# PACSystems™ RSTi-EP

STANDALONE 1GHz PROGRAMMABLE CONTROLLER
(EPSCPE100)



**EMERSON.**

# Contents

# Caution & Warning Notes as Used in this Publication

⚠ **WARNING**

Warning notices are used in this publication to emphasize that hazardous voltages, currents, temperatures, or other conditions that could cause personal injury exist in this equipment or may be associated with its use.

In situations where inattention could cause either personal injury or damage to equipment, a Warning notice is used.

⚠ **CAUTION**

Caution notices are used where equipment might be damaged if care is not taken.

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# User Features

The PACSystems™ RSTi-EP EPSCPE100 (or CPE100), is an enhanced performance standalone 1GHz programmable controller equipped with 1 MB of user memory and four Ethernet ports. It is designed to run real-time, deterministic control applications and supports distributed I/O.

LAN 1 is a dedicated high-speed Ethernet port. LAN 2 is comprised of 3 switched ports configurable as either an embedded Ethernet controller or an embedded PROFINET controller supporting PROFINET simplex mode. All four ports are located on the front panel, as shown in Figure 1.

The CPE100 is programmed and configured over Ethernet via PAC Machine Edition (PME) software.  It can control/process up to 2K I/O points.

Features include:

- A built-in PACSystems RSTi-EP PLC CPU
  - o User may program in Ladder Diagram, Structured Text, or Function Block Diagram.
  - o Contains 1Mbytes of configurable data and program memory.
  - o Supports auto-located Symbolic Variables that can use any amount of user memory.
  - o Reference table sizes include 2k bits for discrete %I and %Q and up to 32k words each for analog %AI and %AQ. Bulk memory (%W) also supported for data exchanges.
  - o Supports up to 512 program blocks. Maximum block size is 128KB.
- The embedded communications interface has dedicated processing capability, which permits the CPU to independently support LAN 1 and LAN 2 with:
  - o Up to 16 combined SRTP Server and Modbus TCP Server connections out of which Modbus TCP cannot exceed more than 8 connections (or) up to 16 simultaneous SRTP Server connections (or) up to 8 simultaneous Modbus TCP Server connections.

- o 8 Clients total are permitted and may be a combination of SRTP or Modbus/TCP.
- o Up to 8 simultaneous Class 1 Ethernet Global Data (EGD) exchanges.
- o When used in combination for optimal performance, use must not exceed 4 Channels for Server (Modbus/SRTP) and 4 Channels for client (Modbus/SRTP), 8 PROFINET nodes and 8 EGD data exchanges.
- Ability to display serial number and date code in PME Device Information Details.
- Media Redundancy Protocol (MRP) allows the CPE100 to participate in a PROFINET I/O network with MRP ring technology. This eliminates the I/O network as a single point of failure. The CPE100 may be used as either a Media Redundancy Manager or Media Redundancy Client.
- OPC UA Server supports up to 2 concurrent sessions with up to 4 concurrent variable subscriptions and up to 1000 variables.
- Modbus RTU Slave and Serial, I/O support on two serial ports i.e. RS-232 and RS-485 with both 2-wire and 4 -wire interface. These ports are located on the underside side of the controller and does not provide any type of isolation.
- Operating temperature range -40 °C to 70 °C (-40 °F to 158 °F).
- Supports 32-bit C blocks compiled with the C Toolkit Version 8.10 or later. All pre-existing C blocks must be recompiled before downloading.
- Supports Authorized Firmware Update feature. Users may now authorize access to firmware updates using a custom password. Details are included in the revised firmware update instructions.

## Membrane Run/Stop Pushbutton

**Figure 1: Start/Stop Pushbutton**



The Membrane Run/Stop push button is located at the bottom right of the front panel (see Figure 1). Pressing it briefly, will change the state of CPU from the state it is in to the next state. It acts as a toggle switch, as shown in the following state diagram:

The **Run/Stop** switch is enabled by default; it can be disabled in PME Hardware Configuration (HWC) settings.



