

EC10 Series PLC Quick Start User Manual

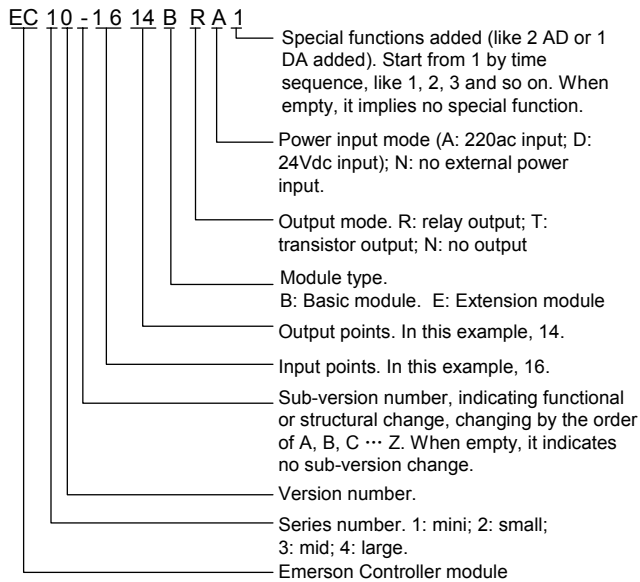
Thank you for using Emerson programmable logic controller (PLC). Before using the EC10 series PLC product, please carefully read this booklet so as to better understand it, fully use it, and ensure safety.

This quick start manual is to offer you a quick guide to the design, installation, connection and maintenance of EC10 series PLC, convenient for on-site reference. Briefly introduced in this booklet are the hardware specs, features, and usage of EC10 series PLC, plus the optional parts and FAQ for your reference. For detailed product information, please refer to our *EC10 Series PLC User Manual*, *ControlStar Programming Software User Manual*, and *EC20/EC10 Series PLC Programming Manual*. For ordering the above user manuals, contact your Emerson distributor or sales office.

1 Introduction

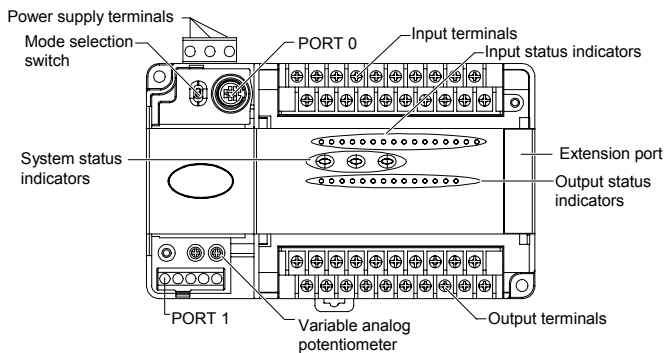
1.1 Model Designation

The model designation is shown in the following figure.



1.2 Outline

The outline of the basic module is shown in the following figure by taking the example of EC10-1614BRA.



PORT0 and PORT1 are communication terminals. PORT0 uses RS232 mode with Mini DIN8 socket. PORT1 uses RS485 or RS232 mode. The busbar socket is for connecting the extension module. The mode selection switch has three positions: ON, TM and OFF.

1.3 Terminal Introduction

Different PLC has different terminal layout. Listed in the following table are the terminals common in all PLCs.

| Pin | Function |
|------|--|
| L/N | 220Vac input live line and neutral line |
| ⊕ | Earth terminal |
| +24V | Auxiliary DC power for users' external equipment, work with COM |
| COM | Negative pole of +24V auxiliary power |
| S/S | Input mode selection: sink mode when connected with +24V, or source mode when connected with COM |
| ● | Null, for isolation. Leave it suspended |

The input & output terminals of different PLCs are shown below.

