
| [2] | Power supply, Input (X) terminals |
| [3] | Terminal block mounting screws<br>(FX3U-16M□ terminal block cannot be installed/removed) |
| [4] | Terminal names |
| [5] | Output (Y) terminals |

### 1.2 External dimensions and weight




*1 FX3U-32MR/UA1 uses 4-ϕ4.5 mounting holes.

*2 Except FX3U-32MR/UA1

| Model name | W:<br>mm (inches) | W1:<br>mm (inches)<br>Direct mounting hole pitches | MASS (Weight):<br>kg (lbs) |
|---|---|---|---|
| FX3U-16M□ | 130 (5.12") | 103 (4.06") | 0.6 (1.32lbs) |
| FX3U-32M□*3 | 150 (5.91") | 123 (4.85") | 0.65 (1.43lbs) |
| FX3U-48M□ | 182 (7.17") | 155 (6.11") | 0.85 (1.87lbs) |
| FX3U-64M□*4 | 220 (8.67") | 193 (7.6") | 1.00 (2.2lbs) |
| FX3U-80M□ | 285 (11.23") | 258 (10.16") | 1.20 (2.64lbs) |
| FX3U-128M□ | 350 (13.78") | 323 (12.72") | 1.80 (3.96lbs) |

*3 FX3U-32MR/UA1 is equivalent to FX3U-48M□.

*4 FX3U-64MR/UA1 is equivalent to FX3U-80M□.

**Installation**

•35-mm-wide DIN rail or Direct (screw) mounting (M4)

## 2. Installation (general specifications)

As for installation of the input/output extension units/blocks, special adapters and expansion boards, refer to FX3U Series User's Manual - Hardware Edition.

**INSTALLATION PRECAUTIONS** ⚠CAUTION

- 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, $Cl_2$, $H_2S$, $SO_2$ or $NO_2$), 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.
  - Peripheral devices, display modules, expansion boards and special adapters
  - Extension units/blocks and the FX Series terminal block
  - Battery and memory cassette

**INSTALLATION PRECAUTIONS** ⚠CAUTION

- 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.
  - 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 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 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** ⚠DANGER

- 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

| 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*1 | | Fre-quency (Hz) | Accele-ration ($m/s^2$) | 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 | - | |
| Shock resistance*1 | 147 $m/s^2$ Acceleration, Action time: 11ms, 3 times by half-sine pulse in each direction X, Y, and Z | | | | |
| Noise resistance | By noise simulator at noise voltage of 1,000 Vp-p, noise width of 1 μs, rise time of 1 ns and period of 30 to 100 Hz | | | | |
| Dielectric withstand voltage*2 | 1.5kV AC for one minute | Between each terminals and ground terminal | | | |
| | 500V AC for one minute | | | | |
| Insulation resistance*2 | 5MΩ or more by 500V DC megger | | | | |
| Grounding | Class D grounding (grounding resistance: 100 Ω or less) <Common grounding with a heavy electrical system is not allowed.>*3 | | | | |
| Working atmosphere | Free from corrosive or flammable gas and excessive conductive dusts | | | | |
| Working altitude | <2000m*4 | | | | |

*1 The criterion is shown in IEC61131-2.

*2 Dielectric withstand voltage and insulation resistance are shown in the following table.

| Terminal | Dielectric strength | Insulation resistance |
|---|---|---|
| **Main units, Input/output extension units/blocks** | | |
| Between power supply terminal (AC power) and ground terminal | 1.5 kV AC for one minute | 5MΩ or more by 500V DC megger |
| Between power supply terminal (DC power) and ground terminal | 500V AC for one minute | |
| Between 24V DC service power supply connected to input terminal (24V DC) and ground terminal | 500V AC for one minute | |
| Between input terminal (100V AC) and ground terminal | 1.5 kV AC for one minute | |
| Between output terminal (relay) and ground terminal | 1.5 kV AC for one minute | |
| Between output terminal (transistor) and ground terminal | 500V AC for one minute | |
| Between output terminal (triac) and ground terminal | 1.5 kV AC for one minute | |
| **Expansion boards, Special adapters, Special function units/blocks** | | |
| Between terminal of expansion board and ground terminal | Not allowed | Not allowed |
| Between terminal of special adapter and ground terminal | 500V AC for 1min | 5MΩ or more by 500V DC megger |
| Special function unit/block | Each manual | |

For dielectric with stand voltage test and insulation resistance test of each product, refer to the following manual.

