Maple Systems

USER MANUAL

MAPLE MODULAR PLC

CPU Modules

MODELS

- **PLC-ES1616P**
- **PLC-ES0808P**
- **PLC-ES0806R**

1010-1154 REV 1.1

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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.

Design Precautions (⚠ Warning)

Please install a safety circuit to protect the entire control system in case of an unexpected power shut-down 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.

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 short, fire or malfunctions.

In 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.

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 screw, turn off the power of 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 cell phone devices at least 30 cm 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="5">Specification</th><th>Standards</th></tr>
<tr><td>Ambient Temp.</td><td colspan="5">-10℃~60℃</td><td>-</td></tr>
<tr><td>Storage Temp.</td><td colspan="5">-25℃~80℃</td><td>-</td></tr>
<tr><td>Ambient Humidity</td><td colspan="5">5~95% RH, Non-condensing</td><td>-</td></tr>
<tr><td>Storage Humidity</td><td colspan="5">5~95% RH, Non-condensing</td><td>-</td></tr>
<tr><td rowspan="8">Vibration</td><td colspan="5">For discontinuous vibration</td><td rowspan="8">IEC 61131-2</td></tr>
<tr><td>Frequency</td><td colspan="2">Acceleration</td><td>Amplitude</td><td>Times</td></tr>
<tr><td>5 ≤ f < 9 Hz</td><td colspan="2">-</td><td>3.5 mm</td><td rowspan="2">10 times
in X, Y, Z</td></tr>
<tr><td>9 ≤ f ≤ 150 Hz</td><td colspan="2">9.8 m/s² (1G)</td><td>-</td></tr>
<tr><td colspan="5">Continuous vibration</td></tr>
<tr><td>Frequency</td><td colspan="2">Acceleration</td><td>Amplitude</td><td>Times</td></tr>
<tr><td>5 ≤ f < 9 Hz</td><td colspan="2">-</td><td>1.75 mm</td><td rowspan="2">10 times
in X, Y, Z</td></tr>
<tr><td>9 ≤ f ≤ 150 Hz</td><td colspan="2">4.9 m/s² (0.5G)</td><td>-</td></tr>
<tr><td>Shocks</td><td colspan="5">• 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="4">± 2 kV</td><td>-</td></tr>
<tr><td>Electrostatic Discharge</td><td colspan="4">±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="4">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 colspan="2">CPU, Power</td><td rowspan="2">2 kV</td><td rowspan="4">IEC 61131-2
IEC 61000-4-4</td></tr>
<tr><td colspan="2">Digital/Analog I/O (AC)</td></tr>
<tr><td colspan="2">Digital/Analog I/O (DC)</td><td rowspan="2">1 kV</td></tr>
<tr><td colspan="2">Communication</td></tr>
<tr><td>Ambient Conditions</td><td colspan="5">No corrosive gas and no dust</td></tr>
<tr><td>Altitude</td><td colspan="5">2,000 m or less</td></tr>
<tr><td>Pollution</td><td colspan="5">Pollution Degree 2 or less</td></tr>
<tr><td>Cooling</td><td colspan="5">Natural Air Cooling</td></tr>
</table>

CPU Performance Specifications

Items		Specification
		PLC-ES1616P **PLC-ES0808P** **PLC-ES0806R**
Power		DC 12/24 VDC Note: 24 VDC is needed for Relay Outputs
Weight		120g / 155g / 165g
Program Control Method		Cyclic Execution, Time Driven Interrupt
I/O Control Method		Indirect method, Directed by program instruction
Program Language		IL (Instruction List), LD (Ladder Diagram), SFC (Sequential Function Chart), FBD (Function Block Diagram), FBD Extension
Data Processing Method		32-bit (4 Bytes)
Instructions	**Sequence**	60
	Application	480
Processing Speed	**LD**	300 ns/Step
	MOV	
	Floating-point Arithmetic	
Floating-point Arithmetic		Supporting instructions for floating-point arithmetic
Number of Program Blocks		Max 128 blocks
Operation mode		Remote Run, Remote Stop
Data Preservation Against Power Failure		K device and conservation (Latch) in M, L, T, C, S, D device