EC10-1006BRA, EC10-1006BTA

| Terminal | Function | |
|---------------|--|--|
| X0 ~ X11 | Digital inputs, work with COM to generate input signal | |
| Y0, COM0 | Digital outputs, group 0 | The COMx of different output groups are isolated from each other |
| Y1, COM1 | Digital outputs, group 1 | |
| Y2 ~ Y5, COM2 | Digital outputs, group 2 | |

EC10-1410BRA, EC10-1410BTA

| Terminal | Function | |
|-------------|--|--|
| X0 ~ X15 | Digital inputs, work with COM to generate input signal | |
| Y0, COM0 | Digital outputs, group 0 | The COMx of different output groups are isolated from each other |
| Y1, COM1 | Digital outputs, group 1 | |
| Y2~Y11,COM2 | Digital outputs, group 2 | |

EC10-1614BRA, EC10-1614BTA

| Terminal | Function | |
|---------------|--|--|
| X0 ~ X17 | Digital inputs, work with COM to generate input signal | |
| Y0, COM0 | Digital outputs, group 0 | The COMx of different output groups are isolated from each other |
| Y1, COM1 | Digital outputs, group 1 | |
| Y2 ~ Y7, COM2 | Digital outputs, group 2 | |
| Y10~Y15,COM3 | Digital outputs, group 3 | |

EC10-2416BRA, EC10-2416BTA

| Terminal | Function | |
|---------------|--|--|
| X0 ~ X27 | Digital inputs, work with COM to generate input signal | |
| Y0, COM0 | Digital outputs, group 0 | The COMx of different output groups are isolated from each other |
| Y1, COM1 | Digital outputs, group 1 | |
| Y2 ~ Y7, COM2 | Digital outputs, group 2 | |
| Y10~Y17,COM3 | Digital outputs, group 3 | |

EC10-1614BRA1, EC10-1614BTA1

| Terminal | Function | |
|-------------------|--|--|
| X0 ~ X17 | Digital inputs, work with COM to generate input signal | |
| Y0, COM0 | Digital outputs, group 0 | The COMx of different output groups are isolated from each other |
| Y1, COM1 | Digital outputs, group 1 | |
| Y2 ~ Y7, COM2 | Digital outputs, group 2 | |
| Y10~Y15,COM3 | Digital outputs, group 3 | |
| AV1+, AI1+, AV11- | Analog input, group 1. AV1+: + U input, AI1+: + I input, AV11-: common negative pole for Uinput and I input | |
| AV2+, AI2+, AV12- | Analog input, group 2. AV2+: + U input, AI2+: + I input, AV12-: common negative pole for U input and I input | |
| AVO+, AIO+, AO- | Analog output. AVO+: + U output, AIO+: + I output, AO-: common negative pole for U output and I output | |

2 Power Supply

The specification of PLC built-in power and power for extension modules is listed in the following table.

| Item | Unit | Min. | Rated | Max. | Note |
|----------------------|---------|------|-------|------|---|
| Power supply voltage | Vac | 85 | 220 | 264 | Normal startup and operation |
| Input current | A | / | / | 1.5 | Input: 90Vac, 100% output |
| Output current | 5V/GND | mA | / | 900 | The total power of outputs 5V/GND and 24V/GND ≤ 10.4W. Max. output power: 24.8W (sum of all branches) |
| | 24V/GND | mA | / | 300 | |
| | 24V/COM | mA | / | 600 | |

3 Digital Inputs & Outputs

Input Characteristic And Specification

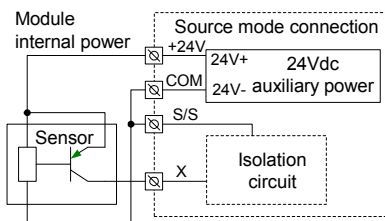
The input characteristic and specs are shown as follows:

| Item | High-speed input terminals X0~X7 | General input terminal |
|---------------------|---|--|
| Input mode | Source mode or sink mode, set through s/s terminal | |
| Electric parameters | Input voltage | 24Vdc |
| | Input impedance | 3.3kΩ / 4.3kΩ |
| | Input ON | External circuit resistance < 400Ω |
| | Input OFF | External circuit resistance > 24kΩ |
| Filtering function | Digital filter | X0~X17 have digital filtering function. Filtering time: 0, 8, 16, 32 or 64ms (selected through user programme) |
| | Hardware filter | Input terminals other than X0 ~ X17 are of hardware filtering. Filtering time: about 8ms |
| High-speed function | X0~X7: high-speed counting, interrupt, and pulse catching X0 and X1: up to 50kHz counting frequency X2~X5: up to 10kHz counting frequency The sum of input frequency should be less than 60kHz | |
| Common terminal | Only one common terminal: COM | |

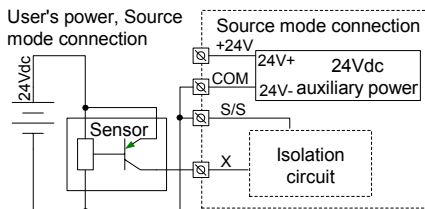
The input terminal act as a counter has a limit over the maximum frequency. Any frequency higher than that may result in incorrect counting or abnormal system operation. Make sure that the input terminal arrangement is reasonable and external sensors used are proper.

