MITSUBISHI ELECTRIC

PROGRAMMABLE CONTROLLERS
MELSEC-F

FX3U-J1939

INSTALLATION MANUAL

FX 3U

Manual Number	JY997D43001
Revision	D
Date	April 2015

This manual describes the part names, dimensions, mounting, and specifications of the product. Before use, read this manual and the manuals of all relevant products fully to acquire proficiency in handling and operating the product. Make sure to learn all the product information, safety information, and precautions.
Store this manual in a safe place so that it can be taken out and read whenever necessary. Always forward it to the end user.

Registration:

- The company and product names described in this manual are registered trademarks or the trademarks of their respective companies.

Effective April 2015
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Safety Precautions (Read these precautions before use.)

This manual classifies the safety precautions into two categories:

⚠WARNING and ⚠CAUTION.

⚠WARNING	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.

Associated Manuals

Manual name	Manual No.	Description
FX3U-J1939 User's Manual	JY997D43101	Describes details of the FX3U-J1939 Communication Special Function Block.
FX3G Series User's Manual - Hardware Edition	JY997D31301 MODEL CODE: 09R521	Explains the FX3G Series PLC specifications for I/O, wiring, installation, and maintenance.
FX3GC Series User's Manual - Hardware Edition	JY997D45401 MODEL CODE: 09R533	Explains the FX3GC Series PLC specifications for I/O, wiring, installation, and maintenance.
FX3U Series User's Manual - Hardware Edition	JY997D16501 MODEL CODE: 09R516	Explains the FX3U Series PLC specifications for I/O, wiring, installation, and maintenance.
FX3UC Series User's Manual - Hardware Edition	JY997D28701 MODEL CODE: 09R519	Explains the FX3UC Series PLC specifications for I/O, wiring, installation, and maintenance.

How to obtain manuals
For product manuals or documents, consult with your local Mitsubishi Electric representative.

Certification of UL, cUL standards

FX3U-J1939 units comply with the UL standards (UL, cUL).
UL, cUL File Number: E95239
Regarding the standards that comply with the main unit, please refer to either the FX series product catalog or consult with your nearest Mitsubishi product provider.

Compliance with EC directive (CE Marking)

This note does not guarantee that an entire mechanical module produced in accordance with the contents of this note will comply with the following standards. Compliance to EMC directive and LVD directive for the entire mechanical module should be checked by the user / manufacturer. For more information please consult with your nearest Mitsubishi product provider.
Regarding the standards that comply with the main unit, please refer to either the FX series product catalog or consult with your nearest Mitsubishi product provider.

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

- 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, 2012 FX3U-J1939

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

Caution for Compliance with EC Directive

1) Caution for wiring
   For noise prevention, please ground at least 35 mm (1.38") of the twisted-pair cable along the grounding plate to which the ground terminal is connected.
   → **Refer to subsection 3.2.3**
2) Installation in Enclosure
   → **For details regarding installation in an enclosure, refer to the User's Manual - Hardware Edition of the respective PLC main unit**

1. Introduction

The FX3U-J1939 communication block is an interface block that allows FX3G/FX3GC/FX3U/FX3UC Series PLCs to connect to a J1939 system. FX3U-J1939 can be connected directly to the FX3G/FX3GC*1/FX3U/FX3UC*1 series PLC's extension port, or to any other extension unit / block's right side extension port.
Specification abstract:

- 75 messages (8 bytes / message) and 4 extension messages (a maximum of 250 bytes / message) can be sent and received on J1939 communication.
- A Command Interface (CIF) for asynchronous services and configuration, and diagnosis
- CAN Layer 2 communication

*1 An FX2NC-CNV-IF or FX3UC-1PS-5V is necessary to connect the FX3U-J1939 to an FX3GC/FX3UC Series PLC.

For safe use ⚠CAUTION

- This product has been manufactured as a general-purpose part for general industries, and has not been designed or manufactured to be incorporated in a device or system used in purposes related to human life.
- Before using the product for special purposes such as nuclear power, electric power, aerospace, medicine or passenger movement vehicles, consult with Mitsubishi Electric.
- This product has been manufactured under strict quality control. However when installing the product where major accidents or losses could occur if the product fails, install appropriate backup or failsafe functions in the system.

