



Programmable Controller  
MELSEC iQ-F

## MELSEC iQ-F FX5-2HC/ES

# Hardware Manual



Manual Number	IB(NA)-0800695
Revision	B
Date	November 2024

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.

Registration:  
The company names, system names and product names mentioned in this manual are either registered trademarks or trademarks of their respective companies. In some cases, trademark symbols such as "™" or "®" are not specified in this manual.

Effective November 2024

Specifications are subject to change without notice.

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### Safety Precautions (Read these precautions before use.)

If the product is used in a manner not specified by Mitsubishi Electric, the protection provided by the product may be impaired.

This manual classifies the safety precautions into two categories: **WARNING** and **CAUTION**.

<b>WARNING</b>	Indicates that incorrect handling may cause hazardous conditions, resulting in death or severe injury.
<b>CAUTION</b>	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.

### Relevant manuals

Manual name	Manual No.	Description
MELSEC iQ-F FX5 High-Speed Counter Module User's Manual	SH-082631ENG	Details of the high-speed counter module
MELSEC iQ-F FX5S/FX5UJ/FX5U/FX5UC User's Manual (Hardware)	SH-082452ENG	Details of hardware of the CPU module, including performance specifications, wiring, installation, and maintenance

For the necessary product manuals or documents, consult with your local Mitsubishi Electric representative. Or, access the following URL and download the data.

[www.mitsubishielecric.com/fa/ref/ref.html?kisyu=plc&manual=download\\_all](http://www.mitsubishielecric.com/fa/ref/ref.html?kisyu=plc&manual=download_all)

### Applicable standards

The FX5-2HC/ES complies with the EU Directive (EMC Directive) and UL standards (UL, cUL), and has a UKCA marking on it. For an external power supply, use a SELV (safety extra-low voltage) power supply that meets LIM (limited-energy circuit) or UL 1310 Class 2.

Further information can be found in the following manual.

→ **MELSEC iQ-F FX5 High-Speed Counter Module User's Manual**  
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

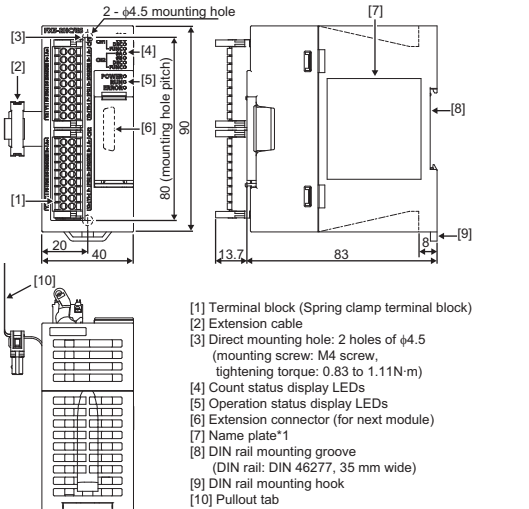
The FX5-2HC/ES high-speed counter module (hereinafter referred to as "FX5-2HC/ES") is an intelligent function module that performs the high-speed input from differential line driver type devices.

#### 1.1 Incorporated Items

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

<b>Product</b>	FX5-2HC/ES high-speed counter module
	Dust proof protection sheet (1 sheet)
<b>Included Items</b>	Hardware manual [Japanese /English] (This manual)
	Hardware manual [Chinese]

#### 1.2 External Dimensions, Part Names



Weight: Approx. 0.2 kg  
Outer painting color: Munsell 0.6B 7.6/0.2

\*1 The **CAUTION** mark indicates that the further product information can be obtained from the following manual.

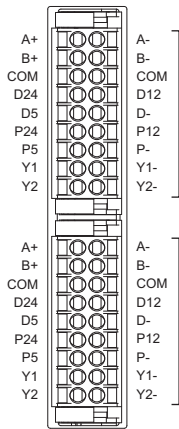
→ **MELSEC iQ-F FX5S/FX5UJ/FX5U/FX5UC User's Manual (Hardware)**  
Download the manual from the following URL.