CPU Performance Specifications

Supporting Program	LD	Scan, Subroutine, Initialize (COLD), Initialize (HOT), Periodic interrupt
	Special Configuration	Initializing special card, PID control, I/O Input module filter setting, High-speed Counter
	Communication	User protocol (Serial), User protocol (Ethernet), MODBUS TCP/RTU Master, High-Speed PLC link, Security
	SFC	SFC Program
	FBD	FBD (Function Block Diagram), FBD Extension
Periodic Interruption		Maximum 15, cycle setting (10-60,000 ms, Unit: 10 ms), priority setting (0-14)
Max Expansion Blocks		CPU+Max. 11 expansion blocks
Self-Diagnosis		Monitoring process delay, WDT (Detects delay of scan time), Memory error, I/O error, Low Battery Power ON/OFF Status
Watch Dog Timer (WDT)		10-5000 ms (Unit: 10 ms)
Restarting		Cold, Hot Restart
Timer		Cycle: 0.01-6,553.5 s (Either 10 or 100 ms) On Delay, Addition, Monostable, Retriggerable TC (Current value), TS (Setting value)
Counter		Counter range: -32,768-32,767 Up Counter, Down Counter, Up-Down Counter, Ring Counter CC (Current value), CS (Setting value)
Positioning		X axis: Position/Speed control 100Kpps Y axis: Position control 5Kpps, Speed control 100kpps
PID		32 Channels, Auto-Tuning
Communication Channels	USB	USB 2.0: For Loader Protocol

CPU Performance Specifications

	Serial	RS-232C (Max 115200 bps), RS-485/422 (Max 57600 bps): MAPLELOGIC Loader, Modbus RTU Master/Slave, User Protocol
	Ethernet	10/100Base-T/TX MAPLELOGIC Loader, Modbus TCP Slave
Event log		Max 16 logs (Power, Mode, Error)
Max. Counting Speed		1 Phase: 20 kHz 2 Phase: 10 kHz
Features		I/O Reservation, RTC, Online Edit Option: SD/MMC Slot
Capacity of Scan Program		10k steps
Memory Card	**Spec**	SD Memory Card: FAT32, 32 GB
	Function	Firmware up/down grade, Program download
Device Memory	**X**	1024
	Y	1024
	M	8192
	L	4096
	K	4096
	F	2048
	T	512
	C	512
	S	100*100 steps (00.00-99.99)
	D	10000 Words
	Z	1024 Words
	Q	8192
	R	16 Words (Index)

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 Notation**

- 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]

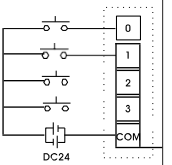
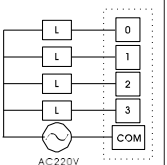
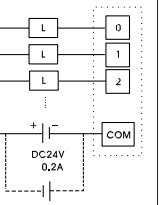
- Word Data: [Device] + [Card No.]
Device: D, Z, T, C, Card No.: 10 Dec. 5 Characters
Ex) D0100➔10 Dec. (Word): [100th word Address]

- 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]

Internal I/O Specifications

Items	DC Input	Relay Output	TR Output
Rated I/O Voltage	DC 24 V DC 12 V/24 V (High Speed Counter)	AC 220 V/DC 24 V	DC 24 V
Rated I/O Current	4 mA	1 point 2 A/COM 5 A	1 point 0.2 A/COM 2 A
On V/A	CH1–4: DC 10 V/4 mA CH5–16: DC 14 V/4 mA	-	-
Off V/A	CH1–4: DC 6 V/1 mA CH5–16: DC 12 V/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	-	-
Output method	-	Relay	Source
Circuit Diagram			

Features of CPU

▶ Built-in Functions

• PID Control

It operates 32 LOOP PID without PID module.

• Positioning

Up to 100Kpps 2 axes of Pulse Output (ES1616P, ES0808P)

• RTC

It reads time from RTC and saves it in the F device address.

• I/O reservation

It scans the module at the designated slot.

It refers to a 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

• SD/MMC Built-in

Scan program or firmware can be upgraded by SD memory card.