PLC provides the S/S terminal for selecting input mode: sink mode or source mode. You can select the sink mode by connecting S/S terminal with +24V terminal, which enables you to connect a NPN mode sensor.

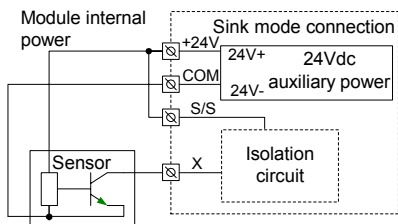
Wiring of source mode input with internal power



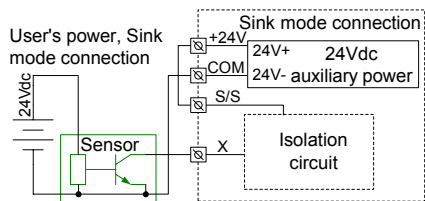
Wiring of source mode input with external power



Wiring of sink mode input with internal power



Wiring of sink mode input with external power



Output characteristic and specification

The following table shows the relay output and transistor output.

| Item | Relay output | Transistor output |
|-------------|---|-------------------|
| Output mode | When output state is ON, the circuit is closed; OFF, open | |

| Item | Relay output | Transistor output |
|-----------------|--|--|
| Common terminal | Divided into multiple groups, each with a common terminal COMn, suitable for control circuits with different potentials. All common terminals are isolated from each other | |
| Voltage | 220Vac; 24Vdc, no polarity requirement | 24Vdc, correct polarity required |
| Current | Accord with output electric specs (see following Table) | |
| Difference | High driving voltage, large current | Small driving current, high frequency, long lifespan |
| Application | Loads with low action frequency such as intermediate relay, contactor coil, and LEDs | Loads with high frequency and long life, such as control servoamplifier and electromagnet that action frequently |

The electric specs of outputs is shown in the following table.

| Item | Relay output terminal | Transistor output terminal | |
|---------------------------------|--|---|--|
| Switched voltage | Below 250Vac, 30Vdc | 5~24Vdc | |
| Circuit isolation | By Relay | PhotoCoupler | |
| Operation indication | Relay output contacts closed, LED on | LED is on when optical coupler is driven | |
| Leakage current of open circuit | / | Less than 0.1mA/30Vdc | |
| Minimum load | 2mA/5Vdc | 5mA (5~24Vdc) | |
| Max. output current | Resistive load | Y0, Y1: 0.3A/1 point; Others: 0.3A/1 point, 0.8A/4 point, 1.2A/6 point, 1.6A/8 point. Above 8 points, total current increases 0.1A at each point increase | |
| | Inductive load | 220Vac, 80VA | Y0, Y1: 7.2W/24Vdc Others: 12W/24Vdc |
| | Illumination load | 220Vac, 100W | Y0, Y1: 0.9W/24Vdc Others: 1.5W/24Vdc |
| Response time | OFF→ON | 20ms Max | |
| | ON→OFF | 20ms Max | |
| Y0, Y1 max. output frequency | / | Each channel: 100kHz | |
| Output common terminal | Y0-COM0; Y1-COM1. After Y2, every 8 terminals use one isolated common terminal | | |
| Fuse protection | No | | |

4 Analog Inputs & Outputs

4.1 Usage Of Analog Terminals

EC10 series PLC provides the basic module with integrated AD/DA function, serving as a small-scale total solution with low cost for users who need to control the analog signal.

