PACSystems™ Rx3i

CEP PROFINET SCANNER
USER MANUAL

EMERSON™

Contents

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

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Section 1 Overview

This chapter provides an overview of the RX3i CEP (carrier embedded PROFINET) product for PACSystems RX3i I/O modules and their operation.

The RX3i CEP carriers for PACSystems RX3i I/O modules product line includes the following:

Catalog Number[1]	Description
IC695CEP001	RX3i CEP Carrier with RJ-45 Copper Ethernet Interfaces
IC694CEE001	RX3i CEP Expansion Carrier

1.1   Revisions in this Manual

Rev	Date	Description
G	Jul 2022	Updates to the following sections: *Specifications, Supported I/O Modules and Compatibility.*
F	Sep 2019	Following Emerson 's acquisition of this product, changes have been made to apply appropriate branding and registration of the product with required certification agencies. No changes to material, process, form, fit or functionality.
E	Mar-2018	• Updated for CPE302 compatibility. • Corrected all footnotes.
D	Dec-2015	• Documented additional Supported I/O Modules. • Added support of HART® Pass Through using PROFINET • Added new sections 4.3, Add New I/O Devices & 4.4, Update Existing I/O Devices
C	Jan-2015	• Updated specifications for IC695CEP001 41G1701-FW01-000-A0 Firmware Upgrade • Updated Supported I/O Modules to include IC695ALG600, Universal Analog Input module

1.2   CEP Carrier

The RX3i CEP Carrier (IC695CEP001) interfaces a remote node of one RX3i I/O module to a PROFINET I/O Local Area Network (LAN).

The RX3i CEP Carrier works as a PROFINET Scanner. It scans the I/O modules installed on it and, if present, the RX3i CEP Expansion Carrier, retrieving input data and providing output data, and exchanges that data on the PROFINET I/O LAN at the configured production rate. It also manages PROFINET communication and module configuration between an I/O-

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[1] For a list of I/O Modules supported by CEP001 & CEE001, refer to Section 1.7, Supported I/O Modules.

Controller and modules in the remote node. If network communications are lost, the RX3i CEP Carrier manages I/O states according to the individual module configurations.

The RX3i CEP Carrier supports 10/100 Mbps Ethernet communication. Although PROFINET communications only work with 100 Mbps link speed, 10 Mbps can be used for other types of Ethernet traffic such as PING.

RX3i CEP Carrier features include:

- Full programming and configuration services for all supported RX3i I/O Modules using PAC Machine Edition
- Supports daisy-chain/line, star, or ring (redundant media) network topologies
- Two switched Ethernet ports: two eight-conductor RJ-45 shielded twisted pair 10/100 Mbps copper interfaces
- USB port for field updates of firmware using WinLoader
- Supports Hot-Standby CPU Redundancy using PROFINET I/O (requires RX3i CEP001 2.01 GSDML to version 2.3 or later)
- Supports HART® Pass Through using PROFINET.

Note: *The CEP Carrier requires a user-supplied +24 Vdc power source.*

1.3 CEP Expansion Carrier

The RX3i CEP Expansion Carrier is attached to the RX3i CEP Carrier and provides the ability to add one additional RX3i IC694 I/O module to the remote node. It is used only with an RX3i CEP Carrier, which performs I/O scanning of the Expansion Carrier. The RX3i CEP Expansion Carrier does not have Ethernet or USB interfaces, nor does it require an external power source

1.4 Specifications

Item	Specification	
PROFINET support	PROFINET Version 2.3 Class A I/O-Device	
Power requirements	IC695CEP001: 5.25W (0.22 A) at 24 Vdc with or without Expansion Carrier (IC694CEE001)1[2] DC power supply input range: 19.2V – 30V	
Module dimensions	177.2 mm x 51 mm x 35 mm (6.98 in x 2.01 in x 1.38 in) Same for CEP001 and CEE001.	
Operating temperature range	0°C to 60°C (32° F to 140° F) maximum surrounding air temperature	
Number of port connectors	IC695CEP001: Two RJ-45 10/100BASE-TX receptacles IC694CEE001: None	
USB connector (for firmware upgrades)	IC695CEP001: One Micro-B connector. USB 2.0 compliant running at Full-speed (12 MHz) in device mode IC694CEE001: None	
PNS Status and Control bits	32 input status bits and 32 output control bits	
I/O data update on the PROFINET LAN	Configurable: 1ms, 2ms, 4ms, 8ms, 16ms, 32ms, 64ms, 128ms, 256ms and 512ms	
Number of IP addresses	One. Supports Classless Inter-Domain Routing (CIDR)	
Number of MAC addresses	Three. One per external port and one internal. External MAC addresses are only used for specialized Ethernet protocols such as MRP or LLDP	
I/O station maximum limits	Number of I/O Modules per station	IC695CEP001: One IC695CEP001 with IC694CEE001: Two
	I/O data per station	1024 bytes total 512 bytes of input data 512 bytes of output data
Configuration	V2.3 GSDML file is included with PAC Machine Edition; available for import into 3rd-party tools	

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[2] Value does not include the power consumption of the installed I/O modules. When calculating the total power requirements, you will need to add the power consumption of the I/O modules according to the I/O module datasheet.

> *Note:* For product standards, general operating specifications, and installation requirements, refer to PACSystems RX3i System Manual, GFK-2314.

1.5 Controls and Indicators

Figure 1: RX3i CEP Carrier with the Expansion Carrier Connected
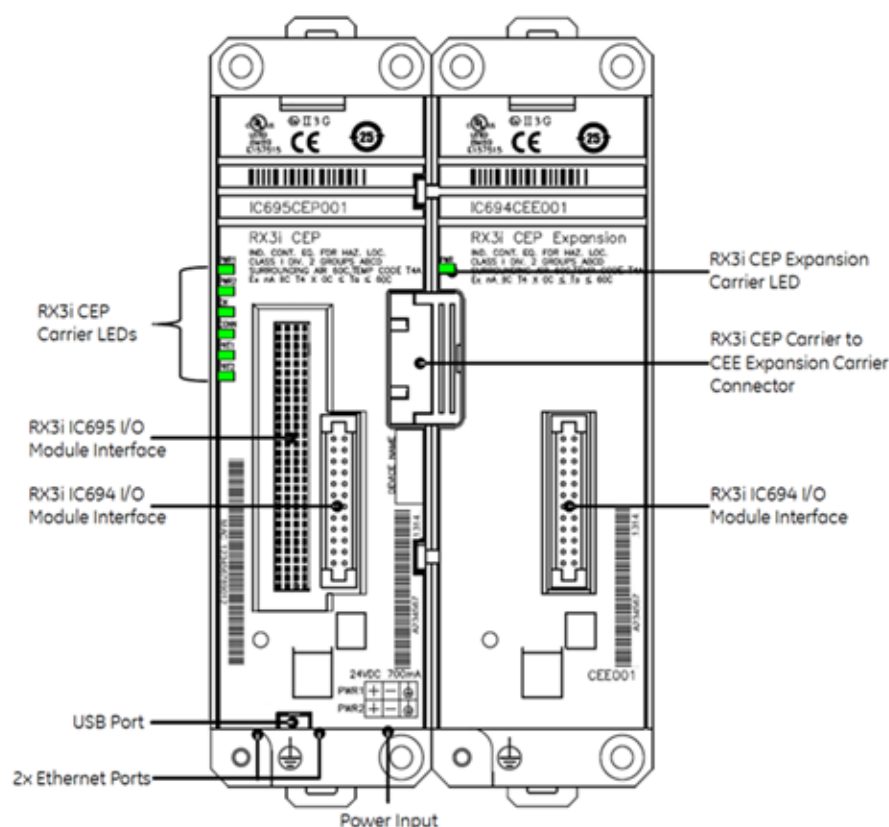
1.5.1 LEDs on the RX3i CEP Carrier and Expansion Carrier

LEDs provide an immediate visual indication of the RX3i CEP's operational state and port link status. The LEDs and their operation are described in Section 2 *LED Operation and Connectors*.

1.5.2   USB Port

The USB Port is used for installing new firmware using the WinLoader tool. The USB port accepts a standard USB cable (USB Micro-B Male to USB Type A Male, not included). Before use, the port must be configured.

1.5.3   Ethernet Port Connections

Figure 2: CEP001 Underside View
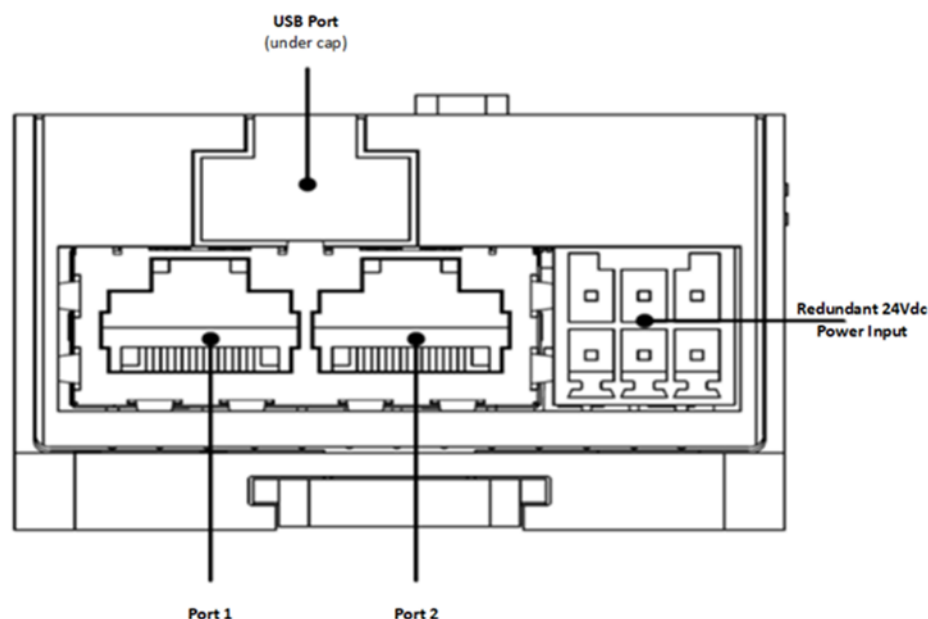
The two external Ethernet ports are on the bottom of the module. Each port on an RX3i CEP Carrier operates independently, so devices that operate at different speeds and/or duplex modes can be attached to the ports. By default, all ports are set for Automatic, which enables auto-negotiation for the widest range of options supported by the port.

Connections to the RX3i CEP Carrier can be made using standard Cat 5/5e/6 shielded twisted pair Ethernet cables. Each of the ports can be used to connect to different devices on the same network. The PROFINET protocol can be sent and received over either or both two external ports

1.6   PROFINET Operation

The RX3i CEP Carrier uses PROFINET communications for data exchange. The same network can also be used for basic Ethernet communications, but use of a separate Ethernet network and RX3i Ethernet interface is recommended.

A PROFINET network can include three types of devices:

Table 1

PROFINET IO-Controller	A PROFINET IO-Controller collects data from I/O devices (inputs) and provides data to the devices (outputs). It is associated with one or more IO-Devices.
PROFINET IO-Device	A PROFINET IO-Device is a distributed I/O Device that is coupled to a PROFINET IO-Controller through PROFINET. In an RX3i system, the RX3i CEP Carrier operates as an IO-Device, managing initialization, configuration, and communication between the PROFINET controller and the I/O modules.
PROFINET IO-Supervisor	An IO-Supervisor can be a programming device, a computer, or an HMI device. The PROFINET IO-Supervisor is typically used for commissioning or diagnostics.

1.6.1 PROFINET Communications

For details about communications on an RX3i PROFINET network, refer to the PACSystems RX3i & RSTi-EP PROFINET I/O Controller Manual, GFK-2571, and to the PACSystems RX3i PROFINET Scanner Manual, GFK-2737.

1.6.2 Media Redundancy Protocol Support

PROFINET Media Redundancy Protocol (MRP) supports devices configured in a ring topology. It is based on the functions of IEC62439. Media Redundancy Protocol is not routable between different IP subnets.

Each device within a Redundant Media network has two physical pathways to two other devices on the network. To connect to the ring, each device requires an integrated switch with at least two external ports (ring ports) that support Media Redundancy Protocol. Devices that are not MRP-capable can be connected to a device, such as an MRP-capable switch, in the ring, but they cannot be in the ring themselves. The redundant paths only extend to the devices on the ring that are MRP-capable and enabled.

One of the devices on the ring must be configured as the Media Redundancy Manager (MRM), and all the other devices must be configured as Media Redundancy Clients (MRCs). The RX3i CEP Carrier can be configured to be an MRC. Configuring the RX3i CEP Carrier as an MRC alters how the Ethernet ports connect to the network. They attempt to indicate their state to the MRM before allowing traffic to flow between the ports and close the ring topology through the internal switch. They also send out notifications to the MRM when a port is lost. Operation of the RX3i CEP Carrier is otherwise unchanged.

Bumpless Operation with MRP

The RX3i CEP Carrier supports bumpless operation with the Emerson PROFINET IO-Controller if specific conditions are met. Bumpless operation means that a single break in an MRP ring will not cause the PROFINET connection to be lost and there is no observed loss and addition of PROFINET I/O Devices while the ring network recovers.

Without bumpless MRP, when a device is lost, it must be re-acquired by the IO-Controller; a typical recovery time is on the order of seconds. There are two ways an MRM detects a break in the ring:

- Message from an MRC that provides LinkUp/LinkDown detection
- Test packet timeout interval

A network using Media Redundancy Protocol recovers from a ring failure within 80 milliseconds when running at 100/1000 Mbps full duplex with default Media Redundant Manager (MRM) test packet values. Actual failover time depends on the device responsiveness to network disconnection and reconnection, number of devices in the ring, media speed, length of media, and frequency of sending test frames over the network. Network recovery time is shorter with fewer devices, faster media speed, and shorter media lengths. Third-party devices in the MRP ring may introduce additional network recovery time. Network recovery time is limited by the ring participant with the slowest ring failure recovery time. Devices that do not provide LinkUp/LinkDown detection should be considered when calculating network recovery time.

For bumpless network recovery (without disturbing I/O communications to an IO-Device), the I/O Update Rate for the IO-Device should be configured to be greater than 1/3 of the network recovery time. This permits the ring to be disconnected or reconnected without timing out the communication connection between the IO-Device and its IO-Controller.

MRP Operation for I/O Update Rates of 16ms or Greater

The RX3i PROFINET IO-Controller supports bumpless operation at 16ms with the requirement that the MRP Manager be configured for an MRP Test Packet Interval and MRP Test Packet Count that is faster than the fastest IO timeout possible.

