PACSystems™ RX3i PROFINET Controller

IC695PNC001-BFBE[1] [2]

Firmware Version 3.25

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[1] *Includes conformal coat and low temperature module variants, if available.*

[2] *The last two characters of the catalog number suffix may not increment with every firmware release beginning with IC695PNC001-BCBD Release 3.15.*

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Warnings and Caution Notes as Used in this Publication

⚠ WARNING

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

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

⚠ CAUTION

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

Note: Notes merely call attention to information that is especially significant to understanding and operating the equipment.

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Overview

The PACSystems™ RX3i PROFINET Controller module, IC695PNC001 or PNC001, connects a PACSystems RX3i controller to a high-speed PROFINET local area network. It enables the RX3i controller to communicate with I/O devices on the LAN. The PNC001 provides all the functions, services, and protocols required for certification as a PROFINET I/O Version 2.2 I/O Controller, running at both 100 Mbps and 1 Gbps.

The PNC001 supports 10/100/1000 Mbps Copper, 100/1000 Mbps Multi-mode Fiber, and 100/1000 Mbps Single-mode Fiber. The LAN can include media interfaces of more than one type. PROFINET communications on the LAN require 100 and 1000 Mbps link speed. 10 Mbps cannot be used for PROFINET communications. However, 10 Mbps can be used for other types of Ethernet traffic such as ping and telnet.

Features of the RX3i PNC001 include:

- Full configuration services for the RX3i PROFINET Controller, plus all connected Emerson and third-party I/O-Devices using PAC Machine Edition (PME).

- Firmware upgrades using the WinLoader software utility (if the host CPU has a serial port) or using a Web-based tool (if the host CPU has no serial port). Instructions are included with the firmware upgrade kit.

- Support for star, ring, and daisy-chain/line network topologies.

- Four switched Ethernet ports - two 8-conductor RJ-45 shielded twisted pair 10/100/1000 Mbps copper interfaces and two Small Form-factor Pluggable (SFP) cages for user-supplied SFP devices.

- Internal clock synchronized with the RX3i CPU for time-stamped diagnostics entries.

- Restart the pushbutton to manually restart the PNC001 without power cycling the system.

- LEDs: OK, LAN, STATUS, CONFIG, ACTIVE, and Port LEDs.

- Compliant with EU RoHS Directive using the following exemptions identified in the Annex: 7c-I and 7c-III.

Ordering Information

Part Number	Description
IC695PNC001	PACSystems RX3i PROFINET Controller Module 10/100/1000, 4 Ports - 2 SFP connections, 2 Copper
IC695SPC100	RX3i 10/100/1000base-TX (CAT5 100m) SFP
IC695SPF002	RX3i 100Base-FX (fiber 2 km) SFP
IC695SPF550	RX3i 1000Base-SX (fiber 550 m) SFP (MMF)
IC695SPF010	RX3i 1000Base-LX (fiber 10 km) SFP (Single mode fiber - SMF)

Specifications: PNC001

Specifications	Descriptions	
PROFINET Support	PROFINET Version 2.2 General Class A I/O-Controller. Redundantly controlled operation conforms to PROFINET V2.3 Type S-2 System Redundancy.	
RX3i CPU Compatibility	See the *Functional Compatibility* section.	
Power Requirements	*PNC001-Ax*	*PNC001-Bxxx*
	3.3 Vdc: 0.6 A with no SFP devices 1.3 A maximum (two SFP devices installed, 0.35 A per SFP device)	3.3 Vdc: 0.5 A with no SFP devices 1.2 A maximum (two SFP devices installed, 0.35 A per SFP device)
	5 Vdc: 1.5 A maximum	5 Vdc: 0.75 A maximum
Operating Temperature Range	**PNC001-Ax:** 0°C to 60°C **PNC001-Bxxx:** -25°C to 60°C Maximum surrounding air temperature without a fan. A lower maximum temperature may be required depending on the PNC001 location and SFP population. Refer to the section, *Operating Range for Surrounding Air Temperature (section 1.4)* in *PACSystems RX3i PROFINET I/O Controller Manual,* GFK-2571K or later.	
Number of Port Connectors	Two RJ-45 and two SFP Cages (SFP devices not included, available separately)	
Micro USB Connector	One, is for communication with a computer using Command Line Interface.	
LAN	IEEE 802.2 Logical Link Control Class I IEEE 802.3 CSMA/CD Medium Access Control 10/100/1000 Mbps	
Maximum I/O Memory	128 Kbytes of combined input/output memory per PROFINET Controller	
CPU Status Bits	32	
PROFINET I/O Device Data Update Rates on the PROFINET LAN	Configurable: 1 ms, 2 ms, 4 ms, 8 ms, 16 ms, 32 ms, 64 ms, 128 ms, 256 ms, and 512 ms	
Number of IP addresses	One	
Number of MAC Addresses	Five. One per external port and one internal.	
Hot-swappable	Yes	
System Maximum Limits		
PNCs per RX3i CPU	Four. Must be located in the main rack. Cannot be located in a remote node.	
I/O-Devices per I/O-Controller	128 per PROFINET Controller (Configured as an MRP Manager, the PNC001 is limited to managing no more than 63 MRP Clients).	
I/O-Devices per Network	255 per network, spread across up to 8 IO-Controllers	
I/O-Devices per RX3i CPU	255 per RX3i CPU, spread across up to 4 PROFINET Controllers	
I/O-Controllers per network	8	
Number of PROFINET Slots per device	256	
Number of PROFINET Subslots per slot	256	

