

F5 Series PLCs

Hardware Manual

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Preface

Overview

Thank you for choosing Flexem products. This manual details the hardware appearance, features, and installation method of the F5 Series PLCs(hereinafter referred to as equipment or controller).





Target Reader

This document is mainly intended for readers who are interested in learning about the hardware feature and installation method of the F5 Series PLCs. It includes installation engineers, electrical engineers, etc. This document assumes that readers have a certain level of knowledge in the following areas:

- ◆ Hardware installation method
- ◆ Basic electrical knowledge
- ◆ How PLC works

Security Information

Before trying to install, operate, or maintain the equipment, please read the following instructions carefully and familiarize yourself with the equipment by viewing them. The following special information may appear elsewhere in this document or on the equipment to alert the user to potential hazards or to draw attention to information that clarifies or simplifies a process.

Icon	Description
	Tips, operation tips for users to solve problems.
	Description, supplementary and explanatory information for the main text.
	Caution, reminders for operation precautions, improper operation may cause potential equipment damage or data loss.
	Warning, the content following this icon requires special attention, otherwise it may result in personal injury.

The installation, operation, repair and maintenance of electrical equipment should only be carried out by qualified professionals. Shanghai Flexem Technology Co., Ltd. is not responsible for any consequences arising from using this document.

A qualified professional is a person with skills and knowledge related to the manufacture and operation of electrical

equipment, who can detect and avoid relevant dangers after safety training.



- ◆ The designer of any control scheme must consider the possibility of control path failures and provide a means for certain critical control functions to return to a safe state in the event of, and after, a path failure. Emergency and overrun stops, power failures and restarts are all critical control functions.
- ◆ Separate or redundant control paths must be provided for critical control functions.
- ◆ System control paths can include communication links. Unforeseen transmission delays or connection failures must be taken into account.
- ◆ Comply with all accident prevention regulations and local safety guidelines.
- ◆ To ensure correct operation, the equipment must be thoroughly tested separately for each execution before it is put into use.

The equipment is designed for operation outside any hazardous area. The equipment should only be installed in a known safe environment.



Danger of electric shock, explosion and voltaic arc

- ◆ Before removing any protective cover or door, or installing or removing any accessories, hardware, cables, or wires, disconnect all equipment from power (including connected equipment), except as otherwise specified in the appropriate hardware guide for the equipment.
- ◆ Always confirm that all power is off at the indicated location and time using the appropriate rated voltage sensor.
- ◆ Replace and tighten all protective covers, accessories, hardware, cables and wires, and make sure the earthing connection is correct before powering up the equipment.
- ◆ The specified voltage must be used when operating this equipment and related products.

This product should not be used on machines that do not have effective operation point protection. The lack of effective operation point protection on the machine may result in serious injury to the operator of the machine.

F5 Series PLCs and related software are used to control a wide variety of industrial processes. The type or model of automation equipment suitable for each application varies depending on the control function required, the level of protection needed, production methods, exceptional conditions, government regulations, and other factors. In some applications, more than one processor may be required if back-up redundancy is required.

Only the user is aware of the conditions and factors that arise during the installation, operation and maintenance of the machine, therefore, only the user can determine the correct automation equipment and associated safety equipment and interlocks device to be used. When selecting automation and control equipment and related software for a particular application, the user should refer to applicable local and national standards and regulations.

For some applications, additional operator protection such as operation point protection must be provided. Such protection must be provided if the operator's hands and other body parts have free access to a pinch point or other hazardous area that could result in serious injury. The F5 Series PLCs and associated software products alone cannot prevent operator injury. Therefore, this equipment cannot be replaced, nor can it replace operation point protection. Before using the equipment, ensure that the appropriate safety equipment and mechanical/electrical interlocks associated with the operation point protection are installed and operational. All interlocks and safety equipment

associated with operation point protection must be used in conjunction with the associated automation equipment and software programs.

Get Help

If you have any problem during use, please call the service hotline at 4008-033-022.

Please visit <https://www.flexem.com/download> to obtain more documents.

Contact information

Address: 9th Floor of INNO Center Building A, No. 386 Guo'an Road, Yangpu District, Shanghai

Postcode: 200043

Website: <https://www.flexem.com>

1 Product Overview

1.1 Product Profile

The F5 Series PLCs are the latest generation of PLCs from Shanghai Flexem Technology Co., Ltd., integrating the latest technology and components in the industry. The F5 Series PLCs adopt an object-oriented programming design concept, complies with the IEC61131-3 standard, supports Ladder Diagram and Structured Text (ST) programming languages. It is compatible with Japanese and European programming methods, takes into account the user's habits and the implementation of complex calculation functions, and the motion control complies with the PLCOPEN standard.

Object-oriented structured task programming approach is in line with international standards and industry trends, it reduces user difficulty and extends the product life-cycle. The programming software is developed based on the most popular development platforms and natively supports the cloud platform architecture; the graphical programming configuration interface and the printing function can greatly reduce the archiving workload and complete the project documentation delivery with one click.

1.2 System Structure

The F5 Series PLCs are connected to the extension module via a connection interface on both sides of the body.

The F5 Series PLCs CPU can be extended with up to 31 right extension modules and 1 left Internet extension module, as well as the built-in extension board slots for functional extension, allowing flexible configuration and data upload to the cloud.



Limited by the power supply of the CPU, the FSU software configuration interface can get the specific number of expansion modules that the CPU can carry by accumulating current consumption for each module.

1.3 Hardware Specifications

Hardware specifications of each model is listed in the table below.

Model	Power Supply	Extension Board	Input	Relay Output	HSC(Point)	PTO (Point)	Ethernet Port
FC5M-20M*-AC	AC	1	12	8	7	6	1
FC5M-30M*-AC	100~240V	1	18	12	7	6	1

Model	Power Supply	Extension Board	Input	Relay Output	HSC(Point)	PTO (Point)	Ethernet Port
FC5M-40M*-AC	50/60Hz	2	24	16	7	6	1
FC5-20M*-AC		1	12	8	0	0	1
FC5-30M*-AC		1	18	12	0	0	1
FC5-40M*-AC		2	24	16	0	0	1
FC5M-20M*-DC	DC 24V	1	12	8	7	6	1
FC5M-30M*-DC		1	18	12	7	6	1
FC5M-40M*-DC		2	24	16	7	6	1
FC5-20M*-DC		1	12	8	0	0	1
FC5-30M*-DC		1	18	12	0	0	1
FC5-40M*-DC		2	24	16	0	0	1

“*” indicates the output type, with values of R(Relay), N(NPN Transistor), P(PNP Transistor).

2 Hardware Structure

2.1 Equipment Appearance

The main panel of the equipment is shown in the figure below.



Number	Name	Application
1	Ethernet Port	RJ45 Ethernet communication port
2	Removable Terminal Blocks	Input signal, 24 V DC power output (be applicable to AC power supply models)
3	Status Indicator	PWR: Operation power indicator
		RUN: Running indicator
		SL1: Serial Port1 communication indicator
		SL2: Serial Port2 communication indicator
	ETH: Ethernet connection indicator	
4	Type-C USB Interface	User program download port
5	RUN/STOP Switch	CPU run/stop switch
6	DB 9 Serial Port	Serial communication port 1
7	Status Indicator	CPU input and output signal operating status indicator

Number	Name	Application
8	Extension Board	Extension board slot
9	Operating Power	Power input terminal
10	Output terminal	CPU output signal
11	RS485 port	Serial communication port 2 with photoelectric isolators
12	Lock	Lock to install left/right extension module

2.2 Characteristics of Each Component

2.2.1 Storage

F5 Series PLCs have a built-in 2MB RAM and 2MB ROM, and users can use 192KB and 2MB storage areas, respectively. The corresponding storage areas are as follows.

Area	Storage
ROM (2MB)	User project, configuration, communication configuration, etc.
RAM (192KB)	Variables, mapped address variables, communication configuration generated data, etc.



The F5 Series PLCs Retain data area capacity is 4KB.

2.2.2 Built-in Communication port

Three separate types of communication ports are available based on the controller model:

- ◆ Ethernet port
- ◆ Type-C USB port
- ◆ Serial port

2.2.3 Built-in Conventional Input and Output

Built-in conventional I/O types are available based on the controller model:

- ◆ Digital inputs
- ◆ High-speed counting input
- ◆ PTO output
- ◆ Relay output
- ◆ Conventional transistor output

2.2.4 Extension Module

The number of I/O for the controller can be extended by adding I/O modules of the following types:

- ◆ Digital input module
- ◆ Digital output module
- ◆ Digital mixed module
- ◆ Analog input module
- ◆ Analog output module
- ◆ Analog mixed module
- ◆ Serial communication extension board
- ◆ Analog extension board

2.2.5 Real Time Clock

The F5 Series PLCs have a built-in RTC (Real Time Clock) function that not only provides system date and time information, but also supports functions that require a real-time clock. The clock function can also be kept running for up to 1 year after an external power is off.