[www.mitsubishielecric.com/fa/ref/ref.html?kisyu=plc&manual=download\\_all](http://www.mitsubishielecric.com/fa/ref/ref.html?kisyu=plc&manual=download_all)

#### 1.3 Indications of LEDs

LED display	LED color	Status	Indication
POWER	Green	On	Power on
		Off	Power off or error
RUN	Green	On	Normal operation
		Off	Error
ERROR	Red	On	Minor error
		Flashing	Moderate error
		Off	Normal operation
CH1/CH2	φA	Green	On: Phase A pulse input ON Off: Phase A pulse input OFF
CH1/CH2	φB	Green	On: Phase B pulse input ON Off: Phase B pulse input OFF
CH1/CH2	DEC	Green	On: Counter is performing down count. Off: Counter is performing up count.
CH1/CH2	FUNC	Green	On: Function start input ON Off: Function start input OFF

### 1.4 Terminal Layout



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

→ **MELSEC iQ-F FX5 High-Speed Counter Module User's Manual**

### 2. Installation

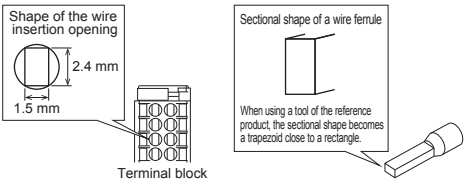
<b>INSTALLATION PRECAUTIONS</b>	<b>WARNING</b>
<ul style="list-style-type: none"><li>Make sure to cut off all phases of the power supply externally before attempting installation or wiring work. Failure to do so may cause electric shock or damage to the product.</li><li>Use the product within the generic environment specifications described in the User's Manual (Hardware) for the CPU module to be used. Never use the product in areas with excessive dust, oily smoke, conductive dusts, corrosive gas (salt air, Cl<sub>2</sub>, H<sub>2</sub>S, SO<sub>2</sub> or NO<sub>2</sub>), 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.</li></ul>	

<b>INSTALLATION PRECAUTIONS</b>	<b>CAUTION</b>
<ul style="list-style-type: none"><li>Do not touch the conductive parts of the product directly. Doing so may cause device failures or malfunctions.</li><li>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.</li><li>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.</li><li>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.</li><li>Install the product securely using a DIN rail or mounting screws.</li><li>Connect the extension cables securely to their designated connectors. Loose connections may cause malfunctions.</li><li>Connect this product to the extension connector on the CPU module or on a module connected to the CPU module.</li></ul>	

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

→ **MELSEC iQ-F FX5S/FX5UJ/FX5U/FX5UC User's Manual (Hardware)**

Check the shape of the wire insertion opening with the following figure, and use the smaller wire ferrule than the described size. Also, insert the wire with care so that the wire ferrule is in proper orientation. Failure to do so may cause the bite of the terminal and the damage of the terminal block.



The following table shows wire ferrules and its associated tools compatible with the terminal block. Because the shape of the wire ferrule differs depending on the crimp tool to be used, use the reference product. If the product other than referenced products is used, the wire ferrule cannot be removed. Sufficiently confirm that the wire ferrule can be removed before use. When using the FX5-2HC/ES as a UL listed product, use a reference product as well.

<Reference product>

Manufacturer	Model	Wire size	Applicable standards	Crimp tool
PHOENIX CONTACT GmbH & Co. KG	AI 0.5-10 WH	0.5mm <sup>2</sup>	UL Listed	CRIMPFOX 6
	AI 0.75-10 GY	0.75mm <sup>2</sup>		
	A 1-10	1.0mm <sup>2</sup>		
	A 1.5-10	1.5mm <sup>2</sup>		

#### 3) Connecting a wire

- When ferrules with insulation sleeve are used  
Insert a wire with the ferrule with insulation sleeve into the wire insertion opening and push the wire.
- When stranded wires and solid wires are used  
Push the open/close button of the terminal block with a flathead screwdriver. While pushing the open/close button, insert the wire into the insertion opening until the wire reaches the back, and then release the open/close button.

Then, pull the wire lightly and check that it is clamped securely.

<Reference>

Manufacturer	Model name of a flathead screwdriver
PHOENIX CONTACT GmbH & Co. KG	SZS 0.4×2.5 VDE

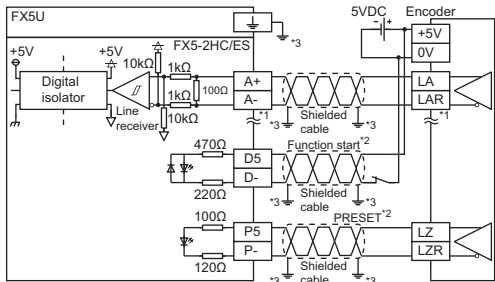
#### 4) Disconnecting a wire

Pull out the wire with the open/close button pushed using a flathead screwdriver.