Specifications	Descriptions
Number of PROFINET Submodules per RX3i CPU	2048
Programmer Limits	
Number of I/O-Controllers	128 (32 RX3i CPU targets × 4 IO-Controllers per RX3i CPU)
Number of I/O-Devices	4080 (255 per network × 16 PROFINET networks)
Total number of devices	4208 (does not include backplanes, power supplies, or I/O modules)

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

EMC Installation Requirements

To meet EN 55011 and FCC Class A radiated emissions, the Control system in which the IC695PNC001 module is used shall be mounted in a metal enclosure when three or more IC695PNC001 modules are used. All surfaces of the enclosure must be adequately grounded to adjacent surfaces to provide electrical conductivity. Wiring external to the enclosure must be routed in a metal conduit or equivalent. The conduit must be mounted to the enclosure using standard procedures and hardware to ensure electrical conductivity between the enclosure and conduit.

When installing, operating, or maintaining the IC695PNC001, personnel must ensure any electrostatic charge is discharged through the use of a grounded ESD strap or other means.

Installation Location

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 12mm (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 *PACSystems RX3i System Manual*, GFK-2314.

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 an 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

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

Status Reporting

The PNC001 provides 32 bits of status information to a configured location in the RX3i CPU's reference memory.

The status data consists of the Module OK bit, which indicates the health of the module itself, a status bit for each external port, and a bit that indicates the connection status of the configured devices.

All Status bits are active high. The status location may be configured in %I, %Q, %AI, %AQ, %R, %G, %T, %M or %W or I/O Variable reference memory in the RX3i CPU.

Bit	Name	Description
1 (lsb)	Module OK	Indicates the health of the PNC001 module. 1 indicates the module is functioning properly. 0 indicates the module is powering up or has failed.
2	Port1 Link Up	1 indicates the port is connected to another device and is operating correctly. 0 indicates the port is not connected to another device or the port has an error preventing communications, or the SFP cage is empty or has an incompatible SFP device.
3	Port2 Link Up	
4	Port3 Link Up	
5	Port4 Link Up	
6	Reserved	Reserved. Always 0.
7	Port3 SFP OK	Indicates the health of the SFP plugged in port 3. 1 indicates that the SFP matches the configuration and is operational. 0 indicates that either the SFP does not match the configuration or is not operational.
8	Port4 SFP OK	Indicates the health of the SFP plugged in port 4. 1 indicates that the SFP matches the configuration and is operational. 0 indicates that either the SFP does not match the configuration or is not operational.
9	All Devices Connected[3]	1 indicates all configured devices are connected and communicating over PROFINET. 0 indicates no devices are configured or one or more configured devices have not established a PROFINET connection.
10	Reserved	Always 0.
11	MRP Enabled	0 indicates that MRP is not enabled. 1 indicates that MRP is enabled.

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[3] *It is recommended that the All Devices Connected status bit be checked first to determine whether all devices belonging to the PNC001 are functioning. If this bit is 0, indicating that one or more devices is not OK, the PNIO_DEV_COMM function block can then be used to determine which specific devices are not communicating. For details on this status bit, refer to the section entitled Status Reporting in the RX3i PROFINET I/O Controller Manual, GFK-2571.*

Bit	Name	Description
12	MRP Role	If MRP is enabled: 0 indicates that the PNC001 is currently an MRP client. 1 indicates that the PNC001 is currently the MRP Manager. If MRP is not enabled, this bit will be set to 0.
13	MRP Ring Status	If MRP is enabled and the PNC001 is currently the MRM: 0 indicates that the ring is open (ring broken). 1 indicates that the ring is closed (ring complete). If MRP is not enabled or if the PNC001 is an MRC, this bit will be set to 0.
14-32	Reserved	Set to 0

LEDs on the PROFINET Controller Module

The table below summarizes LED functions. Note that there are differences between the -Ax version and the -Bxxx version. For detailed information refer to *Installation* and *Diagnostics* in *PACSystems RX3i PROFINET I/O Controller Manual,* GFK-2571K or later.

LED	Description
OK	Indicates whether the module is able to perform a normal operation.
LAN	Indicates network packets are being processed by the network interface (not just passing through the embedded switch).
STATUS	Indicates the condition of the PROFINET Controller during normal operation. It indicates whether an entry other than the startup event is present in the module's local log. STATUS can also indicate whether any of the MAC addresses are invalid.
CONFIG	Indicates whether the module has received its configuration from the RX3i CPU.
ACTIVE	Indicates the status of PROFINET connections.
USB	Indicates activity on the USB port (-Ax version only).
Port LEDs	Indicate link speed, link connection, and link activity corresponding to the four possible external Ethernet ports. Note differences between -Ax hardware implementation and behavior versus that of -Bxxx. Refer to GFK-2571K or later.