2.2.6 Transistor Input Characteristics

Characteristic		Parameter
Rated voltage		24V DC
Input range		0V~28.8V DC
Rated current		7mA
Peak value	Voltage	30V
	Current	9mA
State	Voltage in state 1	>15V
	Voltage in state 0	<5V
	Current in state 1	>2.5mA
	Current in state 0	<1.0mA
Isolation	-	Optocoupler
Input impedance		3.3kΩ
Filter time		Default 1ms, 16 equally divided levels selectable from unfiltered to 100ms
Compatibility		Compatible with 2/3 wire sensors

Characteristic	Parameter
Input type	Source/sinking
Cable length and type	Max 100m shielded cable, 50m unshielded cable
Protection (overvoltage)	Maximum 30V, limited to 1 hour per day frequency
Wiring terminal	Removable terminal block

2.2.7 Relay Output Characteristics

Characteristics		Parameter
Rated voltage		24V DC; 220V AC
Input range		5V~30V DC; 100V~250V AC
Rated current		Max 2A /point
Current/group (4-point)		4A (relay output @60° C, 50% derating required)
Peak value	Maximum switching voltage	250V AC; 30V DC
	Current/point	5A
Isolation type		Relay coil
Maximum output frequency	Maximum load	0.1Hz
	Without load	5Hz
Resistive load		2A/point, 24V DC / 220V AC
Mechanical life		Minimum 5,000,000 times
Electrical contact life		Minimum 100,000 times
Short circuit protection		None
Wiring terminal		Removable terminal block

2.2.8 Transistor Output Characteristics

Characteristics	Parameter
Output type	NPN or PNP (based on controller model)

Characteristics	Parameter
Rated voltage	24V DC
Voltage range	19.2V~28.8V DC
Rated current	2A
Current/group	4A * Output point of each group
Voltage drop	Maximum 1V DC
Leakage current when turned off	<5 μ A
Maximum power of incandescent lamp	2.4W
Derating	None
Start time	Maximum 34 μ s
Turn-off time	Maximum 250 μ s
Maximum output frequency	1kHz
Short circuit protection	Available
Peak short-circuit output current	1.3A
Self-recovery after short circuit or overload	Per 10ms
Clamping voltage	Maximum 39V \pm 1V DC
Isolation	500V AC between output and internal logic
Type of Cable	Unshielded
Cable length	Unshielded 50m
Wiring terminal	Removable terminal block

2.2.9 Fast Transistor (PTO) Output Characteristics

Characteristics	Parameter
Rated voltage	24 V DC
PTO Power input range	19.2V~28.8V DC
PTO Power reverse protection	Available
Output type	NPN or PNP (based on controller model)
PTO/PWM output current	0.5A (when used as normal output)

Characteristics	Parameter
	0.1A (when used as a fast output)
Insulation resistance	> 10 MΩ
Leakage voltage	< 1.5V (Current is 0.1A)
Minimum load impedance	80Ω
Maximum PTO output frequency	<ul style="list-style-type: none"> ◆ NPN: 200kHz ◆ PNP: 100kHz
Maximum PWM output frequency	50kHz
Duty cycle resolution	Not greater than 0.5%
Duty cycle range	0%~100%
Operating mode	Pulse/direction output
Cable length	Maximum 5m
Cable type	Shielded cable, including 24V DC power supply
Wiring terminal	Removable screw terminals

3 Installation and Dimensions

3.1 Installation Notes

The F5 Series PLCs are designed to be easy to install. The F5 Series PLCs can be mounted on a panel or standard rail and can be mounted horizontally or vertically. The small size of the F5 Series PLCs allow the user to make efficient use of space. To avoid equipment damage or personal injury caused by improper installation method, please comply with following notes:

- ◆ Assemble all optional components and modules before installing the control system to the mounting rails, mounting plates or panels. Remove the control system from the mounting rail, mounting plate or panel before disassembling the equipment.
- ◆ The electrical equipment standard classifies F5 Series PLCs as open equipment. The F5 Series PLCs must be installed in a chassis, control cabinet or electrical control room. Only authorized personnel may open the chassis, control cabinet or access the control room.
- ◆ PLC should be installed in a dry environment.
- ◆ The installation should provide approved mechanical strength, flammability protection, and stability protection for open equipment in specific location categories in accordance with applicable electrical and building codes.
- ◆ Conductive contamination due to dust, humidity and atmospheric pollution can cause operational and electrical failures in the PLC.
- ◆ If the PLC is placed in an area where conductive contamination may exist, the PLC must be protected by a chassis with an appropriate level of protection.
- ◆ Isolate the F5 Series PLCs from thermal radiation, high voltage and electrical noise.
- ◆ As a basic rule for laying out the various devices in the system, devices that generate high voltage and high electrical noise must be isolated from low-voltage logic-type devices such as F5 Series PLCs.
- ◆ When configuring the layout of the F5 Series PLCs on the panel, consider heat generating devices and locate electronic devices in cooler areas of the control cabinet. Less exposure to high temperatures will extend the life of all electronic devices.
- ◆ Also consider the wiring of equipment in the panel. Avoid laying low voltage signal and communication cables in slots with AC power lines and high energy fast switching DC lines.

3.2 Safety Requirement

3.2.1 Chassis Requirement

The F5 Series PLCs system components are designed as industrial equipment for zone B, category A, in accordance with the published IEC standards.

The ability to comply with EMC requirements (if conducted and/or radiated interference exists) may be reduced if used in an environment other than that described in this standard, or in an environment that does not meet the specifications in this manual.

All F5 Series PLCs system components comply with the requirements defined by the European Union (CE) in

EN61131-2 for open equipment. These components must be installed in chassis dedicated to specific environmental conditions, minimizing the possibility of accidental exposure to dangerous voltages. The use of metal chassis improves the electromagnetic interference resistance of F5 Series PLC systems. The use of chassis with keyed locking mechanisms minimizes unauthorized access.

3.2.2 Environmental Characteristics

This equipment complies with the CE requirements listed in the table below. This equipment is intended for using in industrial environments with a pollution class 2.

The following table provides general environmental characteristics.

Category	Characteristic
Operating ambient temperature	-10°C~60°C
Storage temperature	-20°C~70°C
Relative humidity	5% to 95%, without condensation
Class of pollution	2 (IEC60664)
Class of protection	IP20
Coating	Coated protection, dry film thickness $\geq 20\mu\text{m}$; reinforced dry film thickness $\geq 40\mu\text{m}$
Altitude	Operation: 0m~3,000m Transportation: $\leq 6,000\text{m}$
Seismic performance	5~13.2Hz Amplitude 7mm, 13Hz~100Hz Acceleration 2G, 20 times each in X, Y and Z axes
Impact performance	Semi-positive sine wave, acceleration 15G, duration 11ms, 6 times in each of the X, Y and Z directions

3.2.3 Electromagnetic Susceptibility

The F5 Series PLCs system meets the specifications for electromagnetic susceptibility as described in the following table.

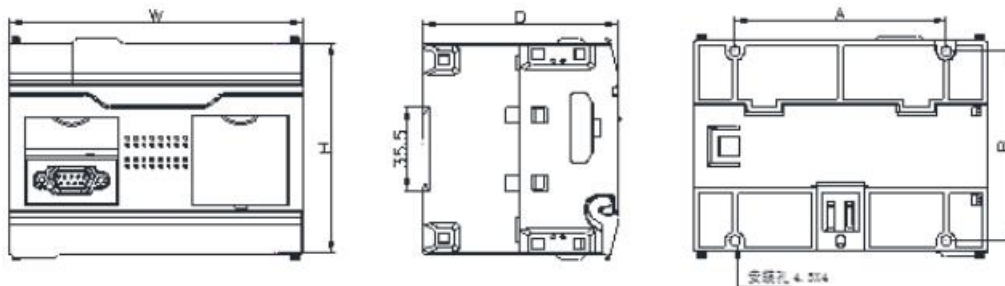
Standard	Method	Item
EN IEC 61000-6-4:2019	CISPR 16-2-1	Conducted Emissions at AC Mains Power Port (150kHz~30MHz)

Standard	Method	Item
	CISPR 32	Conducted Emissions at Wired Network Port(150kHz~30MHz)
	CISPR 16-2-3	Radiated Emissions(30MHz~1GHz)
	CISPR 16-2-3	Radiated Emissions(Above 1GHz)
EN IEC 61000-6-22019	EN 61000-4-6:2014	Conducted Immunity at AC Mains Power Port(150kHz-80MHz)
	EN 61000-4-6:2014	Conducted Immunity at Signal Port 150kHz~80MHz
	EN 61000-4-4:2012	Electrical Fast Transients Burst at AC Mains Power Port
	EN 61000-4-4:2012	Electrical Fast Transients Burst at Signal Port
	EN 61000-4-2:2009	Electro static Discharge
	EN 61000-4-8:2010	Power Frequency Magnetic Field
	EN IEC 61000-4-3:2020	Radiated Immunity(80MHz~6GHz)
	EN 61000-4-5:2014+A1:2017	Surge at AC Mains Power Port
	EN 61000-4-5:2014+A1:2017	Surge at Signal Port
	EN IEC 61000-4-11:2020	Voltage Dips and Interruptions

The F5 Series AC power supply type PLCs system meets the following safety standards:

- ◆ IEC 61010-1:2010 + A1:2019
- ◆ AMD1: 2016

3.3 CPU Appearance Dimension



Unit: mm

Model	Total points	Guide rail dimension	Mounting dimensions for screw holes		Boundary dimension
			A	B	W×H×D
F*5-20M△-◎	20 points	35	90	81	125×90×83
F*5-30M△-◎	30 points				
F*5-40M△-◎	40 points		137	81	172×90×83

Product model △ mark, when △ is R—the host outputs are relay models, when△ is N or P —the host outputs are transistorised models

Product mode ◎ mark, when ◎ is AC—power supply for the host is 220V AC, when ◎ is DC—power supply for the host 24V DC

3.4 ventilation requirements

The equipment needs to be installed in a cabinet with good ventilation conditions and to ensure that there is enough space around the equipment to allow it to dissipate heat.