For example, assume the worst-case scenario when a ring break occurs immediately after the RX3i CEP received a test packet and immediately before the RX3i CEP was scheduled to receive an I/O packet. In the case of a 16ms I/O Update Rate, a timeout will occur after three consecutive missed I/O packets, which can occur in slightly over 32ms. If the Test Packet Interval is configured for 10ms and the Test Packet Count is configured for 2ms, we can detect a ring break in just less than 30ms. This ring recover scenario would look like the following timeline.

To ensure a successful ring recovery using the Test Packets at a 16ms or greater I/O Update rate, make sure the following statement is true:

Test Packet Interval × (Test Packet Count + 1) < I/O Update Rate ×

Figure 3: Timeline for Successful MRP Ring Repair at 16ms I/O Update Rate
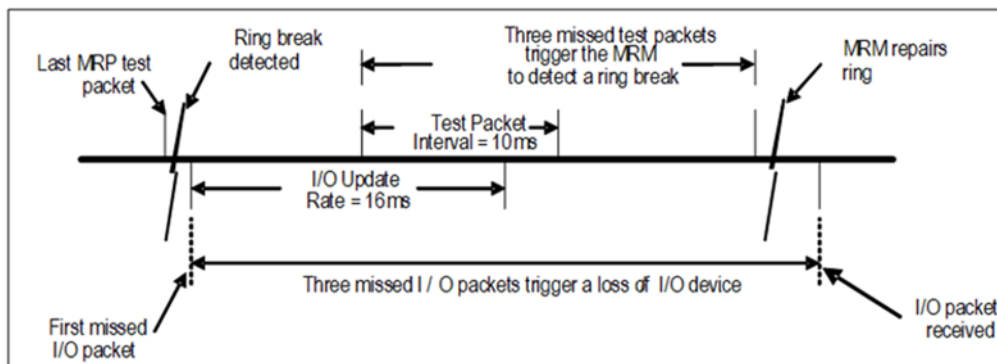
MRP Operation at I/O Update Rates less than 16ms

The RX3i CEP Carrier implementation of MRP supports LinkUp/LinkDown detection, an optional part of the MRP standard. This allows an MRC experiencing a network link failure or recovery to send LinkUp/LinkDown messages to the MRM immediately. The MRM can heal the network without needing to wait for multiple test-packet timeouts to detect the failure. This feature allows the network recovery time to be significantly

shorter than the test packet timeout interval because the break is detected immediately.

Minimum I/O Rate when Configured in an MRP Ring

The minimum I/O rate that is possible for bumpless operation depends on the speed and the type of physical connection being used for the MRP ring ports. The RX3i PROFINET IO Controller supports a specified number of Emerson PROFINET I/O devices running at or above the minimum I/O Update Rate listed in the following table.

For RX3i PNC operating specifications, refer to the PACSystems RX3i & RSTi-EP PROFINET I/O Controller Manual, GFK-2571.

For operating specifications of the embedded PNC function of the RXi Controller, refer to the PACSystems RXi ICRXICTL000 Distributed I/O Controller User's Manual, GFK-2816.

Minimum I/O Rates for Bumpless RX3i CEP Recovery

RX3i CEP Catalog Number	Minimum I/O Update Rate	
	100 Mb/s	**Number of Devices**
IC695CEP001	1ms	8

1.7 Supported I/O Modules

The following table indicates the minimum CEP001 firmware version required for compatibility with the listed I/O modules and whether the module can be installed in the RX3i Expansion Carrier CEE001

Table 2

Catalog Number	Module Description	Distin-guishing Classes[3]	Earliest CEP001 Compatible Version	CEE001[4] Comp-atible
Discrete Input Modules				
IC693MDL230	8-Circuit Input 120 Vac Isolated	8 in	2.30	Y
IC693MDL231	8-Circuit Input 240 Vac Isolated	8 in	2.50	Y
IC693MDL240	16-Circuit Input 120 Vac	16 in	2.30	Y
IC693MDL241	16-Circuit Input 24 Vac / Vdc	16 in	2.50	Y
IC693MDL260	32-Circuit Input 120 Vac, Input Filtering Off	32 in	2.50	Y
IC693MDL260	32-Circuit Input 120 Vac, Input Filtering On	32 in/32 out	2.50	Y
IC693MDL632	8-Circuit Input 125 Vdc Positive / Negative Logic	8 in	2.30	Y
IC693MDL634	8-Circuit Input 24 Vdc Positive / Negative Logic	8 in	2.50	Y
IC693MDL635	16-Circuit Input 125 Vdc Positive / Negative Logic	16 in	2.30	Y
IC693MDL645	16-Circuit Input 24 Vdc Positive / Negative Logic	16 in	2.40	Y
IC693MDL648	16-Circuit Input 48 Vdc Positive / Negative Logic Fast	16 in	2.30	Y
IC693MDL654	32-Circuit Input 5/12 Vdc Positive / Negative Logic	32 in	2.50	Y
IC693MDL655	32-Circuit Input 24 Vdc Positive / Negative Logic Fast	32 in	2.50	Y
IC693MDL660	32-Circuit Input 24 Vdc Positive / Negative Logic, Input Filtering Off	32 in	2.30	Y
IC693MDL660	32-Circuit Input 24 Vdc Positive / Negative Logic, Input Filtering On	32 in/32 out	2.30	Y
IC694MDL230	8-Circuit Input 120 Vac Isolated	8 in	2.30	Y
IC694MDL231	8-Circuit Input 240 Vac Isolated	8 in	2.50	Y
IC694MDL240	16-Circuit Input 120 Vac	16 in	2.30	Y
IC694MDL241	16-Circuit Input 24 Vac / Vdc	16 in	2.50	Y
IC694MDL250	16-Circuit Input 120 Vac Isolated	None	1.00	Y

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[3] The RX3i CEP Carrier and the RX3i CEP Expansion Carrier cannot distinguish between modules within the same Distinguishing Class type. This means that any module physically present that is within the same class as the one configured will not alert the user with a System Configuration Mismatch fault on the Controller Fault Table. Refer to GFK-2222 Chapter 3 for CPU operation during System Configuration Mismatch faults.

[4] CEE001 supports IC693 and IC694 series I/O modules, but not IC695 series modules.

Catalog Number	Module Description	Distin-guishing Classes[3]	Earliest CEP001 Compatible Version	CEE001[4] Comp-atible
IC694MDL260	32-Circuit Input 120 Vac	None	2.50	Y
IC694MDL632	8-Circuit Input 125 Vdc Positive / Negative Logic	8 in	2.30	Y
IC694MDL634	8-Circuit Input 24 Vdc Positive / Negative Logic	8 in	2.50	Y
IC694MDL635	16-Circuit Input 125 Vdc Positive / Negative Logic	16 in	2.30	Y
IC694MDL645	16-Circuit Input 24 Vdc Positive / Negative Logic	16 in	2.40	Y
IC694MDL646	16-Circuit Input 24 Vdc Positive / Negative Logic Fast	16 in	1.00	Y
IC694MDL648	16-Circuit Input 48 Vdc Positive / Negative Logic Fast	16 in	2.30	Y
IC694MDL654	32-Circuit Input 5/12 Vdc Positive / Negative Logic	32 in	2.50	Y
IC694MDL655	32-Circuit Input 24 Vdc Positive / Negative Logic Fast	32 in	2.50	Y
IC694MDL658	32-Circuit Input 48 Vdc Positive / Negative Logic Fast	32 in	2.50	Y
IC694MDL660	32-Circuit Input 24 Vdc Positive / Negative Logic	None	2.30	Y
IC695MDL664	16-Circuit Input with diagnostic	None	1.00	N
Discrete Output Modules				
IC693MDL310	12-Circuit Output 120 Vac 0.5A	16 out	2.50	Y
IC693MDL330	8-Circuit Output 120/240 Vac 2A	8 out	2.40	Y
IC693MDL340	16-Circuit Output 120 Vac 0.5A	16 out	2.50	Y
IC693MDL350	16-Circuit Output 120/240 Vac Isolated	16 out	2.50	Y
IC693MDL390	5-Circuit Output 120/240 Vac 2A Isolated	8 out	2.30	Y
IC693MDL732	8-Circuit Output 12/24 Vdc 0.5A Positive	8 out	2.50	Y
IC693MDL734	6-Circuit Output 125 Vdc 1A Positive/Negative	8 out	2.50	Y
IC693MDL740	16-Circuit Output 12/24 Vdc 0.5A Positive	16 out	2.50	Y
IC693MDL741	16-Circuit Output 12/24 Vdc 0.5A Negative	16 out	2.50	Y
IC693MDL752	32-Circuit Output 5/24 Vdc 0.5A Negative	32 out	2.50	Y
IC693MDL753	32-Circuit Output 12/24 Vdc 0.5A Positive	32 out	2.50	Y
IC693MDL754	32-Circuit Output 24 Vdc 0.75A Positive, Diagnostics Off	32 out	2.30	Y
IC693MDL754	32-Circuit Output 24 Vdc 0.75A Positive, Diagnostics On	32 in/32 out	2.30	Y
IC693MDL930	8-Circuit Output 4A Relay Isolated	8 out	2.30	Y
IC693MDL931	8-Circuit Output Relay Form BC Isolated	8 out	2.50	Y
IC693MDL940	16-Circuit Output 2A Relay	16 out	2.30	Y
IC694MDL310	12-Circuit Output 120 Vac 0.5A	16 out	2.50	Y
IC694MDL330	8-Circuit Output 120/240 Vac 2A	8 out	2.40	Y
IC694MDL340	16-Circuit Output 120 Vac 0.5A	16 out	2.50	Y

Catalog Number	Module Description	Distin-guishing Classes[3]	Earliest CEP001 Compatible Version	CEE001[4] Comp-atible
IC694MDL350	16-Circuit Output 120/240 Vac Isolated	None	2.50	Y
IC694MDL390	5-Circuit Output 120/240 Vac 2A Isolated	None	2.30	Y
IC693MDL732	8-Circuit Output 12/24 Vdc 2A Positive	8 out	2.50	Y
IC693MDL734	6-Circuit Output 125 Vdc 1A Positive/Negative	8 out	2.50	Y
IC694MDL740	16-Circuit Output 12/24 Vdc 0.5A Positive	16 out	2.50	Y
IC694MDL741	16-Circuit Output 12/24 Vdc 1A Negative	16 out	2.50	Y
IC694MDL742	16-Circuit Output 12/24 Vdc 1A Positive	16 out	1.00	Y
IC694MDL752	32-Circuit Output 5/24 Vdc 0.5A Negative	32 out	2.50	Y
IC694MDL753	32-Circuit Output 12/24 Vdc 0.5A Positive	32 out	2.50	Y
IC694MDL754	32-Circuit Output with ESCP	None	2.30	Y
IC694MDL916	16-Circuit Output 4A Relay	None	1.00	Y
IC694MDL930	8-Circuit Output 4A Relay Isolated	8 out	2.30	Y
IC694MDL931	8-Circuit Output Relay Form BC Isolated	8 out	2.50	Y
IC694MDL940	16-Circuit Output 2A Relay	16 out	2.30	Y
IC695MDL765	16-Circuit Smart Output 24/125 Vdc 2A Positive Logic with Diagnostics	None	1.00	N
Mixed Discrete Input/Output Modules				
IC693MDR390	8-Circuit Mixed 24 Vdc Input / Relay Output	8 in/8 out	2.40	Y
IC693MAR590	8-Circuit Mixed 120 Vac Input / Relay Output	8 in/8 out	2.30	Y
IC694MDR390	8-Circuit Mixed 24Vdc Input/Relay Output	8 in/8 out	2.40	Y
Analog Input Modules				
IC693ALG222	16-Point Analog Voltage Input	ALG IN 16	2.50	Y
IC693ALG223	16-Point Analog Current Input	ALG IN 16	2.50	Y
IC694ALG222	16-Point Analog Voltage Input	ALG IN 16	2.50	Y
IC694ALG223	16-Point Analog Current Input	ALG IN 16	2.50	Y
IC695ALG112	12-Point Isolated Analog Current/Voltage Input[5]	None	2.01	N
IC695ALG600	8 point Universal Analog Input Module	None	2.01	N
IC695ALG616	16-Point Analog Current / Voltage Input[5]	None	1.00	N
IC695ALG626	16-Point Analog Current / Voltage Input (HART Support)[5,6]	None	1.00[7]	N

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[5] The RX3i CEP001 Carrier and the RX3i CEE001 Expansion Carrier do not support Fault Reporting or Interrupts from this module.

[6] The RX3i CEP001 Carrier does not support HART features which are logic-driven. HART data obtained via HART Pass Through is, however, available.

[7] RX3i CEP001 version 2.30 is required for HART Pass Through functionality. Refer to Section 1.8, *Compatibility*.

Catalog Number	Module Description	Distin-guishing Classes[3]	Earliest CEP001 Compatible Version	CEE001[4] Comp-atible
Analog Output Modules				
IC693ALG392	8-Point Analog Current / Voltage Output	ALG OUT 8	2.50	Y
IC694ALG392	8-Point Analog Current / Voltage Output	ALG OUT 8	2.50	Y
IC695ALG704	4-Point Analog Current / Voltage Output[5]	None	2.50	N
IC695ALG708	8-Point Analog Current / Voltage Output[5]	None	2.50	N
IC695ALG728	8-Point Analog Current / Voltage Output (HART Support)[5,6]	None	1.00[7]	N
IC695ALG808	8-Point Isolated Analog Current / Voltage Output[5]	None	1.00	N
Analog Mixed Modules				
IC693ALG442	4-Input / 2-Output, Current / Voltage	ALG IN 4, ALG OUT 2	2.30	Y
IC694ALG442	4-Input / 2-Output, Current / Voltage	ALG IN 4 ALG OUT 2	2.30	Y
Thermocouple Input Modules				
IC695ALG312	12-Point Isolated Thermocouple Input[5]	None	2.50	N
High-Speed Counter Modules				
IC695HSC308	High-Speed Counter Module, 1.5MHz, 16 Inputs, 14 Outputs	None	2.50	N
Specialty Modules				
IC694PSM001	Power Sync and Measurement Module	None	2.01	Y
Communications Modules				
IC695CMM002	Serial Communication Module[8] (Two isolated serial ports)	None	2.80	N
IC695CMM004	Serial Communication Module[8] (Four isolated serial ports)	None	2.80	N

1.8 Compatibility

The PROFINET Scanner modules require the CPU firmware and programming software versions listed in the following table

