Maple Systems

USER MANUAL

MAPLE MICRO PLC

MODELS

- **PLC-FB0808P**
- **PLC-FB1616P0202**
- **PLC-FB1616R0202**

1010-1153 Rev. 3.0

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- For your safety and the safe operation of this product, please read this manual before using the product. The manual is subject to change without notice.
- Please review the product specifications in this manual to determine the suitability of this product for its intended use.
- For your safety only qualified persons should perform electrical and wiring attachments to this product.

Before You Start

This manual contains important information on the use and operation of this device. Please read all the information carefully for optimal performance and to prevent any damage or misuse of the device.

To keep products safe, all activities including product installation, wiring operation, and maintenance are required to be treated by trained personnel.

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Safety symbols are classified into two categories, “WARNING” and “CAUTION”.

Warning: This symbol describes situations that could cause major or fatal injury to the user.

Caution: This symbol describes situations that may cause minor injury or damage to the device.

SAFETY SYMBOLS USED IN THIS PRODUCT MEAN:

This symbol warns the user of potential hazards.

This symbol warns the user of uninsulated voltage within the unit that can cause dangerous electric shock.

Keep this manual near the operating devices so it can be easily checked.

UL Certified Equipment

This product is certified by the UL Certification.

Design Precautions (⚠ Warning)

Please install a safety circuit to protect the entire control system in case of an unexpected power shutdown or PLC module malfunction. Such anomalies may severely compromise the integrity of the overall system.

External to the PLC, please install circuits and switches to safeguard the system from mechanical damages (ex. emergency stop, upper/lower limit switches, forward/reverse direction interlocking circuits, etc).

When the PLC detects either of the following failure conditions, it may stop operation and turn off all outputs.

- The overcurrent protection or overvoltage protection of the power supply module is activated.

- The PLC CPU detected a failure, such as the watchdog timer error or module installation failure, with its self-diagnostic function.

In addition, all outputs may be turned on when there is a failure that the PLC CPU cannot detect, such as in the relay or TR terminal. Build an extra monitoring circuit that will monitor any output signal that could cause serious accidents.

A greater than normal current passed through the PLC for an extended period of time, or a short-circuited load flowing through the output module may cause a fire.

Build a circuit that turns on the external power supply after the PLC power supply is turned on. If the external power supply is turned on first, it could result in output failure or malfunction.

In order to ensure that the system operates safely, please configure an interlock circuit in the scan program for the following situations:

- When exchanging data with a computer or other devices.

- When operated by a computer or other devices.

Not doing so could result in output failure or malfunction.

Precautions for design (⚠ Caution)

Do not bundle the input/output signal or communication cables with the main circuit and power cables. They should be installed at least more than 100 mm (3.94 inches) apart. Not doing so could result in output failure or malfunction.

Precautions for mounting (⚠Caution)

Use the PLC in an environment that meets the general specifications given in this manual.

Using this PLC in any environment outside the range of the general specifications could result in electric shock, fire, malfunction, or damage to or deterioration of the product.

Please ensure that each module is installed correctly in its place. Loosely or incorrectly installed pieces may result in malfunction, failure, or free-fall.

The PLC power supply should be turned off before mounting the module. Not doing so could cause an electric shock or damage to the device.

Install I/O devices or extension connectors correctly. If they are installed incorrectly, it may result in an input or output failure.

Do not convey direct vibration into the PLC. Doing so could cause electric shock, fire or malfunctions.

After wiring work, please make sure to close the terminal cover before turning on the power for the PLC system.

Precautions for wiring (⚠Warning)

Make sure to check the device's rated voltage and circuit arrangement before wiring. Failure to do so may cause electric shock or damage to the device.

Make sure to close the terminal cover before turning on the power of the PLC system after wiring work. Failure to do so may cause electric shock.

When connecting the power cable,
- Use 14-18 AWG cable and tighten the terminal screw with a tightening torque of Lb In. 6.9
- Use a power cable with at least 75°C of heat resistance.
- Use copper conductors only.

Precautions for wiring (⚠ Caution)

Make sure to check the device's regular voltage and sequence of terminals. Failure to do so may cause fire, electric shock and malfunctions.

Make sure to tighten the screws with standard torque. Loose connections may cause a short circuit, fire or malfunctions.

When grounding the FG ground terminals, be sure to conduct the product with at least D type (Class 3) grounding. Not doing so could result in electric shock or malfunctions.