PLCs that support input and output of analog signals are listed below:

| Model | Analog input | | | Analog output | | |
|---------------|----------------|---------|---------|----------------|---------|---------|
| | Channel number | V input | I input | Channel number | V input | I input |
| EC10-1614BRA1 | 2 | ✓ | ✓ | 1 | ✓ | ✓ |
| EC10-1614BTA1 | 2 | ✓ | ✓ | 1 | ✓ | ✓ |

The user terminals related to analog signals are defined below.

| Terminal | Note | Terminal | Note |
|----------|--------------------------|----------|-------------------------------|
| AV1+ | Input CH1: voltage input | AVO+ | Output CH: volt signal output |
| AI1+ | Input CH1: current input | | |
| AV1- | Input CH1: common ground | | |
| AV2+ | Input CH2: voltage input | AIO+ | Output CH: current output |
| AI2+ | Input CH2: current input | | |
| AVI2- | Input CH2: common ground | AO- | Output CH: common GND |

Note: Never input voltage signal and current signal to the same channel simultaneously. When measuring the current signal, short the voltage signal input terminal with the current signal input terminal

4.2 Analog Signal Input & Output Specs

The analog signal input and output specs is listed in the following table.

| Item | Description |
|-----------------------|---------------|
| Max. conversion speed | AD conversion |
| | DA conversion |

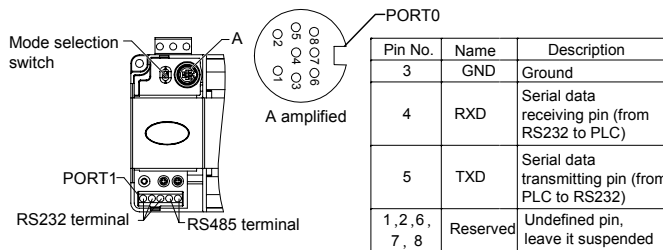
| Item | Description | |
|---------------------|--|--|
| Analog input range | Voltage input | -10 ~ 10Vdc (input impedance $\geq 200k\Omega$), input signal freq. <10Hz. Warning: the unit could be damaged with input voltage $>\pm 15Vdc$ |
| | Current input | -20 ~ 20mA (input impedance: 250 Ω), input signal freq. <10Hz. Warning: the unit could be damaged with input voltage $>\pm 30mA$ |
| Analog output range | Voltage output | -10~10Vdc(external load impedance:2k Ω ~1M Ω) |
| | Current output | 0 ~ 20mA (external load impedance: $\leq 500\Omega$) |
| Digital range | -10000 ~ 10000 | |
| Resolution | Voltage I/O | 5mV |
| | Current I/O | 10 μA |
| Total precision | Analog input | DC -10 ~ 10V, -20 ~ 20mA: $\pm 1\%$ |
| | Analog output | $\pm 1\%$ |
| Isolation | Between analog circuit and digital circuit: optical coupler. Between analog channels: none | |

5 Communication Port

EC10 series PLC basic module has two serial asynchronous communication ports: PORT0 and PORT1. Supported baud rates:

| | | | |
|------------|-----------|-----------|-----------|
| 115200 bps | 57600 bps | 38400 bps | 19200 bps |
| 9600 bps | 4800 bps | 2400 bps | 1200 bps |

The mode selection switch determines the communication protocol.



As a terminal dedicated to user programming, PORT0 can be converted to programming protocol through the mode selection switch. The relationship between PLC operation status and the protocol used by PORT0 is shown in the following table.

| Mode selection switch position | status | PORT0 operation protocol |
|--------------------------------|---------|---|
| ON | Running | Programming protocol, or Modbus protocol, or free-port protocol, or N: N network protocol (ECBUS), as determined by user program and system configuration |
| ON TM | Running | Converted to programming protocol |
| OFF TM | Stop | |
| OFF | Stop | If the system configuration of user program is free-port protocol, it converts to programming protocol automatically after stop; or system protocol keeps unchanged |

PORT1 is ideal for connection with equipment that can communicate (such as inverters). With Modbus protocol or RS485 terminal free protocol, it can control multiple devices through the network. Its terminals are fixed with screws. You can use a shielded twisted-pair as the signal cable to connect communication ports by yourself.

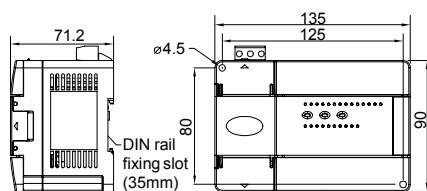
Note: Never use RS232 terminal and RS485 at the same time. Besides, suspend the unused terminals, or communication could be interrupted.