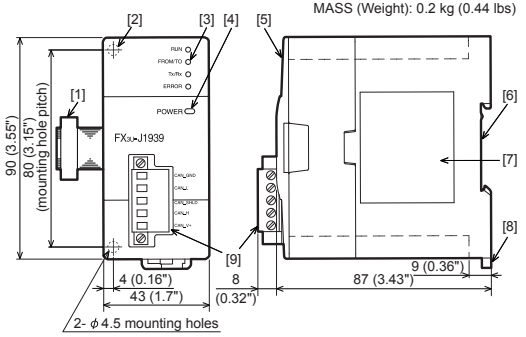
1.1 Incorporated Items

Check to ensure the following product and items are included in the package.

Included Item	
FX3U-J1939	1 unit
Terminating resistor (120 Ω)	1 piece
Special unit/block No. label	1 sheet
Dust proof protection sheet	1 sheet
Manual (English version only)	1 manual

1.2 External Dimensions and Part Names

Unit: mm
MASS (Weight): 0.2 kg (0.44 lbs)



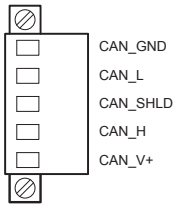
[1] Extension cable
[2] Direct mounting hole
2 holes of φ4.5 (0.18")
(mounting screw: M4 screw)
[3] Status LEDs (see section 1.3)
[4] Power LED (green)
[5] Top cover
[6] DIN rail mounting groove
(DIN rail: DIN46277, 35 mm (1.38") width)
[7] Nameplate
[8] DIN rail mounting hook
[9] CAN bus connector

1.3 Power and status LEDs

LED Name	LED Color	Status	Description
RUN	Green	OFF	Module is offline.
		ON	Module is online.
FROM/TO	Green	OFF	PLC is not accessing BFMs in module.
		ON	PLC is accessing BFMs in module.
Tx/Rx	Green	OFF	Module is not transmitting or receiving messages.
		ON	Module is transmitting or receiving messages.
ERROR	Red	OFF	Normal operation (status)
		SINGLE FLASH*1	Error passive state
		BLINKING*1	General error
		ON	BUS-OFF state
POWER	Green	ON	24 V DC power is properly supplied from PLC main unit.

*1 For details, refer to the following manual.
→ **FX3U-J1939 User's Manual**

1.4 Terminal Layout



Pin No.	Signal	Description
1	CAN_GND	Ground / 0 V / V-
2	CAN_L	CAN_L bus line (dominant low)
3	(CAN_SHLD)	Optional CAN shield
4	CAN_H	CAN_H bus line (dominant high)
5	(CAN_V+)	Optional CAN external positive supply (not connected internally)

2. Installation

For installation details, refer to the following manual.
→ **FX3U-J1939 User's Manual**

INSTALLATION PRECAUTIONS ⚠WARNING

- Make sure to cut off all phases of the power supply externally before attempting installation or wiring work.
  Failure to do so may cause electric shock or damage to the product.

INSTALLATION PRECAUTIONS ⚠CAUTION

- Use the product within the generic environment specifications described in PLC main unit manual (Hardware Edition).
  Never use the product in areas with excessive dust, oily smoke, conductive dusts, corrosive gas (salt air, Cl2, H2S, SO2 or NO2), flammable gas, vibration or impacts, or expose it to high temperature, condensation, or rain and wind.
  If the product is used in such conditions, electric shock, fire, malfunctions, deterioration or damage may occur.
- Do not touch the conductive parts of the product directly.
  Doing so may cause device failures or malfunctions.
- When drilling screw holes or wiring, make sure that cutting and wiring debris do not enter the ventilation slits.
  Failure to do so may cause fire, equipment failures or malfunctions.
- Be sure to remove the dust proof sheet from the PLC's ventilation port when installation work is completed.
  Failure to do so may cause fire, equipment failures or malfunctions.
- 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.
- Install the product securely using a DIN rail or mounting screws.
- Connect extension cables securely to their designated connectors.
  Loose connections may cause malfunctions.

2.1 Connection with PLC

The FX3U-J1939 connects on the right side of a PLC main unit or extension units/blocks (including special function units/blocks).
For connection to an FX3GC/FX3UC Series PLC or FX2NC Series PLC extension block, an FX2NC-CNV-IF or FX3UC-1PS-5V is required.
For details, refer to the respective PLC manual.
→ **Refer to the FX3G Series User's Manual - Hardware Edition**
→ **Refer to the FX3GC Series User's Manual - Hardware Edition**
→ **Refer to the FX3U Series User's Manual - Hardware Edition**
→ **Refer to the FX3UC Series User's Manual - Hardware Edition**

2.2 Mounting

The product is mounted by the following method.