- ◆ Install the equipment that dissipates the most heat on top of the cabinet to ensure proper ventilation.
- ◆ Do not install the equipment next to or above equipment that may cause overheating.
- ◆ To ensure that the equipment works well, please keep the ambient temperature between 0 °C and 55 °C.

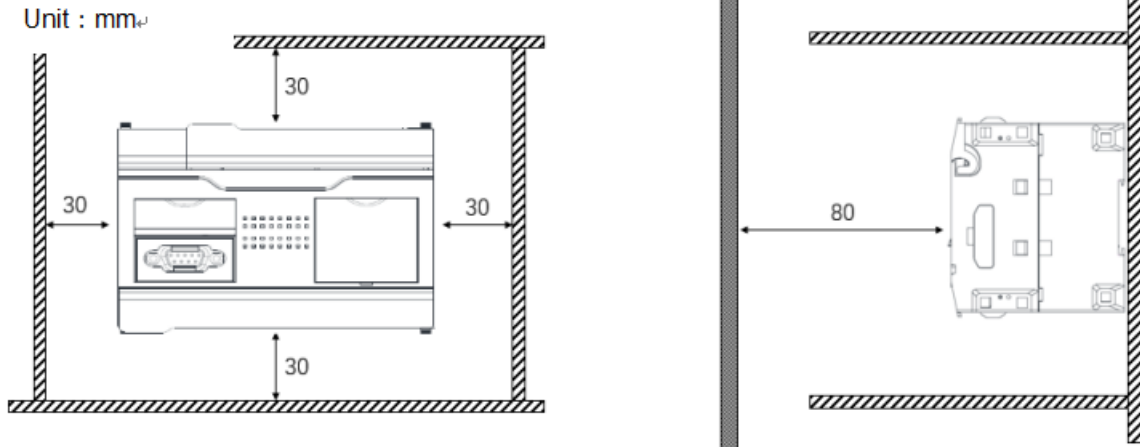
3.4.1 Minimum Spacing

The F5 Series PLCs have an IP20 protection grade and must be installed in a chassis. The installation spacing must be taken into account when installing this product.

There are 3 types of spacing as follows:

- ◆ Spacing to all sides of the cabinet (including panel doors).
- ◆ Spacing between the terminal block and the wiring duct. This distance reduces electromagnetic interference between the controller and the wiring ducts.
- ◆ Spacing to other heat generating equipment installed in the same cabinet.

The following diagram shows the minimum spacing for the F5 Series PLCs installation (the spacing between PLC upper panel (lower panel, left panel, or right panel) and cabinet sides is at least 30mm; the spacing between PLC front panel and cabinet door is at least 80mm).



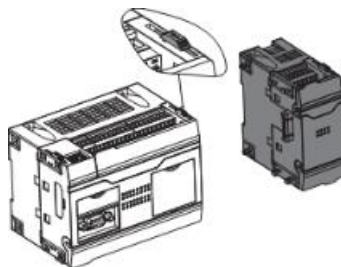
3.4.2 Anti-foreign object sticker

Do not remove the anti-foreign object protection sticker during installation to prevent foreign objects from falling into the machine and causing short circuits and other faults.

After installation and before powering up the unit, the anti-foreign object protection sticker must be removed to avoid overheating of the PLC caused by poor heat dissipation.

3.5 Installation of the Left and Right Extension Module (Optional)

Step1. Unlock the mainframe by pushing the left (right) side latch towards the unlocking direction.



Step2. Then push the extension module into place against the mainframe interface and reverse the latch to lock the extension module.

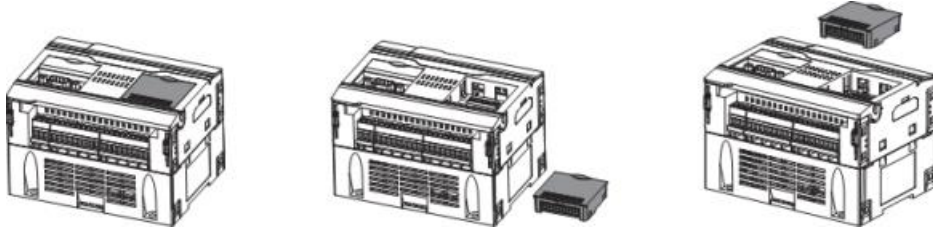


Step3. Add subsequent extension modules and repeat Step1 and Step2.

3.6 Installation and Removal of Extension Boards (Optional)

Step1. Open the cover as shown on the right.

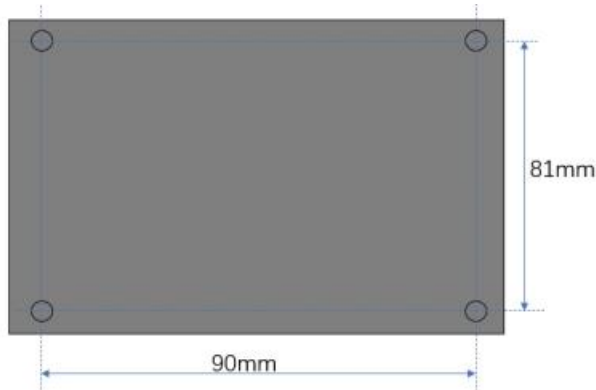
Step2. After aligning the extension plate with the installation position, press down to secure it.



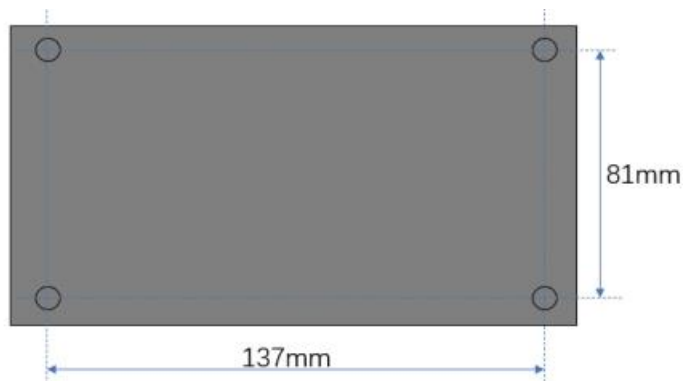
3.7 Installation of Direct Panel Surface

Step1. Determine the position of the four mounting holes on the panel based on the spacing of the actual installation holes of the device, and mark them with markers.

- The following diagram shows the mounting holes for the 20/30 points I/O CPU.



- The following diagram shows the mounting holes for the 40 points I/O CPU.



Step2. Use drilling equipment to drill holes in marked mounting positions on the panel.

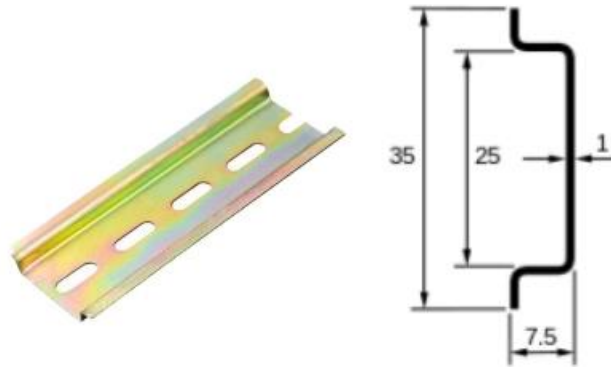
Step3. Select the appropriate screw according to the mounting panel material, point the screw at the device mounting hole, and adjust the position of the device, tighten the screw, and secure the device to the panel.

3.8 Installation of DIN Rail

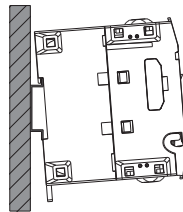
The controller and its extension modules can be installed on DIN rails which can be fitted to a flat installation surface.

Step1. Prepare DIN rails of the following specifications and install DIN rails into the cabinet.

The recommended DIN rail for PLC installation is 35 mm high and 7.5 mm deep, as shown below.



Step2. Insert the upper end of the DIN slot into the upper end of the DIN rail, press the equipment hardly, and insert the lower end of the DIN slot into the lower end of the DIN rail.



4 Connecting cable

4.1 Safety notes

- ◆ Before removing any protective cover or door, or installing or removing any accessories, hardware, cables, or wires, disconnect all equipment from power (including connected equipment), except as otherwise specified in the appropriate hardware guide for the equipment.
- ◆ Always confirm that all power is off using the appropriate rated voltage sensors at the locations and times indicated.
- ◆ Replace and tighten all protective covers, accessories, hardware, cables and wires, and make sure the earthing connection is correct before powering up the equipment.
- ◆ The specified voltage must be used when operating this equipment and related products.

4.2 Wiring Rules and Suggestion

4.2.1 Wiring Rules

When wiring the F5 Series PLCs system, the following rules must be followed:

- ◆ I/O and communication wiring must be done separately from power wiring. These 2 types of wiring cannot be routed in the same cable conduit.
- ◆ Check that the operating conditions and environment are within the range allowed by the specified values.
- ◆ The specifications of the cables used must meet the voltage and current requirements.
- ◆ Use copper conductors only.
- ◆ For analog quantity and fast I/O, shielded twisted pair cable is required.
- ◆ Use shielded twisted pair cables for encoders, networks, and fieldbuses.

4.2.2 Wiring Suggestion

- ◆ Multi-point earthing is permitted if connected to an isoelectric ground to avoid damage to the cable shield in the event of a short-circuit current in the power system.
- ◆ Cross sectional area of pluggable screw terminal blocks: 0.33~2 square millimeter.
- ◆ Screw head: Diameter 2.5 to 3.0mm, One-word screwdriver torque(maximum): 0.5N*m.
- ◆ Stripping length: 6.4mm.
- ◆ Protect output from inductive load damage.