RUN/IO Enabled    STOP/IO Disabled

## LED Indicators (LEDs)
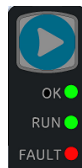
### Ethernet Status Indicators

For each port of LAN1 and LAN2, there are two LEDs (Yellow/Green) embedded in the RJ-45 connectors. The green LED indicates an Ethernet connection has been established on that port. The yellow LED indicates packet traffic on that port.

## Module Status Indicators

As shown at right, there are three LEDs located at the bottom right of the front panel (Figure 2), just below the Membrane Push Button.

The following tables describe the behavior of each module LED:

| LED | LED State | | Operating State (at Power-Up) |
|-----|------|------|-----|
| RUN |  | Blinking; All other LEDs off | This LED indicates the status of PLC during powering up. It starts blinking 6 seconds after applying power to the PLC and remains in this state for up to 15 seconds. After this all LEDs turn off and will remain in this state until PLC is ready. |

| LED | LED State | | Operating State (after Power-Up) |
|-----|------|------|-----|
| OK | 🟢 | On Green | PLC has passed its power-up diagnostics and is functioning properly. |
| | ⚪ | Off | Power is not applied, or PLC has a problem. |
| |  | Blinking; All other LEDs off | PLC in STOP/Halt state; possible watchdog timer fault. If the programmer cannot connect, cycle power and refer to the fault tables. Refer to the section entitled *Troubleshooting* for more details |
| RUN | 🟢 | On Green | PLC is in RUN mode. |
| | ⚪ | Off | PLC is in STOP mode. |

| LED | LED State | | Operating State (after Power-Up) |
|-----|---|---|---|
| |  | Blinking; All other LEDs off | Indicates that PLC has encountered a fatal error and is blinking the error code. |
| Fault | 🔴 | On Red | PLC is in STOP/Faulted mode: a fatal fault has occurred. Refer to the section entitled *Troubleshooting* for more details. |
| | ○ | Off | No fatal faults detected. |

## Ethernet Ports

CPE100 provides two independent Fast Ethernet LANs. LAN1 has only one port and is dedicated to the embedded Ethernet controller. LAN2 is comprised of 3 switched ports, each configurable either as a second embedded Ethernet controller or as an embedded PROFINET controller. Use PME to configure the operation of the ports.

All the Ethernet ports of both the LAN1 and LAN2 are capable of automatically sensing the link data rate (10 Mbps or 100 Mbps), communications mode (half-duplex or full-duplex), and cabling arrangement (straight-through or crossover).

To establish Ethernet communications between the PME programming software and the CPE100, you *first* need to set a valid IP address.

| CPE100 | LAN1 | LAN2 |
|--------|------|------|
| **Default IP Address:** | 192.168.0.100 | 0.0.0.0 |
| **Subnet Mask:** | 255.255.255.0 | 0.0.0.0 |
| **Gateway:** | 0.0.0.0 | 0.0.0.0 |

*Note:*

- *LAN2 will not be operational unless it is configured from the programmer with a valid IP address.*
- *Care must be taken when assigning IP Addresses and subnet masks to each LAN so that an overlapping IP subnet is not created. Intermittent or no Ethernet communication may result if an overlapping IP subnet is created and the two interfaces are NOT connected (cabled) to the same physical network.*
- *By default, PME prohibits configuring both LAN interfaces on an overlapping IP subnet. (This may be changed by going to Controller General Options and changing the Multiple Embedded LANs on Same Subnet to Show as Warning.)*

## Typical Network Application

A typical application will take advantage of the two independent LANs. The dedicated LAN1 port will be used for communications with plant-level or supervisory layers. The switched LAN 2 will be used to communicate with devices over PROFINET within the manufacturing cell or process.