When wiring, make sure that wiring debris does not enter the module. Failure to do so may cause fire, equipment damage, or malfunctions.

The device is only for indoor use.

Use a UL certified product for the power supply. Use a power supply that meets Class 2 or LVLC (Limited Voltage Limited Circuit).

This product is an open type equipment and belongs to Overvoltage Category II.

Precautions for test run and repair (⚠ Warning)

Please do not touch the terminals when the power is on. Doing so could cause an electric shock or malfunctions.

When cleaning or tightening the screws, turn off the power of the PLC and all other systems. Failure to do so could cause an electric shock or malfunctions.

Do not charge, disassemble, heat up, short, or solder the battery. Doing so could cause the battery to heat up, rupture or ignite thereby harming the user.

Precautions for test run and repair (⚠ Caution)

Do not dissociate the PCB from the module's casing or make any modifications to the device. Doing so may cause fire, electric shock, or malfunction.

When mounting or separating the module, make sure to turn off power to the PLC and all other devices. Failure to do so could cause an electric shock or malfunctions.

Use radio, walkie-talkie, or cellphone devices at least 30cm away from the PLC. Not doing so could result in malfunction.

Precautions for disposal (⚠ Caution)

When the product is disposed of, it should be done according to your country's regulations for similar types of industrial waste. Not doing so may cause an occurrence of toxic substances or explosions.

General Specifications

<table>
<tr><th>Items</th><th colspan="4">Specification</th><th>Standards</th></tr>
<tr><td>Ambient Temp.</td><td colspan="4">-10 ℃–55 ℃</td><td>-</td></tr>
<tr><td>Storage Temp.</td><td colspan="4">-25 ℃–80 ℃</td><td>-</td></tr>
<tr><td>Ambient Humidity</td><td colspan="4">5–95% RH, Non-condensing</td><td>-</td></tr>
<tr><td>Storage Humidity</td><td colspan="4">5–95% RH, Non-condensing</td><td>-</td></tr>
<tr><td rowspan="8">Vibration</td><td colspan="4">For Discontinuous Vibration</td><td rowspan="8">IEC 61131-2</td></tr>
<tr><td>Frequency</td><td>Acceleration</td><td>Amplitude</td><td>Times</td></tr>
<tr><td>5 ≤ f < 9 Hz</td><td>-</td><td>3.5 mm</td><td rowspan="2">X,Y,Z Each direction, 10 times</td></tr>
<tr><td>9 ≤ f ≤ 150 Hz</td><td>9.8 m/s² (1G)</td><td>-</td></tr>
<tr><td colspan="4">Continuous Vibration</td></tr>
<tr><td>Frequency</td><td>Acceleration</td><td>Amplitude</td><td>Times</td></tr>
<tr><td>5 ≤ f < 9 Hz</td><td>-</td><td>1.75 mm</td><td rowspan="2">X,Y,Z Each direction, 10 times</td></tr>
<tr><td>9 ≤ f ≤ 150 Hz</td><td>4.9 m/s² (0.5G)</td><td>-</td></tr>
<tr><td>Shocks</td><td colspan="4">• Max. impact acceleration: 147 m/s² (15G)
• Authorized time: 11 ms
• Pulse wave: Sign half-wave pulse (3 times each in X, Y, Z)</td><td>IEC 61131-2</td></tr>
<tr><td rowspan="6">Noise</td><td>Square Wave Impulse Noise</td><td colspan="3">± 2,000 V</td><td>-</td></tr>
<tr><td>Electrostatic Discharge</td><td colspan="3">± 4 kV (Contact), ± 8 kV (Air)</td><td>IEC 61131-2
IEC 61000-4-2</td></tr>
<tr><td>Radiated Electromagnetic Field Noise</td><td colspan="3">80–1000 MHz,10 V/m</td><td>IEC 61131-2
IEC 61000-4-3</td></tr>
<tr><td rowspan="4">Fast Transient Burst Noise (Voltage)</td><td>CPU, Power</td><td rowspan="2">2 kV</td><td rowspan="4">IEC 61131-2
IEC 61000-4-4</td></tr>
<tr><td>Digital/Analog I/O (AC)</td></tr>
<tr><td>Digital/Analog I/O (DC)</td><td rowspan="2">1 kV</td></tr>
<tr><td>Communication</td></tr>
<tr><td>Ambient Conditions</td><td colspan="4">No corrosive gas or dust</td><td></td></tr>
<tr><td>Altitude</td><td colspan="4">2,000 m or less</td><td></td></tr>
<tr><td>Pollution</td><td colspan="4">Pollution Degree 2 or less</td><td></td></tr>
<tr><td>Cooling</td><td colspan="4">Natural air cooling</td><td></td></tr>
</table>