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

*3 For common grounding, refer to section 3.3.

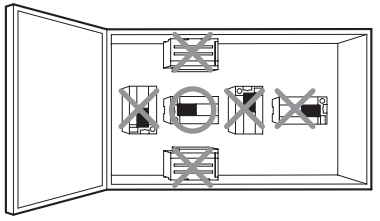
*4 The PLC cannot be used at a pressure higher than the atmospheric pressure to avoid damage.

## 2.2 Installation location

Install the PLC in an environment conforming to the generic specifications (section 2.1), installation precautions and notes.

For more details, refer to FX3U Series User's Manual - Hardware Edition.

**Installation location in enclosure**

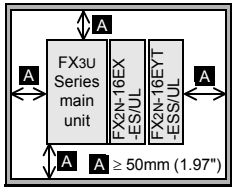


**Space in enclosure**

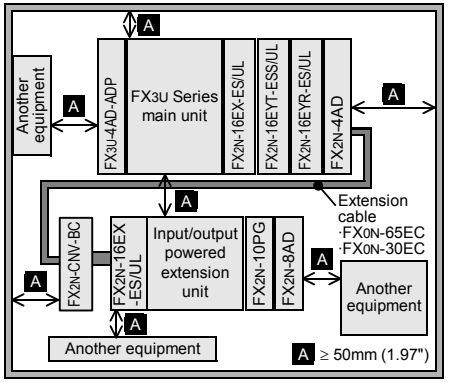
Extension devices can be connected on the left and right sides of the main unit of the PLC.

If you intend to add extension devices in the future, keep necessary spaces on the left and right sides.

Configuration without extension cable




Configuration in 2 stages with extension cable




### 2.2.1 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.

## 2.3 Procedures for installing to and detaching from DIN rail

The products can be installed on a DIN46277 rail [35mm (1.38") wide]. This section explains the installations of the main units.

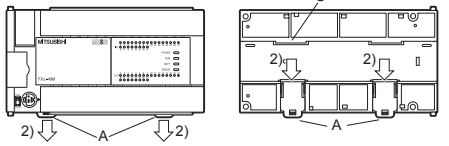
For the input/output extension units/blocks and special adapters, refer to the following manual.

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

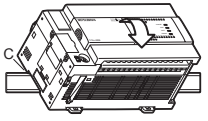
### 2.3.1 Installation

1) Connect the expansion boards and special adapters to the main unit.

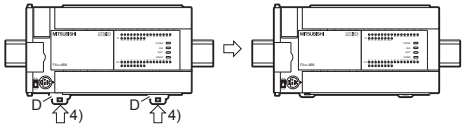
2) Push out all DIN rail mounting hooks (below fig.A)




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).

This section explains the installation of the main units.

As for the details of the installation/detaching for input extension units/blocks and special adapters, refer to the following manual.

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

### 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.

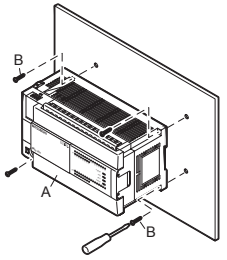
→ **Refer to FX3U Series User's Manual - Hardware Edition.**



### 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** ⚠DANGER

- 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.
  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 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.
  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.

**DESIGN PRECAUTIONS** ⚠CAUTION

- 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.

**Notes**

- Simultaneously turn on and off the power supplies of the main unit and extension devices.
- 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 5ms, 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).

**WIRING PRECAUTIONS** ⚠DANGER

- 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 externally.
  Doing so may damage the product.
- Use class D grounding (grounding resistance of 100Ω or less) with a wire of $2mm^2$ or thicker on the grounding terminal of the FX3U 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.
- Make sure to properly wire to the terminal in accordance with the following precautions.
  Failure to do so may cause electric shock, equipment failures, a short-circuit, wire breakage, malfunctions, or damage to the product.
  - The disposal size of the cable end should follow the dimensions described in the manual.
  - Tightening torque should follow the specifications in the manual.