**Figure 3: Typical Multi-Tier LAN Application (Star/Bus topology)**
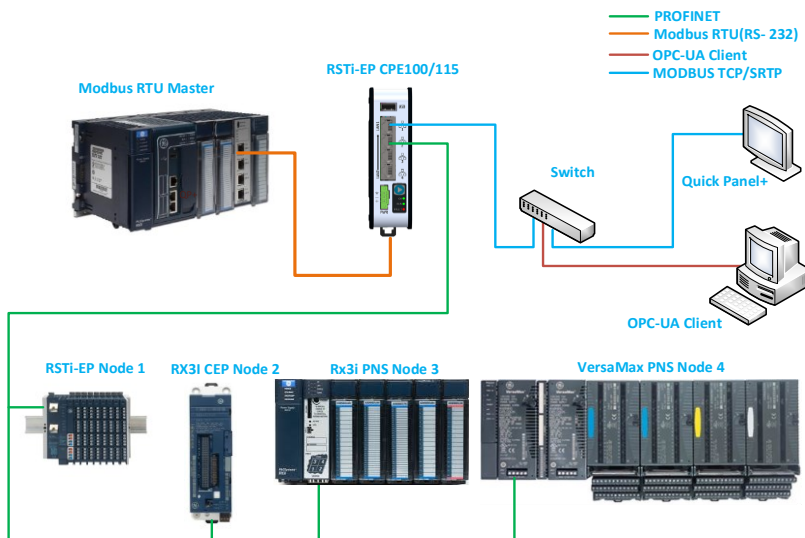
## Multi-Tier Networks

Whenever CPE100 is configured for MRP only, Ethernet Port2 & Port3 of LAN2 may be used to form a ring. Ethernet Port4 of LAN2 may still be used either to connect to the programmer, to a simplex PROFINET device or to any other supported Ethernet protocols.

**Figure 4: Typical Multi-Tier LAN Application with (Ring Topology)**
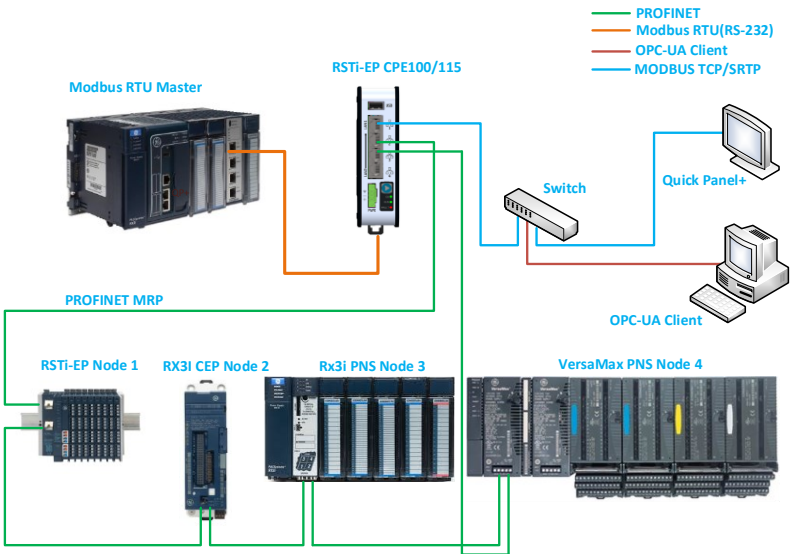
## USB Port

CPE100 has one USB Port located on top of the front panel, but currently it is disabled for security reasons.

## Serial Ports

CPE100 supports both the RS-232 and RS-485 ports. RS-485 port supports only two modes of operations 2-Wire and 4-Wire. These ports are located on the underside of the controller (Figure 5). No isolation is provided.

**Recommendation:** use any suitable commercial off-the-shelf device if an application requires isolation.

Serial port connection details:

**Figure 5: Bottom view of CPE100 showing both the RS-232 & RS-485 serial ports**
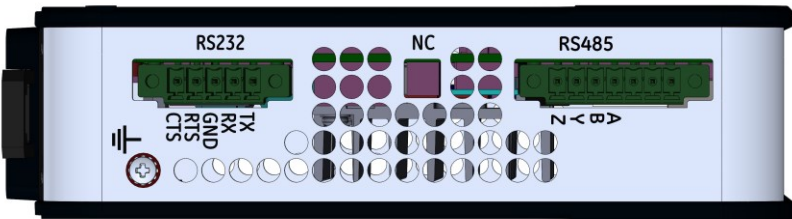
| RS-232 Signals | RS-485 Pins | Signals |
|:---:|:---:|:---:|
| TX | Y | TX+ |
| RX | Z | TX- |
| GND | A | RX+ |
| RTS | B | RX- |
| CTS | | |