Performance Specifications

Items		Specification			Remark
		PLC-FB0808P	PLC-FB1616P0202	PLC-FB1616R0202	
Power		DC 12/24 VDC	DC 12/24 VDC	DC 24 VDC	-
Current Consumption		120 mA	330 mA	400 mA	
Program Control Method		Cyclic execution of stored program, Time Driven Interrupt			-
I/O Control Method		Indirect method, Directed by program instruction			-
Program Language		LD (Ladder Diagram), IL (Instruction List), SFC (Sequential Function Chart), Function block extension			-
Data Processing Method		32-bit			-
Instructions	Sequence	55 Instructions			-
	Application	389 Instructions			-
Processing Speed (Sequence)		300 ns/step			-
Program Capacity		10k step			-
Maximum I/O Points		DI 8 pts/DO 8 pts	DI 16 pts/DO 16 pts/AI 2 pts/AO 2 pts		-
Operation Mode		Remote Run, Remote Stop			-
Back-up Method		K address by (latch) parameter			-
Total Program		128			-
Program Type	Scan	Scan, Subroutine, Cold/Hot start initialization, Periodic interrupts			-
	Periodic Interrupts	Maximum 15 scan programs (minimum period :10 ms)			-
	Special	PID, HSC			-
	Communication	User protocol (serial) comm. program, MODBUS/RTU Master, High-speed PLC Link			-
	Etc.	SFC			-
Self-diagnosis function		Detect delay of scan time, Memory, I/O, Power supply			-
Re-start		Cold, Hot restart			-
Maximum Expansion		No expansion			-
Device Memory	X	8 pts (X00–X07)	16 pts (X00–X0F)		Bit
	Y	8 pts (Y10–Y17)	16 pts (Y10–Y1F)		Bit
	M	8192 pts (M0000–M511F)			Bit
	L	4096 pts (L0000–L255F)			Bit
	K	4096 pts (K0000–K255F)			Bit
	F	2048 pts (F0000–F127F)			Bit
	T	512 pts (T0000–T0511)			Word
	C	512 pts (C0000–C0511)			Word
	S	100 states x 100 set (00.00–99.99)			-
	D	10000 words (D0000–D9999)			Word
	Z	1024 words (Call stack: Z0000–Z0063, Z1000–Z1063)			Word
	Q	8192 pts (Q0000–Q511F)			Bit
	R	16 pts (index)			-

Performance Specifications

High Speed Counter	Maximum: 1Ph 20 kHz, 2Ph. 10 kHz	-
Positioning	X axis: Position/Speed Control 100Kpps Y axis: Position control 5Kpps, Speed Control 100Kpps	-
PID	32 Channels, Auto-Tuning	-
Communication Channels	USB Loader, RS-232C (1 CH, universal), RS-485/422 (1 CH, universal), Ethernet (10/100 Mbps auto-detect)	-
Features	RTC, Floating-point operation, Online edit	-

Analog I/O Specifications

Items	Description						Remark
AD/DA	Analog Input (Voltage/Current)				Analog Output (Voltage/Current)		32-point module exclusive
No. of Channels	2 CHANNELS				2 CHANNELS		
Voltage/Current	Voltage		Current		Voltage	Current	
Input/Output Range	0–5 V 0–10 V	1–5 V 1–10 V	0–20 mA	4–20 mA	0–10 V (Load resistance more than 1 KΩ)	4–20 mA (Load resistance less than 600 Ω)	
Resolution	1/3600	1/3000	1/3600	1/3000	1/3600	1/3000	
Digital Conversion	12-bit (0-4000)						
Absolute Max. Input	Voltage: +12 V		Current: 24 mA		-		
Absolute Max. Output	-				Voltage: +12 V	Current: 24 mA	
Input/Output Mode	Configured by MAPLELOGIC (Voltage/Current Switch)				Configured by MAPLELOGIC		
Input Impedance	1 MΩ				-		
Average	0–255 times				-		
Conversion Speed	Each scan						
Power	Shares 24 V power with CPU (power not insulated)						
COM	Shared AD/DA voltage / current COM (1 POINT COM)						
Precision	± 1% (full scale)						

