GE

Automation & Controls
Programmable Control Products

PACSystems*RX3i PROFINET IO-Scanner User Manual

GFK-2737J

July 2018

Warnings, Cautions, and Notes as Used in this Publication   **GFL-002**

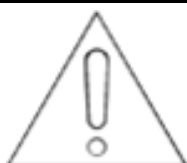|	
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Chapter 1 Introduction

GE Automation and Controls offers the following types of RX3i PROFINET Scanners:

- IC695PNS001 is the general-purpose version of this product. It acts as the "head-end" of its RX3i I/O rack, scanning all configured I/O modules within that rack and interfacing via PROFINET with one or more PROFINET IO Controllers. A list of supported products is provided in Section 1.7. Extension racks are not supported. Two hardware implementations, -Axxx and -Bxxx, are documented in this manual.

- IC695PNS101 is the RX3i Advanced PROFINET Scanner. The IC695PNS101 is being deployed initially to support the RX3i Sequence of Events (SOE) functionality. Operation and restrictions are documented in the *PACSystems RX3i Sequence of Events User Manual*, GFK-3050. It is physically identical to the -Bxxx implementation of IC695PNS001.

- IC695CEP001: a PROFINET Scanner which may control a sub-set of RX3i I/O modules in a remote I/O drop. For product details, refer to the *PACSystems RX3i CEP PROFINET Scanner User Manual*, GFK-2883.

This chapter provides an overview of the PACSystems RX3i PROFINET Scanner (PNS) module and its operation. Section 1.8 provides a glossary that summarizes many terms used in the manual.

Note: For the IC695PNS001-BABA or later revisions there are some differences that will be outlined in this manual. This revision is backward compatible with the previous PNS modules, but has a different front panel look and upgradability to certain future features.

Chapter 2, *LED Operation and Connector Details,* provides detailed description of the module's indicators and ports

Chapter 3, *Installation*, gives instructions for PNS module installation and replacing a PNS module. Provides information for selecting SFP modules and network cabling and connectors.

Chapter 4, *Configuration*, describes how to configure the RX3i PROFINET Scanner and its associated IO-devices.

Chapter 5, *Operations*, describes powering up and restarting the RX3i PROFINET Scanner, the input status data, replacing I/O modules while scanning, and how to update the firmware.

Chapter 6, *Diagnostics*, describes configuration faults, how to check the RX3i PROFINET Scanner version information, fatal error handling, and some common troubleshooting suggestions.

Appendix A, *PROFINET Specifications*, summarizes the features specified for PROFINET v2.3 Class A IO-Devices that are supported by the RX3i PROFINET Scanner module.

The PACSystems RX3i PROFINET Scanner (PNS) module, IC695PNS001, connects a remote universal RX3i I/O rack of Series 90-30 or RX3i modules to a PROFINET I/O Controller. The PROFINET Scanner scans the modules in its rack, retrieving input data and providing output data, and exchanges that data on the PROFINET I/O LAN at the configured production rate.

The PNS manages PROFINET communication and module configuration between an I/O Controller and modules in the remote rack. If network communications are lost, the PNS manages I/O states according to the individual module configurations.

The PNS supports 10/100/1000 Mbps Copper, 100/1000 Mbps multi-mode fiber, and 100/1000 Mbps single-mode fiber. PROFINET communications on the network require 100 or 1000 Mbps link speed. Although 10 Mbps cannot be used for PROFINET communications, 10 Mbps can be used for other types of Ethernet traffic such as PING.

Features of the RX3i PNS include:

- Full programming and configuration services for all supported Series 90-30 and RX3i I/O Modules using Proficy* Machine Edition. For a list of currently supported I/O modules, refer to the Important Product Information (IPI) document provided with the firmware version on your PNS module.
- Support for daisy-chain/line, star, or ring (redundant media) topologies.
- Four switched Ethernet ports - two 8-conductor RJ45 shielded twisted pair 10/100/1000 Mbps copper interfaces and two Small Form-factor Pluggable (SFP) cages for user-supplied SFP devices.
- The network can include media interfaces of more than one type.
- Support for transfer of IO-Device Name to another PNS module using an SD card. This eliminates the need to connect a configuration tool, such as Proficy Machine Edition when replacing a module.
- A front panel port for field updates of firmware. Either a USB port or Ethernet port is provided for this purpose depending on the revision of the PNS module.

Note: For -Axxx HW versions, the USB port is for firmware upgrades only. It is not intended for permanent connection.

For -Bxxx HW versions, the front panel RJ45 Ethernet port is for firmware upgrades only.