The Serial Port Setup COMMREQ function can be used to activate a Modbus RTU protocol over a serial port. To configure the Serial Port COMMREQ Data Block on CPE100, refer to section 6.1.6 of the document PACSystems RX3i and RSTi-EP CPU Reference Manual, GFK-2222. The serial ports support Modbus RTU Slave and Serial I/O protocols only. Hardware Installation

## Initial Checks

Upon receiving your equipment, carefully inspect all shipping containers for damage. If any part of the system is damaged, notify the carrier immediately. The damaged shipping container should be saved as evidence for inspection by carrier.

As the consignee, it is your responsibility to register a claim with the carrier for damage incurred during shipment. Emerson will fully cooperate with you, however, should such action be necessary.

After unpacking the equipment, record all serial numbers. Serial numbers are required if you should need to contact Customer Care during the warranty period. All

shipping containers and all packing material should be saved should it be necessary to transport or ship any part of the system.

Verify that all components of the system have been received and that they agree with your order. If the system received does not agree with your order, contact Customer Care.

## Installation and Mounting

As shipped, the CPE100 is intended for mounting on a DIN rail. An optional panel-mount adaptor is also available (part number: ICMFAACC001-AA). If panel-mounting is required, replace the DIN-rail adaptor with the panel-mount adaptor using the screws supplied with that adaptor. Both adaptors attach to the rear of the CPE100 chassis using four M3 screws. Torque newly-installed screws to 5.3 in-Ibs (0.6 Nm) when installing a new adaptor plate.

CPE100 is considered open equipment (having live electrical parts that may be accessible to users) that may only be installed and operated in lockable housings, cabinets, or electrical operations rooms. Only trained and authorized personnel may access the equipment.

For applications requiring functional safety or in order to maintain compliance with the ATEX Directive [Class 1, Zone 2 area (Category 3)], the surrounding housing must meet at least IP 54.

For installation in marine applications where compliance with the marine Type Approval must be maintained, then the CPE100 must be installed within an RF-shielded enclosure.

### Thermal Requirements

When mounting the CPE100, allow a minimum clearance of 50 mm on the left & right side of the unit and a minimum clearance of 100 mm on the top & bottom sides.

## Instructions for Mounting the CPE100 on a DIN Rail

The CPE100 snaps easily onto the DIN rail, as shown in Figure 3. No additional tools are required.

1) Incline the unit so that the upper hooks of the DIN rail adaptor engage with the upper edge of the DIN rail.

2) Press on the lower part of the unit until you hear a click. The click indicates that the lower hooks of the DIN rail adaptor have engaged with the lower edge of the DIN rail.

If you need any technical help, please contact Technical Support. For phone numbers and email addresses, refer to the back cover of this Guide.

**Figure 6: Mounting of the CPE100 on DIN rail**
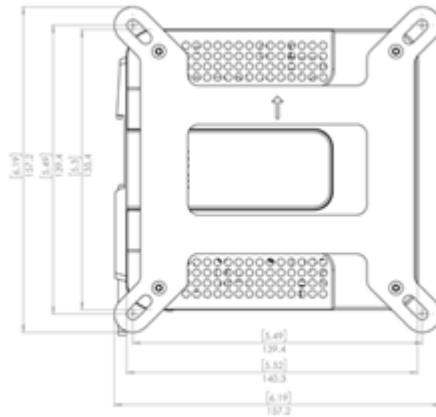
## Instructions for Mounting the CPE100 on a Panel

1) Attach the panel mount plate to the rear side of CPE100 using the four M3 screws supplied with the adapter.