4.2.3 Protective circuit

Depending on the load, the controller and the output of a particular module may require protective circuit. Inductive loads using DC voltages may generate voltage reflections that cause overshoots that can damage output devices or shorten their life.

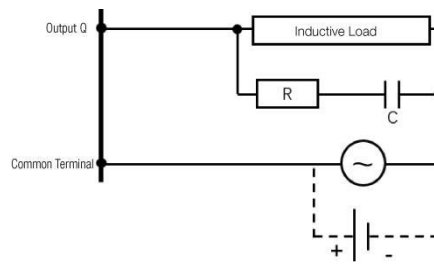
Relay output welding closed.



- ◆ Always use an appropriate external protection circuit or equipment to protect the relay output from damage by inductive AC loads.
- ◆ Do not connect the relay output to a capacitive load.

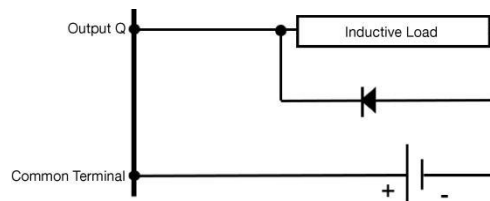
Relay outputs can support up to 240V AC. Inductive damage to these types of outputs can result in welded contacts and loss of control. Each inductive load must be equipped with protective equipment, such as a peak limiter, resistance-capacitance circuit, or fly-wheel diode. These relays do not support capacitive loads.

- ◆ Protective Circuit A: This protective circuit can be used in both AC and DC load power circuits.



- C represents a capacitance with value from 0.1 to 1 μF .
- R represents a resistor whose resistance value is approximately equal to the load.

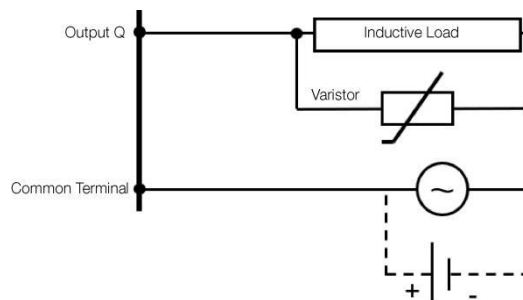
- ◆ Protective Circuit B: This protective circuit can be used for DC load power circuits.



Use diodes with the following ratings:

- Reverse withstand voltage value: ten times the supply voltage of the load circuit.
- Forward current value: greater than the load current.

- ◆ Protective circuit C: This protective circuit can be used in both AC and DC load power circuits.



For applications where inductive loads are switched on and off frequently and/or quickly, ensure that the continuous energy rating (J) of the varistor is at least 20% greater than the peak load energy.

4.3 Earthing the PLC System

Equipment needs to be grounded, including functional earthing (to reduce electromagnetic interference between cables) and protection earthing (to prevent leakage or lightning strikes).

For protective earthing connections (PE), metal pipes or wires can be used as part of the shield length, provided that the entire earthing connection is continuous and uninterrupted. For functional earthing (FE), the use of shielding is intended to reduce electromagnetic interference and the shielding must be continuous throughout the cable without interruption. If the shielding is used for both functional and protective purposes (which is often the case with communication cables), the shielding of the cable must be continuous and uninterrupted. Wherever possible, cables carrying different types of signals or power should be separated.

The cables carrying the fast I/O, analog I/O and fieldbus communication signals must be shielded in the following way.

The shielded cable must be firmly earthed. The fast I/O and analog I/O shields can be connected to the functional earthing (FE) or protective earthing (PE) of the F5 Series PLCs.

The fieldbus communication cable shield must be connected to the protective earthing (PE) using the connection clamps fixed to the conductive backplane installed.

The shield of the following cables must be connected to protective earthing (PE)::

- ◆ Ethernet
- ◆ Modbus

4.4 Connect the Power Cord

Make sure the equipment is grounded correctly before connecting the power cord.

Before powering up the equipment:

- ◆ Remove tools, gauges, and debris from the equipment.
- ◆ Close the equipment cabinet door.
- ◆ Remove the ground wire from the input power cord.
- ◆ Perform all startup tests suggested by the manufacturer.

4.4.1 Connect the AC Power Cord

Safety notes

- ◆ If the specified voltage range cannot be maintained, the output may not switch as expected. Please use a proper safety interlock and voltage monitoring circuit.

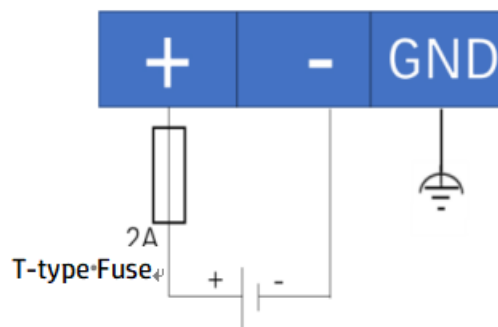
- ◆ Required for the F5 Series PLCs and associated I/O extension modules. According to IEC 61140, the 24 V DC power supply must be rated for Safety Extra Low Voltage (SELV) or Protected Extra Low Voltage (PELV). These power supplies are isolated between the electrical input and output circuits of the power supply.
- ◆ The F5 Series PLCs must be supplied by a 24 V external power supply device. During a power failure, the PLC associated with a suitable power supply can continue to operate normally for at least 10 ms according to the IEC standard.
- ◆ For relay output ($\geq 2A$) wiring, use a conductor with a cross-sectional area of at least 0.5 mm² and a rated temperature of at least 80° C.

F5 series PLCs models support DC power supply, must be supplied by 24V DC external power supply equipment. The characteristics of DC power supply are as follows.

Characteristic		Value
Rated voltage		24V DC
Supply voltage range		20.5V~28.8V DC
Power interruption time		10 ms at 24V DC
Maximum peak current		35A
Maximum power consumption	F*5-20M*-DC	13W
	F*5-30M*-DC	14W
	F*5-40M*-DC	15W

The method of connecting DC power cords is as follows:

- Step1. Connect the positive pole of the external DC power supply to the "+" terminal of the PLC DC power input.
- Step2. Connect the negative pole of the external DC power supply to the "-" terminal of the PLC DC power input.



4.4.2 Connect the AC Power Cord

Safety notes

- ◆ If the specified voltage range cannot be maintained, the output may not switch as expected. Please use a proper safety interlock and voltage monitoring circuit.

- ◆ For relay output ($\geq 2A$) wiring, use a conductor with a cross-sectional area of at least 0.5 mm^2 and a rated temperature of at least 80° C .

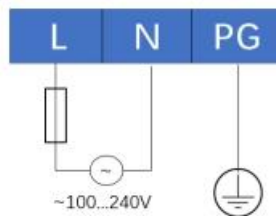
Make sure the external AC power supply meets the following characteristic requirement.

Characteristic		Value
Voltage	Rated	100V~240V AC
	Limited	85V~264V AC
Frequency	Rated	50/60Hz
	Limited	45/66Hz
Power interruption time		10 ms at 100V AC
Maximum peak current	at 240V AC	40A
Maximum power consumption	F*5-20MR-AC	<30W
	F*5-30MR-AC	<30W
	F*5-40MR-AC	<30W
Isolation	Between AC power and internal logic	2300V AC
	Between AC supply and protective earthing	1500V AC

The method of connecting DC power cords is as follows:

Step1. Connect the AC power fire wire to the "L" terminal of the PLC power input.

Step2. Connect the zero cord of the AC power supply to the "N" terminal of the PLC power input.

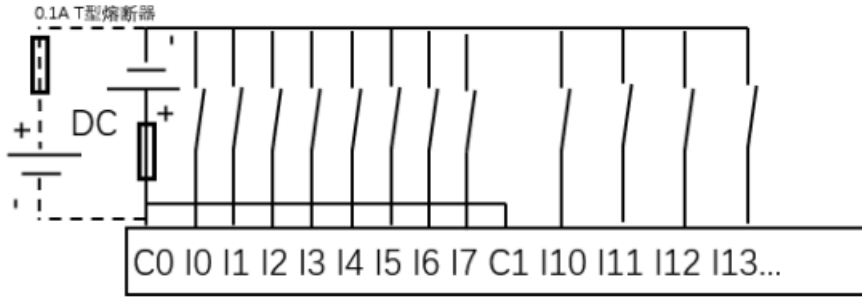


4.5 Wiring

F5 Series PLCs terminal definition diagram:

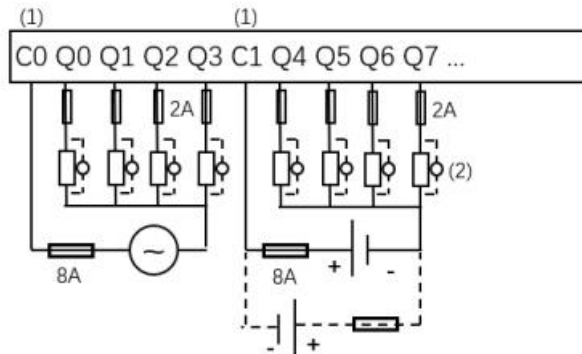
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30		
F+5-20MR-AC	Up	C0	I0	I1	I2	I3	I4	I5	I6	I7	C1	I10	I11	I12	I13	NC	NC	NC	NC	24V	0V	GND											
	Down	L	N	PG	C0	Q0	Q1	Q2	Q3	C1	Q4	Q5	Q6	Q7	NC	NC	NC	NC	NC	A	B	GND											
F+5-30MR-AC	Up	C0	I0	I1	I2	I3	I4	I5	I6	I7	C1	I10	I11	I12	I13	NC	NC	NC	NC	24V	0V	GND											
	Down	L	N	PG	C0	Q0	Q1	Q2	Q3	C1	Q4	Q5	Q6	Q7	C2	Q10	Q11	Q12	Q13	A	B	GND											
F+5-40MR-AC	Up	C0	I0	I1	I2	I3	I4	I5	I6	I7	C1	I10	I11	I12	I13	I14	I15	I16	I17	C2	I20	I21	I22	I23	I24	I25	I26	I27	24V	0V	GND		
	Down	L	N	PG	C0	Q0	Q1	Q2	Q3	C1	Q4	Q5	Q6	Q7	C2	Q10	Q11	Q12	Q13	C3	Q14	Q15	Q16	Q17	NC	NC	NC	NC	A	B	GND		
F+5-20MN-DC	Up	C0	I0	I1	I2	I3	I4	I5	I6	I7	C1	I10	I11	I12	I13	NC	NC	NC	NC	24V	0V	GND											
	Down	+	-	GND	C0	Q0	Q1	Q2	Q3	C1	Q4	Q5	Q6	Q7	NC	NC	NC	NC	NC	A	B	GND											
F+5-30MN-DC	Up	C0	I0	I1	I2	I3	I4	I5	I6	I7	C1	I10	I11	I12	I13	I14	I15	I16	I17	C2	I20	I21											
	Down	+	-	GND	C0	Q0	Q1	Q2	Q3	C1	Q4	Q5	Q6	Q7	C2	Q10	Q11	Q12	Q13	A	B	GND											
F+5-40MN-DC	Up	C0	I0	I1	I2	I3	I4	I5	I6	I7	C1	I10	I11	I12	I13	I14	I15	I16	I17	C2	I20	I21	I22	I23	I24	I25	I26	I27	24V	0V	GND		
	Down	+	-	GND	C0	Q0	Q1	Q2	Q3	C1	Q4	Q5	Q6	Q7	C2	Q10	Q11	Q12	Q13	C3	Q14	Q15	Q16	Q17	NC	NC	NC	NC	A	B	GND		

4.5.1 Digital Input Wiring Diagram



- ◆ As the common terminals C0/C1/C2 are independent of each other, when using the same type of input, please connect the common terminals using short wires.
- ◆ When using the high speed pulse input, use a shielded cable and keep it well earthed.

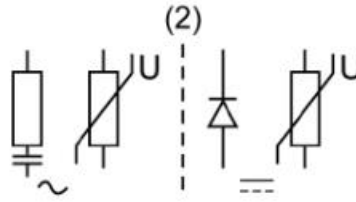
4.5.2 Relay Output Wiring Diagram



C0 and C1 terminals are not connected internally.

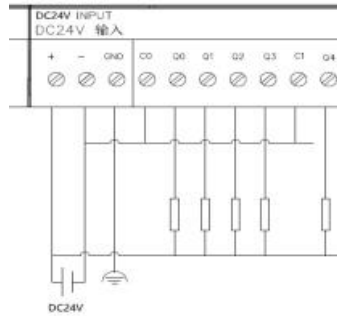
To extend the life of the contacts and to prevent potential damage to inductive load, you must connect a freewheel diode in parallel to each inductive DC load or an RC buffer in parallel to each inductive AC load.

Please check that the load withstand voltage level meets the requirements when using AC power.

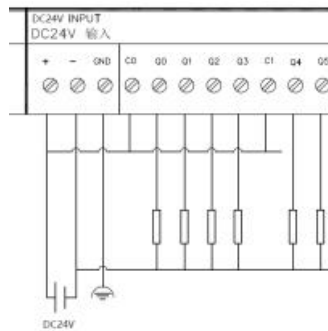


4.5.3 Transistor Output Wiring Diagram

- ◆ NPN type (Sink) transistor output wiring:



- ◆ PNP type (Source) transistor output wiring:



- ◆ When using the high speed pulse output, use a shielded cable and keep it well earthed.
- ◆ C0/C1/C2 are wired in parallel inside the PLC and the power supply can be connected to any one.

4.6 Connect to USB Port

You can program for the PLC via USB interface. The method of connecting USB ports is as follows:

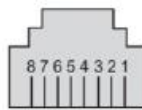
- Step1. Connect the Type-C end of the USB connection cable to the USB interface of the PLC.
- Step2. Connect the Type-A end of the USB cable to the USB interface of the PC.



4.7 Connect to Ethernet Port

Ethernet interface is RJ45 type, 10Mbps/100Mbps, adaptive/half full duplex.

The following diagram shows the Ethernet connector pin definitions:



Pin number	Signal
1	TD+
2	TD-
3	RD+
4	-
5	-
6	RD-
7	-
8	-

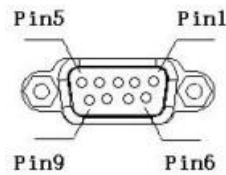
Using RJ45 standard Ethernet cable to connect Ethernet ports of PLC to Ethernet port of device such as PC.

4.8 Connect to Serial Communication Port 1

The position of serial port 1 of the controller is shown below, connect to the port using the DB9 plug.



Serial communication port 1 is DB9 type and supports RS485 or RS232 communication with the pin definitions as follows.



Pin number	Serial port1 (RS485)	Serial port1 (RS232)
1	RS485- (B)	-
2	-	RXD
3	-	TXD
4	-	-
5	GND	GND
6	RS485+ (A)	-
7	-	-
8	-	-
9	-	-

4.9 Connect to Serial Port2

The position of serial port 2 (with photoelectric isolator) of the controller is shown below.



The pin definition of serial port 2 is as follows:

- ◆ A: RS485 +
- ◆ B: RS485 -
- ◆ GND: Shield grounding

Use twisted pair wire to connect to A and B terminals, and the other end of twisted pair to RS485 + and RS485- terminals to the serial port of the peer device, respectively.

5 Extension Module

The F5 Series PLCs provide extension modules to enhance PLC communication and control functions.

5.1 Digital Input Extension Module

Digital input extension module includes F5-MD0800, F5-MD1600, and F5-MD3200.

5.1.1 Characteristics

Transistor input characteristics is shown below.

Characteristics		Parameter
Rated voltage		24V DC
Input range		0V~28.8V DC
Rated current		7mA
Peak value	Voltage	30V
	Current	9mA
State	Voltage in state 1	>15V, 15V~28.8V
	Voltage in state 0	<5V, 0V~5V
	Current in state 1	>2.5mA
	Current in state 0	<1.0mA
Isolation	-	Optocoupler
Input impedance		3.3kΩ
Filter time		Default 1ms, 16 equally divided levels selectable from unfiltered to 100ms
Compatibility		Compatible with 2/3 wire sensors
Input type		Source/sinking
Cable length and type		Max 100m shielded cable, 50m unshielded cable
Protection (overvoltage)		Maximum 30V, limited to 1 hour per day frequency
Wiring terminal		Removable terminal block

5.1.2 Definition of Terminals

For definition of terminals, please refer to the tables below.

F5-MD0800	Upper side	C0	I0	I1	I2	I3	●
	Lower side	C1	I4	I5	I6	I7	●

F5-MD1600	Upper side	C0	I0	I1	I2	I3	●	C1	I4	I5	I6	I7	●
	Lower side	C2	I10	I11	I12	I13	●	C3	I14	I15	I16	I17	●

F5-MD3200	Upper side Lower layer	C4	I20	I21	I22	I23	C5	I24	I25	I26	I27	●
	Upper side Upper layer	C0	I0	I1	I2	I3	C1	I4	I5	I6	I7	●
	Lower side Upper layer	C2	I10	I11	I12	I13	C3	I14	I15	I16	I17	●
	Lower side Lower layer	C6	I30	I31	I32	I33	C7	I34	I35	I36	I37	●

I*: Digital input terminal; C*:Input and relay output common terminal; ●:Empty terminal (Do not use)

5.2 Digital Output Extension Module

The F5 Series PLCs provide digital output extension module,including F5-MD0008R, F5-MD0016R, F5-MD0008N(P), F5-MD0016N(P), and F5-MD0032N(P).

5.2.1 Characteristics

For relay output characteristics, please refer to the table below.

Characteristics		Parameter
Rated voltage		24V DC; 220V AC
Input range		5V~30V DC; 100V~250V AC
Rated current		Maximum 2A /point
Current/group (4 points)		4A(relay output, @60°C, 50% derating required)
Peak value	Maximum switch voltage	250V AC; 30V DC
	Current/point	5A
Isolation type		Relay coil
Maximum output frequency	Maximum load	0.1Hz
	Without load	5Hz
Resistive load		2A/point 24V DC/ 220V AC
Mechanical life		Minimum 5,000,000 times
Electrical contact life		Minimum 100,000 times
Short circuit protection		None
Wiring terminal		Removable terminal block

For NPN/PNP Transistor output characteristics, please refer to the table below.