1.1 Revisions in this Manual

Rev	Date	Description
J	Jul-2018	• Addition of IC695CPL410 and IC695PNS101 (new related products). • Addition of I/O module vs PNS firmware compatibility list (Section 1.7). • Support of IC695HSC304.
H	Mar-2018	• Added CPE302 throughout • Added compatibility with CPE100 embedded PROFINET • Added details in Section 4.2.1, *Adding an RX3i PROFINET Scanner to the PROFINET LAN*
G	Feb-2017	• Updates for new hardware version -Bxxx.
F	Dec-2016	• Updates for CPE400 (new related product). • Updated list of supported I/O Modules in Section 1.7 per GFK-2738L • Added footnotes tracking PNS firmware support for various I/O modules. • Added footnotes tracking PNS firmware support for various features, such as HART Pass Through. • Added note on support for *Remote Get HART Device Information COMMREQ.*
E	Apr-2015	In Section 1.7, corrected data for IC695SPF010 in table
D	May-2014	• In Section 4.2.6, *Configuring Module Parameters*, added Universal Analog Input Module and Power Sync and Measurement Module and related rules to the table, • In Section 4.2.6.1, *RX3i PROFINET Scanner Configuration Validation,* added IC695ALG600 to the table.

1.2 RX3i PROFINET Scanner Specifications

PROFINET Support	PROFINET Version 2.3 Class A IO-Device Redundantly controlled operation conforms to PROFINET V2.3 Type S-2 System Redundancy.	
Controller CPU Version Required	RX3i CPU315/CPU320 with firmware version 7.10 or later RX3i CPE305/CPE310 with firmware version 7.10 or later RXi Controller with firmware version 7.80 or later. All versions of CPE302.	
Proficy Machine Edition Version Required	Version 8.5 SIM2 or later	

Power Requirements	**Rev. –Bxxx or later:**
	3.3Vdc: 0.6A with no SFP devices
	        1.3A maximum (two SFP devices installed, 0.35 A per SFP)
		Rev. –Axxx:
		3.3 Vdc: 1.2A with no SFP devices installed,
		        1.9A maximum (two SFP devices installed, 0.35A per SFP)

	Rev. –Bxxx or later: 5 Vdc: 0.7 A maximum	**Rev. –Axxx**: 5 Vdc: 1.1A maximum
Operating Temperature Range	**Rev. -Bxxx or later**: -25°C to 60°C de-rated to 57°C: • If 100 Mbps Fiber SFPs installed, or • If Copper SFPs operating at 1 Gbps	**Rev. -Axxx**: 0°C to 60°C de-rated to 57°C: • If 100 Mbps Fiber SFPs installed, or • If Copper SFPs operating at 1 Gbps
Number of PROFINET Ports	Two RJ45 and Two SFP Cages (SFP devices not included, available separately.)	
Front Ethernet Port (for firmware upgrades)	**Rev. –Bxxx or later**: One RJ45 supporting 10/100/1000Mbps Ethernet for firmware updates.	**Rev. – Axxx**: One Micro-B connector. USB 2.0 compliant running at Full-speed (12 MHz)
SD Card	Supports SD and SDHC cards.	
PNS Status and Control Bits	32 input status bits and 32 output control bits	
PROFINET I/O production rate (ms) (I/O Update Rate)	Configurable selections: 1, 2, 4, 8, 16, 32, 64, 128, 256 or 512 ms	
Number of MAC Addresses	**Rev. -Bxxx or later**: 6 One per external port (including additional front panel port) and one internal for switched ports.	**Rev. -Axxx**: 5 One per external port and one internal.
I/O Station Maximum Limits	**Number of I/O Modules per station**	Number of backplane slots in the host RX3i rack less one for PNS001 module itself less the number of slots occupied by the RX3i power supply
	I/O data per station	2880 bytes total 1440 bytes of input data 1440 bytes of output data
Configuration	V2.3 GSDML file. The file is included with Proficy Machine Edition; available for import into 3rd-Party tools. **Note:** Configuration software that supports GSDML V2.3 MenuList elements (such as Proficy Machine Edition 8.0 or later) is required to display the configuration parameters of most IC695xxx I/O modules. **Note:** There are different, dated revisions of the GSDML file. The file contained in the firmware update kit should be used with a particular release. PME contains the most current version of the GSDML file with each SIM. The GSDML file for the RX3i PROFINET Scanner contains support for the PNS001 (both -Axxx and -Bxxx hardware implementations) and the PNS101. All of the IO module information is present in that file, only once, and each PNS refers to the modules it supports. Thus, it is not possible to select I/O modules that are incompatible with the identified PNS.	