Device & Address

▶ **Device**

- Input: X
- Output: Y
- Sub Relay: M
- Keep Relay: K
- Timer: T
- Counter: C
- Data Device: D
- Sub Data Device: @D
- Link Relay: L
- Step control Relay: S
- Special Relay: F
- Index register: R

▶ **Device Address**

- **Bit Data: [Device] + [Card No.] + [Bit No.]**

  Device: X, Y, M, K, L, F, card No: 10 dec (decimal). 3 characters

  Bit No: 16 hex. 1 character

  Ex) X0100 -> 10 dec. (word) + 16 hex (last bit): [10th address and 0th bit]

- **Word Data: [Device] + [Card No.]**

  Device: D, Z, T, C, card No: 10 dec. 4 characters

  Ex) D0100 -> 10 dec. (word): [100th word address]

- **Timer, Counter Output: [Device] + [Bit No.]**

  Device: T. C, Bit No: 10 dec 4 characters

  Ex) T0100 -> 10 dec. (word): [T 100th bit address]

- **Step Controller I/O: [Device] + [Card No.] + [.] + [Step No.]**

  Device: S

  Card No: 10 dec. 2 characters, Step No: 10 dec. 2 characters

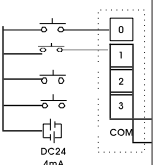
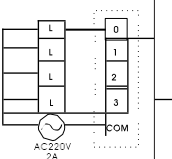
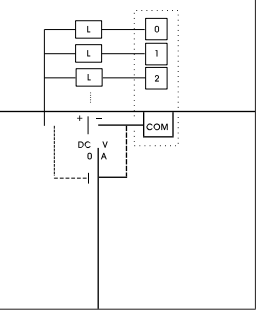
  Ex) Sxx.xx -> xx is 10 dec. (0–99)

- **Assign Bit Device to Word: [Device] + [Card No.] + [0]**

  Device: X, Y, M, K, L, F, Card No: 10 dec. 3 characters

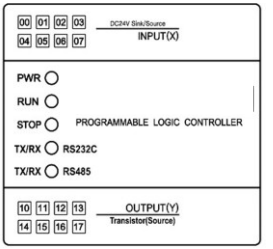
  Ex) X010 -> 10 dec. (word): [X 10th address]

I/O Specifications

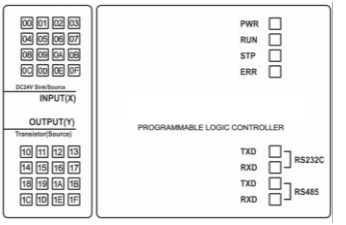
Item	DC Input	Relay Output	TR Output	
Module	**Common (All CPU's)**	**PLC-FB1616R0202**	**PLC-FB0808P**	**PLC-FB1616P0202**
Rated I/O Voltage	DC 12/24 V *12 VDC only used for HSC	AC 220 V DC 24 V	DC 12V or 24 VDC	
Rated I/O Current	4 mA	220 Vac/24 Vdc, 2 A/Point, 8 points/COM, Total 2COM (1COM 5A)	24 Vdc, 0.2 A/Point, 8 Points/COM Total 1COM (1COM 1A)	24 Vdc, 0.2 A/Point, 8 Points/COM Total 2COM (1COM 1A)
On V/A	DC 10 V (Ch: 1–4) /3 mA, DC 14 V (Ch: 5–8) /3 mA	-	-	
Off V/A	DC 8 V (Ch: 1–4)/ 1 mA, DC 12 V (Ch: 5–8)/ 1 mA	-	-	
Response Time	3 ms or less	10 ms or less	1 ms or less	
Operation Indicator	Input ON, LED ON	Input ON, LED ON	Input ON, LED ON	
Insulation Method	Photocoupler insulation	Relay insulation	Photocoupler insulation	
Input Method	SINK/SOURCE combined	-	-	
Output Method	-	RELAY	SOURCE (separate models)	
Method				

