

Programmable Controller
MELSEC iQ-F

MELSEC iQ-F FX5-DP-M

Hardware Manual

FX5

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Revision	B
Date	October 2019

This manual describes the part names, dimensions, installation, and specifications of the product. Before use, read this manual and manuals of relevant products fully to acquire proficiency in 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.

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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 minor or moderate injury or property 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 Manual

Manual name	Manual No.	Description
MELSEC iQ-F FX5 User's Manual (PROFIBUS)	SH-081910ENG	Describes the functions of the PROFIBUS-DP master module.
MELSEC iQ-F FX5UJ User's Manual (Hardware)	SH-082206ENG	Explains FX5UJ CPU module specification details for I/O, wiring, installation, and maintenance.
MELSEC iQ-F FX5U User's Manual (Hardware)	JY997D55301	Explains FX5U CPU module specification details for I/O, wiring, installation, and maintenance.
MELSEC iQ-F FX5UC User's Manual (Hardware)	JY997D61401	Explains FX5UC CPU module specification details for I/O, wiring, installation, and maintenance.

How to obtain manuals

For the necessary product manuals or documents, consult with your local Mitsubishi Electric representative.

Applicable standards

FX5-DP-M complies with the EC Directive (EMC Directive) and UL standards (UL, cUL). Further information can be found in the following manual.

→ MELSEC iQ-F FX5 User's Manual (PROFIBUS)

Regarding the standards that relate to the CPU module, please refer to either the product catalog or consult with your local Mitsubishi Electric representative.

Attention

This product is designed for use in industrial applications.

1. Outline

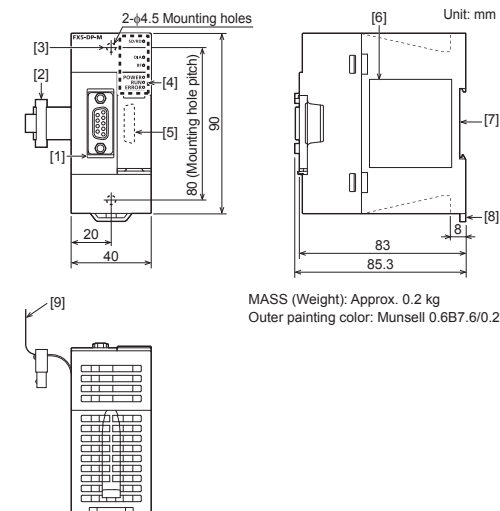
FX5-DP-M type PROFIBUS-DP master module (hereinafter referred to as FX5-DP-M) is an intelligent function module for connecting to a PROFIBUS-DP network as a master station.

1.1 Incorporated Items

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

Product	FX5-DP-M type PROFIBUS-DP master module
Included Items	Dust proof protection sheet (1 sheet)
	Hardware manual [Japanese/English] (This manual)
	Hardware manual [Chinese]

1.2 External Dimensions, Part Names



Unit: mm
MASS (Weight): Approx. 0.2 kg
Outer painting color: Munsell 0.6B7.6/0.2

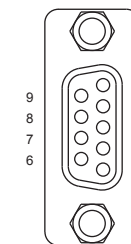
- [1] PROFIBUS-DP interface connector (D-Sub 9-Pin Connector: #4-40 UNC screws)
- [2] Extension cable
- [3] Direct mounting hole: 2 holes of $\phi 4.5$ (mounting screw: M4 screw)
- [4] Operation status display LEDs
- [5] Extension connector (for next module)
- [6] Name plate
- [7] DIN rail mounting groove (DIN rail: DIN 46277, 35 mm wide)
- [8] DIN rail mounting hook
- [9] Pullout tab

1.3 Indications of LEDs

LED display	LED color	Status	Indication
SD/RD	Green	On	During data exchange, or Acyclic communication ^{*1}
		Flashing	
		Off	During data exchange stop
DIA	Red	On	Diagnostic information or alarm is detected
		Off	No diagnostic information and no alarm
BF	Red	On	Diagnostic information is detected
		Off	No diagnostic information
POWER	Green	On	Power on
		Off	Power off or module failure
RUN	Green	On	Normal operation
		Off	Error
ERROR	Red	On	Minor error or major error
		Flashing	Moderate error or major error
		Off	Normal operation

^{*1} Flashes when the module requests or responds to the Acyclic communication.

1.4 Pin Configuration



Pin No.	Name	Description
1	NC	Not connected
2	NC	Not connected
3	RxD/TxD-P	Receive/send data-P
4	CNTR-P ^{*1}	Control signal of repeaters
5	DGND ^{*2}	Data ground
6	VP ^{*2}	Voltage +
7	NC	Not connected
8	RxD/TxD-N	Receive/send data-N
9	NC	Not connected

^{*1} Optional signal^{*2} Signal used for connecting a bus terminator

2. Installation

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. - Use the product within the generic environment specifications described in the User's Manual (Hardware) of the CPU module to be used. 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.	