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

1.3 RX3i PROFINET Scanner Controls and Indicators
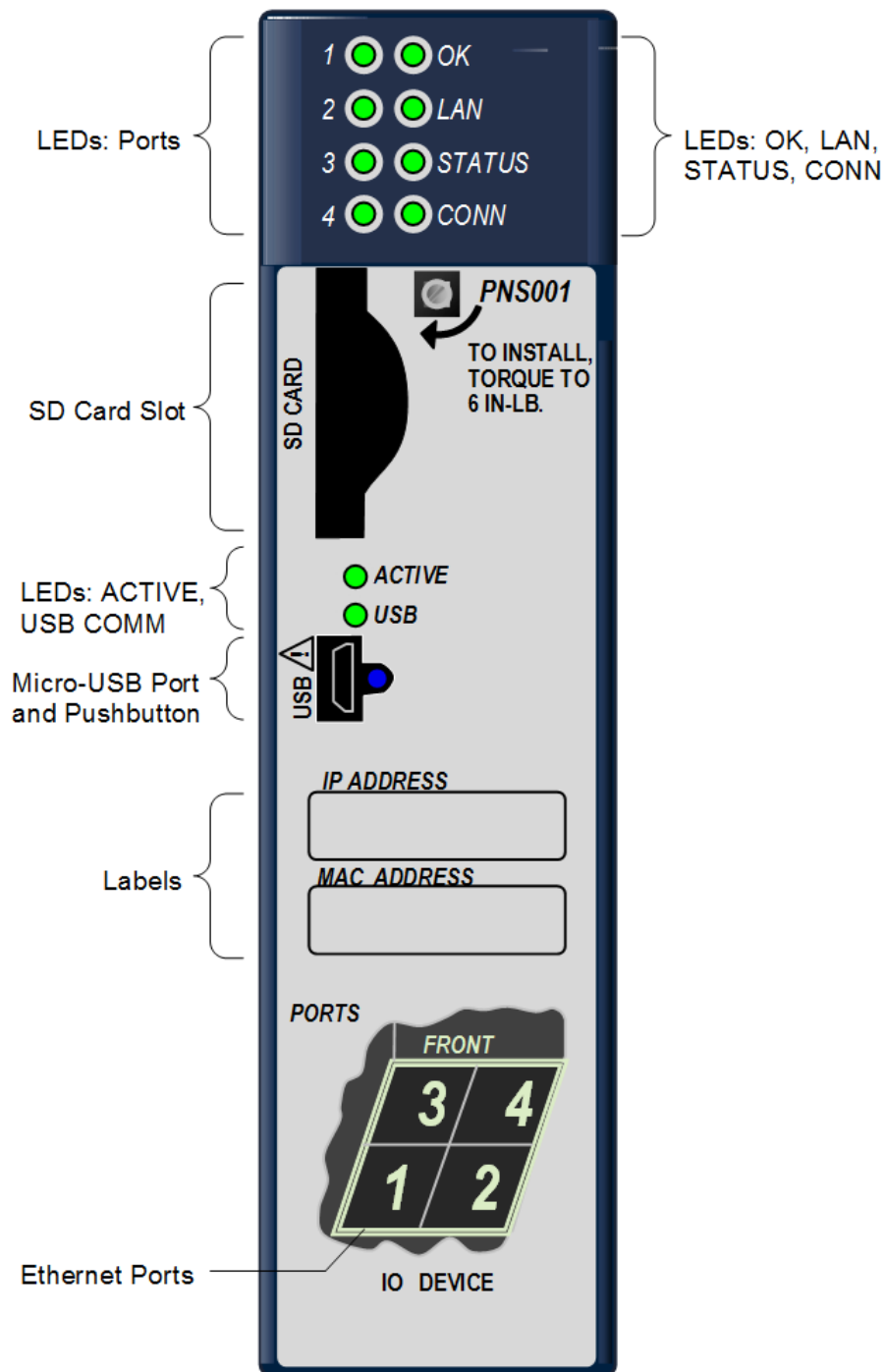
Figure 1: Front View IC695PNS001-Axxx
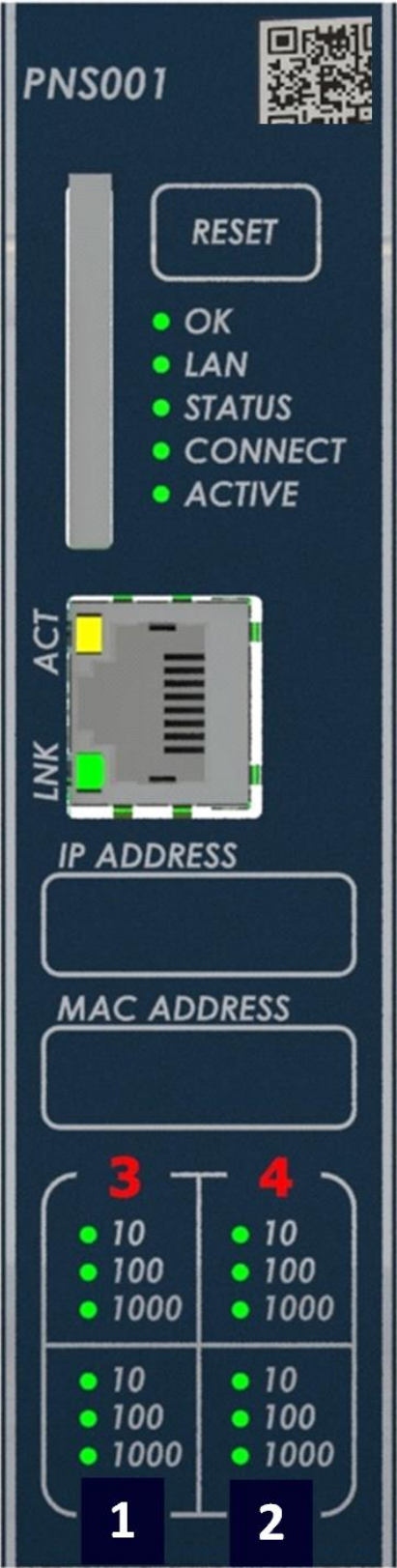
Figure 2: Front View IC695PNS001-Bxxx