### 3.2 Example of Wiring

#### 1) Wiring with a differential line driver output type encoder

When connecting the differential line driver (equivalent to AM26C31) output type encoder and the FX5-2HC/ES, wire the 5V system terminal as shown below.

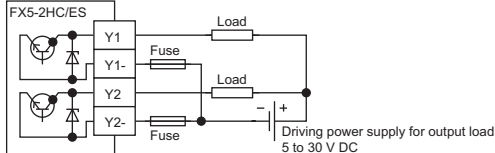


\*1 Wire the phase B in the same manner as the phase A.

\*2 Do not wire it when not using the preset input and the function start (disable function or others) input.

\*3 Perform class D grounding (grounding resistance: 100Ω or less).

2) Y1 output and Y2 output wiring (sink wiring)



### Caution

- Install a protection fuse in the output. Also, use a power supply for driving a load with the capacity that is about twice the load current.
- Source wiring is not supported.

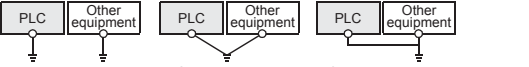
#### 3.3 Grounding

Ground the PLC as stated below.

- Perform class D grounding (grounding resistance: 100Ω or less).
  - Ground the PLC independently if possible.
- If the PLC cannot be grounded independently, perform the "Shared grounding" shown below.

For details, refer to the following manual.

→ **MELSEC iQ-F FX5S/FX5UJ/FX5U/FX5UC User's Manual (Hardware)**



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

### 4. Specification

<b>DESIGN PRECAUTIONS</b>	<b>WARNING</b>
<ul style="list-style-type: none"><li>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.<ul style="list-style-type: none"><li>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).</li></ul></li><li>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.</li><li>To convert data of a running programmable controller, configure an interlock circuit in the program to ensure that the entire system will always operate safely. For other forms of control (such as program modification, parameter change, forced output, or operating status change) of a running programmable controller, read the relevant manuals carefully and ensure that the operation is safe before proceeding. Improper operation may damage machines or cause accidents.</li></ul>	

<b>DESIGN PRECAUTIONS</b>	<b>CAUTION</b>
<ul style="list-style-type: none"><li>Simultaneously turn on and off the power supplies of the CPU module and extension modules.</li></ul>	

<b>STARTUP AND MAINTENANCE PRECAUTIONS</b>	<b>CAUTION</b>
<ul style="list-style-type: none"><li>Do not disassemble or modify the PLC. Doing so may cause fire, equipment failures, or malfunctions. For repair, contact your local Mitsubishi Electric representative.</li><li>Do not drop the product or exert strong impact to it. Doing so may cause damage.</li><li>Before handling the module, touch a conducting object such as a grounded metal to discharge the static electricity from the human body. Failure to do so may cause the module to fail or malfunction.</li></ul>	

<b>DISPOSAL PRECAUTIONS</b>	<b>CAUTION</b>
<ul style="list-style-type: none"><li>Please contact a certified electronic waste disposal company for the environmentally safe recycling and disposal of your device.</li></ul>	

<b>TRANSPORTATION PRECAUTIONS</b>	<b>CAUTION</b>
<ul style="list-style-type: none"><li>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.</li></ul>	

#### 4.1 Applicable CPU Module

Model name	Applicability
FX5UJ CPU module	Ver. 1.060 or later
FX5U CPU module	Ver. 1.300 or later
FX5UC CPU module	Ver. 1.300 or later

#### 4.2 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 FX5S/FX5UJ/FX5U/FX5UC User's Manual (Hardware)**

Items	Specifications	
Dielectric withstand voltage	500 V AC for 1 minute	Between all terminals and ground terminal
Insulation resistance	10 MΩ or higher by 500 V DC insulation resistance tester	

#### 4.3 Power Supply Specifications

Items	Specifications	
Internal power supply	Power supply voltage	Bus 5 V DC
	Current consumption	210 mA

#### 4.4 Performance Specifications

Items	Specifications	
Number of input points	Differential input (phase A, phase B)	2 points (1 point × 2 channels)
	Function start input	2 points (1 point × 2 channels)
	Preset input	2 points (1 point × 2 channels)
Number of output points	4 points (2 points × 2 channels)	
Maximum input frequency	2MHz	
Number of occupied I/O points	8 points	