Quick Start

Before installing and operating the PNC001, refer to *PACSystems RX3i PROFINET I/O Controller Manual,* GFK-2571 for detailed information. Installation and initial startup procedures for the PNC001 include the following steps:

1. Pre-Installation check
2. Installing the PNC001 in an RX3i backplane

The PNC001 must be installed in the main (CPU) rack of the RX3i system, using a Universal Backplane such as IC695CHS007, CHS012, or CHS016. The PNC001 supports insertion/removal while power is applied to the system (hot-swap). This includes backplane power and field power supplied to the PNC001.

The rear of the PNC001 (-Ax version only) has an exposed heat sink which must be engaged into the backplane. Before inserting the module into the backplane, remove the plastic knockout from the slot where the module will be installed. The installation slot must match the slot that is selected for the module in the PME hardware configuration.

⚠ WARNING

Inserting or removing a PNC001 with power applied to the system may cause an electrical arc. This can result in unexpected and potentially dangerous action by field devices. Arcing is an explosion risk in hazardous locations. Be sure that the area is non-hazardous or remove system power appropriately before removing or inserting a PNC001

3. Connecting the PNC001 to the PROFINET network and a 10BaseT, 100BaseTX, or 1000BaseT IEEE 802.3 network for general Ethernet communications

   Note: Shielded cable is required for 1 Gbps operation.

⚠ CAUTION

Do not connect two or more ports on the PNC001 to the same device, either directly or indirectly, unless Media Redundancy is enabled in the PNC001's configuration.

If Media Redundancy will be used, do not close the network ring until after the Media Redundancy configuration which contains one node as a Media Redundancy Manager (MRM) has been downloaded to the PNC001. If a Media Redundancy Manager is not present, packets can continuously cycle on the network, using up significant network bandwidth.

4. Installing SFP devices

⚠ WARNING

Optical SFPs use an invisible laser to generate a fiber-optic signal. Always keep the port covered if a cable is not installed. Do not look into the open port if a cable is not installed.

⚠ WARNING

If the surrounding air operating temperature of the PNC001 is greater than 40°C, SFP devices could have operating temperatures over 70 °C (158 °F). Under these conditions, for your safety, do *not* use bare hands to remove an SFP device from the SFP cage. Use protective gloves or a tool (needle-nose pliers) to avoid handling the hot SFP device directly when removing the SFP device.

5. Configuring the PNC001 and its I/O Devices on a PROFINET network

PME is the primary tool used to configure an RX3i PROFINET network. In addition, certain parameters can be set from a computer through the PNC001's Command Line Interface. For details on system planning and configuration, refer to *PACSystems RX3i PROFINET I/O Controller Manual,* GFK-2571, Chapter 3.

⚠CAUTION

Whenever an RX3i PNC001 is extracted from a powered RX3i backplane, it loses power immediately which may result in data loss. Do not remove or insert the device while downloading hardware configuration to the system.

When the PNC001 is plugged back into a powered backplane, the PNC001 restores data from the internal non-volatile memory. If, however, the RX3i CPU has configuration data for the PROFINET Controller, it re-delivers the data to the PNC001, superseding parameters previously stored in non-volatile memory.

Release History

Version	Firmware Revision	Date	Comments
IC695PNC001-BFBE	3.25	May 2023	PACSystems RX3i PROFINET Controller (PNC) Release 3.25 adds support for MRP Fiber SFP Ring break detection during a single fiber break. It also resolves the issues found in *Problems Resolved in this Release.*
IC695PNC001-BFBE	3.21	Aug 2022	Manufacturing component issues.
IC695PNC001-BEBD	3.20	July 2022	Support for IC695CMM002 and IC695CMM004 MODBUS master and slave serial communications to the RX3i PROFINET scanners IC695PNS001-Bxxx, IC695PNS101, and IC695CEP001
IC695PNC001-BEBD IC695PNC001CA-BEBD IC695PNC001LT-BEBD	3.16	Nov 2021	The product's labels have been updated to show compliance with new certifications. For updated certifications, please refer to https://emerson-mas.my.site.com/communities/en_US/Article/Certifications-and-Agency-Approvals-Landing-Page.
IC695PNC001-BDBD	3.16	Sep 2020	Manufacturing update. No change to fit, form, or function.
IC695PNC001-BCBD	3.16	Aug 2020	Resolved a Loss of Device in an MRP Ring after the PNC001-Bxxx is reset.
IC695PNC001-BCBD[22]	3.15	Oct 2019	Rebranded the PNC001 to Emerson, applied patches for VxWorks URGENT/11 vulnerabilities, and made additional updates to enhance cyber security.
IC695PNC001-BBBC	3.11	May 2019	Resolves an issue sending COMMREQs to the IC695GCG001 Genius Communication Gateway if its PROFINET Device ID is 128 or greater.
IC695PNC001-BBBB	3.10	Nov 2018	Hardware change: slight housing dimension change to address the issue of difficulty installing a module into a slot with another module already installed in the left adjacent slot.
IC695PNC001-BABB	3.10	Oct 2018	Corrects these issues: PROFINET IO Not Scanned After Loss of Both Critical Ring Ports, Addition of IO Module Causes IO Device to Disconnect, and Bumpless IO Using Link Change Detection May Fail Using a PNC001-Bxxx as an MRM. Also includes updates to enhance cyber security.
IC695PNC001-BABA	3.00	Feb 2018	Redesign hardware and firmware for component obsolescence, reduce power requirements, and comply with EU RoHS.