**Notes**

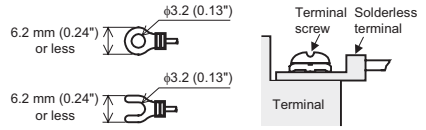
- Input/output wiring 50 to 100 m (164'1" to 328'1") long will cause almost no problems of noise, but, generally, the wiring length should be less than 20 m (65'7") to ensure the safety.
- Extension cables are easily affected by noise. Lay the cables at a distance of at least 30 to 50 mm (1.19" to 1.97") 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 to 0.8 N•m.
Do not tighten terminal screws exceeding the specified torque.
Failure to do so may cause equipment failures or malfunctions.

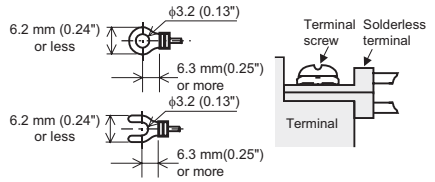
- When one wire is connected to one terminal




<Reference>

| 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




<Reference>

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

### 3.1.2 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 exceeding the specified torque.
Failure to do so may cause equipment failures or malfunctions.

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

## 3.2 Power supply specifications and example of external wiring

As for the details of the power supply specifications and example of external wiring, refer to the following manual.

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

### 3.2.1 Power supply specifications [Main unit, Input/output extension units]

| Item | | Specification | |
|---|---|---|---|
| | | AC power type | DC power type*6 |
| Supply voltage | | 100 - 240V AC | 24 V DC |
| Allowable supply voltage range | Main unit | 85 to 264V AC | 16.8 to 28.8V DC*5 |
| | FX2N-32E□, FX2N-48E□ | | 24V DC +20%, -30% |
| Rated frequency | | 50/60Hz | – |
| Allowable instantaneous power failure time | | Operation can be continued upon occurrence of instantaneous power failure for 10 ms or less. *4 | Operation can be continued upon occurrence of instantaneous power failure for 5 ms or less. |
| Power fuse | FX3U-16M□ to 32M□*7 | 250V 3.15A | |
| | FX3U-48M□ to 128M□ | 250V 5A | |
| | FX2N-32E□ | 250V 3.15A | - |
| | FX2N-48E□ | 250V 5A | 250V 5A |
| Rush current | Main unit | 30A max. 5ms or less/100V AC 65A max. 5ms or less/200V AC | 35A max. 0.5ms or less/24V DC |
| | FX2N-32E□, FX2N-48E□ | 40A max. 5ms or less/100V AC 60A max. 5ms or less/200V AC | - |
| Power consumption *1 | FX3U-16M□ | 30W | 25W |
| | FX3U-32M□ | 35W | 30W |
| | FX3U-48M□ | 40W | 35W |
| | FX3U-64M□ | 45W | 40W |
| | FX3U-80M□ | 50W | 45W |
| | FX3U-128M□ | 65W | – |
| | FX2N-32E□ | 30W(35VA) | – |
| | FX2N-48E□ | 35W(45VA) | 30W |
| 24V DC service power supply*2 | FX3U-16M□ to 32M□ | 400mA or less | – |
| | FX3U-48M□ to 128M□ | 600mA or less | – |
| | FX2N-32E□ | 250mA | – |
| | FX2N-48E□ | 460mA | – |
| 5V DC builtin power supply*3 | Main unit | 500 mA or less | |
| | FX2N-32E□ | 690mA or less | |
| | FX2N-48E□ | | |



*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.
For the power (current) consumed by the extension units/ blocks for input/output, refer to FX3U Series User's Manual - Hardware Edition.
For the power consumed by the special extension units/blocks, refer to the appropriate manual.

*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.
The AC power (AC input) type and DC power type do not have a service power supply.

*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.
The following manual shows further information.
→ **Refer to FX3U Series User's Manual - Hardware Edition.**

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

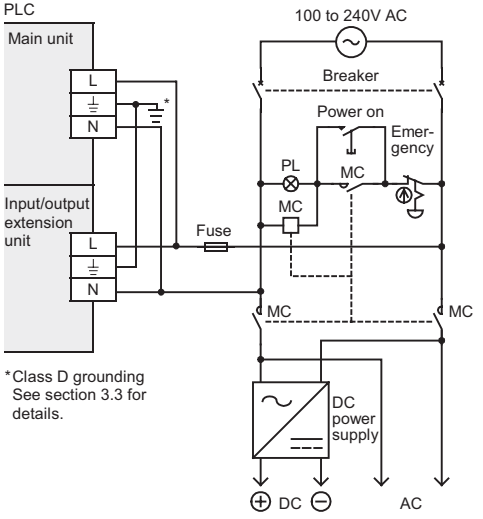
*5 When supply voltage is DC 16.8-19.2V, the connectable extension equipment decreases. The following manual shows further information.
→ **Refer to FX3U Series User's Manual - Hardware Edition.**