Names of Parts and Mode Change

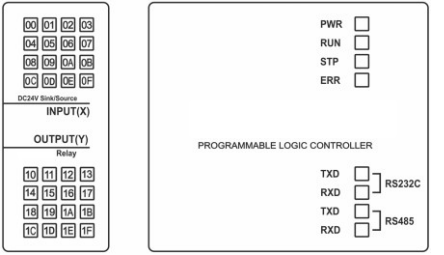
▶ **Names of Parts**



PLC-FB0808P



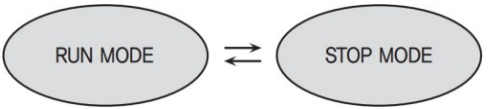
PLC-FB1616P0202



PLC-FB1616R0202

Names of Parts and Mode Change

▶ **Mode change**



- Operation mode is changed using the mode switch.
- The mode can be changed through MAPLELOGIC, but when the power is reset, RUN/STOP mode is decided based on the switch position.

CPU Module Features

▶ **Built-in Function**

- **PID Control**

  It operates 32 LOOP PID without PID module.

- **Positioning**

  Up to 100Kpps 2 axes of Pulse Output (FB1616P0202, FB0808P)

- **RTC**

  Reads the time data from the RTC and stores it in F device.

- **I/O Reservation**

  Scans module at designated slot.

  Refers to reservation function which writes a program without I/O change in case of expansion, damage or replacement.

- **Online Edit**

  Program can be edited while in Run mode.

▶ **Features**

- **2 Built-in High Speed Counters (1Ph Max. 20 kHz, 2Ph Max. 10 kHz)**

  Uses 2 Ph. 2/4 Multi. input mode. Voltage input type (open collector)

- **Max. 4 communications can work simultaneously. (USB, RS232, RS485, RS-422, Ethernet)**

  MODBUS RTU/TCP, High-speed PLC Link, Protocol program (user protocol), Loader protocol, Remote access & up/download supported.

- **Memory (10k step)**

- **Data reserved in case of power outage**

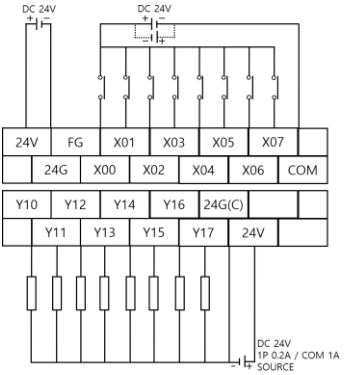
  Built-in flash memory enabling permanent backup of program without any separate battery.

► **Recommendations on using USB Cable**

1. Recommended to use MAPLE SYSTEMS's shielded cable within 3m length.
2. In case of using PC that is vulnerable to noise, it is recommended to use USB Hub or Isolator