INSTALLATION PRECAUTIONS	⚠ CAUTION
- 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 of the PLC. Failure to do so may cause fire, equipment failures or malfunctions. - The dust proof sheet should be affixed to the ventilation slits before installation and wiring work to block foreign objects such as cutting and wiring debris. However, when the installation work is completed, make sure to remove the sheet to provide adequate ventilation. 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 the extension cables securely to their designated connectors. Loose connections may cause malfunctions.	

For further information on mounting, refer to the following manual.

→ MELSEC iQ-F FX5UJ User's Manual (Hardware)
→ MELSEC iQ-F FX5U User's Manual (Hardware)
→ MELSEC iQ-F FX5UC User's Manual (Hardware)

3. Wiring

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
- Install module so that excessive force will not be applied to connector. Failure to do so may result in wire damage/breakage or PLC failure. - Make sure to observe the following precautions in order to prevent any damage to the machinery or accidents due to malfunction of the PLC caused by abnormal data written to the PLC due to the effects of noise: - Do not bundle the communication cables together with or lay them close to the main circuit, high-voltage line, load line or power line. As a guideline, lay the power line, control line and communication cables at least 100 mm away from the main circuit, high-voltage line, load line or power line. - Ground the shield of the shielded wire or shielded cable at one point on the PLC. However, do not use common grounding with heavy electrical systems. - Use a cable dedicated for the PROFIBUS system. Otherwise, the performance of the PROFIBUS system cannot be guaranteed. Also, for the total extension length of the cables and cable length between stations, make sure to follow the specifications described in this manual. If wiring not in accordance with the specifications is performed, normal data transmission cannot be guaranteed. - Check the interface type and correctly connect the cable. Incorrect wiring (connecting the cable to an incorrect interface) may cause failure of the module and external device.	

3.1 PROFIBUS Cable and Connectors

3.1.1 PROFIBUS cable

Use PROFIBUS cables that satisfy the following specifications (compliant with TypeA (IEC61158-2)).

Item	Specifications
Applicable cable	Shielded twisted pair cable
Impedance	135 to 165 Ω (f = 3 to 20 MHz)
Capacity	Less than 30 pF/m
Conductor resistance	Less than 110 Ω/km
Cross-sectional area	0.34 mm ² or more
Wire diameter	AWG 22
Type	Stranded wire
Material	Copper wire

3.1.2 Connectors

Use D-sub 9-pin male connectors for PROFIBUS cables.
Use #4-40 UNC screws for the connector. Tighten the screws within the range of 0.20 to 0.28N·m.

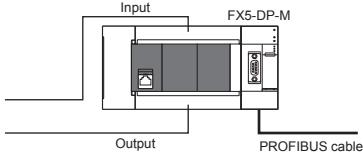
3.2 Wiring precautions

3.2.1 Communication cable wiring

Do not route the communication cable of the FX5-DP-M near the main circuit, power cable, or load cable other than that of the programmable controller. In addition, do not bundle those cables together. Otherwise the FX5-DP-M may be affected by noise or surge induction.

3.2.2 Wiring from input/output of programmable controller

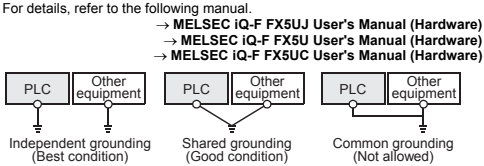
Place the PROFIBUS cable as far away from input/output wiring of the module as possible.



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 the PLC cannot be grounded independently, perform the "Shared grounding" shown below.



- Bring the grounding point close to the PLC as much as possible so that the ground cable can be shortened.

3.4 Bus Terminator

The modules at each end of the PROFIBUS-DP network segment must have a bus terminator. This will either be in the DP-Master or DP-Slave module or in the connector.

However, the FX5-DP-M does not have a terminating resistance built-in.

4. Specification

DESIGN PRECAUTIONS WARNING

- Make sure to set up the following safety circuits outside the PLC to ensure safe system operation even during external power supply problems or PLC failure. Otherwise, malfunctions may cause serious accidents.
 - Most importantly, set up the following: an emergency stop circuit, a protection circuit, an interlock circuit for opposite movements (such as normal vs. reverse rotation), and an interlock circuit (to prevent damage to the equipment at the upper and lower positioning limits).
 - Note that when the CPU module 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 CPU module 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 station after a communication failure, refer to manuals relevant to the network. Incorrect output or malfunction due to a communication failure may result in an accident.
- Construct an interlock circuit in the program so that the whole system always operates on the safe side before executing the control (for data change) of the PLC in operation. Read the manual thoroughly and ensure complete safety before executing other controls (for program change, parameter change, forcible output and operation status change) of the PLC in operation. Otherwise, the machine may be damaged and accidents may occur due to erroneous operations.
- Especially, when a remote programmable controller is controlled by an external device, immediate action cannot be taken if a problem occurs in the programmable controller due to a communication failure. To prevent this, configure an interlock circuit in the program, and determine corrective actions to be taken between the external device and CPU module in case of a communication failure.
- If a communication cable is disconnected, the network may be unstable, resulting in a communication failure of multiple stations. Configure an interlock circuit in the program to ensure that the entire system will always operate safely even if communications fail. Failure to do so may result in an accident due to an incorrect output or malfunction.
- To maintain the safety of the programmable controller system against unauthorized access from external devices via the network, take appropriate measures. To maintain the safety against unauthorized access via the Internet, take measures such as installing a firewall.