Characteristics	Parameter
Output type	NPN
Rated voltage	24V DC
Voltage range	19.2V~28.8V DC
Rated current	0.5A
Current/group	0.5A*Output point of each group
Voltage drop	Maximum 1V DC
Leakage current when turned off	<5μA

Characteristics	Parameter
Maximum power of incandescent lamp	2.4W
Derating	None
Start time	Maximum 34μs
Turn-off time	Maximum 250μs
Maximum output frequency	1kHz
Short circuit protection	Available
Peak short-circuit output current	1.3A
Self-recovery after short circuit or overload	Per 10ms
Clamping voltage	Maximum 39V DC , ±1V
Isolation	500V AC between output and internal logic
Type of electrical channel	Unshielded
Cable length	Unshielded 50m
Wiring terminal	Removable terminal block

5.2.2 Definition of terminals

For definition of terminals, please refer to the tables below.

F5-MD0008R	Upper side	C0	Q0	Q1	Q2	Q3	●
	Lower side	C2	Q4	Q5	Q6	Q7	●

F5-MD0016R	Upper side	C0	Q0	Q1	Q2	Q3	●	C2	Q4	Q5	Q6	Q7	●
	Lower side	C3	Q10	Q11	Q12	Q13	●	C4	Q14	Q15	Q16	Q17	●

F5-MD0008N	Upper side	0V	Q0	Q1	Q2	Q3	●
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	Lower side	0V	Q4	Q5	Q6	Q7	●
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F5-MD0008P	Upper side	●	Q0	Q1	Q2	Q3	24V
	Lower side	●	Q4	Q5	Q6	Q7	24V

F5-MD0016N	Upper side	0V	Q0	Q1	Q2	Q3	●	0V	Q4	Q5	Q6	Q7	●
	Lower side	0V	Q10	Q11	Q12	Q13	●	0V	Q14	Q15	Q16	Q17	●

F5-MD0016P	Upper side	●	Q0	Q1	Q2	Q3	24V	●	Q4	Q5	Q6	Q7	24V
	Lower side	●	Q10	Q11	Q12	Q13	24V	●	Q14	Q15	Q16	Q17	24V

F5-MD0032N	Upper side	0V	Q20	Q21	Q22	Q23	0V	Q24	Q25	Q26	Q27	●
	Lower layer											
	Upper side Upper layer	0V	Q0	Q1	Q2	Q3	0V	Q4	Q5	Q6	Q7	●
	Lower side Upper layer	0V	Q10	Q11	Q12	Q13	0V	Q14	Q15	Q16	Q17	●
Lower side Lower layer	0V	Q30	Q31	Q32	Q33	0V	Q34	Q35	Q36	Q37	●	

F5-MD0032P	Upper side Lower layer	●	Q20	Q21	Q22	Q23	24V	Q24	Q25	Q26	Q27	24 V
	Upper side Upper layer	●	Q0	Q1	Q2	Q3	24V	Q4	Q5	Q6	Q7	24 V
	Lower side Upper layer	●	Q10	Q11	Q12	Q13	24V	Q14	Q15	Q16	Q17	24 V
	Lower side Lower layer	●	Q30	Q31	Q32	Q33	24V	Q34	Q35	Q36	Q37	24 V

For the meaning of marks, please refer to the table below.

mark	Meaning
I*	Digital input terminal
Q*	Digital output terminal
C*	Input or relay output common terminal
0V	Transistor output common terminal
24V	Transistor output power terminal
●	Empty terminal (Do not use)

5.3 Digital Mixed Extension Module

The F5 Series PLCs Provide digital mixed extension module, including F5-MD0808R, F5-MD0404R, F5-MD1616R, and F5-MD1616N.

5.3.1 Characteristics

For Transistor input characteristics of module, please refer to the table below.

Characteristics	Parameter
Rated voltage	24V DC
Input range	0~28.8V DC
Rated current	7mA

Characteristics		Parameter
Peak value	Voltage	30V
	Current	9mA
State	Voltage in state 1	>15V (15~28.8V)
	Voltage in state 0	<5V (0~5V)
	Current in state 1	>2.5mA
	Current in state 0	<1.0mA
Isolation		Optocoupler
Input impedance		3.3kΩ
Filter time		Default 1ms, 16 equally divided levels selectable from unfiltered to 100ms
Compatibility		Compatible with 2/3 wire sensors
Input type		Source/sinking
Cable length and type		Max 100m shielded cable, 50m unshielded cable
Protection(overvoltage)		Maximum 30V, limited to 1 hour per day frequency
Wiring terminal		Removable terminal block

For relay output characteristics of module, please refer to the table below.

Characteristics		Parameter
Rated voltage		24V DC; 220V AC
Input range		5V~30V DC; 100V~250V AC
Rated current		Maximum 2A/point
Current/group (4 points)		4A (relay output @60°C, 50% derating required)
Peak value	Maximum switch voltage	250V AC; 30V DC
	Current/point	5A
Isolation		Relay coil
Maximum output	Maximum load	0.1Hz

Characteristics		Parameter
frequency	Without load	5Hz
Resistive load		2A/point, 24V DC/220V AC
Mechanical life		Minimum 5,000,000 times
Electrical contact life		Minimum 100,000 times
Short circuit protection		None
Wiring terminal		Removable terminal block

5.3.2 Definition of Terminals

For definition of terminals, please refer to the table below.

F5-MD0808R	Upper side	C0	I0	I1	I2	I3	●	C1	I4	I5	I6	I7	●
	Lower side	C2	Q0	Q1	Q2	Q3	●	C3	Q4	Q5	Q6	Q7	●

F5-MD0404R	Upper side	C0	I0	I1	I2	I3	●
	Lower side	C2	Q0	Q1	Q2	Q3	●

F5-MD1616R	Upper side Lower layer	C4	Q0	Q1	Q2	Q3	C5	Q4	Q5	Q6	Q7	●
	Upper side Upper layer	C0	I0	I1	I2	I3	C1	I4	I5	I6	I7	●
	Lower side Upper layer	C2	I10	I11	I12	I13	C3	I14	I15	I16	I17	●
	Lower side Lower layer	C6	Q10	Q11	Q12	Q13	C7	Q14	Q15	Q16	Q17	●

F5-MD1616N	Upper side Lower layer	0V	Q0	Q1	Q2	Q3	0V	Q4	Q5	Q6	Q7	●
	Upper side Upper layer	C0	I0	I1	I2	I3	C1	I4	I5	I6	I7	●
	Lower side Upper layer	C2	I10	I11	I12	I13	C3	I14	I15	I16	I17	●

	Lower side Lower layer	0V	Q1 0	Q11	Q12	Q13	0V	Q14	Q15	Q16	Q17	●
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For meaning of the marks, please refer to the table below.

Mark	Meaning
I*	Digital input terminal
Q*	Digital output terminal
C*	Input or relay output common terminal
●	Empty terminal (Do not use)

5.3.3 LED Indicator

Indicator	State	Description
PWR	Steady green light	Power on
	Off	Not connected to power supply
ERR	Steady red light	Serious error on the BUS
	Blinking red light	Unstable BUS
	Off	No error on BUS
Digital input	Steady green light	Input state activated
	Off	Input state not activated
Digital output	Steady green light	Output state activated
	Off	Output state not activated

5.4 Analog Input Extension Module

F5 Series PLCs Provide analog input extension module, including F5-MA0400A and F5-MA0800A.

5.4.1 Characteristics

Characteristics	Parameter
Input range	<ul style="list-style-type: none"> ◆ Voltage input: -10 ~ 10 V DC or 0~10V DC ◆ Current input: 0 ~ 20mA or 4 ~ 20mA
Input impedance	<ul style="list-style-type: none"> ◆ Voltage input: >200kΩ ◆ Current input: 237.5~262.5Ω

Characteristics	Parameter	
I/O terminal	Removable terminal block	
Sampling time	1 ms / channel + 1 scan cycle	
Total input system transfer time	4 ms+1 scan cycle	
Input deviation	Maximum $\pm 0.2\%$ of full scale range	
Resolution	16-bit Signed	
Temperature drift	$\pm 0.06\%$ of full scale range/ $^{\circ}\text{C}$	
Common-mode rejection	40 dB, DC to 60 Hz	
Noise suppression	400, 60, 50 or 10Hz	
Non-linear	$\pm 0.4\%$ of full scale range	
Maximum operating input (no damage)	$\pm 30\text{ V DC}$	$\pm 30\text{mA DC}$
Type of protection	Input isolated from internal power supply	
Misconfiguration (voltage -> current)	<ul style="list-style-type: none"> ◆ When the input is between $\pm 30\text{ V DC}$, no damage can be caused ◆ When the input exceeds $\pm 30\text{ V DC}$, permanent damage is caused 	
Misconfiguration (current -> voltage)	<ul style="list-style-type: none"> ◆ When the input is between $\pm 30\text{ mA}$, no damage can be caused ◆ When the input exceeds $\pm 30\text{ mA}$, permanent damage is caused 	
Cable type	Shielded cable	
Calbe length	3~30m	

5.4.2 Definition of terminals

F5-MA0400*	Upper side	VI0	C0	AI0	VI1	C1	AI1
	Lower side	VI2	C2	AI2	VI3	C3	AI3

F5-MA0800*	Upper side	VI0	C0	AI0	VI1	C1	AI1	VI2	C2	AI2	VI3	C3	AI3
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	Lower side	VI4	C4	AI4	VI5	C5	AI5	VI6	C6	AI6	VI7	C7	AI7
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For the meaning of marks, please refer to the table below.

Mark	Meaning
VI*、AI*	Analog input positive terminal
C*	Analog input output common terminal

5.4.3 LED Indicator

Indicator	State	Description
PWR	Steady green light	Power on
	Off	Not connected to power supply
ERR	Steady red light	Serious error on the bus
	Blinking red light	Unstable bus
	Off	No error on bus
Analog input	Steady green light	Channel configured
	Off	Channel not configured

5.5 Analog Output Extension Module

F5 Series PLCs provide analog output extension module F5-MA0004A.