Version	Firmware Revision	Date	Comments
IC695PNC001-AN	2.27	May 2017	Adds support for the Genius Communication Gateway's (GCG001) Switch BSM and Enable/Disable Outputs COMMREQs.
IC695PNC001-AM	2.26	Jun 2016	Supports the Remote Get HART Device Information COMMREQ. Information from a HART device connected to an RX3i Analog Module in an IC695PNS001 RX3i PROFINET Scanner may be read into the user application using the Remote Get HART Device Information COMMREQ.
IC695PNC001-AL	2.25	Nov 2015	Supports extended PROFINET device Subslot Numbers to support additional 3rd party devices. The maximum Subslot Number has been increased from 255 to 21845.
IC695PNC001-AK	2.20	May 2015	Added support for HART® Pass-Through feature set over PROFINET. A HART-capable PROFINET scanner (IC695PNS001 or IC695CEP001) must also be employed to support the HART-capable RX3i analog modules over PROFINET. The CPU used in the application must also contain firmware that supports HART Pass-Through.
IC695PNC001-AJ	2.11	Feb 2015	Increased number of PROFINET Devices that PNC001 can control from 64 to 128. Still limited to 63 devices in an MRP Ring if the PNC001 is the MRP Ring Manager. Added new *SFP OK* status bits to existing PNC001 status dword. Introduced new *Critical Network Port* diagnostic fault configuration and logging. Configuring ports as critical also forces Copper ports to 100 Mbps.
IC695PNC001-AH	2.05	Jun 2014	Adds support for COMMREQs required by the Genius Communication Gateway (GCG001) module.
IC695PNC001-AG	2.00	Dec 2013	Adds remote PROFINET IO to PACSystems RX3i Hot Standby Redundancy systems. Also adds MRP status bits. For details, see *New Features and Enhancements* hieronder.
IC695PNC001-AF	1.23	Aug 2013	Corrects issue storing PROFINET device configuration greater than 64K bytes in size. For details, see *RX3i PROFINET Controller IPI,* GFK-2573F.

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Version	Firmware Revision	Date	Comments
IC695PNC001-AE	1.22	Jul 2013	Corrects an issue where, in some configurations, the PNC001 entered a mode that caused it to repeatedly power up.
IC695PNC001-AD	1.21	Jul 2012	Addresses a power-up issue affecting the following revisions IC695PNC001-AB and IC695PNC001-AC. Although no units that exhibited this issue were shipped, it is recommended to update the firmware to prevent the possibility of encountering a power-up issue in the field.
IC695PNC001-AC	1.20	Mar 2012	Adds support for up to 255 PROFINET IO Devices per RX3i CPU.
IC695PNC001-AB	1.10	Dec 2011	Adds support for SNMP and LLDP standards to facilitate network management. Provides enhanced Revision Information in the Explore PROFINET Networks tool.
IC695PNC001-AA	1.00	Jun 2011	Initial release. Supports GSDML Version 2.2 and earlier.

Upgrades

Upgrade Kit: 41G2472-FW01-000-A7

Only IC695PNC001-Bxxx or later revision modules are field-upgradable to this release using the upgrade kit listed above. IC695PNC001-Ax modules cannot be upgraded with this kit due to hardware and firmware design changes in the PNC001-Bxxx revision.

Applications using the IC695CPE302, CPE305, CPE310, or CPE330 Version 10.05 (or later) with a PNC001-Bxxx must also upgrade the PNC to Version 3.16 (or later) for compatibility with the CPE3xx controller.

Release in line with software license compliance requirements.

New Features and Enhancements

The following feature was added in Release 3.25.

Feature	Description
MRP Fiber SFP Ring break detection during a single fiber break	The Rx3i Rack-based IC695PNC001-Bxxx PROFINET Controller and IC695PNS001-Bxxx/IC695PNS101 PROFINET Scanners can detect a ring break on a single fiber of the network fiber pair on a fiber SFP. All the supported Fiber SFP modules use LC connector type fiber optic cables. These cables consist of a pair of fibers that connect the TX/RX of two fiber SFP modules. The modules detect a break when the RX signal is no longer detected. In practice, that means that if only one fiber of the pair is broken, only 1 of the SFP modules detects that the ring is broken. On the RX3i PNS001-Bxxx, PNS101-Axxx, and PNC001-Bxxx, when 1 of the fibers of the pair is broken between 2 SFP modules, the ring indicates that it is open and self-heals. Since only 1 of the SFP modules detects the lost RX signal, only 1 of them indicates that the Link is down on the front panel Link LED and in the module's port Link status bit. **Note:** The feature requires the IC695PNC001-Bxxx and IC695PNS001-Bxxx/IC695PNS101. It is not available on the IC695PNC001-Ax PROFINET Controller, the IC695PNS001-Axxx PROFINET Scanner, and the IC200PNS001/IC200PNS002 VersaMax PROFINET Scanners.

Problems Resolved in this Release

The following problem was resolved in Release 3.25.

Problem	Defect ID	Resolution
Cyber Security Updates	DE9617 SFDC02002236	Added security enhancements to harden the product against a malicious actor.