DESIGN PRECAUTIONS CAUTION

- Simultaneously turn on and off the power supplies of the CPU module and extension modules.

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.
- 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 PRECAUTIONS CAUTION

- The product is a precision instrument. During transportation, avoid impacts larger than those specified in the general specifications by using dedicated packaging boxes and shock-absorbing pallets.
Failure to do so may cause failures in the product. After transportation, verify operation of the product and check for damage of the mounting part, etc.

4.1 Applicable CPU Module

Model name	Applicability
FX5UJ CPU module	From first production
FX5U CPU module	Ver. 1.110 or later
FX5UC CPU module ^{*1}	Ver. 1.110 or later

^{*1} FX5-CNV-IFC or FX5-C1PS-5V is necessary to connect FX5-DP-M to the FX5UC CPU module.

4.2 Applicable Software Package

Software	Applicability
GX Works3	FX5UJ CPU CPU module: Ver. 1.060N or later FX5U/FX5UC CPU module: Ver. 1.050C or later
PROFIBUS Configuration Tool	FX5UJ CPU CPU module: Ver. 1.03D or later FX5U/FX5UC CPU module: Ver. 1.02C or later

4.3 General Specifications

The items other than the following are equivalent to those of the CPU module.
For the general specification, refer to the following manual.

- MELSEC IQ-F FX5UJ User's Manual (Hardware)
- MELSEC IQ-F FX5U User's Manual (Hardware)
- MELSEC IQ-F FX5UC User's Manual (Hardware)

Item	Specifications	
Dielectric withstand voltage	500 V AC for 1 minute	Between all terminals and frame of communication connector
Insulation resistance	10 MΩ or higher by 500 V DC insulation resistance tester	

4.4 Power Supply Specifications

Item	Specifications	
Internal power supply	Power supply voltage	24 V DC
	Current consumption	150 mA

4.5 Performance Specifications

Item	Specifications	
PROFIBUS-DP station type	DP-Master (Class 1)	
Electrical standard and characteristics	Compliant with EIA-RS485	
Medium	Shielded twisted pair cable	
Network configuration	Bus topology (or tree topology when repeaters are used)	
Data link method	- Between DP-Masters: Token passing - Between DP-Master and DP-Slave: Polling	
Encoding method	NRZ	
Transmission speed ^{*1}	9.6 kbps, 19.2 kbps, 93.75 kbps, 187.5 kbps, 500 kbps, 1.5 Mbps, 3 Mbps, 6 Mbps, 12 Mbps	
Transmission distance	Differs depending on the transmission speed (Refer to section 4.6)	
Max. No. of repeaters (Between DP-Master and DP-Slave)	3 repeaters	
No. of connectable modules (per segment)	32 per segment (including repeaters)	
Max. No. of DP-Slaves	64	
No. of connectable nodes (No. of repeaters)	32, 62(1), 92(2), 122(3), 126(4)	
Transmission data	Input data	Max. of 2048 bytes (Max. of 244 bytes per DP-Slave)
	Output data	Max. of 2048 bytes (Max. of 244 bytes per DP-Slave)
No. of occupied I/O points	8 points	
No. of connectable units	1 unit	

^{*1} Transmission speed accuracy is within ±0.2% (compliant with IEC61158-2).

4.6 Transmission distance

Transmission speed	Transmission distance	Max. transmission distance when repeater are used ^{*1}
9.6 kbps, 19.2 kbps, 93.75 kbps	1200 m/Segment	4800 m/Network
187.5 kbps	1000 m/Segment	4000 m/Network
500 kbps	400 m/Segment	1600 m/Network
1.5 Mbps	200 m/Segment	800 m/Network
3 Mbps, 6 Mbps, 12 Mbps	100 m/Segment	400 m/Network

^{*1} The max. transmission distance shown in the above table indicates the distance when three repeaters are used.
To calculate the max. transmission distance when repeaters are used and the transmission distance is extended, use the following formula.
Max. transmission distance [m/network] = (No. of repeaters + 1) × Transmission distance [m/segment]

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Warranty

Exclusion of loss in opportunity and secondary loss from warranty liability
Regardless of the gratis warranty term, Mitsubishi shall not be liable for compensation to:
(1) Damages caused by any cause found not to be the responsibility of Mitsubishi.
(2) Loss in opportunity, lost profits incurred to the user by Failures of Mitsubishi products.
(3) Special damages and secondary damages whether foreseeable or not, compensation for accidents, and compensation for damages to products other than Mitsubishi products.
(4) Replacement by the user, maintenance of on-site equipment, start-up test run and other tasks.

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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