1.3.1 LEDs on the PROFINET Scanner Module

LEDs provide an immediate visual indication of the operational state of the PNS and port link status. The LEDs and their operation are described in Chapter 2, *LED Operation and Connector Details*. The figures above illustrate the differences between the version -Axxx and -Bxxx front panels.

1.3.2 SD Card Slot

The SD Card Slot supports an SD or SDHC card. It can be used to transfer the IO-Device Name to another PROFINET Scanner Module unit without a configuration tool such as Proficy Machine Edition.

1.3.3 Pushbutton

The pushbutton adjacent to the USB port on Rev. -Axxx units is reserved for future use.

1.3.4 Reset Button

The reset button available on units Rev. -Bxxx and later will reset the unit on release. It is also used to prove physical presence when assigning the web update password.

1.3.5 Front Panel Port

The front panel Port is used for installing new firmware. An Ethernet port is provided for revision –Bxxx or later modules to use with the secure firmware update within a web browser. A USB port is provided for -Axxx revisions of the module to update firmware using the WinLoader tool.

1.3.6 Ethernet Port Connections

Each port on an RX3i PNS operates independently, so devices that operate at different speeds and/or duplex modes may be attached to the ports. By default, all ports, including empty, unconfigured SFP cages, are set for Automatic, which enables auto negotiation for the widest range of options supported by the port.
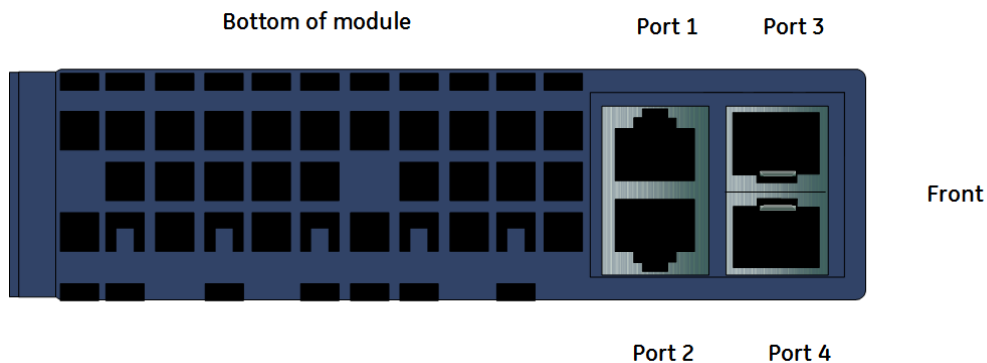
Figure 3: Ethernet Port Connectors on IC695PNS001

Connections to the PROFINET Scanner can be made using standard Cat 5e/6 Ethernet cables. Different devices on the same network can be connected using the multiple ports on the RX3i PNS (Figure 3).

For other options, refer to Section 4.2.4.2, *Adding and Configuring an Ethernet Port*.

1.4 PROFINET Communications

For a full discussion of PROFINET Communications and interactions with the controlling RX3i CPU, refer to Chapter 4 of the *PACSystems RX3i PROFINET Controller User Manual*, GFK-2571.
The following topics are covered:

- PROFINET Operation Overview
  - ➢ PROFINET Communications
  - ➢ Application Relationships
  - ➢ Types of PROFINET Communications
- Operations of the PROFINET Controller in the RX3i System
  - ➢ Duplicate PROFINET Device IP Address
  - ➢ Duplicate PROFINET Controller IP Address
  - ➢ Resolving Duplicate IP Addresses
- I/O Scanning
- Data Coherency
- Performance Factors
- PROFINET IO Update Rate Configuration
- RX3i CPU Operations for PROFINET
  - ➢ Reference ID Variables for the RX3i Application
  - ➢ PNIO_DEV_COMM Function Block
  - ➢ Reset Smart Module for the PROFINET Controller
  - ➢ DO I/O for Remote IO Modules
  - ➢ Scan Set I/O for Remote I/O Modules
  - ➢ RX3i CPU Defaults - Inputs
  - ➢ RX3i CPU Defaults – Outputs

1.4.1   Notes on Available PROFINET Controllers

Each PROFINET I/O Network is controlled by one or more PROFINET I/O Controllers. PROFINET I/O Controllers may be GE products or third-party products.