- DIN rail mounting
- Direct mounting (mounting screw: M4 screw)

For details, refer to the respective PLC manual.
→ **Refer to the FX3G Series User's Manual - Hardware Edition**
→ **Refer to the FX3GC Series User's Manual - Hardware Edition**
→ **Refer to the FX3U Series User's Manual - Hardware Edition**
→ **Refer to the FX3UC Series User's Manual - Hardware Edition**

3. Wiring

For wiring details, refer to the following manuals.
→ **FX3U-J1939 User's Manual**

WIRING PRECAUTIONS ⚠WARNING

- Make sure to cut off all phases of the power supply externally before attempting installation or wiring work.
  Failure to do so may cause electric shock or damage to the product.

WIRING PRECAUTIONS ⚠CAUTION

- Perform class D grounding (grounding resistance: 100 Ω or less) to the shield of the twisted shield cable (refer to subsection 3.2.3).
  Do not use common grounding with heavy electrical systems (refer to the manual of the PLC main unit).
- 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.
- Install module so that excessive force will not be applied to communication connectors or communication cables.
  Failure to do so may result in wire damage/breakage or PLC failure.
- Make sure to affix the CAN bus connector with fixing screws.
  Tightening torque should follow the specifications in the manual.
  Loose connections may cause malfunctions.

WIRING PRECAUTIONS ⚠CAUTION

- Make sure to properly wire to the terminal block (CAN bus connector) 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.
  - Twist the end of strand wire and make sure that there are no loose wires.
  - Do not solder-plate the electric wire ends.
  - Do not connect more than the specified number of wires or electric wires of unspecified size.
  - Affix the electric wires so that neither the terminal block nor the connected parts are directly stressed.
- Make sure to observe the following precautions in order to prevent any damage to the machinery or accidents due to abnormal data written to the PLC under the influence of noise:
  1) Do not bundle the main circuit line together with or lay it close to the main circuit, high-voltage line or load line.
     Otherwise, noise disturbance and/or surge induction are likely to take place. As a guideline, lay the control line at least 100 mm (3.94") or more away from the main circuit or high-voltage lines.
  2) Ground the shield wire or shield of a shielded cable.
     Do not use common grounding with heavy electrical systems (refer to the manual of the PLC main unit).
- Place the communication cable in grounded metallic ducts or conduits both inside and outside of the control panel whenever possible.

3.1 Applicable Cable and Connector

3.1.1 Applicable connector

FX3U-J1939 uses a CAN bus connector. This connector is removable.
For removal and installation of the CAN bus connector, refer to the following section.

→ **Refer to subsection 3.1.4**

3.1.2 Applicable cable

Item	Applicable Cable	
	SAE J1939-11, CAN (Layer 2)	SAE J1939-15
Cable Type	Twisted pair cable	
Unshielded/Shielded	Shielded	Unshielded*1
No. of Pairs	2 pair	
Conformance Standard	ISO 11898/1993	
Wire Size	0.3 mm² to 0.82 mm² (AWG22 to 18)*2	
Impedance	120 Ω	

*1 Shielded twisted pair cable is recommended.

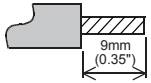
*2 When bus length is long, use thicker wire. For details, refer to the following manual.

→ **FX3U-J1939 User's Manual**

3.1.3 Termination of cable end

Strip 9 mm (0.35") of insulation from the end of the wire.
In case of stranded wires, use wire ferrules. Refer to the following manual.

→ **FX3U-J1939 User's Manual**



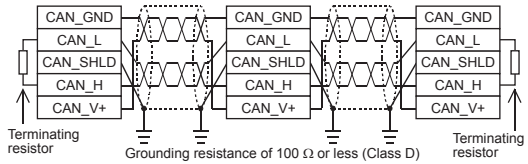
The tightening torque must be 0.4 to 0.5 N•m.
Do not tighten terminal screws with a torque outside the above-mentioned range.
Failure to do so may cause equipment failures or malfunctions.

3.1.4 Removal and installation of CAN connector

1) Removal
   Evenly unscrew both CAN connector mounting screws, and remove the CAN connector from the module.
   If the cable is attached to the connector, hold and pull the connector on the side. Do not pull the cable.
2) Installation
   Place the CAN connector in the specified position, and evenly tighten both CAN connector mounting screws.
   Tightening torque 0.4 to 0.5 N•m
   Do not tighten the terminal block mounting screws with a torque outside the above-mentioned range.
   Failure to do so may cause equipment failures or malfunctions.