*6 When attaching high-speed input/output special adapter (FX3U-4HSX-ADP, FX3U-2HSY-ADP) and special function block (FX0N-3A, FX2N-2AD, FX2N-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.**

*7 250V 5A is specified for the power fuse of FX3U-32MR/UA1.

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

100 to 240V AC power is supplied to the main unit and input/output extension units. For the details of wiring work, refer to section 3.1.

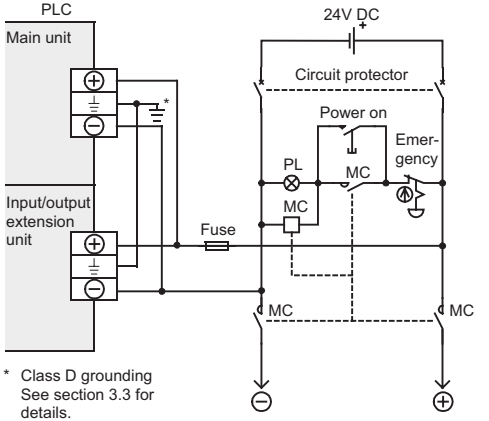



*Class D grounding
See section 3.3 for details.

Power supply for loads connected to PLC output terminals

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

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



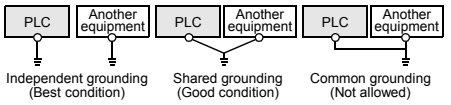

* Class D grounding
See section 3.3 for details.

Power supply for loads connected to PLC output terminals

## 3.3 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 $mm^2$).
- Position the grounding point as close to the PLC as possible to decrease the length of the ground wire.

## 3.4 Input specifications and external wiring

As for the details of the input specifications and external wiring, refer to the following manual.

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

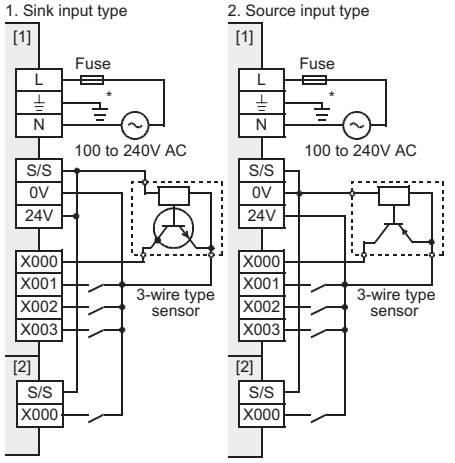
### 3.4.1 Input specifications (24V DC input type)

| Item | | Specification |
|---|---|---|
| Number of input points | FX2N-8ER□ | 4 points (8 points)*1 |
| | FX3U-16M□, FX2N-8EX□ | 8 points |
| | FX3U-32M□, FX2N-16EX□, FX2N-32E□ | 16 points |
| | FX3U-48M□, FX2N-48E□ | 24 points |
| | FX3U-64M□ | 32 points |
| | FX3U-80M□ | 40 points |
| | FX3U-128M□ | 64 points |