Functional Compatibility

The following CPU firmware and programming software versions are required to use the features introduced in PNC001 release 2.00 and later:

Subject	Feature	Minimum Version Required
RX3i backplane hardware	RX3i backplane hardware	The following *minimum* backplane hardware revision *must* be used: IC695CHS012-BAMP IC695CHS016-BAMP IC695CHS012CA-BAMP IC695CHS016CA-BAMP or IC695CHS012-CA (or later) IC695CHS016-CA (or later) IC695CHS012CA-CA (or later) IC695CHS016CA-CA (or later) or IC695CHS007-AA (or later) When installing, operating, or maintaining the IC695PNC001, personnel must ensure any electrostatic charge is discharged through the use of a grounded ESD strap or other means.
PLC CPU Firmware Version Requirements	RX3i PNC001 Release 3.20 IC695CMM002/004 support in IC695PNS001-Bxxx, IC695PNS001, and IC695CEP001	CPE330 Release 10.30 CPE310/CPE305/302 Release 10.30
	RX3i PNC001-Bxxx Release 3.00 New Hardware & Firmware to Resolve Component Obsolescence	CPE330 Release 8.95 CPU320/CPU315 Release 8.95 CPE310/CPE305 Release 8.95 CRU320 Release 8.95 CPE302 Release 9.40 (Other CPU models are not supported)
	RX3i PNC001 Release 2.26 Support Remote Get HART Device Information COMMREQ	CPE330 Release 8.95 CPU320/CPU315 Release 8.95 CPE310/CPE305 Release 8.95 CRU320 Release 8.95 CPE302 Release 9.40 (Other CPU models are not supported)

Subject	Feature	Minimum Version Required
	Extended PROFINET device Subslot Number range	CPE330 Release 8.70 CPU320/CPU315 Release 8.70 CPE310/CPE305 Release 8.70 CRU320 Release 8.70 CPE302 Release 9.40 (Other CPU models are not supported)
	RX3i PNC001 Release 2.20 HART Pass-Through	CPE330 Release 8.50 CPU320/CPU315 Release 8.50 CPE310/CPE305 Release 8.50 CRU320 Release 8.50 CPE302 Release 9.40 (Other CPU models are not supported)
	RX3i PNC001 release 2.11 (or later) Hot Standby Redundancy with PROFINET I/O	CRU320 Release 8.40 CPE330 Release 8.70 (Other CPU models are not supported)
	RX3i PNC001 Release 2.00 Hot Standby Redundancy with PROFINET I/O	CRU320 Release 8.00 CPE330 Release 8.70 (Other CPU models are not supported)
	RX3i PNC001 Release 2.00 Non-Hot Standby Redundancy system	CPU320/CPU315 Release 7.13 CPE310/CPE305 Release 7.10 CRU320 Release 8.00 CPE302 Release 9.40 (Other CPU models are not supported)
PROFINET Controller version requirements	Single fiber break detection	IC695PNC001-Bxxx Release 3.25
	IC695CMM002/004 support in IC695PNS001-Bxxx, IC695PNS001, and IC695CEP001	IC695PNC001-Bxxx 3.20
	Applications using the IC695CPE302, CPE305, CPE310, or CPE330 Version 10.05 (or later) with a PNC001-Bxxx must also upgrade the PNC to Version 3.16 (or later) for compatibility with the CPE3xx controller.	IC695PNC001-Bxxx: 3.16

Subject	Feature	Minimum Version Required
	If using PROFINET System Redundancy, users MUST upgrade the PNC001 (PROFINET Controller) to Version 2.2 or later firmware.	Effective with PME 8.6 SIM 3 and PME 8.5 SIM 11 (PPS 2.6 SIM3 and PPS 2.5 SIM11), the PNC001 is configured to use RT Class 2 for redundant PROFINET connections. To meet specifications, this requires PNC001 firmware 2.2 or later. **Under these conditions, redundant VersaMax and/or CEP PROFINET I/O will NOT connect or transfer I/O or Alarm Data if the PNC001 is running firmware prior to Version 2.2.**
RX3i PROFINET Scanner Version Requirements	Single fiber break detection	IC695PNS001-Bxxx or IC695PNS101 Release 3.40
	IC695CMM002/004 support in IC695PNS001-Bxxx, IC695PNS001, and IC695CEP001	IC695PNS001 Bxxx or IC695PNS101 with firmware version 3.35 or later and GSDML version: GSDML V2.3 IntelligentPlatformsLLC RX3iPNS-20210817.xml
	RX3i PNC001 Release 3.00 New HW/FW to address component obsolescence	IC695PNS001 with firmware version 3.00 or later and GSDML version: GSDML-V2.3-GEIP-RX3iPNS-20170109.xml.
	RX3i PNC001 Release 2.26 Support Remote Get Device Information COMMREQ	IC695PNS001 with firmware version 2.41 or later and GSDML version: GSDML-V2.3-GEIP-RX3iPNS-20160602.xml.
Programmer version requirements	IC695CMM002/004 support in IC695PNS001-Bxxx, IC695PNS001, and IC695CEP001	PME 10.00 or later
	RX3i PNC001 Release 3.00	PME 8.50 SIM 9 or 8.60 SIM 1
	RX3i PNC001 Release 2.11(or later) 128 PROFINET Device Support[4] Critical Network Port[4]	PME 8.50 SIM 9 or 8.60 SIM 1
	RX3i PNC001 Release 2.00 (or later) Hot Standby Redundancy with PROFINET I/O Non-Hot Standby Redundancy system using CRU320	PAC Machine Edition 8.00 SIM 5