Table 3

PAC Machine Edition	PAC Machine Edition version 8.6 SIM 3 or later
RX3i CPU Version	PACSystems RX3i CPU, IC695CPU315/CPU320/CPE302/CPE305/CPE310/CPE330/CRU320, with firmware version 8.50 or later
RX3i PNC Version	PACSystems RX3i PROFINET IO-Controller, IC695PNC001, with firmware version 2.20 or later
RXi Controller Version	Effective with IC695CEP001 Firmware version 2.30, the PACSystems RXi Distributed I/O Controller, ICRXICTL000, is no longer compatible with IC695CEP001. ICRXICTL000 with firmware version 7.80 or later may be used with CEP001 version 2.01 or earlier.
RX3i I/O Modules	For a complete list of modules supported by the current firmware release, refer to the section, *Supported I/O Modules,* above.
HART Pass Through	HART Pass Through entails usage of PC-based applications, RX3i Analog modules with HART functionality and (optionally) supporting PROFINET products. HART Pass Through operation is described in the *PACSystems HART Pass Through User Manual*, GFK-2929.
Serial Communication	IC695CMM002/004 IO Modules are now supported in a remote rack that is managed by a PACSystems RX3i CEP PROFINET Scanner. Each CMM port can be configured as Disabled or for MODBUS Master and/or MODBUS Slave. CCM Slave, DNP3 Master, DNP3 Slave, and Serial I/O protocols are not allowed at this time, nor is the Serial Protocol Language. The following PACSystems controller firmware and programming software are required to use this feature • PACSystems RX3i CPU, IC695CPU315/CPU320/CPE302/CPE305/CPE310/CPE330/CRU320, with firmware version 10.30 or later • PACSystems RX3i PROFINET IO-Controller, IC695PNC001, with firmware version 3.20 or later • PACSystems RX3i CEP PROFINET SCANNER, IC695CEP001, with firmware version 2.80 or later. • PAC Machine Edition version 10.0 or later

1.9 PACSystems Documentation

1.9.1 PACSystems Manuals

PACSystems RX7i, RX3i and RSTi-EP CPU Reference Manual   GFK-2222

PACSystems RX7i, RX3i and RSTi-EP CPU Programmer's Reference Manual   GFK-2950

PACSystems RX7i, RX3i and RSTi-EP TCP/IP Ethernet

Communications User Manual   GFK-2224

PACSystems TCP/IP Ethernet Communications Station

Manager User Manual	GFK-2225
PACSystems Hot Standby CPU Redundancy User Manual	GFK-2308
PAC Machine Edition Logic Developer Getting Started	GFK-1918
PAC Process Systems Getting Started Guide	GFK-2487

PACSystems RXi, RX3i, RX7i and RSTi-EP Controller Secure

Deployment Guide	GFK-2830
PACSystems RX3i & RSTi-EP PROFINET I/O Controller Manual	GFK-2571

1.9.2   RX3i Manuals

PACSystems RX3i System Manual	GFK-2314
PACSystems RX3i PROFINET Scanner Manual	GFK-2737
PACSystems RX3i PROFINET I/O Devices Secure Deployment Guide	GFK-2904

In addition to these manuals, datasheets and product update documents describe individual modules and product revisions. The most recent PACSystems documentation is available on the Emerson support website https://www.Emerson .com/Industrial-Automation-Controls/support

Section 2   LED Operation and Connectors

This chapter provides detailed description of the carriers' indicators and ports as follows:

- Normal LED operation
- Special LED blink patterns
- IC695CEP001 ports

2.1   Normal LED Operation

2.1.1   IC695CEP001 LEDs

Figure 4: CEP001 LEDs

Power LEDs

The RX3i CEP001 Carrier has two Power LEDs, PWR1 and PWR2 that indicate whether the power is applied and is within range corresponding to the two power sources.

🟢	Green,	Power is applied at the minimum specified level
⚪	OFF	Power supply does not have power or has failed

OK LED

The OK LED indicates whether the CEP001 Carrier can perform normal operation.

🟢	Green, ON	RX3i CEP001 is OK
🟡	Amber, ON	Either the RX3i CEP001 Carrier or I/O module has a fault
◑	Amber, blink pattern	Fatal error- flashes once between error codes
◑	Fast blinking	CEP001 has no valid MAC addresses
⚪	OFF	CEP001 has an unrecoverable fault

Connect LED

The CONN LED indicates the status of PROFINET connections.

🟢	Green, ON	At least one PROFINET connection (AR) exists with an
◑	Amber, blink pattern	Fatal error- flashes once between error codes blinked on
◑	Amber, blink in 1Hz	No device name configured
⚪	OFF	No PROFINET connection (AR) exists

Port LEDs

The RX3i CEP001 has two Port LEDs, PRT1 and PRT2 that indicate link speed, link connection and link activity corresponding to the two external Ethernet ports.

🟢	Green, ON	Link connected, 100 Mbps
◑	Green, blinking	Port active, 100 Mbps
🟡	Amber, ON	Link connected, 10 Mbps
◑	Amber, blinking	Port active, 10 Mbps
◑	Amber, blink pattern	Fatal error - flashes once between error codes blinked on
⚪	OFF	Associated Ethernet port is not connected to an active link (can be disabled by configuration)

Note: *Multiple LEDs can blink in patterns that indicate special conditions, such as a request for module identification.*

2.1.2 Power LED (IC694CEE001)

The RX3i Expansion Carrier CEE001 has one PWR LED to indicate whether the power provided by the RX3i CEP001 Carrier is within range.

🟢	Green, ON	OK
🟡	Amber, ON	Power 24Vdc and/or 5Vdc is not in specified range
⚪	OFF	No power

2.2 Special LED Blink Patterns

The RX3i CEP Carrier's LEDs can operate in tandem to indicate fatal error, module location/identification, and update conditions, as described below.

2.2.1   Fatal Error Codes

When the RX3i CEP encounters a fatal error, it blinks an error code pattern on the OK LED with an Amber color. In this mode all other LEDs except PWR LEDs flash Amber once to indicate the start of the error code. Next the OK LED blinks a 2-digit decimal error code. The LED first blinks to indicate the most significant error digit, then after a brief pause blinks again to indicate the least significant error digit. After another brief pause, all LEDs flash Amber again and the error code pattern repeats. Repetitions continue indefinitely until the Carrier is power cycled.

2.2.2   Carrier Identification

The LEDs on an RX3i CEP Carrier can be commanded to repeatedly turn ON and OFF in a special sequence, to help locate or identify the CEP Carrier:

- First the green LEDs are turned on in the following order (from bottom to top): PRT2, PRT1, CONN, OK. There is a short delay between turning on each LED.

- The LEDs are then turned off in the reverse order (from top to bottom). There is a short delay between turning off each LED.

The Carrier Identification LED Pattern is initiated by the PROFINET DCP Identify Device command. Carrier identification can be initiated using the PAC Machine Edition Discovery Tool by refreshing the device list, double clicking on the RX3i CEP, and clicking the Identify Device button on the RX3i CEP properties pop-up window.

2.2.3   Firmware Update

While the RX3i CEP is in firmware update mode, the OK, CONN, PRT1 and PRT2 LEDs blink Green for 1 second and then off for 1 second in unison. During firmware update operation, all the PORT LEDs and the CONN LED blink in the firmware update

pattern since the ports are disabled, and all the PWR LEDs are off even the corresponding power source is good.

2.2.4   Power-up LED Patterns

When power is applied to the RX3i CEP Carrier, it loads a firmware image. The PWR1 and/or PWR2 LEDs are green and steadily ON. During the power-up/reset process, the CEP runs diagnostics and initializes its hardware components.

After completing power-up sequence, the OK LED changes to green, steadily ON. If a fatal error occurs during powerup, the LED blinks instead.

2.3 IC695CEP001 Ports

2.3.1 Ethernet Network Ports

The two external RJ-45 Ethernet ports are on the underside of the CEP Carrier.

Figure 5: Underside of CEP001 Showing Ethernet Ports
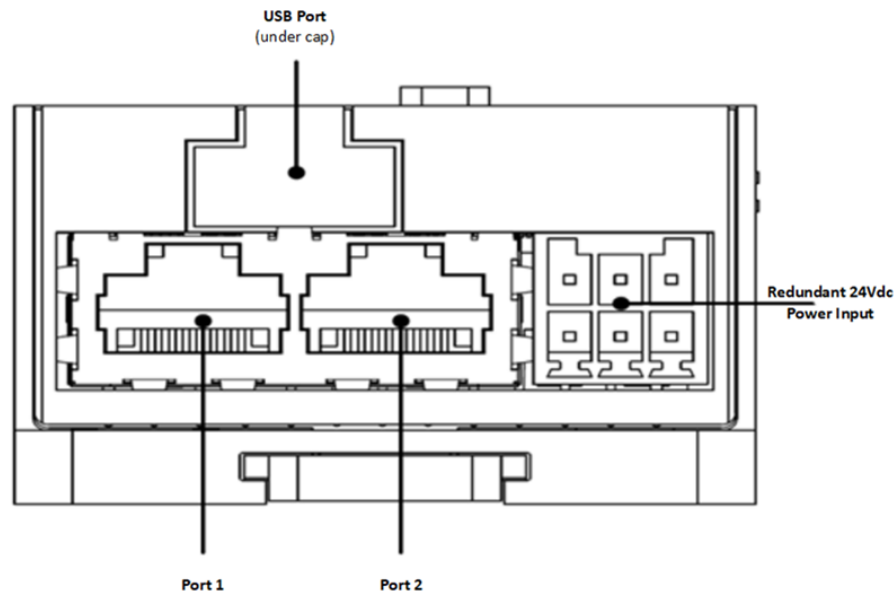
The RJ-45 ports provide 10/100 Mbps copper interfaces. These ports support CAT5/5e/6 Shielded Twist-pair cabling of up to 100m. Each Ethernet port automatically senses the type of network and adjusts speed and connection parameters. The PROFINET protocol can be sent and received over any or both two external ports.

Devices connected to the RX3i CEP ports should have Ethernet Auto-negotiation enabled. The RX3i CEP Carriers and other participating devices can be connected in a daisy chain/line, or star topology.

⚠ WARNING

Do not connect both ports on the Ethernet interface, directly or indirectly, to the same device to form a circular network unless Media Redundancy is enabled with one node actively set up as the Media Redundancy Manager.

2.3.2 USB Port

The USB port, located on the bottom of the RX3i CEP Carrier, can be used to connect to a computer for firmware updates for the RX3i CEP Carrier. The USB port accepts a standard

USB cable (USB Micro B Male to USB Type A Male, not included). The port must be set up before using it, as described in the Operations chapter.

> *Note:*   *The USB port is for firmware upgrades only. It is not intended for permanent connection*

Section 3　　Installation and Mounting

This chapter provides RX3i CEP Carrier installation instructions and information for selecting network cabling and connectors as follows:

- Carrier installation and mounting
    — Installing RX3i CEP Carrier on a DIN-rail
    — Removing RX3i CEP Carrier from the DIN-rail
    — Panel mounting
    — Installing RX3i CEE Expansion Carrier
    — Removing RX3i CEE Expansion Carrier
    — Grounding
    — Power requirements
    — Installing modules on the carriers
- Connecting power supplies
- External switch VLAN priority settings

3.1　　Carrier Installation

The CEP Carrier and Expansion Carrier can be mounted on a DIN-rail or a panel. As shown in Figure 6, adequate installation space is required for:

1. Clearance for communications port cables.
2. Power wiring
3. Operating the DIN latch.

Figure 6: Mounting & Clearance Notes CEP001 & CEE001

177.2 mm (6.98 inches)

51 mm (2.01 inches)　51 mm (2.01 inches)
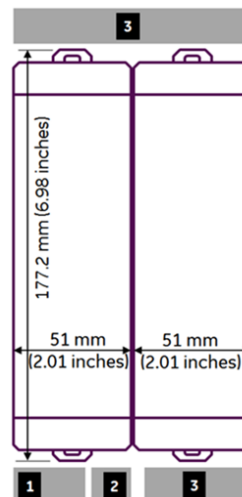
> *Note:*
>
> - *You may need to allow more space for installation of cables and connectors than what is required for heat dissipation. To avoid impacting mechanical reliability and signal quality, cable installation must comply with the minimum bend radius specified by the cable manufacturer.*
>
> - *The RX3i CEP Carriers with I/O modules attached require an enclosure with minimum depth of 16 5 mm.*

Rated thermal specifications are based on a clearance of 5.1 cm (2 in) above and below the equipment and 2.54 cm (1 in) to the left of the RX3i CEP Carrier.

3.1.1 Installation Requirements

This product is intended for use with the RX3i system. Its components are considered open equipment (having live electrical parts that may be accessible to users) and must be installed in an ultimate enclosure that is manufactured to provide safety. At a minimum, the enclosure shall provide a degree of protection against solid objects as small as 12 mm (0.47 in)(fingers, for example). This equates to a NEMA/UL Type 1 enclosure or an IEC60529 IP20 rating providing at least a pollution degree 2 environment. For details about installing RX3i rack systems, refer to the PACSystems RX3i System Manual, GFK-2314.

3.1.2 Installation in Hazardous Areas

The following information is for products bearing the UL marking for Hazardous Areas or ATEX marking for explosive atmospheres:

Class 1 Division 2 Groups ABCD

- This equipment is open-type device and is meant to be installed in an enclosure suitable for the environment that is only accessible with the use of a tool.

- Suitable for use in Class I, Division 2, Groups A, B, C and D Hazardous Locations, or non-hazardous locations only.

⚠ WARNING

- Explosion hazard - Substitution of components may impair suitability for Class I, Division 2.

- When in hazardous locations, turn off power before replacing or wiring modules.

ATEX ZONE 2

- Device must be mounted in an enclosure certified in accordance with EN60079-15 for use in Class I, Zone 2, GROUP IIC and rated IP54. The enclosure shall only be able to be opened with the use of a tool.

- Provisions shall be made, external to the apparatus, to provide the transient protection device to be set at a level not exceeding 140% of the rated voltage at the input terminals of this apparatus.

3.1.2.1 ATEX Marking

⟨Ex⟩ Ex nA IIC T4 X 0C < Ta < 60C

3.1.3 Installing an RX3i CEP Carrier on a DIN-rail

The carrier mounts on a standard EN 50022, 35 x 7.5 mm DIN-rail. Conductive (unpainted) finish is required for proper grounding.

For best resistance to vibration, the DIN-rail should be installed horizontally on a panel using screws spaced approximately 15 cm (6 in) apart.

Figure 7: DIN Rail Mount
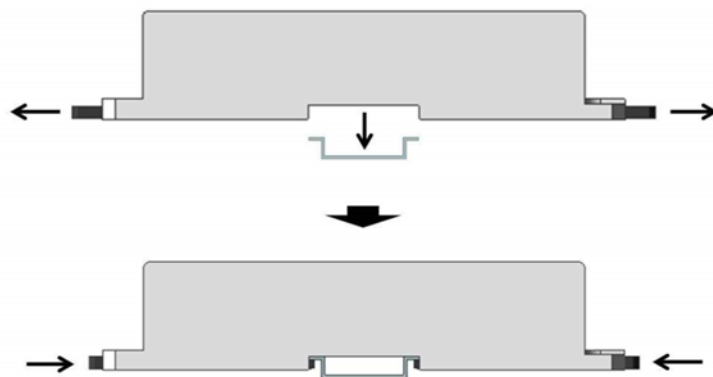
1. With a small flathead screwdriver, pull out the two DIN-rail latches and stand the carrier on the DIN-rail.
2. Push in the two DIN-rail latches so that the latches hold the DIN-rail.