| Item | | | Specification |
|---|---|---|---|
| Input connecting type | | | Refer to FX3U Series User's Manual - Hardware Edition |
| Input form | | | |
| Input signal voltage | Main units | AC power Type | 24V DC +10%, -10% |
| | | DC power Type | 24V DC +20%, -30% |
| | Input/output extension unit | AC power Type | 24V DC +10%, -10% |
| | | DC power Type | 24V DC +20%, -30% |
| Input impedance | Main units | X000 to X005 | 3.9kΩ |
| | | X006, X007 | 3.3kΩ |
| | | X010 or more | 4.3kΩ (Does not apply to FX3U-16M□.) |
| | Input/output extension unit/block | | 4.3kΩ |
| Input signal current | Main units | X000 to X005 | 6mA/24V DC |
| | | X006, X007 | 7mA/24V DC |
| | | X010 or more | 5mA/24V DC (Does not apply to FX3U-16M□.) |
| | Input/output extension unit/block | | 5mA/24V DC |
| ON input sensitivity current | Main units | X000 to X005 | 3.5mA or more |
| | | X006, X007 | 4.5mA or more |
| | | X010 or more | 3.5mA or more (Does not apply to FX3U-16M□.) |
| | Input/output extension unit/block | | 3.5mA or more/24V DC |
| OFF input sensitivity current | | | 1.5mA or less |
| Input response time | | | Approx. 10ms |
| Input signal form | | | • Sink input: No-voltage contact input NPN open collector transistor<br>• Source input: No-voltage contact input PNP open collector transistor |
| Input circuit insulation | | | Photocoupler insulation |
| Input operation display | | | LED on panel lights when photocoupler is driven. |

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

### 3.4.2 Examples of 24V DC input wiring[AC power type]

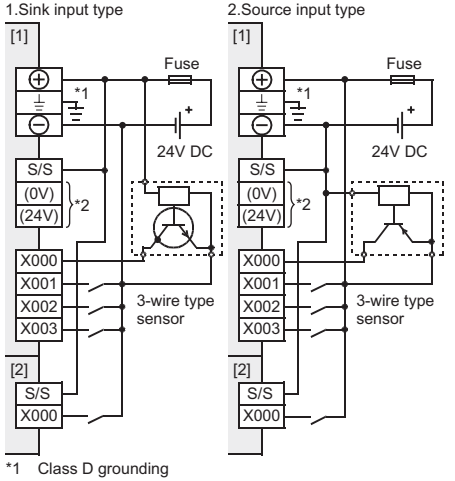



*Class D grounding
See section 3.3 for details.

[1]:Main unit, Input/output extension unit
(Common to both sink and source inputs)

[2]:Input/output extension block
(Common to both sink and source inputs)

### 3.4.3 Examples of 24V DC input wiring[DC power type]




*1 Class D grounding
See section 3.3 for details.

*2 Do not connect the (0V), (24V) terminals with others, since they are not available.

[1]:Main unit, Input/output extension unit
(Common to both sink and source inputs)

[2]:Input/output extension block
(Common to both sink and source inputs)



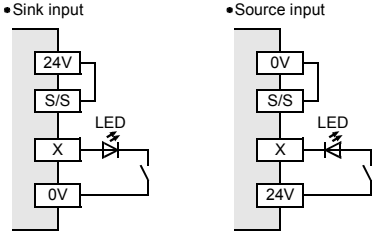
### 3.4.4 Instructions for connecting input devices

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

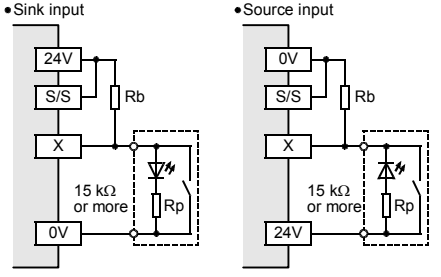
| Type | Model name | Type | Model name |
|---|---|---|---|
| Microswitch | Models Z, V and D2RV | Operation switch | Model A3P |
| Proximity switch | Model TL | Photoelectric switch | Model E3S |

2) 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.



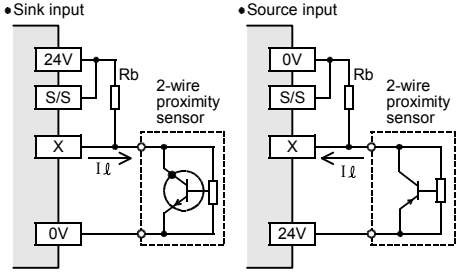

3) In the case of input device with built-in parallel resistance:
Use a device having a parallel resistance, Rp, of 15 kΩ or more.
When the resistance is less than 15 kΩ, connect a bleeder resistance, Rb, obtained from the formula as shown in the following figure.

$$Rb \leqq \frac{4Rp}{15\text{-}Rp}(k\Omega)$$




4) In the case of 2-wire proximity switch:
Use a two-wire proximity switch whose leakage current, Iℓ, is 1.5 mA or less when the switch is off.
When the current is 1.5 mA or more, connect a bleeder resistance, Rb, obtained from formula as shown in the following figure.