6 Installation

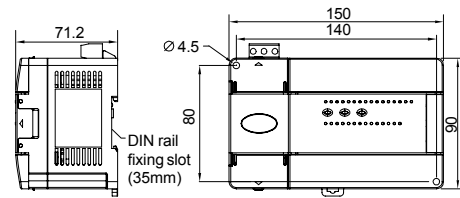
PLC is applicable to Installation category II, Pollution degree 2.

6.1 Installation Dimensions

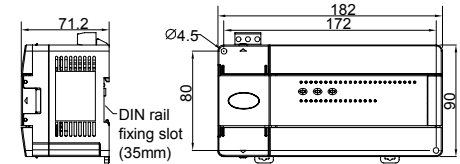
The dimensions for the outline and mounting holes of EC10-1006BRA, EC10-1006BTA, EC10-1410BRA and EC10-1410BTA are shown below



The dimensions for the outline and mounting holes of EC10-1614BRA and EC10-1614BTA are shown in the following figure:

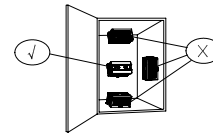


The dimensions for the outline and mounting holes of EC10-2416BRA, EC10-2416BTA, EC10-1614BRA1 and EC10-1614BTA1 are shown in the following figure.



6.2 Installation Position

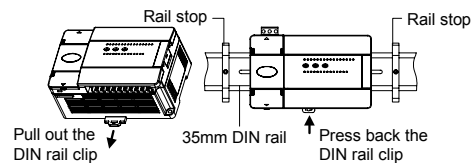
Mount the PLC onto the cabinet backboard horizontally. You must provide a clearance of at least 15cm, both above and below the unit, for proper cooling. Never mount them to the floor or ceiling of an enclosure or other directions. See the following figure. No heat generating equipment should be around the PLC.



6.3 Installation Method

DIN rail mounting

Generally you can mount the PLC onto a 35mm-wide rail (DIN), as shown in the following figure.



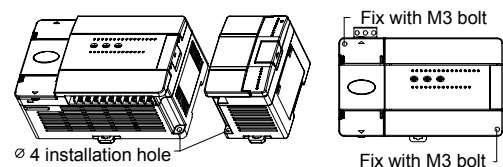
Follow these steps:

1. Fix the DIN rail to the backboard.
2. Pull out the clip on the bottom of the PLC.
3. Hook the back of the PLC onto the rail.
4. Snap the clip back, make sure PLC has been fastened to the rail.
5. At last, mount two rail-stops at the two sides to avoid sliding.

DIN mounting of other EC10 modules can be done in the same way.

Screw fixing

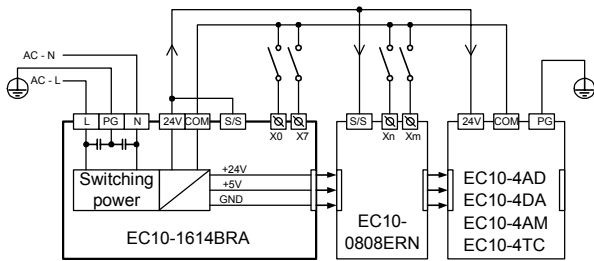
Fixing the PLC with screws can stand greater shock than DIN rail mounting. Use M3 screws through the mounting holes on PLC enclosure to fix the PLC onto the backboard of the electric cabinet, as shown in the following figure.



6.4 Cable Wiring And Specs

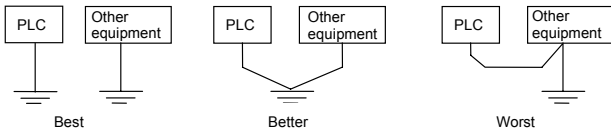
Connecting power supply cable and earth cable

The cable connection of AC power and auxiliary power is shown below.

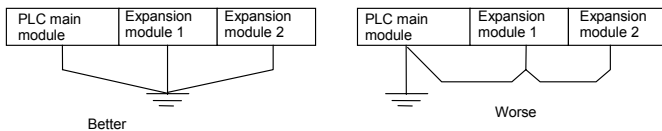


The earth cable can ensure safety and improve PLC EMI immunity.