3.2 CAN-Bus Wiring

3.2.1 Connecting communication cables



For electromagnetic compatibility (EMC), it is recommended to ground the cable shield at both ends.

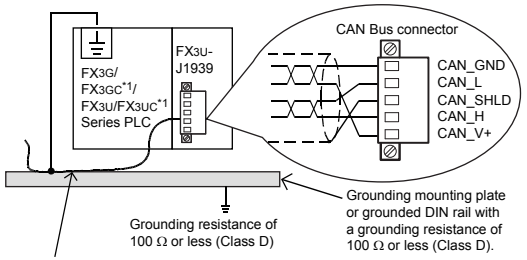
Caution

For safety, always check the potential differences between the grounding points. If potential differences are found, proper measures must be taken to avoid damage.

3.2.2 Module wiring

For PLC wiring details, refer to the following manual.

→ **Refer to the FX3G Series User's Manual - Hardware Edition**
→ **Refer to the FX3GC Series User's Manual - Hardware Edition**
→ **Refer to the FX3U Series User's Manual - Hardware Edition**
→ **Refer to the FX3UC Series User's Manual - Hardware Edition**

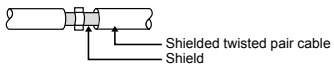


Strip a part of the coating of the shielded twisted pair cable as shown subsection 3.2.3. Ground the PLC's grounding terminal there.

*1 An FX2NC-CNV-IF or FX3UC-1PS-5V is necessary to connect the FX3U-J1939 to an FX3GC/FX3UC Series PLC.

3.2.3 Grounding of twisted pair cable

Strip a part of the coating of the shielded twisted pair cable as shown below, and ground at least 35 mm (1.38") of the exposed shield section.



3.2.4 Termination

The J1939 network requires terminating resistors for both network ends. When FX3U-J1939 is the network end, connect the included terminating resistor (120 Ω 1/2W) between pin number 2 (CAN_L) and 4 (CAN_H).

3.3 Grounding

For details, refer to the following manual.

→ **FX3U-J1939 User's Manual**

4. Specifications

DESIGN PRECAUTIONS ⚠WARNING

- 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.
- For the operating status of each node in the case of a communication error, see the FX3U-J1939 user's manual and the product manual of each node.
  Erroneous output or malfunctions may cause an accident.

DESIGN PRECAUTIONS ⚠WARNING

- When executing control (data changes) to an operating PLC, construct an interlock circuit in the sequence program so that the entire system operates safely. In addition, when executing control such as program changes and operation status changes (status control) to an operating PLC, thoroughly read the manual and sufficiently confirm safety in advance. Especially in control from external equipment to a PLC in a remote place, problems in the PLC may not be able to be handled promptly due to abnormality in data transfer. Construct an interlock circuit in the sequence program. At the same time, determine the actions in the system between the external equipment and the PLC for protection against abnormalities in data transfer.

DESIGN PRECAUTIONS ⚠CAUTION

- Make sure to observe the following precautions in order to prevent any damage to the machinery or accidents due to abnormal data written to the PLC under the influence of noise:
  1) Do not bundle the main circuit line together with or lay it close to the main circuit, high-voltage line or load line.
     Otherwise, noise disturbance and/or surge induction are likely to take place. As a guideline, lay the control line at least 100 mm (3.94") or more away from the main circuit or high-voltage lines.
  2) Ground the shield wire or shield of a shielded cable.
     Do not use common grounding with heavy electrical systems (refer to the manual of the PLC main unit).

STARTUP AND MAINTENANCE PRECAUTIONS ⚠CAUTION

- Do not disassemble or modify the PLC.
  Doing so may cause fire, equipment failures, or malfunctions.
  For repair, contact your local Mitsubishi Electric representative.
- Turn off the power to the PLC before connecting or disconnecting any extension cable.
  Failure to do so may cause equipment failures or malfunctions.
- Do not drop the product or exert strong impact to it.
  Doing so may cause damage.

DISPOSAL PRECAUTIONS ⚠CAUTION

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

TRANSPORTATION AND STORAGE PRECAUTIONS ⚠CAUTION

- The PLC is a precision instrument. During transportation, avoid impacts larger than those specified in the general specifications of the PLC main unit manual.
  Failure to do so may cause failures in the PLC. After transportation, verify the operations of the PLC.