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[4] *Attempts to store a configuration utilizing this feature to a prior-release PNC001 will result in an Unable to deliver configuration to module fault, which leaves the PNC001 in an un-configured state.*

Subject	Feature	Minimum Version Required
	RX3i PNC001 Release 2.00 (or later) Non-Hot Standby Redundancy system	PAC Machine Edition 7.00 SIM 8

PNC001-Bxxx and PNC001-Ax Hardware Comparison

This section outlines the differences between the new (-Bxxx) and old (-Ax) hardware implementations. Functionally, the two are equivalent, except for the removal of the micro USB port and the Command Language Interface (CLI) which operated via that port.

Topic	-Ax	-Bxxx
Appearance	Refer to Figure 2, GFK-2571K	Refer to Figure 3, GFK-2571K
Case	Plastic	Metal
Attachment to Rack	Via plastic case latch and heatsink screw	Via two Phillip's head machine screws
Heatsink	Remove a plastic knockout from the rack	No knockout removal required
Status LEDs	6 LEDs	5 LEDs (no USB LED)
LED Behavior	Refer to Section 2.8, GFK-2571K	Refer to Section 2.8, GFK-2571K
Ethernet Port LEDs	4 singleton LEDs (top of the faceplate)	4 banks of LEDs (bottom of the faceplate). The digits representing the port numbers are backlit by LEDs.
µUSB Port	Present	Absent
Command Line Interface	Uses µUSB Port	Not available
RJ45 Connector on Faceplate	Absent	Present (Disabled)
Power Requirements	Higher	Lower
Operating Temperature Range	0°C to 60°C	-25°C to 60°C
Module Reset	Pushbutton "Restart"	Membrane "Reset"

Restrictions and Open Issues

Restrictions and Open Issues related to PNC001 Operational Behavior

Issue	Description
PNC001 indicates premature MRP Ring closure and logs extra Ring Closed/Ring Open faults when the network cable reconnected	Two scenarios can cause the PNC001 to indicate that an MRP Ring is closed when, in fact, it is still open. The scenarios are: 1. When either an RX3i PNS001 or PNC001 that participates in the MRP ring as an MRP Client communicating via Copper or Fiber SFPs is powered-up in the MRP ring, extra Ring Closed/Ring Open faults are logged in the I/O fault table. A Ring Closed fault occurs during the initial stage of the PNS001/PNC001 power-up, followed by a Ring Open fault in the middle of the PNS001/PNC001 power-up sequence, and finally a Ring Closed fault occurs when the PNS001/PNC001 completes power-up (OK LED on). 2. When the first of two MRP ring breaks is restored, extra Ring Closed/Ring Open faults are logged in the I/O fault table. Upon restoration of the first ring break, a Ring Closed fault occurs, followed by a Ring Open fault. Then upon restoration of the second ring break, a final Ring Closed fault occurs. The duration between faults is a function of the PNC001's configured MRP Default Test Interval and Test Monitoring Count. When either of the two scenarios is invoked, the user sees extra Ring Closed/Ring Open faults in the I/O Fault Table. The extra Ring Closed/Ring Open fault may be ignored.
Store of HWC to the PNC001 may result in three IOC Software Faults	On very rare occasions, storing a very large I/O LAN intensive hardware configuration to the PNC001 may result in three IOC Software faults. The faults tend to occur after a large number of changes are made to the hardware configuration or the current hardware configuration in the system is cleared prior to storing a new configuration. If the controller is Faulted, clear the I/O Fault Table to recover. Otherwise, no additional steps need to be taken, and the faults may be ignored.
STXPNS001 Firmware revision is not displayed correctly when viewed using PAC Machine Edition PROFINET Explorer	PAC Machine Edition does not display firmware revision information correctly for the STXPNS001. To view the correct firmware revision information, use HyperTerminal.

Issue	Description
Clearing RX3i controller memory when it contains a mismatched configuration of Slice I/O causes the programming software to disconnect and the RX3i PNC001 to reset	Downloading a mismatched configuration for a Slice IO node and then clearing the RX3i CPU's memory causes PAC Machine Edition to disconnect and the RX3i PNC001 to reset itself. To recover from this fault, either: • Wait for PNC001 to auto-reset and the OK LED to turn on (solid green), then clear the PLC user memory. • Power cycle the PLC without a battery/energy pack attached. Storing the valid configuration will allow the system to start up without any faults.
Loss of IO Device following hot insertion of mismatched VersaMax I/O module	In very rare cases, hot insertion of a mismatched VersaMax I/O module (for example, an MDL650 is a slot configured for an MDL640) into the VersaMax PNS can cause a loss of connection between the PNS and the controlling PNC(s). No user action is required. When this behavior is seen, the controlling PNC(s) will automatically reconnect to the VersaMax PNS.
Unexpected *Loss of Device* faults	*Loss of Device* faults for currently connected devices may appear in the PLC I/O Fault table and/or PNC001 local log when the PNC001 is reset via its reset pushbutton.
Unintended operation of PNIO_DEV_COMM function block	The power flow output of the PNIO_DEV_COMM function block provides validation of the input parameters and confirms that the PNC001 has locally processed the configuration of the specified I/O Device. As currently implemented, the power flow output will not turn ON until after the PNC001 has made its first attempt to connect to the specified I/O Device. Therefore, we recommend the user not rely on power flow output for parameter validation.
IOC SW Fault with large configurations	When storing a configuration to the PNC001 that is close to the upper limit of the controlling PLC's user memory, the store may fail with an IOC SW Fault logged in the PLC's I/O Fault table. The workaround to resolve this issue is to clear the PLC's existing configuration and store the configuration again.