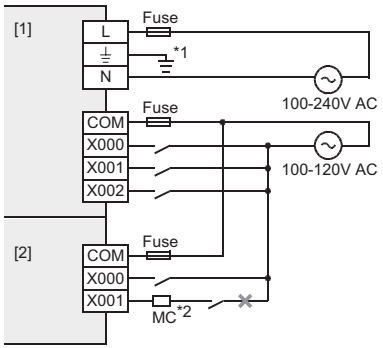
$$Rb \leqq \frac{6}{I\ell\text{-}1.5}(k\Omega)$$




### 3.4.5 Input specifications (100V AC input type)

| Item | | Specification |
|---|---|---|
| Number of input points | FX2N-8EX-UA1/UL | 8 points |
| | FX3U-32MR/UA1 | 16 points |
| | FX2N-48ER-UA1/UL | 24 points |
| | FX3U-64MR/UA1 | 32 points |
| Input connecting type | | Refer to FX3U Series User's Manual - Hardware Edition |
| Input form | | |
| Input signal voltage | | 100V AC to 120V +10%, -15% 50/60Hz |
| Input impedance | | Approx. 21kΩ/50Hz Approx. 18kΩ/60Hz |
| Input signal current | | 4.7mA/100V AC 50Hz 6.2mA/110V AC 60Hz (70% or less when turned on simultaneously) |
| ON input sensitivity current | | 3.8mA or more |
| OFF input sensitivity current | | 1.7mA or less |
| Input response time | | Approx. 25ms to 30ms (A high speed receiving is improper) |
| Input signal form | | Contact input |
| Input circuit insulation | | Photocoupler insulation |
| Input operation display | | LED on panel lights when photocoupler is driven. |

### 3.4.6 Examples of 100V AC input wiring




*1 Class D grounding See section 3.3 for details.

*2 Do not take input signals from loads generating surge.

[1]:Main unit, Input/output extension unit (100V AC input type)

[2]:Input extension block (100V AC input type)

## 3.5 Relay output specifications and example of external wiring

As for the details of Instructions for connecting input devices, refer to the following manual.

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

### 3.5.1 Relay output specifications

| Item | | Specification |
|---|---|---|
| Number of output points | FX2N-8ER□ | 4 points (8 points)*1 |
| | FX3U-16MR□, FX2N-8EYR□ | 8 points |
| | FX3U-32MR/□, FX2N-32ER□, FX2N-16EYR□ | 16 points |
| | FX3U-48MR□, FX2N-48ER□ | 24 points |
| | FX3U-64MR/□ | 32 points |
| | FX3U-80MR□ | 40 points |
| | FX3U-128MR/ES | 64 points |
| Output connecting type | | Refer to FX3U Series User's Manual - Hardware Edition |
| Output form | | Relay |
| External power supply | | 30V DC or less<br>240V AC or less ("250V AC or less" if not a CE, UL, cUL compliant item) |
| Max. load | Resistance load | 2A/point*2 |
| | Inductive load | 80VA |
| Min. load | | 5V DC, 2mA (reference value) |
| Open circuit leakage current | | - |
| Response time | OFF→ON | Approx. 10ms |
| | ON→OFF | Approx. 10ms |
| Circuit insulation | | Mechanical insulation |
| Display of output operation | | LED on panel lights when power is applied to relay coil. |

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

*2 The total load current of resistance loads per common terminal should be the following value or less.

- 1 output points/common terminal : 2A
- 4 output points/common terminal : 8A
- 8 output points/common terminal : 8A

As for the number of outputs per common terminal, refer to "Chapter 4 interpretation of partition" and the following manual.

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

### 3.5.2 Life of relay output 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 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 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/100V AC | 3 million times |
| | 0.1A/200V AC | |
| 35VA | 0.35A/100V AC | 1 million times |
| | 0.17A/200V AC | |
| 80VA | 0.8A/100V AC | 2 hundred thousand times |
| | 0.4A/200V AC | |

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

→ **For countermeasures while using inductive loads, refer to Subsection 3.5.4.**

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.