GE Automation and Controls offers the following PROFINET Controllers:

- IC695PNC001: this is an RX3i rack-based intelligent module located in a slot of the host RX3i CPU rack. The host CPU may be equipped with a maximum of four IC695PNC001 modules.

- The IC695CPE330 RX3i CPU provides an optional embedded PROFINET Controller. To utilize this feature, LAN2 must be configured as a PROFINET Controller. In addition, the IC695CPE330 may host a maximum of four IC695PNC001 modules in its CPU rack.

- The IC695CPE400 and IC695CPL410 RX3i CPUs both provide an optional embedded PROFINET Controller. To utilize this feature, LAN2 must be configured as a PROFINET Controller. Since these are Rackless CPUs, they cannot host any IC695PNC001 modules.

- The EPSCPE100 and EPSCPE115 are RSTi-EP Standalone CPUs. They provide an optional embedded PROFINET Controller.

Each of the RX3i PROFINET Controllers mentioned above is capable of controlling a PROFINET I/O Network containing PROFINET Scanners supplied by GE or by third-party vendors. Many vendors also supply I/O devices that connect directly to the PROFINET network.

For PROFINET Controller product details, refer to the *PACSystems RX3i PROFINET Controller User Manual*, GFK-2571.

1.4.2   Operations of the PROFINET Scanner

The RX3i PROFINET Scanner (PNS) is the head-end unit responsible for monitoring and controlling I/O modules installed in its RX3i I/O rack. All PROFINET communications are passed between the PROFINET I/O Controller and the PNS. The PNS is one type of IO-Device the PROFINET I/O Controller expects to encounter. Other third-party IO-Devices may also be present on the PROFINET network.

A PNS will normally be present on a PROFINET network controlled by an RX3i PROFINET Controller (PNC). However, it is possible to use a PNS in conjunction with any qualified PROFINET I/O Controller.

The RX3i PNS performs the following operations:

- Consumes PROFINET IO-Device configuration from the PROFINET IO-Controller over the PROFINET network and applies it to its modules.
- Scans input data from each module it manages and produces that data to the PROFINET IO-Controller.
- Consumes the output data that it receives from the PROFINET IO-Controller and applies it to each module it manages.

1.5 PROFINET Redundant Media

For a full discussion of PROFINET Redundant Media and interactions with the controlling RX3i CPU, refer to Chapter 6 of the *PACSystems RX3i PROFINET Controller User Manual*, GFK-2571. The following topics are covered:

- PROFINET Media Redundancy Protocol
  - ➢ MRP Failover Performance
  - ➢ Bumpless Operation with MRP
  - ➢ MRP Operation for I/O Update Rates of 16ms or Greater
  - ➢ MRP Operation at I/O Update Rates Less Than 16ms
  - ➢ Minimum I/O Rate When Configured in an MRP Ring
  - ➢ Minimum I/O Update Rates for Bumpless Operation in a Ring Topology
  - ➢ Third-party MRP Manager Use with PNC as MRP Client
- Ring Topology with One Controller
- Ring Topology with Multiple Controllers
- Setting Up Media Redundancy Protocol
  - ➢ Media Redundancy Setup for a PROFINET I/O Controller
- Sequence for Enabling Media Redundancy
- Sequence for Replacing a Media Redundancy Manager
- Procedure for Disabling Media Redundancy

1.6 System Limits

I/O Controllers will have limitations on the system they support. One of these limits is the number of PROFINET submodules supported. In the RX3i PNS rack, each power supply or I/O module is represented by one PROFINET submodule. The RX3i PNS uses four to six submodules:

- two submodules for basic operation of the PNS module
- two built-in port submodules that are always configured
- up to two additional port submodules, one for each optional Ethernet port configured

Other limitations, such as the configuration and I/O sizes, are specific to the configuration options chosen. Note that not every combination of options is supported in every system.

If the configuration uses all slots in every device with a large device count, the memory of the I/O Controller system will be a limiting resource.

1.7 Supported Modules, Power Supplies and Backplanes

For an updated list of modules, power supplies and backplanes that can be used with an RX3i PROFINET Scanner, refer to the most recent version of the *PACSystems RX3i PROFINET Scanner Important Product Information*, GFK-2738.