2) Fasten the tabs of panel mount adapter in the appropriate location of panel with the four screws. The screw size used for each panel mount tab should not exceed M5.

**Figure 7: Panel-Mounting of the CPE100**

## Grounding

Proper grounding of the CPE100 is essential. Use the ground terminal located on the underside, as shown in Figure 8. Use a 16-22 AWG braided wire with lugs to connect the ground terminal of the CPE100 to a suitable ground stud in the enclosure panel, or to the DIN Rail. The DIN rail onto which this product will be mounted must be grounded as per the instructions provided in the *PACSystems RSTi-EP User's Manual,* GFK-2958.

**Figure 8: Location of CPE100 Ground Terminal (Underside)**

**Figure 9: Earth Ground Symbol**
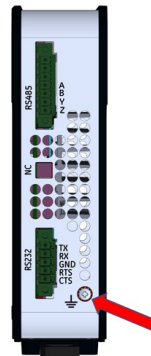
# Module Start-up

## Power-Up Time

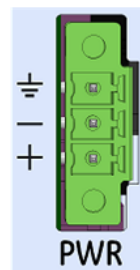The CPE100 requires at a minimum 35 to 40 seconds to complete power-up. When power is applied, all the Ethernet Port LEDs blink once. When power up is complete, the OK LED turns on and remains steady whereas the RUN LED indicates the current run mode.

Whenever the internal super capacitors are completely discharged, the CPE100 might take approximately 105 seconds to complete the power-up sequence. Typically, this occurs when the unit is without power for a few days.

## You Will Need:

**Figure 10: CPE Power Connector Pin-out**



- This PACSystems standalone controller RSTi-EP CPE100.

- An external power supply 9-30 VDC provided by a Class II power supply marked as "double insulated", Limited Power Source (LPS), or a SELV source with a minimum 32 VDC listed fuse with 3 A max rating is required to power the CPE100.

- The 3-Way pluggable terminal block which is a mating connector for the power input terminal block header located on the front panel of CPE100 comes along with the package. This mating connector accepts wire sizes 22 to 16 AWG. Screw torque: 2 in-lb. Temperature rating for copper wire: 80 °C. Wiring should be stripped prior to connecting to the mating connector and cannot exceed 30 m in length.

- A DIN rail, typically mounted in an enclosure, as discussed above. Alternately, mount the unit using the (optional) compatible panel-mount adaptor.

- A computer running PAC Machine Edition (PME) configuration and programming software. PME Version 9.50 & SIM 1 or later.

- Ethernet cable for connecting the PME programmer computer to the CPE100.
- Very small slotted screwdriver (2 mm jeweler's size) for securing wires to the connector shown in Figure 10.

## Basic Installation Steps:

For start-up and configuration of the CPE100, complete the following steps:

1) Be sure to disconnect the power to CPE100.
2) Mount the unit as described
3) *Installation and* Mounting.
4) The ESCPE100 is designed to be DIN-rail-mounted.
5) Plug the Ethernet cable for Programmer & Protocol (SRTP, Modbus, EGD) into the LAN 1 port.
6) Plug the Ethernet cable for the PROFINET network into a LAN 2 port.
7) Apply power to CPE100.

## Programming the CPE100

To configure the CPE100, connect the computer running the PME programming software to an Ethernet port of LAN1 using the default IP address 192.168.0.100. PME 9.5 SIM 1 or later is required.

Configuration will either start out using the RSTi-EP CPE100 template when creating a new project or will convert an existing project to the CPE100 using the *Family Conversion* feature in PME.

## Backwards Compatibility

To convert an existing project which uses any other PLC, use the Family Conversion feature in PME. Be aware of the constraints involved, as will be notified in PME. For instance, the first PROFINET Controller in an RX3i CPU320 application will be assigned to the embedded PROFINET Controller feature of the CPE100.

## PROFINET Controller Configuration

An Embedded PROFINET Controller may be configured on LAN2. To enable the PROFINET Controller in a CPE100 project, select the CPE100 target in the PME Navigator (Figure 11) and open the Hardware Configuration.