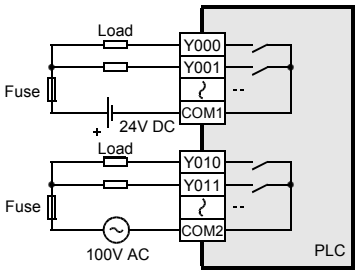
2) Lamp load
Lamp loads generally generate rush current 10 to 15 times the stationary current. Make sure that the rush current does not exceed the current corresponding to the maximum specified resistance load.

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.

→ **For the maximum specified resistance load, refer to Subsection 3.5.1.**



### 3.5.3 Example of relay output wiring




### 3.5.4 Cautions in external wiring

For cautions in external wiring, refer to the following manual.

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

**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. 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.

## 3.6 Transistor output specifications and example of external wiring

As for the details of the transistor output specifications and external wiring, refer to the following manual.

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

### 3.6.1 Transistor output specifications

| Item | | | Specification |
|---|---|---|---|
| Number of output points | FX3U-16MT/□, FX2N-8EYT□ | | 8 points |
| | FX3U-32MT/□, FX2N-32ET□, FX2N-16EYT□ | | 16 points |
| | FX3U-48MT/□, FX2N-48ET□ | | 24 points |
| | FX3U-64MT/□ | | 32 points |
| | FX3U-80MT/□ | | 40 points |
| | FX3U-128MT/ES(S) | | 64 points |
| Output connecting type | | | Refer to FX3U Series User's Manual - Hardware Edition |
| Output form | FX3U-□□MT/□S(-A), FX2N-□ET, FX2N-48ET-D, FX2N-□EYT, FX2N-8EYT-H | | Transistor(Sink) |
| | FX3U-□□MT/□SS, FX2N-□ET-ESS/UL, FX2N-48ET-DSS, FX2N-□EYT-ESS/UL | | Transistor(Source) |
| External power supply | | | 5 to 30V DC |
| Max. load | Resistance load | FX3U-□□MT/□, FX2N-□ET, FX2N-□ET-□, FX2N-□EYT, FX2N-□EYT-ESS/UL | 0.5A/point*1 |
| | | FX2N-8EYT-H | 1A/point*2 |
| | | FX2N-16EYT-C | 0.3A/point*3 |
| | Inductive load | FX3U-□□MT/□, FX2N-□ET, FX2N-□ET-□, FX2N-□EYT, FX2N-□EYT-ESS/UL | 12W/24V DC*4 |
| | | FX2N-8EYT-H | 24W/24V DC*5 |
| | | FX2N-16EYT-C | 7.2W/24V DC*6 |
| Min. load | | | – |
| Open circuit leakage current | | | 0.1mA or less/30V DC |
| ON voltage | | | 1.5V or less |

| Item | | | | Specification |
|---|---|---|---|---|
| Response time | OFF → ON | Main unit | Y000 to Y002 | 5μs or less/10mA or more (5 to 24V DC) |
| | | | Y003 or more | 0.2ms or less/200mA or more (at 24V DC) |
| | | Input/output extension units/blocks*7 | | 0.2ms or less/200mA or more (at 24V DC) |
| | ON → OFF | Main unit | Y000 to Y002 | 5μs or less/10mA or more (5 to 24V DC) |
| | | | Y003 or more | 0.2ms or less/200mA or more (at 24V DC) |
| | | Input/output extension units/blocks*7 | | 0.2ms or less/200mA or more (at 24V DC) |
| Circuit insulation | | | | Photocoupler insulation |
| Display of output operation | | | | LED on panel lights when photocoupler is driven. |

*1 The total load current of resistance loads per common terminal should be the following value or less.
- 1 output point/common terminal : 0.5A
- 4 output point/common terminal : 0.8A
- 8 output point/common terminal : 1.6A

As for the number of outputs per common terminal, refer to "Chapter 4 interpretation of partition" and the following manual.

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

*2 The total load current of resistance loads per common terminal should be the following value or less.
- 4 output points/common terminal : 2A

As for the number of outputs per common terminal, refer to the following manual.

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

*3 The total load current of resistance loads per common terminal should be the following value or less.
- 16 output point/common terminal : 1.6A

As for the number of outputs per common terminal, refer to the following manual.

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

*4 The total of inductive loads per common terminal should be the following value or less.
- 1 output point/common terminal : 12W/24V DC
- 4 output points/common terminal : 19.2W/24V DC
- 8 output points/common terminal : 38.4W/24V DC

As for the number of outputs per common terminal, refer to "Chapter 4 interpretation of partition" and the following manual.