5.5.1 Characteristics

Characteristics	Parameter
Output range	<ul style="list-style-type: none"> ◆ Voltage output: 0 ~10V DC ◆ Current output: 0 ~ 20 mA DC or 4~20mA DC
I/O terminal	Removable terminal block
Load impedance	<ul style="list-style-type: none"> ◆ Voltage output: >2kΩ ◆ Current output: <500Ω
Load type	Resistive load
Stabilization time	750μs
Total output system transfer	3 ms + 1 scan cycle

Characteristics	Parameter
time	
Output error - total error	$\pm 0.5\%$ of full scale range
Resolution	16-bit Signed
Temperature drift	$\pm 0.06\%$ of full scale range/ $^{\circ}\text{C}$ 。
Non-linear	$\pm 0.5\%$ of full scale range
Protection type	Input isolated from internal power supply
Output protection	<ul style="list-style-type: none"> ◆ Short circuit without damage (voltage output) ◆ Open circuit protection (current output)
Cable type	Shielded cable(meets electromagnetic immunity requirements)
Cable length	3m~30m

5.5.2 Definition of Terminals

F5-MA0004	Upper side	VQ0	C0	AQ0	VQ1	C1	AQ1
	Lower side	VQ2	C2	AQ2	VQ3	C3	AQ3

For the meaning of marks, please refer to the table below.

Mark	Meaning
VQ*、AQ*	Analog output positive terminal
C*	Analog input output common terminal

5.5.3 LED Indicator

Indicator	State	Description
PWR	Steady green light	Power on
	Off	Not connected to power supply
ERR	Steady red light	Serious error on the bus
	Blinking red light	Unstable bus
	Off	No error on bus
Analog	Steady green light	Channel configured

Indicator	State	Description
output	Off	Channel not configured

5.6 Analog Mixed Extension Module

F5 Series PLCs Provide analog mixed extension module, including F5-MA0404A and F5-MA0402A.

5.6.1 Characteristics

Input characteristics	Parameter
Input range	<ul style="list-style-type: none"> ◆ Voltage input: -10 ~10 V DC or 0~10 V DC ◆ Current input: 0~20mA or 4~20mA
Input impedance	<ul style="list-style-type: none"> ◆ Voltage input:>200kΩ ◆ Current input:237.5~262.5Ω
I/O terminal	Removable terminal block
Sampling time	1 ms / channel + 1 scan cycle
Total input system transfer time	4 ms+1 scan cycle
Input deviation	Maximum $\pm 0.2\%$ of full scale range
Resolution	16-bit Signed
Temperature drift	$\pm 0.06\%$ of full scale range/°C
Common-mode rejection	40 dB, DC to 60 Hz
Noise suppression	400, 60, 50 or 10 Hz
Non-linear	$\pm 0.4\%$ of full scale range
Maximum operating input (no damage)	<ul style="list-style-type: none"> ◆ Voltage input: DC ± 30 V ◆ Current input: DC ± 30mA
Type of protection	Input isolated from internal power supply
Misconfiguration (voltage -> current)	<ul style="list-style-type: none"> ◆ When the input is between ± 30 V DC, no damage can be caused ◆ When the input exceeds ± 30 V DC, permanent damage is caused
Misconfiguration (current -> voltage)	<ul style="list-style-type: none"> ◆ When the input is between ± 30 mA, no damage can be caused ◆ When the input exceeds ± 30 mA, permanent damage is caused

Input characteristics	Parameter
Cable type	Shielded cable
Cable length	3~30m

For Output characteristics of extension module, please refer to the table below.

Output characteristics	Parameter
Output range	<ul style="list-style-type: none"> ◆ Voltage output: 0~10V DC ◆ Current output: 0~20mA DC or 4~20mA DC
I/O terminal	Removable terminal block
Load impedance	<ul style="list-style-type: none"> ◆ Voltage output:>2kΩ ◆ Current output:<500Ω
Load type	Resistive load
Stabilization time	750 μs
Total output system transfer time	3 ms + 1 scan cycle
Output error - total error	±0.5 % of full scale range
Resolution	16-bit Signed
Temperature drift	±0.06% of full scale range/°C
Non-linear	±0.5 % of full scale range
Protection type	Input isolated from internal power supply
Output protection	<ul style="list-style-type: none"> ◆ Short circuit without damage (voltage output) ◆ Open circuit protection (current output)
Cable type	Shielded cable(meets electromagnetic immunity requirements)
Calbe length	3~30m

5.6.2 Definition of Terminals

F5-MA0404*	Upper side	VI0	C0	AI0	VI1	C1	AI1	VI2	C2	AI2	VI3	C3	AI3
	Lower side	VQ0	C4	AQ0	VQ1	C5	AQ1	VQ2	C6	AQ2	VQ3	C7	AQ3

F5-MA0402*	Upper side	VI0	C0	AI0	VI1	C1	AI1	VI2	C2	AI2	VI3	C3	AI3
	Lower side	VQ0	C4	AQ0	VQ1	C5	AQ1						

For the meaning of marks , please refer to the table below.

Mark	Meaning
VI*、AI*	Analog input positive terminal
VQ*、AQ*	Analog output positive terminal
C*	Analog input output common terminal

5.6.3 LED Indicator

Indicator	State	Description
PWR	Steady green light	Power on
	Off	Not connected to power supply
ERR	Steady red light	Serious error on the bus
	Blinking red light	Unstable bus
	Off	No error on bus
Analog output	Steady green light	Channel configured
	Off	Channel not configured

5.7 Temperature Sensor Module

Temperature Sensor Module with built-in temperature sensor to capture temperature information, includes F5-MS0400K, F5-MS0800K, F5-MS0400P, and F5-MS0800P.

5.7.1 Characteristics

For Characteristics of Thermal couple sensor module, please refer to the table below.

Characteristics	MS0400K	MS0800K
Description	Thermal couple sensor module	
Input channels	4	8
Rated power consumption	≤40mA (Full load)	≤80mA (Full load)

Characteristics	MS0400K	MS0800K
Rated power	Bus 24V DC	
Sensor type	K, J, R, S, B, E, T, N, C type Thermal Couple; NTC	
Resolution	Temperature: 0.1℃ Resistor: 15bits+sign	
Max accuracy at ambient 25 °C	<ul style="list-style-type: none"> ◆ Thermocouple: $\pm 0.3\%$ or $\pm 1\text{ }^{\circ}\text{C}$ of the displayed value, use the bigger ◆ NTC: $\pm 0.1\%$ or $\pm 1\text{ }^{\circ}\text{C}$ of the displayed value, use the bigger 	
The influence of measuring temperature (Temperature range: -20 ° C to 60 ° C)	<ul style="list-style-type: none"> ◆ Thermocouple inputs (R, S, B, C): ($\pm 1\%$ of PV or $\pm 2.5\text{ }^{\circ}\text{C}$, use the bigger) ◆ Other thermocouple inputs: ($\pm 1\%$ of PV or $\pm 1\text{ }^{\circ}\text{C}$, use the bigger) 	
Connector type	Screw terminal	
Signal type	Electric isolation	
Input resistance	$\geq 1\text{ M}\Omega$	
Sample period	$\leq 100\text{ms/Channel}$	
Connector type	0.1℃	
Out of range detection	Available	
Wire broken warning	Available	
Input filter	0~10s (unit: 0.01s)	
Input range	<ul style="list-style-type: none"> ◆ K: -200~1300℃ ◆ J: -200~1000 °C ◆ R: 0~1760℃ ◆ S: 0~1760℃ ◆ B: 0~1820 °C ◆ E: 200~800℃ ◆ T: -200~400℃ ◆ N: -200~1300℃ ◆ C: 0~2315℃ NTC: Measuring resistance range:100 Ω~200 kΩ Calculate temperature range: - 90~150 °C	

For Characteristics of Platinum resistor sensor module, please refer to the table below.

Characteristics	MS0400P	MS0800P
Description	Platinum resistor sensor module	
Input Channels	4	8
Rate Power consumption	≤30mA (Full load)	≤60mA (Full load)
Rate power	Bus 24V DC	
Sensor type	PT100、PT1000、NI100、NI1000、Cu50、Cu100	
Resolution	0.1℃	
Max accuracy at ambient 25 °C	±0.5% or ±1℃, Use the bigger	
The influence of measuring temperature (Temperature range: -20 ° C to 60 ° C)	◆ Pt100、Pt1000、Ni100、Ni1000: ±1% of PV or ±1° C, use the bigger ◆ Cu50、Cu100: ±1% of PV or ±1.5° C, use the bigger	
Connector Type	Screw terminal	
Signal type	Electric isolation	
Input impedance	≥1 MΩ	
Sample period	≤100ms/Channel	
Minimum input	0.1℃	
Out of range detection	Available	
Wire Broken warning	Available	
Input Filter	0~10S (unit: 0.01s)	
Input range	◆ Pt100: -200~850℃ ◆ Pt1000: -200~600℃ ◆ Ni100: -60~180℃ ◆ Ni1000: -60~180℃ ◆ Cu50: -50~150℃ ◆ Cu100: -50~150℃	

5.7.2 Definition of Terminals

F5-MS0400K	Upper side	I0+	I0-	FG	I1+	I1-	FG
	Lower side	I2+	I2-	FG	I3+	I3-	FG

F5-MS0800K	Upper side	I0+	I0-	FG	I1+	I1-	FG	I2+	I2-	FG	I3+	I3-	FG
	Lower side	I4+	I4-	FG	I5+	I5-	FG	I6+	I6-	FG	I7+	I7-	FG

For the meaning of marks, please refer to the table below.