3.1.4 Removing an RX3i CEP Carrier from a DIN-rail

Figure 8: Extract from DIN Rail Mount
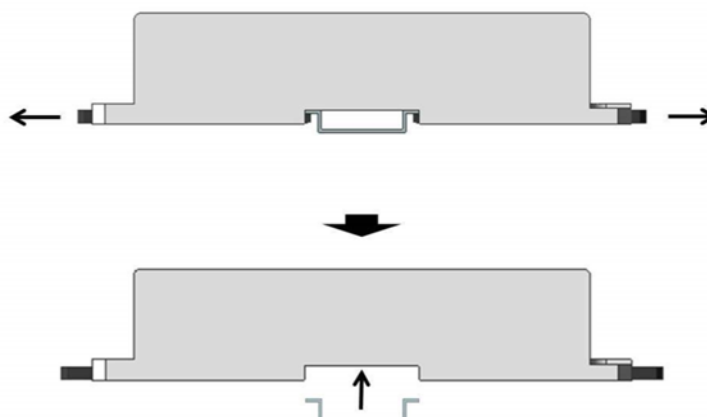
1. If the carrier is attached to the panel with screws, remove the screws.

2. With a small flathead screwdriver, pull out the two DIN-rail latches and release the latches from the DIN-rail, then remove the carrier.

3.1.5   Panel Mounting

For applications requiring maximum or long-term resistance to mechanical vibration and shock, the panel-mounting method is strongly recommended. A minimum panel thickness of 2.4 mm (.093 in) is required.

Figure 9: Panel Mount
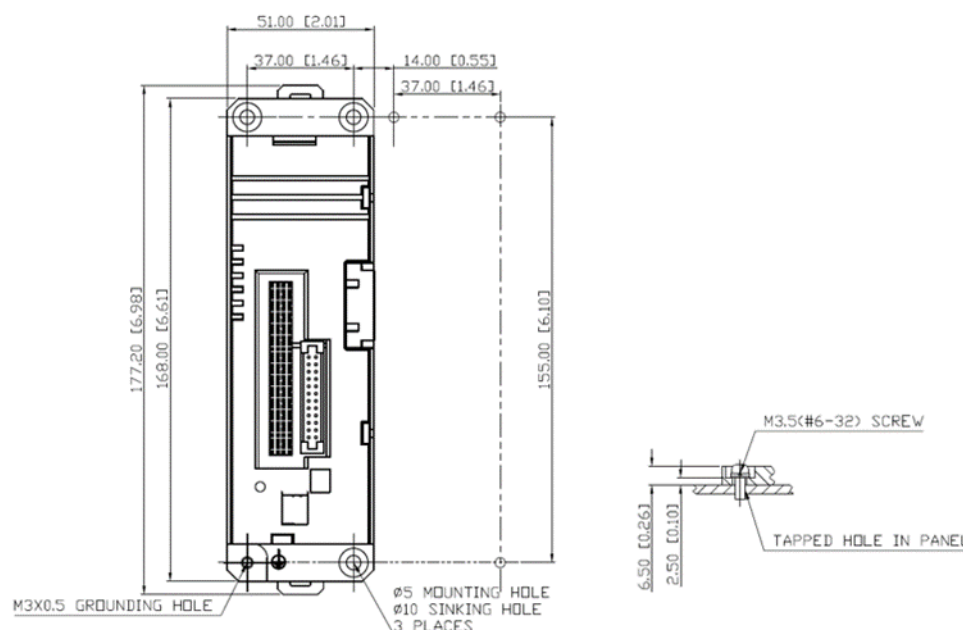
The mounting diagram shown in Figure 9 applies to both the CEP001 Carrier and CEE001 Expansion Carrier.

Note :

- *Tolerances on all dimensions are ±0.2mm (0.078 inch) non-cumulative.*

- *Apply 1.1 to 1.4 Nm (10 to 12 in/lbs) of torque to M3.5 (#6-32) steel screws threaded into tapped holes in the panel.*

3.1.6   Installing a RX3i CEE Expansion Carrier

- To install a RX3i CEE Expansion Carrier

  1. Open the connector cap on the RX3i CEP Carrier.

  2. Slide and install the CEE Expansion Carrier along the guide slots on the CEP Carrier.

  3. When the Expansion Carrier is aligned with the CEP Carrier, engage the expansion connectors.

  4. Close the connector cap.

  5. Secure the Expansion Carrier to the DIN-rail or panel. Refer to the procedure, Installing an RX3i CEP Carrier on a DIN-rail, or Panel Mounting.

  6. Connect the grounding hole on the CEE001 to the panel or enclosure. Refer to the section, Grounding.

Figure 10: Interconnecting CEP001 & CEE001
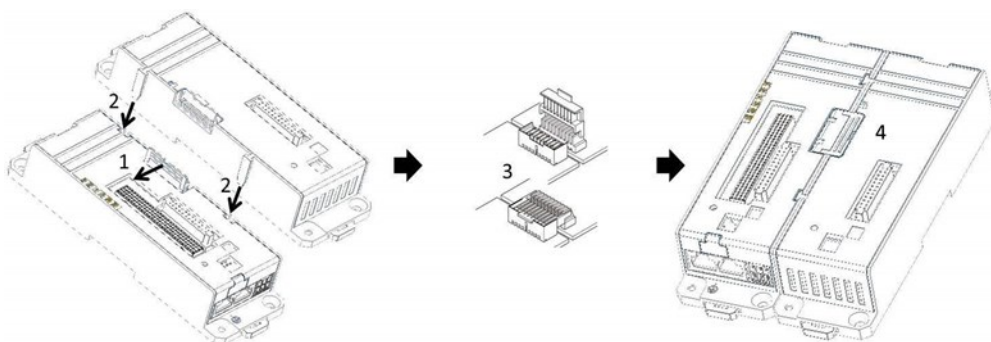
3.1.7   Removing a RX3i CEE Expansion Carrier

- To remove a RX3i CEE Expansion Carrier

  1. Remove the RX3i I/O module from the RX3i CEE Expansion Carrier to be removed.

  2. Open and gently pull out the connector vertically to disengage the expansion connectors.

  3. Release the DIN-rail latch from the DIN-rail and/or remove the panel mount screws.

  4. Slide the Expansion Carrier along the guide slot of the RX3i CEP Carrier and remove the Expansion Carrier

3.1.8   Grounding

⚠ WARNING

All CEP Carriers in a system must be grounded to minimize electrical shock hazard. Failure to do so can result in severe personal injury.

The RX3i CEP Carrier and Expansion Carrier each provide two grounding connection contacts:

- Grounding clips at the back of the carrier, which require DIN-rail installation
- Grounding screw hole at the left-bottom of the carrier

Note :   *When the Carrier is mounted on a DIN-rail, the grounding clips on the back of the Carrier do not provide an adequate ground connection. The Carrier's metal back must also be grounded using a separate conductor.*

Ground each Carrier to the panel or enclosure using a minimum AWG #12 (3.3 mm2) wire with ring terminals. Use an M3 screw, star lock washer and a flat washer to connect the wire at the Carrier's grounding hole. Connect the other end of the ground wire to a tapped hole in the grounded mounting panel or enclosure, using a machine screw, star lock washer and flat washer. Alternately, if the panel has a ground stud, use a nut and star lock washer for each wire on the ground stud to ensure adequate grounding. Where connections are made to a painted panel, the paint should be removed so clean, bare metal is exposed at the connection point. Terminals and hardware used should be rated to work with the aluminum Carrier material.

Note: *The star lock washer method is suitable for a shield ground, but not suitable for a safety ground.*

Figure 11: Grounding Diagram
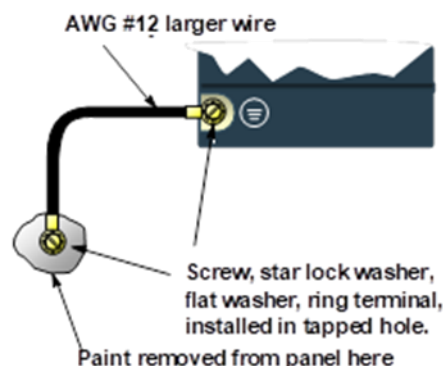
3.2   Installing Modules on the Carriers

The insertion and removal of I/O modules is the same as in a RX3i Universal Backplane. For details, refer to, the PACSystems RX3i System Manual, GFK-2314.

> ⚠**CAUTION**

Do not install a Power Supply module on the CEP or CEE Carrier. Attempting to do so could damage the module and/or the Carrier

3.2.1 Unsupported Modules

> ⚠**CAUTION**

If an unsupported module is inserted in the CEP or CEE Carrier, the module will not be recognized correctly and could cause damage to the Carrier or the module.

When an unsupported I/O module is inserted in either the RX3i CEP Carrier or RX3i CEE Expansion Carrier, no alarm is reported to indicate this.

Some unsupported I/O modules have the same Distinguishing Class (for example, IC694MDL740 has the same Distinguishing Class as IC694MDL742). Refer to Section 1.7, *Supported I/O Modules*.

> *Note:* *For the latest updated list of supported I/O modules, refer to the Important Product Information document provided with the firmware version on your RX3i CEP product.*

3.3 Connecting Power Supplies

The following equipment is needed to connect power supplies:

- One 24 Vdc power supply which provides a low voltage/limited current (LVLC) power source (for example, the combination of an isolated DC supply and a fuse, listed 30 Vdc minimum and 3A maximum, connected in series with the input)
- Power cord with 28–16 AWG / 0.08–1.32 mm2 wires
- Ferrules for 28–16 AWG wires (optional)
- Frame ground wire, 28–16 AWG
- Input power terminal block – provided (WAGO Part Number 713-1103)
- Small flathead screwdriver (jeweler's size 14)

> *Note :*
>
> - *Two power supplies are required if using redundant power supplies.*
> - *For CE Mark purposes, input power lines to the CEP Carrier should be limited 30 m or less.*
> - *Before inserting the wires into the power connector terminal block, use a small flathead screwdriver to release the spring clamp on the terminal block.*

Figure 12: Spring Clamp Release
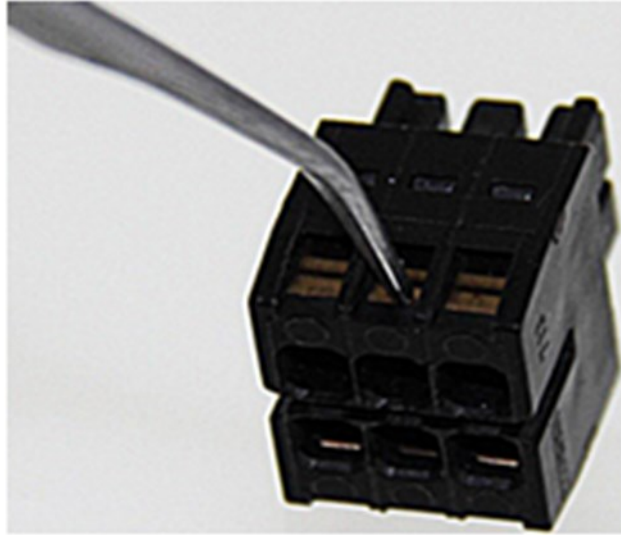
- To connect power supplies
    1. Using the power cord, attach the power supply to the power terminal block. Recommended wire stripping length is 6–7 mm (0.25 in).
    2. If using redundant power supplies, connect the second power supply to the input power terminal block.
    3. Insert the input power terminal block into the Input Power connector.

Note: *There are no user-serviceable fuses in the CEP Carrier.*

Figure 13: Connecting Power to the RX3i CEP Carrier
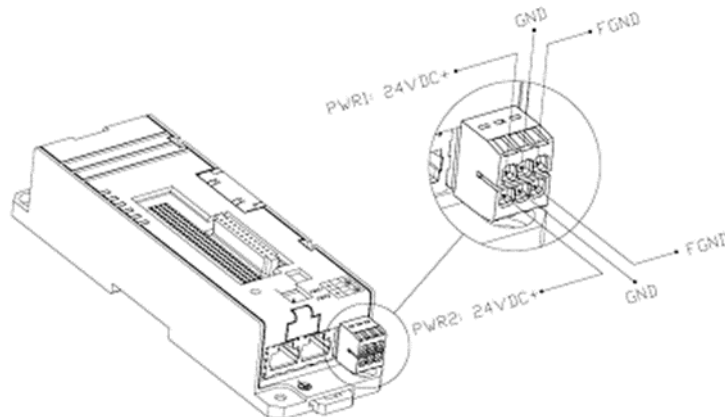
3.3.1   Adding a Redundant Power Supply

Perform the following procedure to add a redundant power supply to a system that is already in operation.

- To add a redundant power supply

    1. Remove power from the primary power supply to the RX3i CEP carrier

    2. Remove the power terminal block from the carrier.

    3. Without disturbing the primary power supply input lines, connect the redundant power supply input lines to the power terminal block.

    4. Insert the power terminal block into the Input Power connector.

    5. Apply power to the redundant power supply. The PWR2 LED on the RX3i CEP carrier should turn on.

    6. Apply power to the primary power supply. The PWR1 LED on the CEP Carrier should turn on.

3.3.2 Replacing a Redundant Power Supply

If two power supplies are applied to the RX3i CEP Carrier, the RX3i CEP will continue to operate without disruption if one of the power supplies fails or is turned off. If the power sources can be turned off independently of each other, either one can be removed or replaced without disrupting system operation.

Note: *When replacing a power supply that is connected to a powered-up CEP Carrier, disconnect and connect the power cable only from the power supply that has power removed. Do not attempt to perform these operations on the input power terminal block.*

- To replace a redundant power supply

    1. Check the PWR LEDs on the RX3i CEP carrier to be sure that the input source that is not being removed is currently supplying power.

    2. Remove power from the power supply that is to be removed.

    3. Wait until the PWR LED for the power supply that is being removed goes off.

    4. Remove and replace the power supply that is powered off.

    5. Apply power to the power supply and confirm that the corresponding LED is on.

3.4 External Switch VLAN Priority Settings

If a system includes external switches, these switches must be configured to match the VLAN Priority groupings listed below for the RX3i CEP.

The PROFINET-I/O specification indicates the VLAN priorities for each type of Ethernet traffic that originates from a PROFINET IO-Device. VLAN priorities range from 0 to 7, with 7 being the highest.