#### 4.5 Input/output Specifications

Items	Specifications	
Input signal	Phase-A and phase-B input	5 V DC (EIA Standard RS-422-A differential line driver level)
	Function start input <sup>*1</sup>	[D24] 24 V DC ±10% Current consumption 8 mA or lower
		[D12] 12 V DC ±10% Current consumption 8 mA or lower
		[D5] 5 V DC ±10% Current consumption 7 mA or lower
	Preset input <sup>*1</sup>	[P24] 24 V DC ±10% Current consumption 10 mA or lower
Maximum frequency (phase A and phase B)		[P12] 12 V DC ±10% Current consumption 10 mA or lower
		[P5] 2.4 to 5.5 V DC Current consumption 25 mA or lower
	1-phase input	1 input 2MHz
	2-phase input	Multiplication by 1 2MHz Multiplication by 2 1MHz Multiplication by 4 500kHz

### 3. Wiring

<b>WIRING PRECAUTIONS</b>	<b>WARNING</b>
<ul style="list-style-type: none"><li>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.</li><li>Make sure to properly wire to the spring clamp terminal block 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.<ul style="list-style-type: none"><li>The disposal size of the cable end should follow the dimensions described in the manual.</li><li>Twist the ends of stranded wires and make sure that there are no loose wires.</li></ul></li><li>Do not solder-plate the electric wire ends.</li><li>Do not connect more than the specified number of wires or electric wires of unspecified size.</li><li>Affix the electric wires so that neither the terminal block nor the connected parts are directly stressed.</li></ul>	

<b>WIRING PRECAUTIONS</b>	<b>CAUTION</b>
<ul style="list-style-type: none"><li>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:<ul style="list-style-type: none"><li>Do not bundle the power line and control line 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 and control line at least 100 mm away from the main circuit, high-voltage line, load line or power line.</li></ul></li><li>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.</li><li>To terminal blocks, connect circuits isolated from hazardous voltage by double/reinforced insulation.</li></ul>	

#### 3.1 Applicable Wire

##### 3.1.1 Spring clamp terminal block

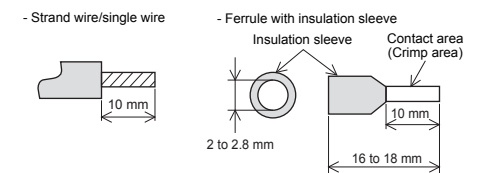
1) Suitable wiring

No. of wire per terminal	Wire size		Temperature rating
	Single wire, Strand wire (Material: Copper wire)	Ferrules with insulation sleeve	
One wire	AWG24 to 16 (0.2 to 1.5 mm <sup>2</sup> )	AWG23 to 19 (0.25 to 0.75 mm <sup>2</sup> )	80 °C or more

2) Wire end treatment

Strip the cable about 10 mm from the tip to connect a wire ferrule at the stripped area. Failure to do so may result in electric shock or short circuit between adjacent terminals because of the conductive part. If the wire strip length is too short, it may result in the poor contact to the spring clamp terminal part.

When using a wire ferrule with an insulating sleeve, choose a wire with proper cable sheath referring to the above outside dimensions, otherwise the wire cannot be inserted easily.



Items	Specifications	
Pulse waveform	t1	t1
	t2	t3
	t4	t4
	t1 (ON/OFF pulse width)	0.25 μs or more
	t2 (phase difference between phase A and phase B)	0.125 μs or more
	t3 (overlap time)	0.125 μs or more
Measuring range	t4 (rise/fall)	0.12μs or less
	Preset (phase Z) input signal width	ON width: 1.5 μs or more OFF width: 2.5 μs or more
	Function start input terminal	ON width: 100 μs or more OFF width: 100 μs or more
Digital filter (Preset, Function start)	None, 0.1 ms, 1 ms, 10 ms	

\*1 Select a voltage from 5 V DC, 12 V DC, or 24 V DC and use it.

Output specifications

Items	Specifications
Signal output type	Y1: Transistor output on the + side to Y1 output
	Y1-: Transistor output on the - side to Y1 output
	Y2: Transistor output on the + side to Y2 output
Output capacity	Y2-: Transistor output on the - side to Y2 output
	5 to 30 V DC, 0.5 A/point (resistive load)
Response time	Off to on: 2.5 μs or less
	On to off: 2.5 μs or less

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**  
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.

<b>For safe use</b>
<ul style="list-style-type: none"><li>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.</li><li>Before using the product for special purposes such as nuclear power, electric power, aerospace, medicine or passenger movement vehicles, consult with Mitsubishi Electric.</li><li>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.</li></ul>

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