Connect the PG terminal of PLC power supply with the earth electrode. It is recommended to use the AWG12~16 cable, keep it as short as possible, and use an independent earthing device. Avoid sharing common routes with the earth line of other equipment (especially those with strong interference), as shown in the following figure.



If PLC extension modules are used, connect the earth cable of each module to the earth electrode separately, as shown below.



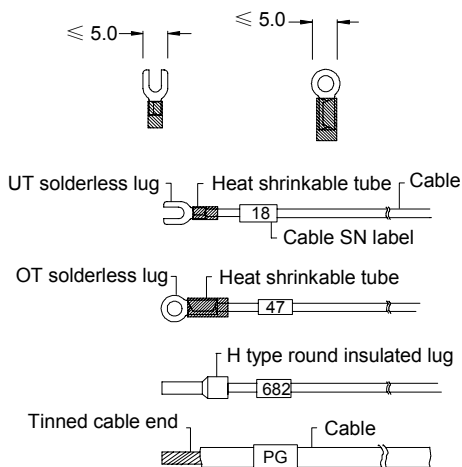
Cable specs

When wiring a PLC, use multi-strand copper wire and ready-made insulated terminals to ensure the quality. The recommended model and the cross-sectional area of the cable are shown in the following table.

| Wire | Cross-sectional area | Recommended model | Cable lug and heat-shrink tube |
|-------------------------|------------------------|-------------------|--|
| AC power cable (L, N) | 1.0~2.0mm ² | AWG12, 18 | H1.5/14 round insulated lug, or tinned cable lug |
| Earth cable (⊕) | 2.0mm ² | AWG12 | H2.0/14 round insulated lug, or tinned cable end |
| Input signal cable (X) | 0.8~1.0mm ² | AWG18, 20 | UT1-3 or OT1-3 solderless lug |
| Output signal cable (Y) | 0.8~1.0mm ² | AWG18, 20 | Φ3 or Φ4 heat shrinkable tube |

Fix the prepared cable head onto the PLC terminals with screws. Fastening torque: 0.5~0.8Nm.

The recommended cable processing-method is shown in the following figure.



7 Power-on Operation And Maintenance

Startup

Check the cable connection carefully. Make sure that the PLC is clear of alien objects and the heat dissipation channel is clear.

1. Power on the PLC, the PLC POWER indicator should be on.

2. Start the Controlstar software on the host and download the compiled user program to the PLC.

3. After checking the download program, switch the mode selection switch to the ON position, the RUN indicator should be on. If the ERR indicator is on, the user program or the system is faulty. Loop up in the *EC20/EC10 series PLC Programming Manual* and remove the fault.

4. Power on the PLC external system to start system debugging.

Routine maintenance

Do the following:

1. Ensure the PLC a clean environment. Protect it from aliens and dust.
2. Keep the ventilation and heat dissipation of PLC in good condition.
3. Ensure that the cable connections are reliable and in good condition.

8 Troubleshooting

If the PLC is faulty, take the following measures:

1. Check the connection of the power supply cable, and the related switches & protective devices.
2. Ensure the user terminal connections are reliable.
3. Ensure that the mode selection switch is in the right position.

If all the conditions are normal but the PLC still does not work, you can analyze the problem according to the PLC operation state and the I/O state LEDs by referring to *EC10 Series PLC User Manual*.

Notice

1. The warranty range is confined to the PLC only.
2. **Warranty period is 18 months**, within which period Emerson Network Power conducts free maintenance and repairing to the PLC that has any fault or damage under the normal operation conditions.
3. **The start time of warranty period is the delivery date of the product**, of which the product SN is the sole basis of judgment. PLC without a product SN shall be regarded as out of warranty.
4. Even within 18 months, maintenance will also be charged in the following situations:
 - Damages incurred to the PLC due to mis-operations, which are not in compliance with the User Manual;
 - Damages incurred to the PLC due to fire, flood, abnormal voltage, etc;
 - Damages incurred to the PLC due to the improper use of PLC functions.
5. The service fee will be charged according to the actual costs. If there is any contract, the contract prevails.
6. Please keep this paper and show this paper to the maintenance unit when the product needs to be repaired.
7. If you have any question, please contact the distributor or our company directly.

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