The switch on an RX3i CEP Carrier supports just two traffic classes, giving two levels of preference. Incoming traffic without a VLAN priority is assigned to the lowest priority traffic

class. The following table lists the VLAN priorities, and their corresponding priorities in the RX3i CEP:

Table 4

VLAN Priority	Preference / Traffic Class
7, 6, 5	Real-time (High Priority). This includes the following Ethernet traffic: PTCP, MRP, MRRT, RT_CLASS_2, RT_CLASS_1, RT_CLASS_UDP, High Priority RTA_CLASS_1, High Priority RTA_CLASS_UDP, Low Priority RTA_CLASS_1, Low Priority RTA_CLASS_UDP.
4, 3, 2, 1, 0	Non-real-time (Lower Priority). This includes the following Ethernet traffic: IP, DCP, and other untagged traffic.

An external switch that supports only two traffic queues must be configured like the RX3i CEP Carrier, as listed in the table above. An external switch that does not support a VLAN priority mapping that exactly matches the mapping used by the RX3i CEP Carrier can be used if it can be configured with the following relationships between VLAN priorities:

- VLAN Priority 7 is forwarded with at least as much preference as VLAN Priority 6.

- VLAN Priority 6 is forwarded with at least as much preference as VLAN Priority 5.

- VLAN Priority 5 is forwarded with more preference than VLAN Priorities 0, 1, 2, 3 and 4.

If the external switch does not allow VLAN priority 4 to be treated differently from priority 5, it should be used only if no device on the network will generate VLAN Priority 4 Ethernet Traffic.

Section 4   Configuration

This chapter provides configuration procedures for RX3i CEP Carriers and their I/O modules in a PROFINET I/O network. For information on configuring the PROFINET I/O Controller and its LAN, refer to the I/O Controller manufacturer's documentation.

> *Note:*   *To configure RX3i CEP Carriers in an RX3i Controller system, refer to the PACSystems RX3i & RSTi-EP PROFINET I/O Controller Manual, GFK-2571.*

This chapter discusses the following topics:

- Configuration Overview
  - Basic Configuration Steps
  - Configuration Tool
- Adding RX3i CEP Carriers to a LAN
  - Configuring RX3i CEP Carriers
  - Adding RX3i I/O Modules to a Remote Node
    - Adding and Configuring an Ethernet Port
    - Configuring Discrete Modules that have DIP switches
    - Configuring Analog Modules that have Jumpers
  - Configuring Module Parameters
- Assigning IO-Device Names
- After the Configuration is Stored to the PROFINET I/O Controller

4.1   Configuration Overview

The RX3i CEP receives its configuration from a PROFINET IO-Controller, which is configured by a PROFINET I/O configuration tool. The GSDML files are provided with PAC Machine Edition. For other PROFINET I/O configuration tools, the RX3i CEP GSDML must be imported. The RX3i CEP GSDML can be obtained by contacting Emerson Technical Support.

> *Note:*   *For details on using the PAC Machine Edition PLC Logic Developer programmer to create and download the configuration for an RX3i PROFINET network and its IO devices, refer to the PACSystems RX3i & RSTi-EP PROFINET I/O Controller Manual, GFK-2571.*

4.1.1   Basic Configuration Steps

The basic configuration steps are:

- Configure a PROFINET IO-Controller and its PROFINET LAN using the Controller manufacturer's recommended PROFINET I/O configuration tool.
- Configure the parameters of the PROFINET Controller.

Add IO-Devices to the LAN.

RX3i CEP and other types of IO-Devices use GSDML files to describe their capabilities. The PROFINET I/O configuration tool imports these GSDML files and incorporates the devices into the configuration.

Note: *These IO-Devices can be VersaMax or RX3i PROFINET Scanner modules, RX3i CEP Carriers or third-party IO-Devices.*

- Configure the parameters of the RX3i CEP Carrier.

- Configure the communications properties of the PROFINET IO-Controller and RX3i CEP.

- Add RX3i I/O modules to the RX3i CEP remote nodes.

- Configure the parameters of the modules.

- When the configuration is ready, use a DCP tool to assign a name to the RX3i CEP so the PROFINET IO Controller can connect to it and deliver the configuration.

- Store the configuration data from the configuration tool to the PROFINET I/O Controller.

4.1.2   Configuration Tool

The configuration tool used to configure the PROFINET LAN containing the RX3i CEP Carriers must support IO Devices configured with GSDML V2.3 files.

4.2   Adding a RX3i CEP to a LAN

Use the PROFINET I/O configuration tool to add RX3i CEP Carriers to the LAN. This process may include importing the RX3i CEP Carriers' GSDML file. If necessary, for your application, change the settings of the RX3i CEP Carriers' configurable parameters listed below.

4.2.1   Configuring a RX3i CEP

All configurations are applied on the RX3i CEP Carrier. The RX3i CEP Expansion Carrier has neither IO data nor configuration parameters.

Input and Output Status Data

The RX3i CEP Carrier has 32-bits of Status data and 32-bits of Control (Output Status) data. These should be mapped to the IO-Controller's memory. For definitions of these bits, refer to Chapter 5, the section, RX3i CEP Status and Control Data.

IO-Device Access Point

The IO-Controller determines the state of the inputs when the RX3i CEP Carrier is unable to provide them. This could happen when the RX3i CEP Carrier is not powered on, connected

to the network, or there is a network or configuration issue such that the IO-Controller cannot communicate with the RX3i CEP Carrier. Emerson IO-Controllers support defaulting inputs to Force Off or Hold Last State values until communication is restored.

Module Parameters

The RX3i CEP Carrier has two parameters on slot 0, subslot 1 that specify Fatal Error Action and the Power Supply type.

The Fatal Error Action parameter determines the action the RX3i CEP Carrier will take in case a fatal error occurs. By default, the RX3i CEP Carrier LEDs will blink a fault code if a fatal error occurs. This parameter can be changed to cause the RX3i CEP to restart instead.

The Power Supply parameter determines whether RX3i CEP Carrier expects redundant +24Vdc power input. By default, the RX3i CEP Carrier monitors both power inputs and reports a fault if one of them is not good. This parameter can be changed to single power input instead.

Network Identification

The Network Identification parameters of an RX3i CEP Carrier (IP Address, subnet mask, and gateway) should be configured so that each device on the network has a unique IP Address. The IO Controller will configure the network parameters for the RX3i CEP Carrier during the Connect sequence.

When the network parameters are set with the DCP tool, they will be maintained over a power cycle while no IO-Controller is connected. If an IO-Controller is connected and the Network parameters configured for the RX3i CEP Carrier do not match the currently retentive parameters stored on the device (those set using a DCP Tool), then the

IO-Controller will assign the configured network parameters to the RX3i CEP Carrier for immediate use during the connection process. This will overwrite the retentive values that were set by DCP with the factory default values for IP, subnet, and gateway, (0.0.0.0/0.0.0.0/0.0.0.0). Note that if the RX3i CEP Carrier is now power-cycled without an IO-Controller connected, the module will power up with the default network settings because network settings configured by the IO-Controller are not retentive. In order to maintain settings over a power-cycle without an IO-Controller connected, the network settings assigned by the IO-Controller must match the network settings configured with the DCP Tool.

Data Exchange Rate

The rate of data exchange is usually configured on the RX3i CEP Carrier in configuration tools. The RX3i CEP Carrier supports update rates from 1ms to 512ms. The correct

setting for each device can depend on the dynamics of the equipment being controlled, the network loading on the PROFINET I/O LAN, and the loading of the IO-Controller. It is possible

to have better performance at 2ms, 4ms or greater periods than at 1ms depending on the overall system requirements, design, and loading.

Media Redundancy Parameters

By default, the RX3i CEP Carrier is not set up for Media Redundancy. If the RX3i CEP Carrier will be a Media Redundancy Client, select the carrier ports that will be used for Ring Port 1, Ring Port 2 and the MRP Domain. The MRP Domain name is used to assign MRP Clients to the media redundancy manager (MRM) for the network ring. The Domain Name is defined in the PROFINET I/O Controller's Media Redundancy tab.

Hot-Standby CPU Redundancy using PROFINET I/O Parameters

The Redundancy tab selects whether the CEP is redundantly controlled. Since the Rx3i CEP supports PROFINET System Redundancy when it is configured in an HSB CPU Redundancy system, the Rx3i CEP Programmer automatically selects redundant control by setting the Redundancy Mode parameter to HSB CPU Redundancy.

When the Rx3i CEP is not configured in an HSB CPU Redundancy system, the Rx3i CEP automatically selects simplex operation (non- redundant control) by setting the Redundancy Mode parameter to None.

If desired, the user may configure a redundancy-capable CEP within an HSB CPU Redundancy system for simplex operation (non-redundant control) by changing the Redundancy Mode parameter on the Redundancy tab form HSB CPU Redundancy to None

4.2.2   Adding RX3i I/O Modules to a Remote Node

For a list of currently supported I/O modules, refer to the Important Product Information document provided with the firmware version on your CEP Carrier.

Configuring Modules with Sub-modules

Some PACSystems RX3i I/O modules have functionality that must be configured before operation; otherwise PAC Machine Edition indicates an error on the module.

Figure 14: Add Sub-Module for Slot 1 Device
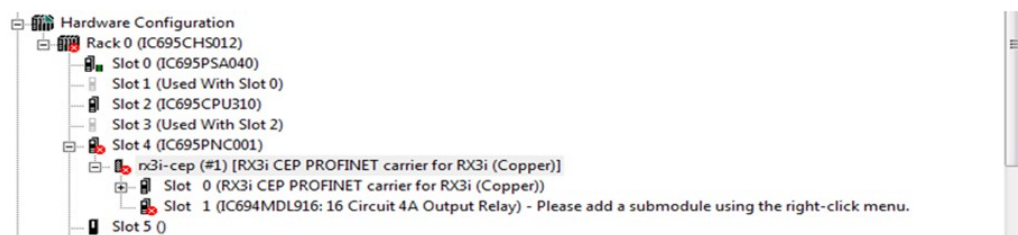
To complete the configuration, right click the slot containing the IO Module (Figure 14) and select Change Submodule List. This opens a dialog box that presents a list of sub-module options.

Configuring Modules with Multiple Modes of Operation

Some PACSystems RX3i analog modules have multiple modes of operation that change the acceptable maximum limits for their configuration values. For example, an IC695ALG616 analog input module supports a different set of A/D Scaling Units when in 4 to 20mA operation than when it is in -10V to +10V operation (Figure 15).

These different configuration options are implemented as groups of controls which are activated by a choice made outside of the group and marked with ± expander controls. Typically, this choice is directly preceding the first group.

If multiple options are available, only the controls associated with the active choice are used. The other settings are maintained but are ignored by the module. To prevent confusion, it is recommended that only the active choice be expanded. The state of the expander control does not affect the choice of active controls. If the active setting is collapsed and not visible, it is still active, and its values are used for the module configuration.

Figure 15: Configuration of Multiple Options for Certain IO Modules

Configuring Discrete Modules that have DIP Switches

Some PACSystems RX3i discrete output modules have a physical DIP switch that controls the operation of their output circuits when connection to an IO-Controller is lost. A switch selects between Force Off and Hold Last State. This setting applies to all the module's outputs.

The module's documentation lists any additional requirements for Hold Last State to operate correctly. For some modules, field power must be maintained on the PACSystems backplane for Hold Last State to operate correctly.

If a discrete output or discrete mixed module does not have a switch or an additional configuration option specifying its output's default action, the hardware default is to Force outputs off.

Configuring Analog Modules that have Jumpers

Some PACSystems RX3i analog modules have jumpers on their terminal strips that control the operation of their I/O. For example, the IC69xALG220 can operate as a +10vdc to -10vdc analog input or a 4-20mA analog input depending on a jumper setting. Similarly, the IC69xALG390 uses a jumper rather than a DIP switch to control Force Off or Hold Last State operation.

Jumper settings are latched when the module is started, so the jumper setting cannot be altered during operation. The RX3i CEP Carrier must be power-cycled for the new jumper setting to be re-evaluated or the module must be removed, then hot-inserted.

4.2.3 Configuring Module Parameters

After adding PACSystems RX3i modules to the remote IO-Device, their parameters must be configured. For all PACSystems RX3i modules, this includes configuring a set of basic parameters such as reference address. Configuration details for those basic parameters are given on the following pages. If the module has no module-specific parameters, a blank grouping of Module Parameters may be displayed in the Configuration Tool.

The RX3i modules listed in the following table require additional configuration beyond the basic parameters described in this chapter. Refer to the PACSystems RX3i System Manual, GFK-2314; or the individual module datasheet for detailed parameter information.

Catalog Number	Module Description	Datasheet
IC693ALG222	Analog Voltage Input Module – 16 Channel	GFK-2654
IC693ALG223	Analog Current Input Module – 16 Channel	GFK-2655
IC693ALG392	Analog Current/Voltage Output Module – 8 Channel	GFK-2557
IC693ALG442	Analog Module, 4 Inputs / 2 Outputs Current/Voltage	GFK-2687
IC694ALG222	Analog Voltage Input Module – 16 Channel	GFK-2654
IC694ALG223	Analog Current Input Module – 16 Channel	GFK-2655
IC694ALG392	Analog Current/Voltage Output Module – 8 Channel	GFK-2557
IC694ALG442	Analog Module, 4 Inputs / 2 Outputs Current/Voltage	GFK-2687
IC694PSM001	Power Sync and Measurement Module	GFK-2748

Catalog Number	Module Description	Datasheet
IC695ALG112	Isolated Analog Current/Voltage Input Module – 12 Channel	GFK-2482
IC695ALG312	Isolated Thermocouple Input Module, 12 Channels	GFK-2500
IC695ALG600	Universal Analog Input Module – 8 Channel	GFK-2348
IC695ALG616	Analog Current/Voltage Input Module – 16 Channel	GFK-2372
IC695ALG626	Analog Current/Voltage Input Module – 16 Channel with HART	GFK-2372
IC695MDL664	Digital Input Module with Diagnostics – 16-Channel	GFK-2590
IC695MDL765	Digital Output Module with Diagnostics – 16 Channel	GFK-2591
IC695ALG704	Analog Current/Voltage Output Module – 4 Channel	GFK-2373
IC695ALG708	Analog Current/Voltage Output Module – 8 Channel	GFK-2373
IC695ALG728	Analog Current/Voltage Output Module – 8 Channel with HART	GFK-2373
IC695ALG808	Isolated Analog Current/Voltage Output Module – 8 Channel	GFK-2481
IC695HSC308	High-Speed Counter Module - 8 Counters	GFK-2441
IC695CMM002/004	Serial Communication Module	GFK-2460

RX3i CEP Configuration Validation

Some configuration validation is performed by the RX3i CEP Carrier when the configuration is delivered to it. The following table indicates the configuration validations performed for the indicated modules. If the RX3i CEP Carrier detects an invalid configuration for a given module, the module transitions to module default operation and point faults are energized on the assigned I/O.

If a module listed below receives an invalid configuration, it rejects the configuration, energizes point faults and blinks its OK LED. The module does not transition to an operational state, as indicated by the OK LED being On-Solid, until a valid configuration is stored.