On the Settings tab, change the LAN2 Mode of the selected port to PROFINET. The PROFINET Controller node description then displays that a PROFINET node exists on the selected LAN (under the CPE100). For further details, refer to the PACSystems RX3i & RSTi-EP PROFINET IO-Controller User Manual, GFK-2571.

**Figure 11: Configuring as an Embedded PROFINET Controller**
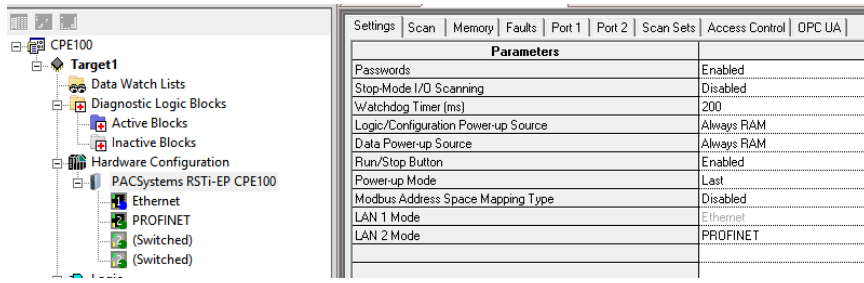
## OPC UA Server Configuration

To configure CPE100 as OPC UA server, refer to chapter 10 of the document PAC Systems RX3i and RSTi-EP TCP/IP Ethernet Communications User Manual, GFK-2224.

## Serial Port Configuration

CPE100 provides two serial ports - COM1(RS-232) and COM2(RS-485). They can each be configured for one of the supported modes using PAC Machine Edition Tool (Version 9.50 & SIM 15 or later). For more details on the configuration of serial ports, refer to section 3.2.10 of the PACSystems RX3i and RSTi-EP CPU Reference Manual, GFK-2222.

Serial I/O protocol is active only when the CPU is in RUN Mode, since it is driven completely by COMMREQ functions in the application program. The different COMMREQ commands that are supported by Serial I/O Protocol are described in section 6.2.4 of the PACSystems RX3i and RSTi-EP CPU Reference Manual, GFK-2222.

## Modbus RTU Configuration

The CPE100 can be configured as a Modbus RTU Slave device using either or both the serial ports (RS-232 and RS-485) located on the underside of the controller. The Serial Port Setup COMMREQ function can be used to activate a Modbus RTU protocol over a serial port.

To configure the Serial Port COMMREQ Data Block on CPE100, refer to section 6.1.6 of the PACSystems RX3i and RSTi-EP CPU Reference Manual, GFK-2222.

## Serial I/O Configuration

The CPE100 may be configured to use Serial I/O protocol using either or both serial ports (RS-232 or RS-485). The Serial Port Setup COMMREQ function can be used to activate a Modbus RTU protocol over a serial port.

To configure the Serial Port COMMREQ Data Block on CPE100, refer to section 6.1.6 of the PACSystems RX3i and RSTi-EP CPU Reference Manual, GFK-2222.

Serial I/O protocol is active only when the CPU is in RUN Mode, since it is driven completely by COMMREQ functions in the application program. The different COMMREQ commands that are supported by Serial I/O Protocol are described in section 6.2.4 of the PACSystems RX3i and RSTi-EP CPU Reference Manual, GFK-2222.

# Performance with Typical Configuration

The below diagram shows the system configuration with four CPE100 connected to one PROFINET I/O node each and interfaced to one RX3i CPE400 with four EGD exchanges each. Out of 4 CPE100 units two of them are connected to Modbus RTU Master having RS-232 and RS-485 Serial connections.