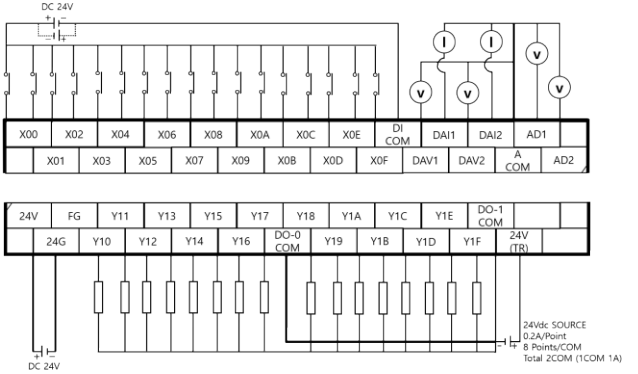
CPU I/O Pin Map

PLC-FB0808P



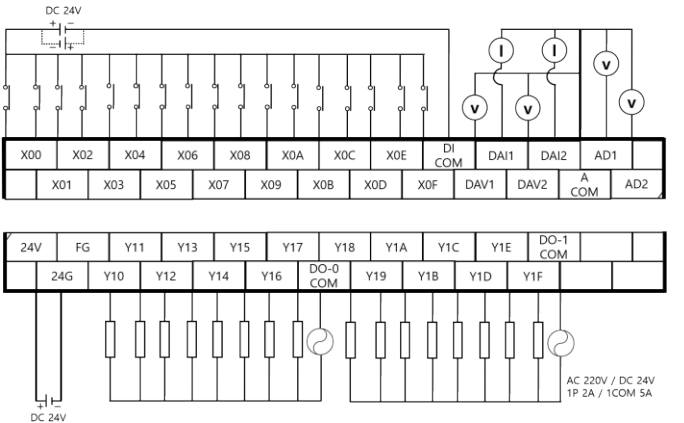
CPU I/O Pin Map

PLC-FB1616P0202



CPU I/O Pin Map

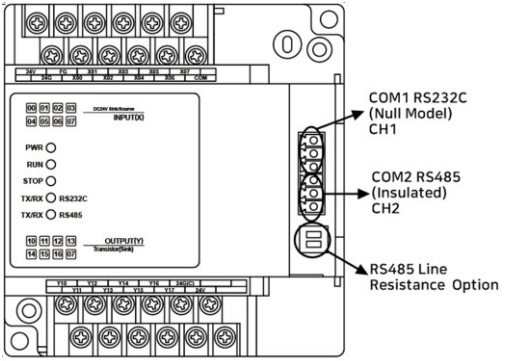
PLC-FB1616R0202

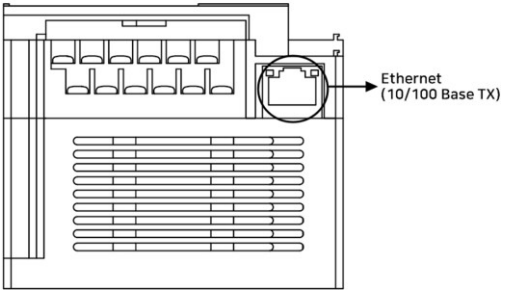


Built-in Communication Specifications

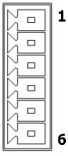
Items		RS232C	RS485/422	Ethernet
Comm. Protocol				
	MAPLELOGIC Protocol	O	O	O
	User Protocol	O	O	X
	MODBUS/RTU	Master/Slave	Master/Slave	Slave
Types	Data Bit	8 Bit		-
	Stop Bit	1 or 2 Bit		-
	Parity	Even / Odd / None		-
Synchronization		Asynchronous		-
Transmission Speed		1200~38400		10/100 Mbps

Communication Interface (16 Point PLC)



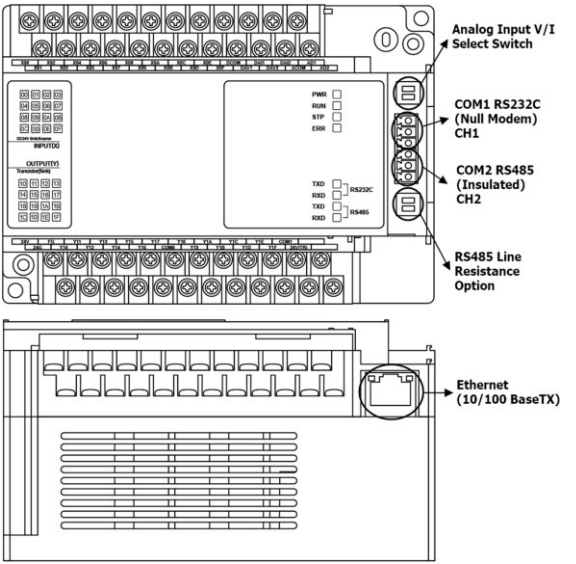


▶ **Serial Port PIN Map**

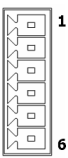


PIN	NAME	COMM
1	TX	RS-232C
2	RX	
3	GND	
4	D+	RS-485
5	D-	
6	SG	

Communication Interfaces (32 Point PLC)



▶ **Serial Port PIN Map**



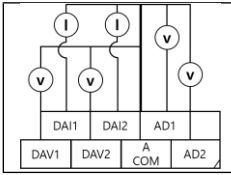
PIN	NAME	COMM
1	TX	RS232C
2	RX	
3	GND	
4	D+	RS485
5	D-	
6	SG	

▶ **RS-485 Line Resistance Option**

If RS-485 communication is not stable because of the surrounding noises, use the “RS-485 Resistance Option” switch to enhance the resistance. Turning on this option switch may improve the communication quality, but the available communication distance will decrease.