Catalog Number	Module Description	Distinguishing Classes[1]	Recommended PNS Version[2]	Earliest PNS Version
	Discrete Input Modules			
IC693ACC300	Input Simulator Module (8-pt & 16-pt operation)	8 in, 16 in	1.00	1.00
IC693MDL230	8-Circuit Input 120 Vac Isolated	8 in	1.00	1.00
IC693MDL231	8-Circuit Input 240 Vac Isolated	8 in	1.00	1.00
IC693MDL240	16-Circuit Input 120 Vac	16 in	1.00	1.00
IC693MDL241	16-Circuit Input 24 Vac / Vdc	16 in	1.00	1.00
IC693MDL250	16-Circuit Isolated Input 120 Vac, Input Filtering Off	16 in	2.30	2.30
IC693MDL250	16-Circuit Isolated Input 120 Vac, Input Filtering On	none	2.30	2.30
IC693MDL260	32-Circuit Input 120 Vac, Input Filtering Off	32 in	2.30	2.30
IC693MDL260	32-Circuit Input 120 Vac, Input Filtering On	32 in/out	2.30	2.30
IC693MDL632	8-Circuit Input 125 Vdc Positive / Negative Logic	8 in	1.00	1.00
IC693MDL634	8-Circuit Input 24 Vdc Positive / Negative Logic	8 in	1.00	1.00
IC693MDL635	16-Circuit Input 125 Vdc Positive / Negative Logic	16 in	1.00	1.00
IC693MDL645	16-Circuit Input 24 Vdc Positive / Negative Logic	16 in	1.00	1.00
IC693MDL646	16-Circuit Input 24 Vdc Positive / Negative Logic Fast	16 in	1.00	1.00
IC693MDL648	16-Circuit Input 48 Vdc Positive / Negative Logic Fast	16 in	1.00	1.00
IC693MDL654	32-Circuit Input 5/12 Vdc Positive / Negative Logic	32 in	1.00	1.00
IC693MDL655	32-Circuit Input 24 Vdc Positive / Negative Logic Fast	32 in	1.00	1.00
IC693MDL660	32-Circuit Input 24 Vdc Positive / Negative Logic, Input Filtering Off	32 in	2.30	2.30
IC693MDL660	32-Circuit Input 24 Vdc Positive / Negative Logic, Input Filtering On	32 in/out	2.30	2.30
IC694ACC300	Input Simulator Module (8-pt & 16-pt Mode)	8 in, 16 in	1.00	1.00
IC694MDL230	8-Circuit Input 120 Vac Isolated	8 in	1.00	1.00
IC694MDL231	8-Circuit Input 240 Vac Isolated	8 in	1.00	1.00
IC694MDL240	16-Circuit Input 120 Vac	16 in	1.00	1.00
IC694MDL241	16-Circuit Input 24 Vac / Vdc	16 in	1.00	1.00
IC694MDL250	16-Circuit Input 120 Vac Isolated	none	2.30	2.30
IC694MDL260	32-Circuit Input 120 Vac	none	1.00	1.00

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[1] The PNS001 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 the section entitled *CPU operation during System Configuration Mismatch Faults* in the *PACSystems RX7i, RX3i and RSTi-EP CPU Reference Manual, GFK-2222*.

[2] The Recommended Version PNS firmware is that version in which all known problems relating to the specific I/O module were resolved. However, GE recommends that the most recent version firmware be used where possible.