Issue	Description
The Push and Hold behavior of the PNC001 Restart Pushbutton results in the CRU320 taking up to 1 second to detect that PNC001 is no longer available	When the PNC001 reset button is held down for more than 1 second, the CRU320 can take up to 1 second to detect the loss of the PNC001 (after the PNC001 module resets). This causes a delay in the CPU signaling the *Loss of IOC*, and in taking the appropriate fault actions (setting point faults, stopping the controller if *Loss of or Missing I/O Controller faults* are configured as Fatal, etc.) In a Hot Standby Redundancy System, if the system is synchronized and the PNC001 in question is in the active unit, this also causes a delay in the redundant system failing over to the backup unit. If this delay exceeds the Redundancy Data Hold Time (RDHT) for a given I/O Device, that IO Device will disconnect from the backup unit before the failover occurs. It is not recommended to use the PNC001 reset button in a normal operating system. If the reset button must be used, it is recommended to first attempt a brief press and release of the PNC001 reset button (the PNC001 should reset as soon as the button is released). Only if the first attempt fails should the PNC001 button be depressed until the PNC001 resets (approximately 2-3 seconds).
Breaking and reconnecting an MRP ring by pulling either of the two MRM ports of the PNC001 causes extra ring open/close faults	In some cases, if the network is broken and repaired at either of the two ring ports of a PNC001 configured to be the MRM, an extra I/O Bus Fault-Redundant Ethernet network ring is broken (open) and the I/O Bus Fault-Redundant Ethernet network ring okay (closed) faults are logged in both the I/O Fault Table and the PNC001 Local Log when the ring is repaired. These additional faults can safely be ignored as long as the last fault to be logged is the I/O Bus Fault-Redundant Ethernet network ring okay (closed). Additional verification of ring status can be obtained by issuing a *show rdnMedia* command using the PNC001's CLI interface.

Restrictions and Open Issues related to the Command Line Interface
(-Ax Version Only)

Restriction/Open Issues	Description
Invalid help response for invalid CLI commands	Occasionally, the CLI will return invalid help suggestions if the user attempts to get help on an invalid command by using the question mark key. Attempting to issue the command based on this help text will result in an Error: Bad command response from the CLI. Use the help command to view a list of available commands. For more information on available CLI commands, please refer to the PACSystems RX3i High-Speed I/O LAN Command Line Interface Manual, GFK-2572A, or later.

Restriction/Open Issues	Description
Page function not available	The output paging function, as described in the *shConfig* command, is not currently functioning.
Response to invalid command entry	The error message displayed in response to an invalid show port help command does not provide useful information. Example: *show port fdp* help is an invalid command. To see a list of valid parameters for the *show port* command, type `show port ?`
telnetd command response	The CLI does not echo the new number of max connections in its response to the *telnetd <maxconnections>* command. However, the command still functions properly and updates the maximum number of telnet connections.
log details command response	When displaying numerous local log table entries using the *log details* command, sometimes erroneous blank characters appear within the display. Use the *log details <log entry number>* command to view the disrupted log table entry. Example: *log details 99*.
term command response	Occasionally, the CLI does not respond to the *term* command. To recover, restart the terminal emulation program.

Operational Notes

Operational Note	Description
Storing updated media redundancy protocol (MRP) configurations to large operating MRP ring networks with fast IO update rates configured can result in PROFINET I/O device Loss/Add faults	When storing Media Redundancy Protocol (MRP) configuration updates to an operating MRP ring network, users may infrequently observe one or more pairs of *Loss of Device* and subsequent *Addition of Device* faults regarding PROFINET I/O Device faults on the network. This is expected behavior and is more likely to occur on ring networks with a large number of PROFINET I/O Devices acting as MRCs with very fast I/O Update Rates configured. Because changing MRP configuration settings require each MRC to break and reconnect its connections to the ring network, IP packets on the network may be lost as this flurry of connection breaks/ reconnects occur on the network. Since a PROFINET I/O Device is considered lost if it misses three consecutive I/O data transactions if three consecutive I/O data packets from a particular PROFINET I/O Device are lost due to network reconfiguration, the device will appear to be lost to the PNC001 and a *Loss of I/O Device* is logged. When the network stabilizes, the PNC001 will be able to re-establish connection with the lost IO Device and an *Addition of I/O Device* fault will be logged.