Catalog Number	Rules
IC695MDL664	1. Pulse test diagnostic reporting and fault reporting must be disabled when pulse testing is disabled. 2. Open wire and short circuit diagnostic reporting must be disabled when the channel is configured for dual-state input type. 3. Short circuit diagnostic reporting must be disabled when the channel is configured for tri-state input type.

Catalog Number	Rules
IC695MDL765	1. Pulse test diagnostic reporting must be disabled when pulse testing is disabled. 2. Auto Pulse Normal State and Auto Pulse Default State must not be equal to each other if pulse testing is enabled.
IC695ALG112 IC695ALG312 IC695ALG616 IC695ALG626	1. The High Scale Value Engineering Units cannot be equal to the Low Scale Value Engineering Units. 2. The High Scale Value A/D Units must be greater than the Low Scale Value A/D Units. 3. The Alarm Limits must be in order, with the High Alarm greater than or equal to the High Alarm, which is greater than the Low Alarm, which is greater than or equal to the Low Alarm. 4. The Alarm Limits must be within the configured Engineering Units plus User Offset range, for example if the High and Low Engineering Unit Scale values are 10,000 and -10,000 and User Offset is 1000, the alarm limit range is +11,000 to -9,000. 5. The Alarm Deadbands must be set such that the Alarm can be cleared. For example, if the Engineering Units Scale Range is -5 to 5 and the High Alarm is 4, the High Deadband must be less than 9 or else it is not possible to reach a value that is low enough to clear the High Alarm. Note that the User Offset modifies the range of Alarms and Alarm Deadbands. The User Offset is added to the High and Low Engineering Unit Scale Values to set the alarm range limits.
IC695ALG600	1. through 5: Same as IC695ALG112 6. The Lead Resistance Compensation must be set to disabled for RTD 2-wire operation.

Catalog Number	Rules
IC695ALG704 IC695ALG708 IC695ALG728	1. The High Scale Value Engineering Units cannot be equal to the Low Scale Value Engineering Units. 2. The High Scale Value A/D Units must be greater than the Low Scale Value A/D Units. 3. The High Alarm must be greater than the Low Alarm. 4. The Alarm Limits must be within the configured Engineering Units minus User Offset range, for example if the High and Low Engineering Unit Scale values are 10,000 and -10,000 and User Offset is 1000, the alarm limit range is +9,000 to -11,000. 5. The valid range of Clamp Limits (if enabled) and Default Value is extended slightly beyond the alarm limits minus User Offset, depending on the configured Range. 6. Integer Current: +/- 400 Eng Units (0-20mA +400 Eng Units only) Floating Point Current: +/- 0.4 Eng Units (0-20mA +0.4 Eng Units only) Integer Voltage: +/- 500 Eng Units Floating Point Voltage: +/-0.5 Eng Units 7. The minimum (slowest) ramp rate is the higher Engineering Unit Scale Value minus the lower Engineering Unit Scale Value divided by 60,000. Put another way, the minimum ramp rate must be no slower than the full Engineering Units range traversed in 60 seconds.
IC695MDL808	1. through 7: Same as IC695ALG708 8. Open Wire Enable Diagnostic reporting is only valid when the module's Range Type is Voltage/Current, and the Range is set to a Current Range. 9. Short Circuit Enable Diagnostic reporting is only valid when the module's Range Type is Voltage/Current, and the Range is set to a Voltage Range.
IC695ALG112	1. through 5: Same as IC695ALG616
IC695HSC308	1. The counter High Range value must be greater than the Low Range Value. 2. If a counter is configured as Continuous within high/low range or One-shot within high/low range, the PreLoad Value must be within the range. 3. If 1ms is selected as the Timebase Units, the Timebase range is 1 to 429496. If Units are 1 μs, the range is 1 to 429496729. If Units are 100 ns, range is 1 to 2147483647. 4. To be used as a counter Setpoint output and External Output must be configured as Setpoint(s) on the Outputs Tab.

Basic Module Parameters

The module parameters define how the IO-Controller scans and stores the module's data. The number of address ranges varies by module and sub-module. For discrete data, there is a starting address and a length for input data and another starting address and length for output data. Analog data can be listed with each analog value as a separate address and a

length of one or as a group with the starting address listed and an overall length value. What is available can depend on the Configuration Tool.

Table 5

Input Data / Output Data:	The address in the IO-Controller's reference memory for the module's data.
	For PACSystems CPUs: Discrete Data can be added to %G, %I, %Q, %T, and %M memory areas. Non-Discrete Data can be added to %AI, %AQ, %R, %W, %G, %T, and %M memory areas.
Length:	For discrete modules, the length of the input /output data is fixed and cannot be edited.
Other Data:	Some modules have other data areas such as Module Status, ESCP Point Status, or Digital Filter settings. Refer to the *PACSystems RX3i System Manual*, GFK-2314, for more details about the data of each I/O Module.

4.3   Add New I/O Devices

- To add new, I/O Devices:

  1. Add a PNC module in the RX3i Rack, right-click on the PNC module, and select Add IO –Device.

Figure 16: Hardware Config: Add IO-Device
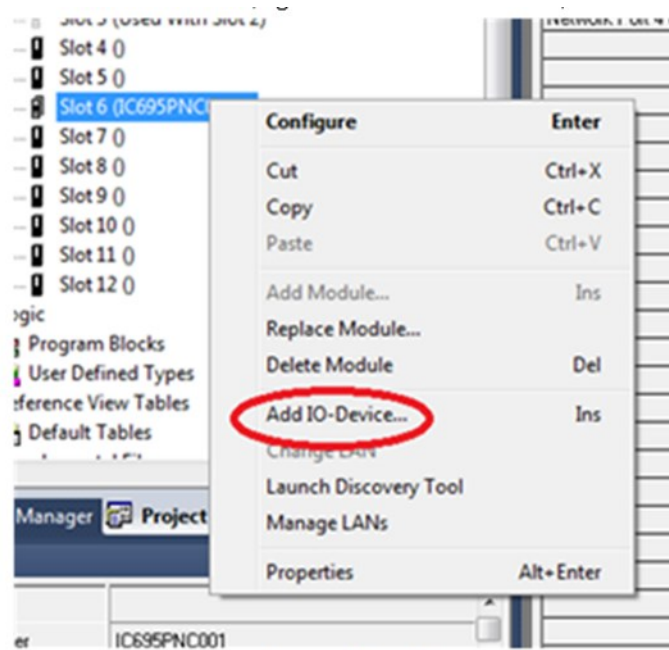
2.   Click **Have GSDML.**

Figure 17: Click on Have GSDML
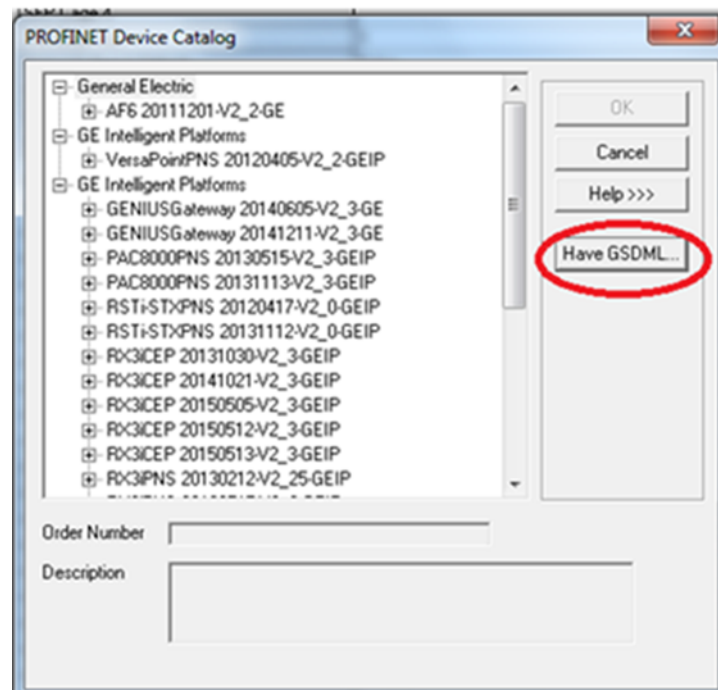
3.   Select the GSDML file to be imported and click Open.

Figure 18: Browse to and Select GSDML file
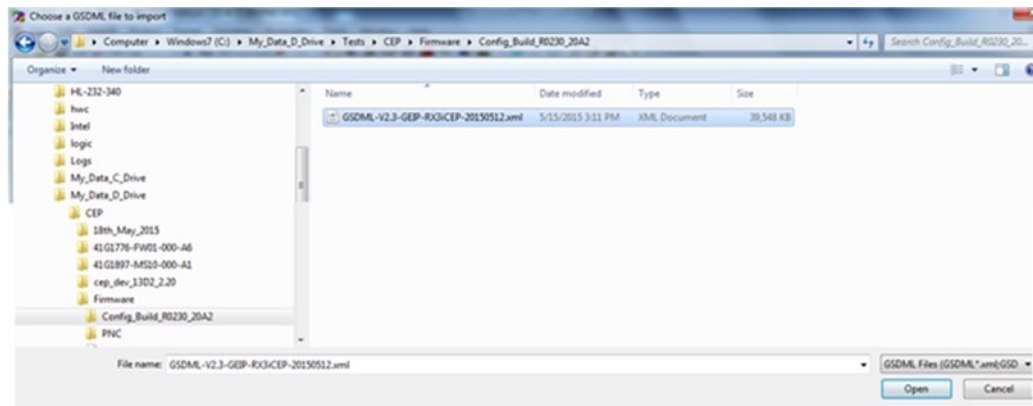
4.   The GSDML file is added to the list. Select the file and click OK.

Figure 19: GSDML Added
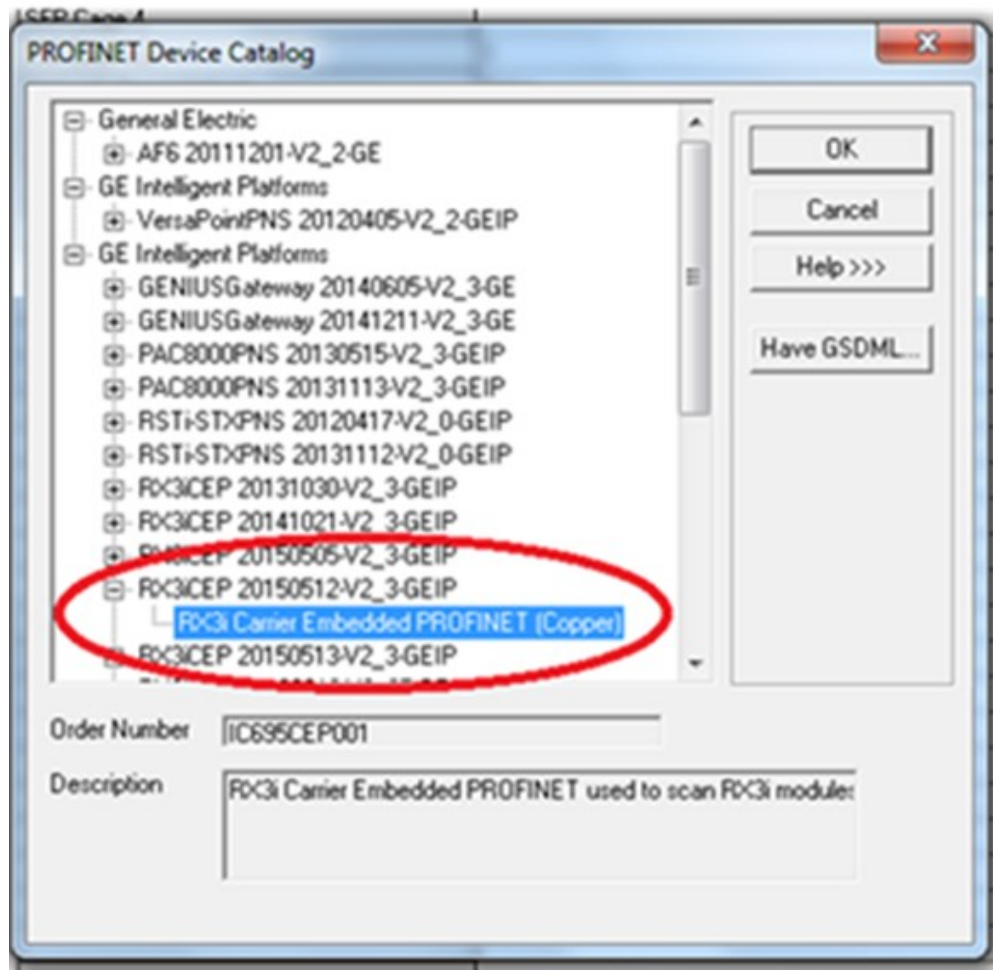
5. The CEP module is added under PNC.

Figure 20: CEP Node Added
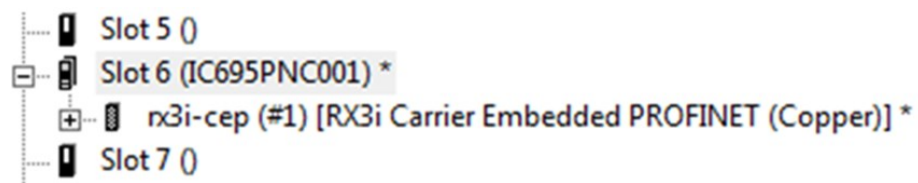
4.4   Update Existing I/O Devices

From time to time, updated GSDML files are made available, such as when new features associated with the device are released. The updated GSDML files may be applied by following the instructions in this section.

- To update existing I/O devices

    1. Right-click the I/O device to update and select Change GSDML.

Figure 21: Update GSDML file
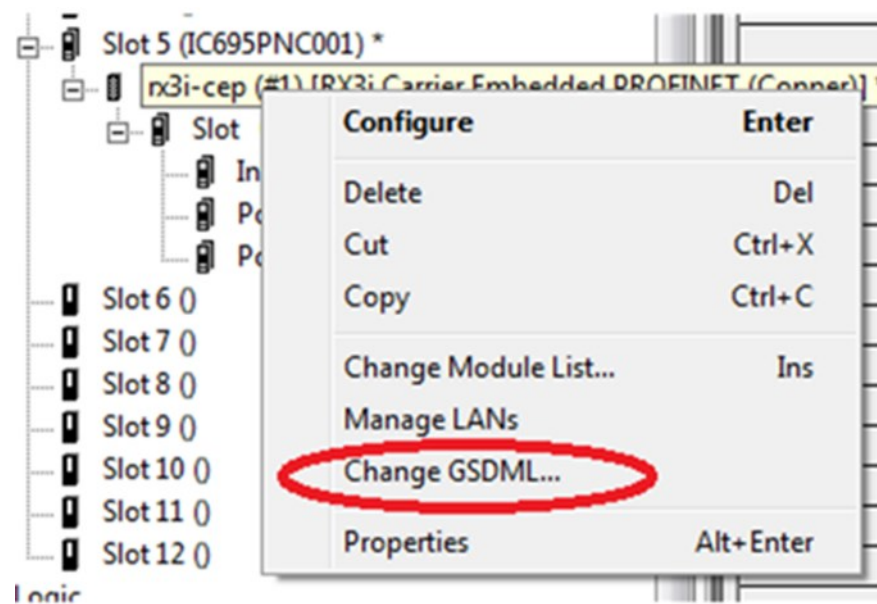
2.   Select **Have GSDML** and browse to the desired file version.