**Figure 12: Process Automation Configuration Using Four CPE100s**
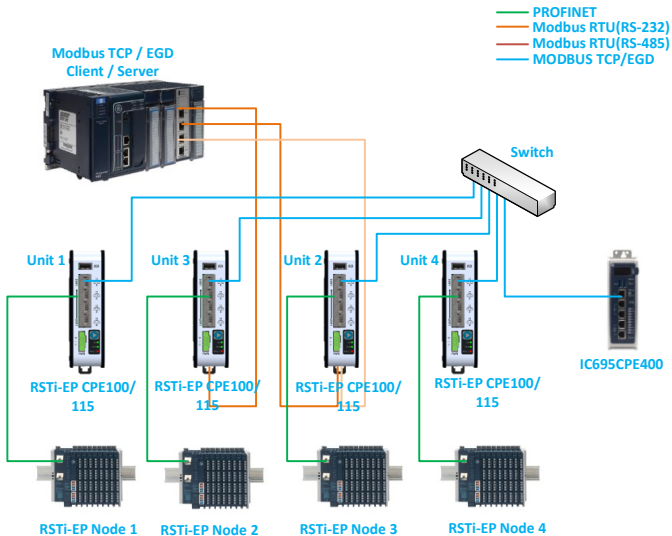
For more details on the configuration of the above set-up and the typical loopback time across all the PROFINET nodes, please refer to GFK-3086. It also documents other examples of system configurations and the performance limitations of this product.

## Product Limitations

1. Timed interrupt blocks are not supported.
2. RDSD are not supported.
3. SNTP not Supported.
4. DNP3 Outstation not supported.

Note:    The above features may be supported in a subsequent firmware release. Refer to the Important Product Information document for this product, GFK-3013.

# Replacement of Internal Supercapacitor

1.  The supercapacitor board associated with the CPE100 is EPSACC001. Use this part number when ordering replacements. Do not attempt to use any other replacement part for this procedure.

    ### ⚠ WARNING

    - Perform all electrical replacements in a suitably clean and dry environment. Clean away all surface contaminants before opening the electrical circuit enclosure.

    - Protect the exposed circuitry from electrostatic discharge, as this may destroy or disable components. Wear a ground-strap while working on exposed circuitry.

    - Dispose of electrical circuit waste in accordance with local laws and regulations. Supercapacitors retain charge for a significant period. A risk of electrical shock exists while the supercapacitors are charged up. A discharge could cause either personal injury or damage to equipment.

    - Be sure that the unit under repair has been disconnected from its power source for 5 minutes. Do not attempt to replace until the supercapacitors have discharged completely.

2.  Power off the unit and wait for 5 minutes to allow the internal supercapacitors to discharge completely.

3.  Clean the exterior surfaces of the unit before bringing it into a suitably clean lab environment.

4. Detach the side panel cover (Figure 13) by removing the (M3) screws with a Phillip's head screwdriver.

**Figure 13: Controller Side Panel**

**Figure 14: Supercapacitor Board Location**

5. Using a screwdriver, remove the two M2.5 screws and detach the supercapacitor card from the carrier board (Figure 15).
6. Disconnect the mating connectors.

**Figure 15: Supercapacitor Carrier Board**

**Figure 16: Supercapacitor Board Assembly**

7. Using the reverse procedure, install the new supercapacitor card onto its carrier board. Check that the mounting holes are aligned properly before tightening both the M2.5 screws. Recommended torque is= 3 in-lb (0.3 Nm).

8. Reconnect the mating connectors.

9. Verify the assembly has been restored as shown in Figure 14.

10. Clean or blow away any contaminants that may have fallen into the enclosure.

11. Mount the side panel cover and tighten the four M3 Screws. Recommended torque is 5 in-lb (0.6 Nm).

12. The unit is now ready for use.

13. Mount the unit and reconnect power.

14. After power-up, confirm that the repaired unit does not log a Failed battery signal fault in the controller fault table.

# Troubleshooting

1. **Why does my controller not power on after I apply power? (None of the front panel LEDs are illuminated.)**

    a. The incorrect power supply may be used. Verify that the correct power supply is connected, and that the power connector is fully seated. Power supply reference information is available in the section entitled *Module Start-up.*

    b. The polarity may be reversed. Verify the polarity of the incoming DC power. The positive, negative, and earth symbols are printed on the power connector of the front panel, as indicated in Figure 17.

    c. Power may be present, but the LED indicators are not operating as designed. Plug a live Ethernet cable into any of the ports for LAN1 or LAN2 to verify the following:

        i. the Activity LED (Green color) is blinking or ON, and/or

        ii. the LINK LED (Amber color) is ON

    d. If none of the above options work, we recommend returning the product.