4.1 Applicable PLC

Model name	Applicability
FX3G Series PLC	Ver. 1.00 and later (Up to 8 blocks can be extended*2)
FX3GC Series PLC*1	Ver. 1.40 and later (Up to 8 blocks can be extended*2)
FX3U Series PLC	Ver. 2.20 and later (Up to 8 blocks can be extended*2)
FX3UC Series PLC*1	Ver. 2.20 and later (Up to 8 blocks can be extended*2*3)

The version number can be checked by reading the last three digits of device D8001/D8101.

*1 An FX2NC-CNV-IF or FX3UC-1PS-5V is necessary to connect the FX3U-J1939 to an FX3GC/FX3UC Series PLC.

*2 Check the current consumption of the connected extension blocks and insert extension power supply units if necessary.

*3 Up to 7 units can be connected to the FX3UC-32MT-LT(-2) PLC.

4.2 General Specifications

Items other than the following are equivalent to those of the PLC main unit.
For general specifications, refer to the manual of the PLC main unit.

→ **Refer to the FX3G Series User's Manual - Hardware Edition**
→ **Refer to the FX3GC Series User's Manual - Hardware Edition**
→ **Refer to the FX3U Series User's Manual - Hardware Edition**
→ **Refer to the FX3UC Series User's Manual - Hardware Edition**

Item	Specification	
Dielectric Withstand Voltage	500 V AC for one minute	Between all terminals and ground terminal
Insulation Resistance	5 MΩ or more by 500 V DC megger	

4.3 Power Supply Specification

Item	Specification
Internal Power Supply	24 V DC, max 110 mA 24 V DC power is supplied internally from the main unit.

For details on the 24 V DC power supply of main unit, refer to the manual of the PLC main unit.

4.4 Performance Specifications

Item		Specification
Transmission Type		CAN Bus network
Applicable Function		J1939 Node or CAN Layer 2 Node
J1939 Services According to SAE Standards		SAE J1939, SAE J1939-11, SAE J1939-15, SAE J1939- 21, SAE J1939-71, SAE J1939-73, SAE J1939-75, SAE J1939-81
Network Size	SAE J1939-11	2 to 30 nodes / segment
	SAE J1939-15	2 to 10 nodes / segment
	CAN (Layer 2)	2 to 127 nodes
Communication Method		Cyclic, acyclic or request driven
Supported Transmission Speed / Max. Bus Length	SAE J1939-11	250 kbps / 40 m (131'2"), stubs max. 1 m (3'3")
	SAE J1939-15	250 kbps / 40 m (131'2"), stubs max. 3 m (9'10")
	CAN (Layer 2)	1 Mbps / 25 m (82')
		800 kbps / 50 m (164')
		500 kbps / 100 m (328'1")
		250 kbps / 250 m (820'2")
		125 kbps / 500 m (1640'5")
		100 kbps / 600 m (1968'6")
		50 kbps / 1000 m (3280'10")
		20 kbps / 2500 m (8202'1")
		10 kbps / 5000 m (16404'2")
Connection Cable		Refer to subsection 3.1.2.
Terminating Resistor		120 Ω (Accessory: 120 Ω 1/2W)
No. of Occupied I/O Points		8 points (taken from either the input or output points of the PLC)

This manual confers no industrial property rights or any rights of any other kind, nor does it confer any patent licenses. Mitsubishi Electric Corporation cannot be held responsible for any problems involving industrial property rights which may occur as a result of using the contents noted in this manual.

Warranty
Mitsubishi will not be held liable for damage caused by factors found not to be the cause of Mitsubishi; opportunity loss or lost profits caused by faults in the Mitsubishi products; damage, secondary damage, accident compensation caused by special factors unpredictable by Mitsubishi; damages to products other than Mitsubishi products; and to other duties.

⚠ For safe use

- This product has been manufactured as a general-purpose part for general industries, and has not been designed or manufactured to be incorporated in a device or system used in purposes related to human life.
- Before using the product for special purposes such as nuclear power, electric power, aerospace, medicine or passenger movement vehicles, consult with Mitsubishi Electric.
- This product has been manufactured under strict quality control. However when installing the product where major accidents or losses could occur if the product fails, install appropriate backup or failsafe functions in the system.

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