(Stop mode ➔ Power off ➔ Insert SD card ➔ Power on ➔ Run mode in 5 sec ➔ Firmware downloading (wait 20 sec) ➔ Confirm flickering RUN, STOP, ERR LED ➔ Remove SD card ➔ Power off ➔ Power on)

• 20 kHz High Speed Counter (2 Channels) Built-in.

2 PH. 2/4 Multi. (2 PH. –10 kHz) Input mode possible, Voltage input type (Photocoupler Insulated)

• Max. 3 communications can work simultaneously. (Ethernet, RS-232, RS-485/422) MODBUS RTU/TCP, High-speed PLC Link,

User protocol, Loader protocol support, Remote access & up/download support.

• Abundant memory

Maximum 10k steps for a user program is available.

• Data reserved in case of power cut

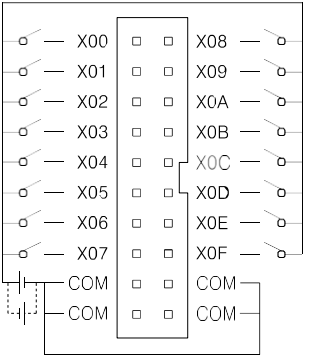
Built-in Flash memory enabling permanent backup of the program without any separate battery.

▶ Recommendations on using USB Cable

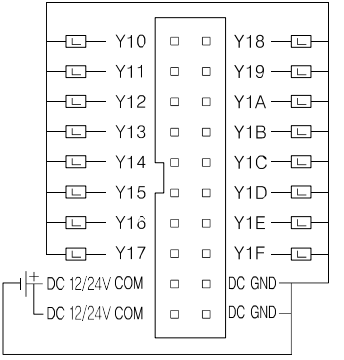
1. Recommended to use MAPLE SYSTEMS's shielded cable within 3 m length.
2. In case of using a PC that is vulnerable to noises, it is recommended to use USB Hub or Isolator.

CPU I/O Pin Map

► **PLC-ES1616P Inputs**

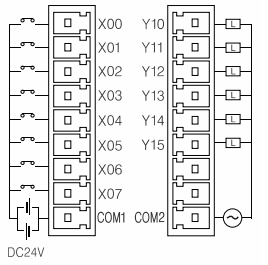


► **PLC-ES1616P Outputs**

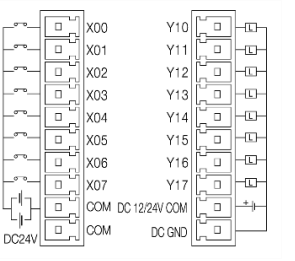


CPU I/O Pin Map

► PLC-ES0806R Inputs/Outputs



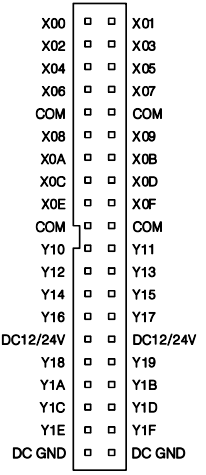
► PLC-ES0808P Inputs/Outputs

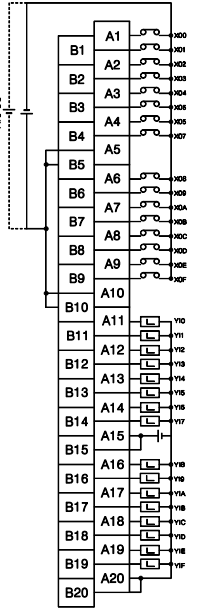


PLC-ES1616P I/O Pin Map

► Terminal Block (ACC-TB32M)