2. **Why does the Fault LED continuously flash after I apply power to the controller?**

    a. The firmware may be corrupt. Power cycle the controller to initiate the boot loader's repair sequence.

    b. If consecutive power cycles do not correct the problem, the drive partition may be corrupt. This is an unrecoverable condition, and we recommend returning the product.

**Figure 17: CPE Power Connector Pin-out**
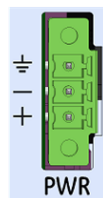
### 3. How can I restore the default IP address or perform a factory reset on my controller?

**Figure 18: Run/Stop Pushbutton**



To reset the IP Address to its default (192.168.0.100) or to perform a factory reset, complete the following:

a. User needs to power down the controller.

b. Press and hold the membrane *Run*/*Stop* pushbutton (Figure 18) during power up.

c. Wait until the **OK** LED becomes steady and then release the push button (It may take approx. 60 seconds to turn on).

   Note: This action will clear flash memory and RAM, including hardware configuration, program and firmware update password to its default value.

### 4. How can I recover the controller from a Stop/Halt state?

To recover the controller from a Stop/Halt state, complete the following:

a. Connect a live Ethernet cable to LAN1.

b. Press and hold the membrane Run/Stop pushbutton and power down the controller.

c. Continue holding the Run/Stop push button until power has drained completely (30 seconds) and then release the pushbutton. The LEDs for the LAN1 port will turn off completely.

   Note: Ethernet LEDs may blink slowly during shutdown.

d. Reconnect power and power on the controller.

   Note: If the configuration and logic was downloaded into flash and the **Power-up Mode** parameter is also set as flash then, the only way to recover from Stop/Halt state is to perform a factory reset.

5.  **How can I recover the controller from the Stop/Faulted state?**

    a.  A Stop/Faulted state cannot persist through a power cycle. To recover the controller, there are two methods:

        i.   Power cycle the controller

        ii.  Perform a CLEAR operation from the PME software.

6.  **When should I replace the internal supercapacitor?**

    Whenever a "Failed Battery Signal" fault is logged in the controller's fault table, replace the internal supercapacitor by following the instructions in the section entitled *Replacement of Internal Supercapacitor.*

7. **How to reset the firmware update password?**

a) Use programming software or the controller's **RUN/STOP** pushbutton (if enabled in the hardware configuration) to place the RSTi-EP Controller module in **Stop Disabled** mode.

b) Open a browser window and go to the PACSystems RSTi-EP Controller's homepage using the IP address assigned to the controller's embedded LAN 1 or LAN 2 Ethernet ports. (e.g. http://192.168.0.100)

c) At the PACSystems RSTi-EP Controller's homepage, select the Administrator button in the top right-hand corner and select the 'Reset Password' option. Dismiss any security warnings the browser may present indicating the certificate is not issued by a known certificate authority. The certificate is dynamically generated by the firmware on each power cycle (i.e. the certificate is self-signed).

Note: If the controller becomes unresponsive it is recommended to repeat the process from step (b) again.

d) Press the Run/Stop button on the unit as directed until the page updates.

e) Release the Run/Stop button on the unit as directed.

f) Enter the new firmware update password and confirm it by entering it a second time. Press OK. The unit will save the password and return to the homepage. The rules for the password are displayed on the screen.

Note:

- Performing a factory reset operation also resets the firmware update password to its default value.

# Additional Information

User manuals, product updates and other information sources are available on the Support website. Please see the links provided at the end of this document.

# Technical Support and Contact Information

Home link: http://www.emerson.com/industrial-automation-controls

Knowledge Base:   https://www.emerson.com/industrial-automation-controls/support

**Note:** If the product is purchased through an Authorized Channel Partner, please contact  the seller directly for any support.

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