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

*5 The total of inductive loads per common terminal should be the following value or less.
- 4 output points/common terminal : 48W/24V DC

As for the number of outputs per common terminal, refer to the following manual.

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

*6 The total of inductive loads per common terminal should be the following value or less.
- 16 output points/common terminal : 38.4W

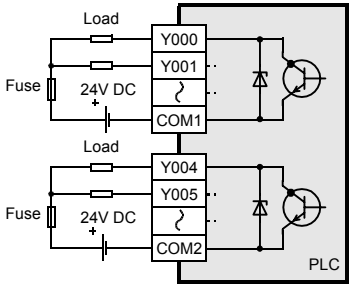
As for the number of outputs per common terminal, refer to the following manual.

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

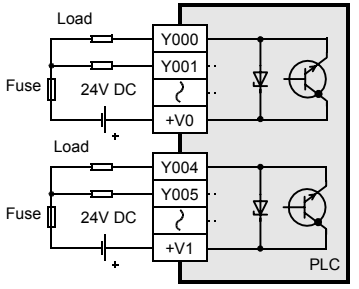
*7 The response time is as follows in the FX2N-8EYT-H.
- OFF→ON : 0.2ms or less/1A
- ON→OFF : 0.4ms or less/1A

### 3.6.2 External Wiring of Transistor Output

**1. External Wiring of Sink Output Type**




**2. External Wiring of Source Output Type**




### 3.6.3 Cautions in external wiring

For cautions in external wiring, refer to the following manual.

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

**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.

## 3.7 Triac output specifications and example of external wiring

As for the details of the triac output specifications and external wiring, refer to the following manual.

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



### 3.7.1 Triac output specifications

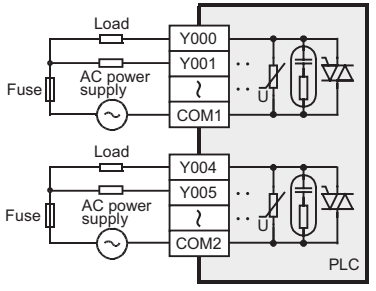
| Item | | Specification |
|---|---|---|
| Number of output points | FX3U-32MS/ES, FX2N-16EYS, FX2N-32ES | 16 points |
| | FX3U-64MS/ES | 32 points |
| Output connecting type | | Refer to FX3U Series User's Manual - Hardware Edition |
| Output form | | Triac (SSR) |
| External power supply | | 85 to 242V AC |
| Max. load | Resistance load | 0.3A/point*1 |
| | Inductive load | 15VA/100V AC, 30VA/200V AC |
| Min. load | | 0.4VA/100V AC, 1.6VA/200V AC |
| Open circuit leakage current | | 1mA/100V AC, 2mA/200V AC |
| Response time | OFF→ON | 1ms or less |
| | ON→OFF | 10ms or less |
| Circuit insulation | | Photo-thyristor insulation |
| Display of output operation | | LED on panel lights when photo-thyristor is driven. |

*1 The total load current of resistance loads per common terminal should be the following value or less.
- 4 output points/common terminal : 0.8A
- 8 output points/common terminal : 0.8A

As for the number of outputs per common terminal, refer to "Chapter 4 interpretation of partition" and the following manual.

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

### 3.7.2 External Wiring of Triac Output




### 3.7.3 Cautions in external wiring

For cautions in external wiring, refer to the following manual.

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

**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.

**Micro current load**

The PLC's internal Triac output circuit is equipped with a turn-off C-R absorber. When connecting a very low current load of "0.4VA/100V AC or less, or 1.6VA/200V AC or less", please connect a surge absorber 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.

| Item | Guide |
|---|---|
| Static electricity 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.

## 4. Terminal block layouts

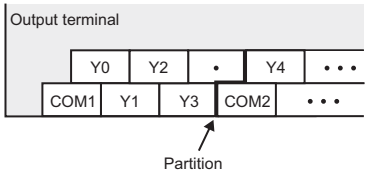
For details on the terminal block layout, refer to the following manual.

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

**Interpretation of partition**

The partition of the output terminals (see following figure) indicates the range of the output connected to the same common.

Example: FX3U-48MT/ES



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