Analog I/O Interfaces (32 Point PLC)

▶ **Analog I/O Interface**

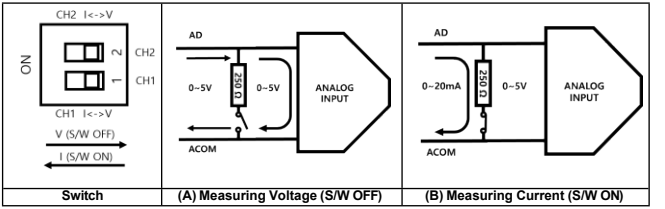


PIN NAME	Description
AD1	Analog Input Ch.1 Terminal
AD2	Analog Input Ch.2 Terminal
DAV1	Analog Voltage Output Ch.1 Terminal
DAV2	Analog Voltage Output Ch.2 Terminal
DAI1	Analog Current Output Ch.1 Terminal
DAI2	Analog Current Output Ch.2 Terminal
ACOM	Analog I/O COM

▶ **ACOM Terminal (Analog I/O COM)**

ACOM terminal is an electric potential of the entire embedded analog I/O signals. For the transmission of the embedded analog I/O signals, ACOM must be wired together.

▶ **Analog Input V/I Select Switch**



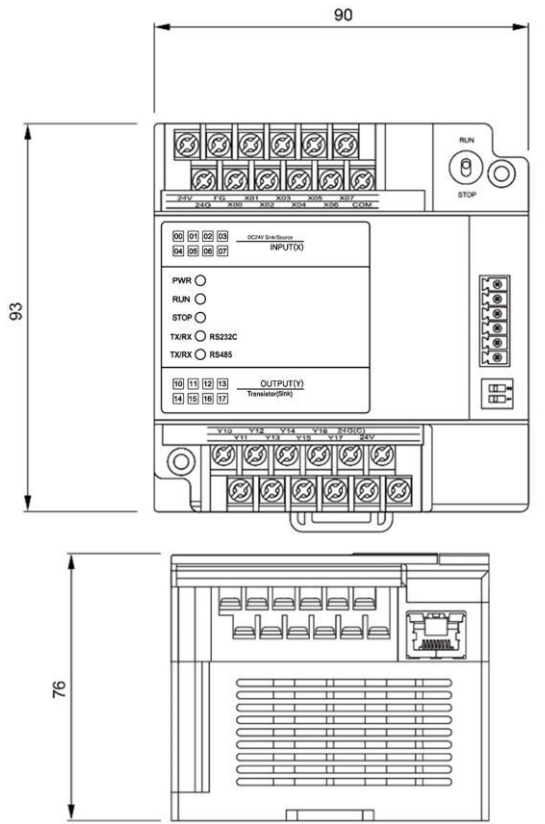
Switch	(A) Measuring Voltage (S/W OFF)	(B) Measuring Current (S/W ON)

Internal analog input port uses 250 Ω precision resistor. Connecting the shunt resistor (250 Ω) by controlling the “analog input select switch” will enable the measurement of current (0-20 mA).

※ Depending on the on/off state of the switch, the impedance value may change.
The switch must be switched to on only when the current is measured.
To measure the voltage, please move the switch to off.

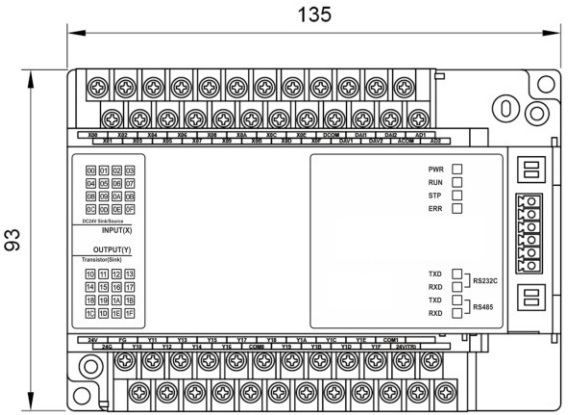
Dimensions

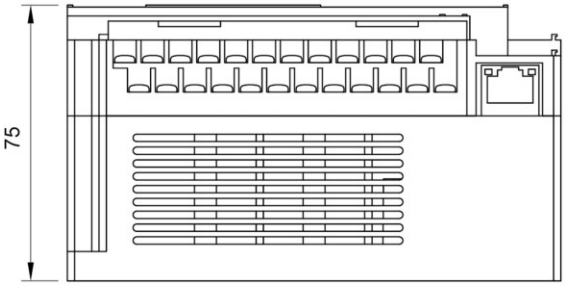
Model: PLC-FB0808P **(Unit: mm)**



Dimensions

Model: PLC-FB1616P0202, PLC-FB1616R0202 **(Unit: mm)**





Product Warranty

Warranty Statements are included with each unit at the time of purchase and are available at www.maplesystems.com.

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