3.

Figure 22: Select Have GSDML file
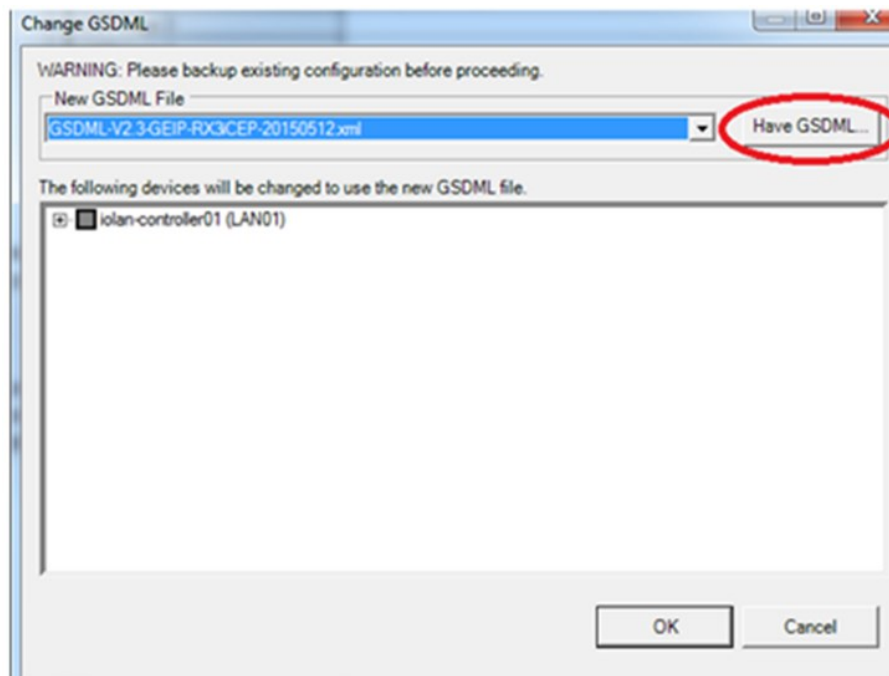
4.   Verify the desired GSDML version displays in the drop-down menu.

Figure 23: List of Available GSDML files
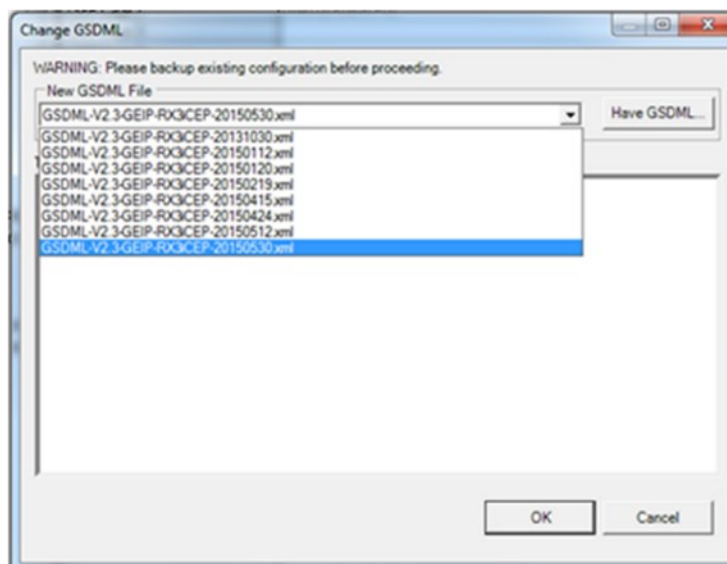
5.   Verify that all the I/O devices to be updated with the new GSDML revision are selected in the menu and click OK.

6.

Figure 24: Verify List of Devices Effected by GSDML Change
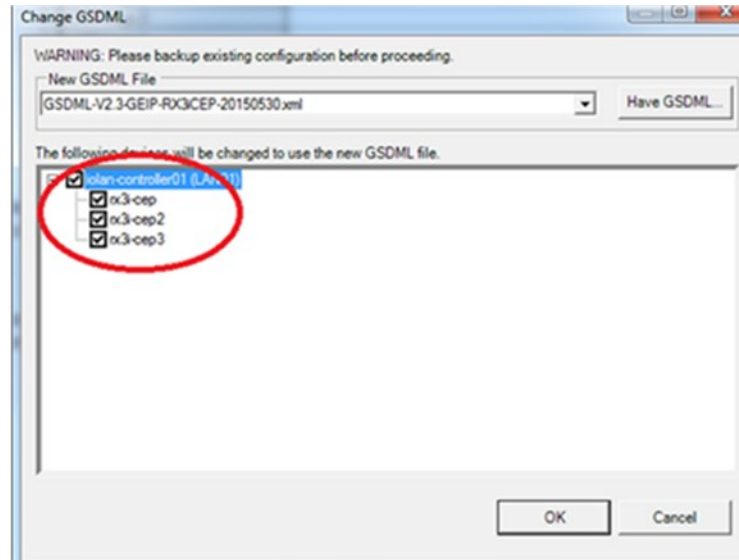
4.5 Assigning IO-Device Names

After the RX3i CEP and other IO-Devices on the LAN have been entered into the configuration, the Discovery and Configuration Protocol (DCP) tool must be used to assign a name to each I/O Device. The name of each device on the LAN must match the hardware configuration in the IO-Controller. This step is required before downloading the configuration from the PROFINET IO-Controller, or the PROFINET IO-Controller will be unable to connect to the devices and deliver the device's configuration.

The DCP tool must be connected directly to the PROFINET I/O LAN. The DCP tool allows you to display an identification pattern on an IO-Device. This can be helpful to distinguish devices apart when all are at factory default settings.

The DCP tool supports issuing a reset command to an IO-Device. A reset clears the device name and sets other nonvolatile settings such as IP, subnet, and gateway to the factory defaults.

4.6 After the Configuration is Stored to the I/O Controller

For complete instructions, refer to the documentation for the IO-Controller and the PROFINET I/O configuration tool.

After successfully processing and applying its configuration data, the IO-Controller transfers the configuration for remote IO-Devices over the PROFINET network.

An IO-Controller delivers configuration to an IO-Device when it establishes a connection with the IO-Device. If all connections are lost, the IO-Device retains the most recent configuration received since it was last powered up. If a module has not been configured since being powered up, it remains in its hardware default condition. When the connection(s) are re-established and a configuration is sent to the IO-Device, and the configuration of a module has changed, the I/O Device applies the new configuration.

If there are differences between the expected, configured modules and the actual modules present in the RX3i CEP Carriers when a connection is established, the RX3i CEP indicates differences back to the IO-Controller. Refer to Section 6, Diagnostics.

Section 5   Operation

This chapter describes RX3i CEP Carrier startup and restart, input status data, I/O modules replacement while scanning, and firmware update as follows:

- Power-up
- I/O Scanning
- Hot Swap of I/O Modules
- Firmware Update
- Installing the USB Port Driver

5.1   Power-up

When power is applied, the RX3i CEP Carrier loads a firmware image. During the power-up process, the CEP Carrier runs diagnostics and initializes its hardware components. After completing power-up sequence, the OK LED changes from being off to solid on green. If a fatal error occurs during powerup, the amber OK LED blinks a unique pattern indicating the nature of the failure.

If the CEP Carrier encounters a hardware failure, invalid firmware image, or the powerup diagnostics fail, the CEP Carrier will not become operational. Cycling power to the carrier may restore operation. Nonvolatile settings such as the PROFINET Device Name, power supply type, and fatal error action are activated before a PROFINET connection is allowed. Refer to the section, Fatal Error Handling.

5.2   I/O Scanning

5.2.1   RX3i CEP Status and Control Data

The RX3i CEP Carrier provides 32 bits of input status data and receives 32 bits of output control data.

The application program in the IO-Controller system can monitor the input status bits for the RX3i CEP Carrier. The output control bits are reserved for future use and have no function at this time.

Output Control Bits

The 32 bits of control output are reserved for future use of the RX3i CEP Carrier.

Input Status Bits

The 32 bits of input status provide information about the RX3i CEP Carrier. All status bits are active high.

Bit 0 is the lsb; bit 31 is the msb.

Table 6

Status Bits	Name	Description
0	Module OK	Indicates the health of the CEP Carrier. A value of 0 indicates the Carrier is powering up or has failed. A value of 1 indicates the Carrier is functioning properly.
1	Fault Present	Diagnosis data is available. Set to 1 when the OK LED indicates a fault; otherwise it is set to 0.
2	Port1 Link Up	1 = port is connected to another device and is operating correctly.
3	Port2 Link Up	0 = port is not connected to another device, or the port has some sort of error preventing communications.
4-7	Reserved	Set to 0
8	Power1 OK	Indicates whether or not the power input is providing power to the RX3i CEP.
9	Power2 OK	
10	MRP Enabled	Indicates whether MRP has been enabled or not. A value of 0 indicates that MRP is not enabled. A value of 1 indicates that MRP is enabled.
11	MRP Role	Indicates the MRP role the CEP Carrier is operating as when MRP is enabled. A value of 0 indicates that the CEP Carrier is currently an MRP Client. A value of 1 indicates that the CEP Carrier is currently an MRP Manager, however the CEP Carrier does not currently support MRP Manager configuration. If MRP is not enabled, then this bit will be set to zero.
12-31	Reserved	Set to 0

5.2.2   Data Coherency

The RX3i CEP provides coherency at a sub-module basis only. This means that output data from a single IO-Controller for multiple modules in the RX3i CEP Carrier and Expansion Carrier might not be applied by the RX3i CEP during the same output scan. Likewise, input data from all modules read in a single RX3i CEP input scan may not be produced by the RX3i CEP during the same PROFINET I/O cycle.

5.3 Hot Swap of I/O Modules

If a module is hot extracted (removed with power applied to the RX3i CEP carrier), the RX3i CEP detects the removal and generates a PROFINET Pull Alarm. When the RX3i CEP Carrier is connected to a PACSystems IO-Controller, the Pull Alarm is reported as a Loss of I/O Module fault and all point faults for the missing module have the corresponding Fault Contact on.

When a module is hot inserted, the RX3i CEP Carrier detects the insertion and determines whether the configuration expects the module to be present or not.

- If the module is not present in the configuration, no alarm or fault is generated. The module remains idle at its default state.

- If a module is inserted while the RX3i CEP has an established PROFINET connection and the module does not match the configured module, including any hardware setting such as a DIP Switch position, a PROFINET Plug Wrong Submodule alarm is generated. This appears as a System Configuration Mismatch fault in RX3i systems. Fault Contacts for the module remain in the Fault (on) state.

- If a module is inserted while the RX3i CEP has an established PROFINET connection and the module matches the configured module, a PROFINET Plug Alarm is generated. This appears as an Addition of I/O Module I/O fault in RX3i systems. The module is configured using the established PROFINET connection and once the I/O module is ready, I/O will start scanning and point fault contacts will transition to reflect any change in the state of the I/O.

Operation must continue to comply with PACSystems Hot Insertion and Removal requirements as documented in the PACSystems RX3i System Manual, GFK-2314. This depends mostly on the timing requirements for physically seating a module.

5.4 Firmware Updates

> *Note:* *The RX3i CEP Carrier does not prevent initiation of firmware update when it is actively connected to an IO-Controller. When the RX3i CEP Carrier enters firmware update mode, the RX3i CEP and its modules go to their IO default modes. During the update, the RX3i CEP does not drive module outputs or send inputs to the IO-Controller. When the firmware update is completed and the RX3i CEP Carrier is rebooted, its previous connections are re-established and control resumes.*

For LED behavior, refer to Section 2.2.3, *Firmware Update*.

The RX3i CEP Carrier enters firmware update mode when commanded to do so from the WinLoader update utility, or if a firmware component is corrupted or invalid. In firmware update mode, the RX3i CEP Carrier blinks its LEDs in a special pattern as described previously, and its Ethernet ports are not operational.

If the RX3i CEP Carrier has experienced a fatal error, the Carrier goes to an LED blink code error condition and does not communicate with Winloader, causing Winloader to return a

timeout failure indication. The Carrier must be power-cycled before reattempting the update.

The RX3i CEP Expansion Carrier does not contain firmware. Installing the USB Port Driver

The USB port is only used for firmware updates. USB driver files are provided as part of upgrade packages compatible with the RX3i CEP.

With the provided installation files accessible on either a local or network drive, connect the computer's USB port to the RX3i CEP Carrier's USB port. When requested, direct the installation to the proper location of the installation files.

The serial port name is COM followed by the next available number from 1 to 256. After the computer assigns the USB port a COM port number, that computer uses the same COM port number each time it connects to that RX3i CEP Carrier.

Note: *When connecting the USB cable to the RX3i CEP Carrier, you may receive a notification about installing a driver that has not passed Windows Logo testing. This notification should be ignored.*

Section 6   Diagnostics

This chapter describes configuration faults, how to check the RX3i CEP Carrier' version information, fatal error handling, and some common troubleshooting suggestions as follows:

- Configuration Faults
- Version Information
- Fatal Error Handling
- Connection Troubleshooting
- PROFINET Diagnosis Alarms.

6.1   Configuration Faults

In the event there are differences between the expected, configured modules and the actual modules present in the RX3i CEP Carrier or the RX3i CEP Expansion Carrier, when a connection is established, the RX3i CEP indicates differences back to the IO-Controller.

- If a module is configured but is not present or operational in the RX3i CEP Carrier or the RX3i CEP Expansion Carrier, the RX3i CEP indicates there is no module. When used with an RX3i PROFINET IO-Controller, a "Loss of Module" fault is reported and all point faults for the missing module have the Fault Contact on.

- If a module is configured but does not match the module present, the RX3i CEP reports the module as wrong. When used with an RX3i PROFINET I/O Controller, a System Configuration Mismatch fault is reported and all point faults for the module have the Fault Contact on.

- If the module configured is correct, but the module has sub-module options that relate to a DIP Switch setting on the hardware and the DIP Switch does not match the configuration, the RX3i CEP reports the module as wrong. When used with an RX3i PROFINET I/O Controller, a System Configuration Mismatch fault is reported and all point faults for the module have the Fault Contact on.