Marks	Meaning
I*+, I*-	Thermocouple input terminals
FG	Shielding layer wiring terminals

F5-MS0400P	Upper side	A0	B0	B'0	A1	B1	B'1
	Lower side	A2	B2	B'2	A3	B3	B'3

F5-MS0800P	Upper side	A0	B0	B'0	A1	B1	B'1	A2	B2	B'2	A3	B3	B'3
	Lower side	A4	B4	B'4	A5	B5	B'5	A6	B6	B'6	A7	B7	B'7

For the meaning of marks, please refer to the table below.

Mark	Meaning
A*	A terminal
B*	B terminal
B'*	B terminal

5.7.3 LED Indicator

Indicator	State	Description
PWR	Steady green light	Power on
	Off	Not connected to power supply
ERR	Steady red light	Serious error on the bus
	Blinking red light	Unstable bus
	Off	No error on bus

Indicator	State	Description
Analog input/output	Steady green light	Channel configured
	Off	Channel not configured

5.8 Analog Extension Board

Analog extension board (includes F5-BA0200B and F5-BA0002B) can be accessed to CPU body.

5.8.1 Characteristics

For input characteristics of analog extension board, please refer to the table below.

Input characteristics	Parameter	
Input range	<ul style="list-style-type: none"> ◆ Voltage input: -10 ~ 10 V DC or DC 0~10V DC ◆ Current input: 0 ~ 20mA or 4 ~ 20mA 	
Input impedance	<ul style="list-style-type: none"> ◆ Voltage input: >200kΩ ◆ Current input: 237.5~262.5Ω 	
I/O terminal	Removable terminal block	
Sampling time	10 ms /Channel + 1 cycle	
Total input system transfer time	20 ms+1 cycle	
Input deviation	Max ±1 % of Full range	
Resolution	12 Bits +signal	
Temperature drift	± 0.5% of Full range /°C	
Common-mode rejection	40 dB, DC to 60 Hz	
Noise suppression	0~5000ms	
Non-linear	± 1 % of Full range	
Maximum operating input (no damage)	± 30 V DC	± 30mA DC
Type of protection	Input isolated from internal power supply	
Misconfiguration (voltage -> current)	<ul style="list-style-type: none"> ◆ When the input is between ±30 VDC, no damage can be caused ◆ When the input exceeds ±30 VDC, permanent damage is caused 	
Misconfiguration (current)	<ul style="list-style-type: none"> ◆ When the input is between ±30 mA, no damage can be caused 	

Input characteristics	Parameter
-> voltage)	◆ When the input exceeds ± 30 mA, permanent damage is caused
Cable type	Shielded cable
Cable length	3~30m

For output characteristics of analog extension module, please refer to the table below.

Output Characteristics	Voltage output	Current output
Output range	0~10V DC	0~20 mA DC 4~20 mA DC
I/O terminal	Removable terminal block	
Load impedance	>2k Ω	<400 Ω
Load type	Resistive load	
Stabilization time	750 μ s	
Total output system transfer time	10ms+1 scan cycle	
Output error - total error	$\pm 1\%$ of full scale range	
Resolution	12 bit signed	
Temperature drift	$\pm 0.5\%$ of full scale range/ $^{\circ}$ C	
Non-linear	$\pm 1\%$ of full scale range	
Type of protection	Input isolated from internal power supply	
Output protection	Short circuit without damage (voltage output)	Open circuit protection (current output)
Cable type	Shielded cable(meets electromagnetic immunity requirements)	
Cable length	3~30m	

5.8.2 Definition of Terminals

F5-BA0200A	Terminal	VI0	C0	AI0	VI1	C1	AI1
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F5-BA0002A	Terminal	VQ0	C0	AQ0	VQ1	C1	AQ1
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For meaning of marks, please refer to the table below.

Mark	Meaning
VI*、AI*	Analog Input Positive
VQ*、AQ*	Analog Output Positive
C*	Analog Input/Output Common

5.9 Extension Module Dimensions

Module	Model F5-*
Size A	MD0404*; MD0800; MD0008*; MA0400*; MA0004*; MS0400*
Size B	MD1600; MD0016*; MD0808*; MA0404*; MA0402*; MA0800; MS0800*
Size C	MD1616*; MD3200; MD0032*;

◆ Size A



◆ Size B

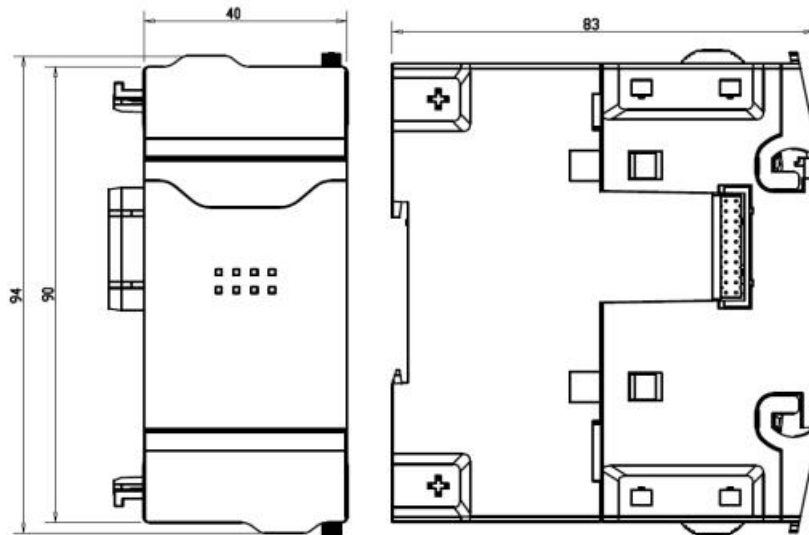


◆ Size C



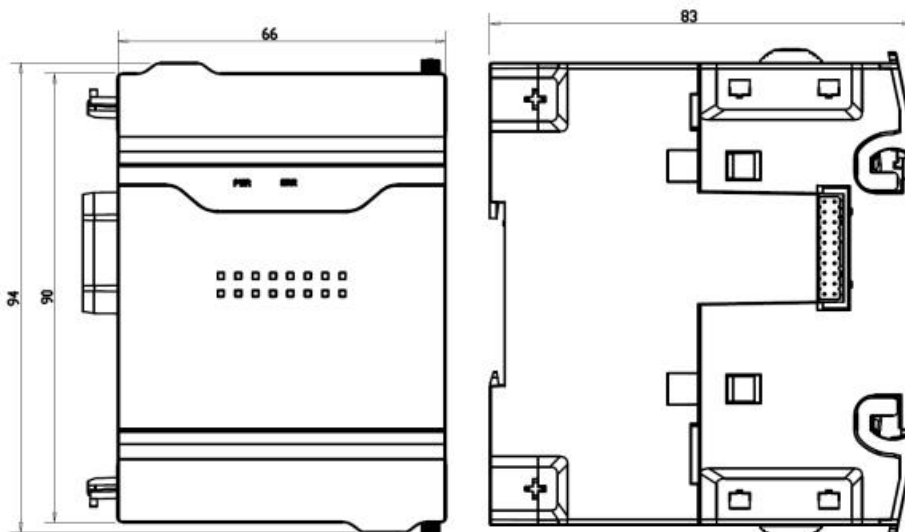
Size A Appearance dimension:40*94*83 (W*H*D)

Unit: mm



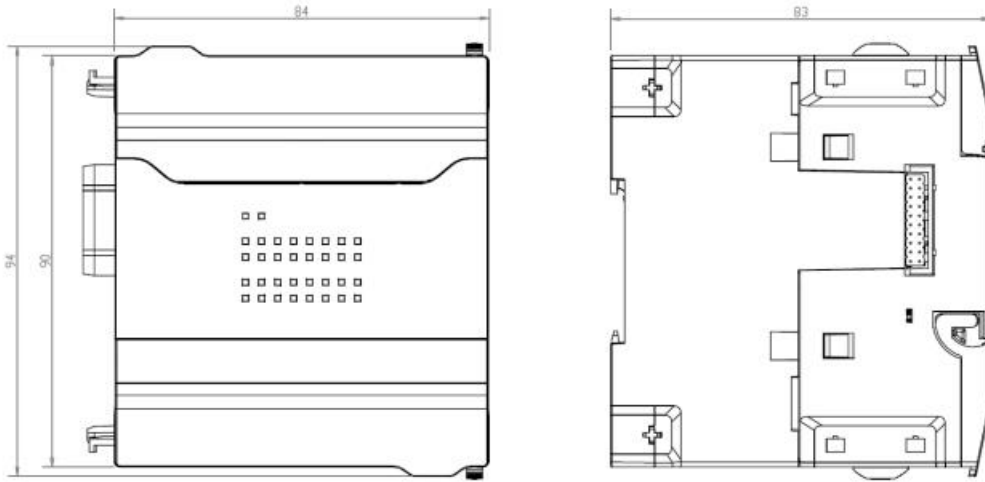
Size B Appearance dimension:66*94*83 (W*H*D)

Unit: mm



Size C Appearance dimension:84*94*83 (W*H*D)

Unit: mm



5.10 Extension Board Dimension

Dimension:40*38*18 (W*H*D)

Unit: mm