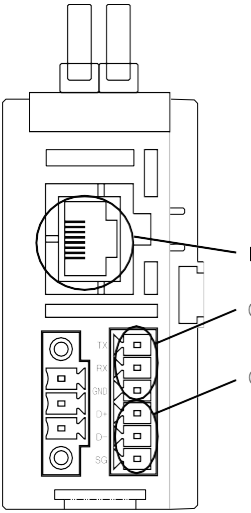


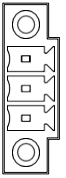


ACC-TB32	PLC-ES1616P
A1	X00
B1	X01
A2	X02
B2	X03
A3	X04
B3	X05
A4	X06
B4	X07
A5	COM
B5	COM
A6	X08
B6	X09
A7	X0A
B7	X0B
A8	X0C
B8	X0D
A9	X0E
B9	X0F
A10	COM
B10	COM
A11	Y10
B11	Y11
A12	Y12
B12	Y13
A13	Y14
B13	Y15
A14	Y16
B14	Y17
A15	DC12/24V
B15	DC12/24V
A16	Y18
B16	Y19
A17	Y1A
B17	Y1B
A18	Y1C
B18	Y1D
A19	Y1E
B19	Y1F
A20	DC GND
B20	DC GND

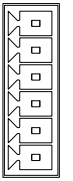
* Terminal (ACC-TB32M) has its own terminal cable.
Terminal Cable: ACC-SCB15M

Communication Interface





Pin	Name
1	24V
2	24G
3	FG



Pin	Name
1	TX
2	RX
3	GND
4	D+
5	D−
6	SG

Built-in Comm. Specification

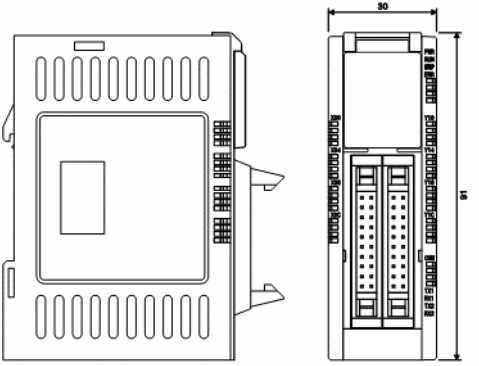
Items		Ch 1	Ch 2
		RS-232C	RS-485/422
Comm. Mode			
	MAPLE Protocol	O	O
	Protocol Program	O	O
	MODBUS/RTU	Master/Slave	Master/Slave
Types	Data Bit	8 Bit	
	Stop Bit	1 or 2 Bit	
	Parity	Even/Odd/None	
Synchronization		Asynchronous	
Transmission Speed		1200~115200	1200~57600

Items		Ethernet
Comm. Mode		
	MAPLE Protocol	O
	Protocol Program	X
	MODBUS/TCP	Slave
	High Speed PLC Link	O
	DHCP	O
Max. Online Client		Max. 5 clients simultaneously
Comm. Speed		10 Mbps, 100 Mbps
Comm. specification		100 base TX

Dimensions

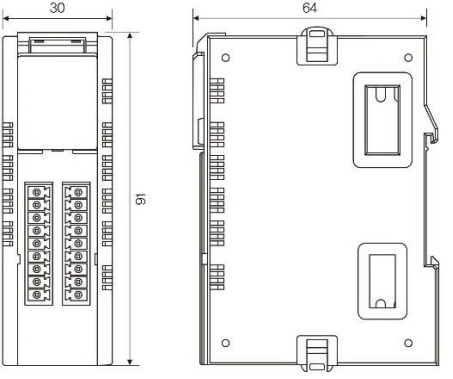
(Unit: mm)

► **PLC-ES1616P**



(Unit: mm)

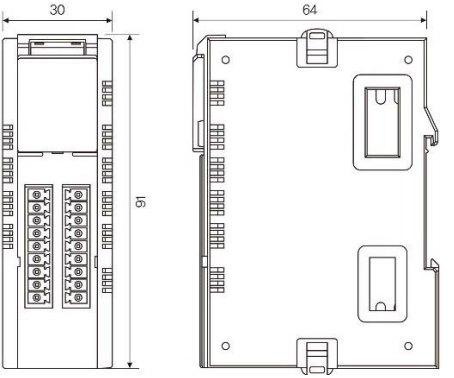
► **PLC-ES0806R**



Dimensions

(Unit: mm)

► PLC-ES0808P



Product Warranty

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

MEMO

MEMO

MAPLE SYSTEMS INC.

808 134th St SW #120
Everett, WA 98204

Phone +1 425-745-3229
Web: www.maplesystems.com

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