Operational Note	Description
Data packets arriving on ports blocked by Media Redundancy Protocol (MRP) still forwarded over mirrored ports	When a network is configured for MRP operation, MRCs and Media Redundancy Managers (MRMs) can put one of their ring ports into a *Blocking* state. MRP uses this blocked port state to break the continuous ring and allow only MRP management traffic to pass through the blocked port. All of the non-MRP management traffic is blocked from ingress or egress of the blocked port. If the port has been set up using the port mirroring *monport* command, to monitor traffic on the blocked port, <u>all</u> of the traffic that arrives at the blocked port is mirrored to the configured monitor port regardless of whether or not the traffic is MRP management traffic. This makes it appear that the traffic is being sent or received on the blocked port even though it is not.
Network monitoring devices should be directly connected to mirrored PNC001 ports	When using the port mirroring *monport* command to monitor Ethernet traffic, you should directly connect your PC/Laptop to the port on the PNC001 that is monitoring the traffic. If there is an intervening switch in the mirrored path, the mirrored traffic will corrupt the intervening switch's routing table. A corrupted routing table can cause dropped Ethernet packets, resulting in the loss of PROFINET I/O and/or other Ethernet communication.
PROFINET IO *Device Loss/Add* Faults for 3rd party I/O devices may occur on hardware configuration store in some large network configurations	When storing hardware configurations with more than 64 PROFINET I/O Devices that include multiple PNC001 modules and 3rd party PROFINET I/O Devices on a single network, occasional *Loss/Addition of I/O Device* faults may be logged for some 3rd Party PROFINET I/O devices. The devices should operate normally after being re-acquired by their controlling PNC001 module. The *Loss/Addition* faults can be disregarded.
PROFINET DCP – Direct Connection indicates that no valid Ethernet adapters are available for PROFINET DCP discovery (must run PME as Administrator to use this feature)	Beginning with PME 8.60, the PROFINET DCP tool requires elevation to administrator privilege to run when it is launched by right-clicking on a PNC001. Since the PME installation does not set up PME or any of its internal tools to run at the administrator privilege level, you will have to inform Windows that you want it to run PME as an administrator. There are two ways to do this: 1. Right-click on the PME icon (and any other shortcuts associated with PME) and select properties. Then select the Compatibility tab and check the checkbox for *Run this program as an administrator*. 2. Right-click on the PME icon and select properties. Then select the Advanced button and check the checkbox *Run as administrator*. This method shows *Run as administrator* in **bold** when you right-click on the icon in the future. You may also launch the PROFINET DCP tool from the Utilities tab menu in PME. However, this launch method does not provide full functionality of the tool. That is, it does not compare I/O devices found to any configuration in the PME Project. Also, if PME was not launched as an administrator, this method of launching the DCP tool requests the user's permission to elevate access to administrator privilege.

Operational Note	Description
PNC001-Ax Reset or Power Supply Fault with PSA140	These issues may occur in a system with a PNC001-Ax module and two IC695PSA140 *Multifunctional 120/240 VAC, 125VDC 40W Power Supplies* when either of the power supplies are turned off and back on: 1. The PNC001-Ax resets and does not power back on. 2. The P/S Fault LED on PSA140 that was not powered off and back on turns on and no power is supplied to the modules in the RX3i rack. If this issue occurs, it may be resolved by turning both power supplies off and back on. This issue only applies to the PNC001-Ax.
Monitoring Remote IO Device Availability	Applications using PROFINET IO should monitor the availability of remote IO devices and take appropriate action if the device becomes unavailable due to a network connectivity issue, power failure at the remote device, etc. PROFINET IO device status is available by monitoring the Controller's *All Devices Connected* status bit, using the *PNIO_DEV_COMM* function block, or monitoring the CPU's IO Fault Table for *Loss of Device* faults. Individual IO modules within a PROFINET IO device should also be monitored so that appropriate action may be taken if the IO module becomes unavailable. The status of input modules may be monitored by enabling point faults and monitoring the fault contact within the application. Outputs may be monitored by looping critical points to an input module and verifying the output value.
Loss / Add of IO Device during dual power up	If both IO Controllers of a PNSR system are powered up at the same time and attempt to connect to redundant PROFINET IO devices at the same time, the second of the two connection attempts will be rejected until the first connection completes. This rejection will cause a Loss of IO Device fault. When the retry is attempted, it will succeed, and an Addition of IO Device fault will be issued. This is an expected operation. If one system is powered on slightly before the other, this condition does not occur.

Additional Information

For additional information, please refer to the manuals listed below. Manuals can be downloaded from the Support website. Please see the link located at the end of this document.

PACSystems RX3i PROFINET I/O Controller Manual	GFK-2571
PACSystems RX3i PROFINET Controller Command Line Interface Manual	GFK-2572
PACSystems RX3i PROFINET Scanner Manual	GFK-2737
PACSystems RX3i CEP PROFINET Scanner User Manual	GFK-2883
PACSystems RX3i System Manual	GFK-2314
PACSystems RX3i and RSTi-EP CPU Reference Manual	GFK-2222
PACSystems RX3i and RSTi-EP CPU Programmer's Reference Manual	GFK-2950
PROFINET I/O Devices Secure Deployment Guide	GFK-2904
PACSystems Rxi, RX3i, and RSTi-EP Controller Secure Deployment Guide	GFK-2830
PACSystems RX3i Genius Communications Gateway User Manual	GFK-2892
PACSystems HART Pass-Through User Manual	GFK-2929
PACSystems Hot Standby CPU Redundancy User's Manual	GFK-2308

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

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