Catalog Number	Module Description	Distinguishing Classes[1]	Recommended PNS Version[2]	Earliest PNS Version
IC694MDL632	8-Circuit Input 125 Vdc Positive / Negative Logic	8 in	1.00	1.00
IC694MDL634	8-Circuit Input 24 Vdc Positive / Negative Logic	8 in	1.00	1.00
IC694MDL635	16-Circuit Input 125 Vdc Positive / Negative Logic	16 in	1.00	1.00
IC694MDL645	16-Circuit Input 24 Vdc Positive / Negative Logic	16 in	1.00	1.00
IC694MDL646	16-Circuit Input 24 Vdc Positive / Negative Logic Fast	16 in	1.00	1.00
IC694MDL654	32-Circuit Input 5/12 Vdc Positive / Negative Logic	32 in	1.00	1.00
IC694MDL655	32-Circuit Input 24 Vdc Positive / Negative Logic Fast	32 in	1.00	1.00
IC694MDL658	32-Circuit Input 48 Vdc Positive / Negative Logic Fast	32 in	1.00	1.00
IC694MDL660[3]	32-Circuit Input 24 Vdc Positive / Negative Logic	none	2.30	2.30
IC695MDL664	16-Circuit Smart Input 24 Vdc Positive Logic[4]	none	2.00	1.10
	Discrete Output Modules			
IC693MDL310	12-Circuit Output 120 Vac 0.5A	16 out	1.00	1.00
IC693MDL330	8-Circuit Output 120/240 Vac 2A	8 out	1.00	1.00
IC693MDL340	16-Circuit Output 120 Vac 0.5A	16 out	1.00	1.00
IC693MDL350	16-Circuit Output 120/240 Vac Isolated	16 out	2.30	2.30
IC693MDL390	5-Circuit Output 120/240 Vac 2A Isolated	8 out	1.00	1.00
IC693MDL730	8-Circuit Output 12/24 Vdc 2A Positive	8 out	1.00	1.00
IC693MDL731	8-Circuit Output 12/24 Vdc 2A Negative	8 out	1.00	1.00
IC693MDL732	8-Circuit Output 12/24 Vdc 0.5A Positive	8 out	1.00	1.00
IC693MDL733	8-Circuit Output 12/24 Vdc 0.5A Negative	8 out	1.00	1.00
IC693MDL734	6-Circuit Output 125 Vdc 1A Positive/Negative	8 out	1.00	1.00
IC693MDL740	16-Circuit Output 12/24 Vdc 0.5A Positive	16 out	1.00	1.00
IC693MDL741	16-Circuit Output 12/24 Vdc 0.5A Negative	16 out	1.00	1.00
IC693MDL742	16-Circuit Output 12/24 Vdc 1A Positive	16 out	1.00	1.00
IC693MDL748	8-Circuit Output 48 Vdc 0.5A Positive	8 out	1.00	1.00
IC693MDL752	32-Circuit Output 5/24 Vdc 0.5A Negative	32 out	1.00	1.00
IC693MDL753	32-Circuit Output 12/24 Vdc 0.5A Positive	32 out	1.00	1.00
IC693MDL754	32-Circuit Output 24 Vdc 0.75A Positive with ESCP, Diagnostics Off	32 out	2.30	2.30
IC693MDL754	32-Circuit Output 24 Vdc 0.75A Positive with ESCP, Diagnostics On	32 in/out	2.30	2.30
IC693MDL758	32-Circuit Output 12/24 Vdc 0.5A Positive with ESCP[4,5]	32 out	2.40	2.40
IC693MDL760	Solenoid Valve Output Module	16 out	1.00	1.00
IC693MDL916	16-Circuit Output 4A Relay	16 out	2.30	2.30
IC693MDL930	8-Circuit Output 4A Relay Isolated	8 out	1.00	1.00
IC693MDL931	8-Circuit Output Relay Form BC Isolated	8 out	1.00	1.00
IC693MDL940	16-Circuit Output 2A Relay	16 out	1.00	1.00
IC694MDL310	12-Circuit Output 120 Vac 0.5A	16 out	1.00	1.00
IC694MDL330	8-Circuit Output 120/240 Vac 2A	8 out	1.00	1.00

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[3] For RX3i Sequence of Events, use IC694MDL660 in combination with IC695PNS101 Release 3.10 or later. Refer to GFK-3050. IC693MDL660 may not be substituted for IC694MDL660 in SOE.
[4] The PNS001 currently does not support *Fault Reporting* from this module.

Catalog Number	Module Description	Distinguishing Classes[1]	Recommended PNS Version[2]	Earliest PNS Version
IC694MDL340	16-Circuit Output 120 Vac 0.5A	16 out	1.00	1.00
IC694MDL350	16-Circuit Output 120/240 Vac Isolated	none	2.30	2.30
IC694MDL390	5-Circuit Output 120/240 Vac 2A Isolated	8 out	1.00	1.00
IC694MDL732	8-Circuit Output 12/24 Vdc 2A Positive	8 out	1.00	1.00
IC694MDL734	6-Circuit Output 125 Vdc 1A Positive/Negative	8 out	1.00	1.00
IC694MDL740	16-Circuit Output 12/24 Vdc 0.5A Positive	16 out	1.00	1.00
IC694MDL741	16-Circuit Output 12/24 Vdc 1A Negative	16 out	1.00	1.00
IC694MDL742	16-Circuit Output 12/24 Vdc 1A Positive	16 out	1.00	1.00
IC694MDL752	32-Circuit Output 5/24 Vdc 0.5A Negative	32 out	1.00	1.00
IC694MDL753	32-Circuit Output 12/24 Vdc 0.5A Positive	32 out	1.00	1.00
IC694MDL754	32-Circuit Output with ESCP	none	2.30	2.30
IC694MDL758	32-Circuit Output 12/24 Vdc 0.5A Positive with ESCP[4]	none	2.40	2.40
IC694MDL916	16-Circuit Output 4A Relay	none	2.30	2.30
IC694MDL930	8-Circuit Output 4A Relay Isolated	8 out	1.00	1.00
IC694MDL931	8-Circuit Output Relay Form BC Isolated	8 out	1.00	1.00
IC694MDL940	16-Circuit Output 2A Relay	16 out	1.00	1.00
IC695MDL765	16-Circuit Smart Output 24/125 Vdc 2A Positive Logic[4]	None	2.00	1.10
Discrete Mixed Modules				
IC693MAR590	8-Circuit Mixed 120 Vac Input / Relay Output	8 in/out	1.00	1.00
IC693MDR390	8-Circuit Mixed 24 Vdc Input / Relay Output	8 in/out	1.00	1.00
Analog Input Modules				
IC693ALG220	4-Point Analog Voltage Input	ALG IN 4	1.00	1.00
IC693ALG221	4-Point Analog Current Input	ALG IN 4	1.00	1.00
IC693ALG222	16-Point Analog Voltage Input	ALG IN 16	2.00	2.00
IC693ALG223	16-Point Analog Current Input	ALG IN 16	2.00	2.00
IC694ALG220	4-Point Analog Voltage Input	ALG IN 4	1.00	1.00
IC694ALG221	4-Point Analog Current Input	ALG IN 4	1.00	1.00
IC694ALG222	16-Point Analog Voltage Input	ALG IN 16	2.00	2.00
IC694ALG223	16-Point Analog Current Input	ALG IN 16	2.00	2.00
IC695ALG106	6-Point Isolated Analog Input Current/Voltage[5,6]	none	2.40	2.40
IC695ALG112	12-Point Isolated Analog Current/Voltage Input[6]	none	2.00	2.00
IC695ALG600	8-Point Universal Analog Input Module[6]	none	2.20	2.20
IC695ALG608	8-Point Analog Input Current / Voltage Input[5,6]	none	2.40	2.40
IC695ALG616	16-Point Analog Current / Voltage Input[6]	none	2.10	1.10
IC695ALG626	16-Point Analog Current / Voltage Input[6] (HART[7] Support)	none	2.41	2.00
IC695ALG628	8-Point Analog Current / Voltage Input[5,6] (HART[7] Support)	none	2.40	2.40