- If the actual module correctly matches the configured module, but the configuration for the module is unacceptable, the module rejects the configuration and energizes point faults until the configuration is corrected. Many modules blink their OK LED when they reject the configuration.

- If a module is installed but not included in the configuration, no problem is reported. The module is ignored by the RX3i CEP and defaults itself.

Refer to RX3i CEP Configuration Validation in Section 4.2.3. This section specifies the rules various modules use to validate their configuration.

6.2 Version Information

The RX3i CEP supports the standard PROFINET Identification and Maintenance (I&M) functions. I&M Revision information is returned for the slot 0 (indicates the RX3i CEP Carrier itself) with the information for the RX3i CEP Carrier.

Refer to the *PACSystems RX3i & RSTi-EP PROFINET I/O Controller Manual*, GFK-2571, Chapter 3, specifically to the documentation for the I/O Controller and configuration tool to access I&M data. For the RX3i PROFINET IO-Controller, this is available under the Explore PROFINET Networks option in PAC Machine Edition.

6.3 Fatal Error Handling

Any failures that occur during power-up or firmware update mode are considered fatal errors. This includes faults detected on non-critical devices such as the USB port. After successful powerup of the RX3i CEP, only catastrophic errors are treated as fatal. When a fatal error occurs, the RX3i CEP blinks an error code on its LEDs, then stays in blinking mode or automatically restarts according to its Fatal Error Action. For example, a blink code of 4-5 is a Watchdog error. This may be expected during heavy network traffic.

Certain conditions can prevent the module from powering up and becoming operational or entering firmware update mode:

For LED behavior, refer to section 2.2.1, Fatal Error Codes.

Table 7

Problem	Indication	Action
Hardware failure	OK LED is off	Contact Customer Service. Return the module to Emerson
Invalid firmware	Enter boot mode, OK, CONN, PORT1 and PORT2 LED flash green in unison	Update firmware to latest version
Power-up diagnostics/ hardware initializations fail that are considered fatal	LED Fatal Error blink code or automatic restart after the blink code appears once	Note the blink code and contact Customer Service
Catastrophic error during operation	LED Fatal Error blink code or automatic restart after the blink code appears once	Note the blink code and contact Customer Service

6.3.1 Automatic Restart

If the RX3i CEP is configured to automatically restart after a fatal error, on the next successful power-up, a diagnosis alarm is generated to indicate the RX3i CEP reset. This diagnosis alarm turns the Fault LED on and persists until the RX3i CEP is power-cycled. There is no way to clear this fault other than a second successful restart.

This might be a preferable setting under certain conditions. For example, if you are experiencing repeated 4-5 Watchdog errors, you could use this setting to automatically recover.

A persistent fatal error that occurs after the RX3i CEP has successfully powered-up can cause the module to continually reset itself. Please record the blink code and contact customer service for this case.

6.4   Connection Troubleshooting

A PROFINET I/O Device can be challenging to troubleshoot if a connection to the I/O Controller will not establish. Below are some suggestions of possible things to consider:

- Verify the network cabling. Scan the network using both the DCP and Explore PROFINET Networks tools in PAC Machine Edition. The I/O Controller and I/O devices should display in both tools.

- Verify the spelling of an IO-Device name in the DCP return value from the I/O Device versus the I/O Device name in the IO-Controller configuration. Verify the I/O Controller configuration matches the configuration active in the I/O Controller.

- Simplify the configuration. Extra, unconfigured modules are generally not an error in PROFINET, so a simpler configuration could connect.

- Invalid configurations could be rejected. For example, disabling all Ethernet ports would lead to significant problems, so the connection with such a configuration is rejected outright. Simplifying the configuration back to defaults can help isolate problem areas and settings.

- PROFINET configuration occurs using the Ethernet IP settings. If an I/O Device cannot be PINGed from the IO-Controller's network location, the problems are more likely in the network or the IO-Device's DCP settings (such as the device has an incorrect name or no IP address) than the IO-Device configuration.

6.5   PROFINET Diagnosis Alarms

The RX3i CEP reports its own non-fatal errors and errors on modules in the remote node using PROFINET Pull/Plug or PROFINET Diagnosis alarms.

Diagnosis Alarms indicate any fault conditions other than a module add, loss, or mismatch that an RX3i CEP Carrier needs to communicate to the PROFINET Controller. Most faults generate Diagnosis alarms.

When the RX3i CEP Carrier detects a fault condition, it sends a Diagnosis alarm to the I/O Controller. If there is a Primary Application Relationship (AR) currently active that includes the affected module, the RX3i CEP sends the Diagnosis alarm over that AR. Otherwise, the alarm is placed in diagnosis memory in the RX3i CEP Carrier to be read later, and no alarm is sent. The RX3i CEP Carrier's OK LED is Amber ON and the FAULT status bit is set to 1. An alarm is not generated on subsequent connections.

The RX3i CEP automatically clears (and sends Diagnosis Disappears alarms for) these diagnosis faults after the fault condition has been corrected. If no additional conditions exist in memory, the OK LED is turned Green ON and the FAULT status bit is set to 0.

The following table lists the faults reported to the I/O Controller. The RX3i CEP generates all its application faults as channel diagnosis faults. The Alarm Type is Diagnosis or Diagnosis Disappears. The left column lists the Channel Error Type in PROFINET.

Pull/Plug alarm is included in the Section 6.1, *Configuration Faults*.

Refer also to section 5.2.1, *RX3i CEP Status and Control Data*.

Table 8

Channel Error Type	Diagnosis Alarm Type	Module or Channel Error	Cause	Fault Text	Recommended Action
1	Channel Diagnosis Appears/Disappears: Short Circuit	Module	Short Circuit	Short Circuit	Overcurrent/Short exists on at least one channel.
6	Channel Diagnosis Appears/Disappears: Line Break	Channel	Open Wire	Line Break	Verify wiring and that current source is energized.
7	Channel Diagnosis Appears/Disappears: Upper limit value exceeded	Channel	High Alarm Channel value is above configured High Alarm	Upper limit value exceeded	Bring process value below configured high alarm level.
8	Channel Diagnosis Appears/Disappears: Lower limit value exceeded	Channel	Low Alarm Channel value is below configured Low Alarm	Lower limit value exceeded	Bring process value above configured low alarm level.
16	Channel Diagnosis Appears/Disappears: Parameterization Fault	Module	Rejected Configuration The intelligent module rejected the configuration due to one of the parameters being incorrect.	Module not Configured	Verify the settings of the module with the module documentation. The module does not support all settings allowed by GSDML in non-Emerson I/O Controllers.
17	Channel Diagnosis Appears/Disappears: Power supply fault	Module	Loss of field power to module	Power supply fault	Verify field power to the specified module is wired and energized correctly. **Note** *This does not apply to the input power on the RX3i CEP.*

Channel Error Type	Diagnosis Alarm Type	Module or Channel Error	Cause	Fault Text	Recommended Action
18	Channel Diagnosis Appears/Disappears: Fuse blown / open	Channel	Short circuit	Fuse Blown	There are no corrective actions for this. Try to fix the IO module hardware.
257	Channel Diagnosis Appears/Disappears	Channel	Over range fault	Over Range	Correct Wiring Provide input in correct range (such as 4-20mA) Verify output is within range (remove shorts)
258	Channel Diagnosis Appears/Disappears	Channel	Under range fault	Under Range	Correct Wiring Provide input in correct range (such as 4-20mA) Verify output is within range (remove shorts)
259	Channel Diagnosis Appears/Disappears	Channel	High-high alarm Channel value is above configured High Alarm.	High-high alarm	Bring process value below configured High-high alarm level.
260	Channel Diagnosis Appears/Disappears	Channel	Low-low alarm Channel value is below configured Low Alarm.	Low-low alarm	Bring process value above configured Low-low alarm level.
261	Channel Diagnosis Appears/Disappears	Channel	Engineering Unit change from previous sample to current sample is negative and greater than Negative rate of change parameter.	Negative Rate of Change Alarm	Check the input history to understand whether it is expected.
262	Channel Diagnosis Appears/Disappears	Channel	Engineering Unit change from previous sample to current sample is positive and greater than Positive rate of change parameter.	Positive Rate of Change Alarm	Check the input history to understand whether it is expected.
263	Channel Diagnosis Appears/Disappears	Channel	Wiring fault RTD measurements are such that wiring problems are suspected	Wiring Fault	Verify RTD wiring and configuration.

Channel Error Type	Diagnosis Alarm Type	Module or Channel Error	Cause	Fault Text	Recommended Action
264	Channel Diagnosis Appears/Disappears	Channel	Calibration fault	Channel Calibration Fault	Pull and plug the I/O module to run calibration again. If still failed, replace another I/O module.
265	Channel Diagnosis Appears/Disappears	Channel	Scaling fault	Scaling Error	There are no corrective actions for this. Try replacing the I/O module.
266	Channel Diagnosis Appears/Disappears	Channel	Upper clamp fault	Upper Clamp Limit	Bring process value below configured upper clamp limit level.
267	Channel Diagnosis Appears/Disappears	Channel	Lower clamp fault	Lower Clamp Limit	Bring process value above configured lower clamp limit level.
268	Channel Diagnosis Appears/Disappears	Channel	Non-volatile store fault	Error writing to non-volatile memory	There are no corrective actions for this. Try store again or fix hardware.
269	Channel Diagnosis Appears/Disappears	Channel	Thermistor fault The thermistor in the thermocouple carrier is out of range	Thermistor fault	Verify the thermocouple carrier.
270	Channel Diagnosis Appears/Disappears	Channel	Automatically restart after a fatal error occurred	Restart after fatal error.	There are no corrective actions for this. Successfully restarting RX3i CEP module again may eliminate the fault.
271	Channel Diagnosis Appears/Disappears	Module	Loss of power input 1 fault	Loss of RX3i CEP power input 1	Verify field power to the power input 1 is wired and energized. If there did expect no power, set power supply configuration to Single in configuration tool.
272	Channel Diagnosis Appears/Disappears	Module	Loss of power input 2 fault	Loss of RX3i CEP power input 2	Verify field power to the power input 1 is wired and energized. If there did expect no power, set power supply configuration to Single in configuration tool.

Channel Error Type	Diagnosis Alarm Type	Module or Channel Error	Cause	Fault Text	Recommended Action
273	Channel Diagnosis Appears/Disappears	Module	Loss of terminal block fault	Loss of terminal block	Verify the terminal block is installed on specified module.
274	Channel Diagnosis Appears/Disappears	Module	The module internal temperature exceeds the allowable limit.	Over temperature	Decrease the temperature.
275	Channel Diagnosis Appears/Disappears	Module	Module output default mode mismatch	Module output default mismatch	Check the hardware configuration and DIP switch on the back of module.
276	Channel Diagnosis Appears/Disappears	Channel	Channel output has no load	Open load detected	Correct wiring, verify load on specified channel.
277	Channel Diagnosis Appears/Disappears	Channel	Short to power fault	Short to power	Verify input source and channel input type configuration.
278	Channel Diagnosis Appears/Disappears	Channel	Channel output over load	Circuit Overload	Correct wiring, verify load on specified channel.
279	Channel Diagnosis Appears/Disappears	Channel	Switch fail fault	Switch Failure	There are no corrective actions for this. Try power cycle the module.
280	Channel Diagnosis Appears/Disappears	Channel	Channel pulse test failed	Pulse Test Failure	There are no corrective actions for this. Try power cycle the module.
281	Channel Diagnosis Appears/Disappears	Channel	Channel communication failed	Loss of Circuit Communication	Check communication on specified channel.
282	Channel Diagnosis Appears/Disappears	Module	Group 1 power loss fault	Loss of Group 1 user side power	Verify field power to group 1 on the specified module is wired and energized correctly.
283	Channel Diagnosis Appears/Disappears	Module	Group 2 power loss fault	Loss of Group 2 user side power	Verify field power to group 2 on the specified module is wired and energized correctly.
284	Channel Diagnosis Appears/Disappears	Module	Group 1 power under voltage fault. For example: the 24Vdc supplied while the module configured to accept 125Vdc.	Group 1 user side power under voltage	Verify field power to group 1 on the specified module matches the module's field power configuration.

Channel Error Type	Diagnosis Alarm Type	Module or Channel Error	Cause	Fault Text	Recommended Action
285	Channel Diagnosis Appears/Disappears	Module	Group 2 power under voltage fault. For example: the 24Vdc supplied while the module configured to accept 125Vdc.	Group 2 user side power under voltage	Verify field power to group 2 on the specified module matches the module's field power configuration.
286	Channel Diagnosis Appears/Disappears	Module	Group 1 power over voltage fault. For example: the 125Vdc supplied while the module configured to accept 24Vdc.	Group 1 user side power over voltage	Verify field power to group 1 on the specified module matches the module's field power configuration.
287	Channel Diagnosis Appears/Disappears	Module	Group 2 power over voltage fault. For example: the 125Vdc supplied while the module configured to accept 24Vdc.	Group 2 user side power over voltage	Verify field power to group 2 on the specified module matches the module's field power configuration.

Appendix A PROFINET Specifications

Release 2.00 of the RX3i CEP Carrier supports PROFINET V2.3 Class A I/O Device with the clarifications listed in the following table. For version-specific updates, refer to the Important Product Information document provided with your version of the CEP Carrier.

A-1   PROFINET Protocol Support

RTC – Real time Cyclic Protocol: RT_CLASS_1

RTA – Real time Acyclic Protocol

DCP – Discovery and Configuration Protocol

CL-RPC – Connectionless Remote Procedure Call

LLDP – Link Layer Discovery Protocol – transmission only

MRP – Client role only (Manager role not supported)

A-2   Technical Data

Table 9

API	Single API (0) Used
Number of Application Relations supported	1 AR or 1SR-AR Set made of 2 SR-ARs
Maximum length of cyclic input data	512 bytes
Maximum length of output data	512 bytes
Acyclic communication	1024 Bytes for Read/Write Record
Alarm Types	Process Alarm, Diagnostic Alarm, Plug Alarm (implicit), Pull Alarm (implicit)
DCP	Get/Set/Identify supported. Only All, Name of Station, and Station Name Alias filters supported
Identification & Maintenance	I&M0 only
Context Management	by CL-RPC
Minimum cycle time	1ms
Ethernet rate	100 Mbit/s full duplex with auto-negotiation

A-3   Limitations

The following features are not supported in release 1.00:

RT over UDP IRT

Multicast communication

DHCP

DCP Hello service

DNS (Domain Name Service protocol) Fast Startup

SNMP

Supervisor-AR. Note: Supervisor-DA-AR is supported. (Device Access supported) CBA

Substitute Data

Only one Input-CR and one Output-CR are supported

General Contact Information

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

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

Technical Support

Americas
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                  Technical Support: support.mas.apac@emerson.com

Any escalation request should be sent to: mas.sfdcescalation@emerson.com

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

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