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[5] PNS001 firmware version 2.40 required for this product.

[6] PNS001 currently does not support *Fault Reporting* or *Interrupts* from this module.

[7] PNS001 firmware version 2.30 supports the HART Pass Through capabilities of this module. PNS001 firmware version 2.41 supports Remote Get HART Device Information COMMREQ support only (no HART variables in IO Data). HART-compatible CPU and PNC001 versions are required.

Catalog Number	Module Description	Distinguishing Classes[1]	Recommended PNS Version[2]	Earliest PNS Version
	Analog Output Modules			
IC693ALG390	2-Point Analog Voltage Output	ALG OUT 2	1.00	1.00
IC693ALG391	2-Point Analog Current Output	ALG OUT 2	1.00	1.00
IC693ALG392	8-Point Analog Current / Voltage Output	ALG OUT 8	1.00	1.00
IC694ALG390	2-Point Analog Voltage Output	ALG OUT 2	1.00	1.00
IC694ALG391	2-Point Analog Current Output	ALG OUT 2	1.00	1.00
IC694ALG392	8-Point Analog Current / Voltage Output	ALG OUT 8	1.00	1.00
IC695ALG704	4-Point Analog Current / Voltage Output[5, 6]	none	2.40	2.40
IC695ALG708	8-Point Analog Current / Voltage Output[6]	none	2.10	1.10
IC695ALG728	8-Point Analog Current / Voltage Output[6] (HART[7] Support)	none	2.41	2.00
IC695ALG808	8-Point Isolated Analog Current / Voltage Output[6]	none	2.00	2.00
	Analog Mixed Modules			
IC693ALG442	4-Input / 2-Output, Current / Voltage	ALG IN 4, ALG OUT 2	1.00	1.00
IC694ALG442	4-Input / 2-Output, Current / Voltage	ALG IN 4, ALG OUT 2	1.00	1.00
	RTD Input Modules			
IC695ALG508	8-Channel Isolated RTD Input[6]	none	2.10	1.10
	Thermocouple Input Modules			
IC695ALG312	12-Point Isolated Thermocouple Input[5, 6]	none	2.40	2.40
IC695ALG412	12-Point Isolated High-Speed Thermocouple Input[5, 6]	none	2.40	2.40
	High-Speed Counter Modules			
IC695HSC304	High-Speed Counter Module – 4 Counters[6, 8]	None	3.10	3.10
IC695HSC308	High-Speed Counter Module - 8 Counters[6]	None	2.10	2.10
	Specialty Modules			
IC694PSM001	Power Sync and Measurement Module	none	2.20	2.20
	Power Supply Modules			
IC695PSA040	Universal 120/240 Vac, 125Vdc 40W Power Supply	none	n/a	n/a
IC695PSA140	Multifunctional 120/240 Vac, 125Vdc 40W Power Supply	none	n/a	n/a
IC695PSD040	24Vdc 40W Power Supply	none	n/a	n/a
IC695PSD140	Multifunctional 24Vdc 40W Power Supply	none	n/a	n/a
	Small Form-Factor Pluggable (SFP) Modules			
IC695SPC100	10/100/1000Base-T Copper SFP	none	1.00	1.00
IC695SPF002	100Base-FX (fiber 2km) SFP	none	1.00	1.00
IC695SPF010	1000Base-LX (fiber 10km) SFP	none	1.00	1.00
IC695SPF550	1000Base-SX (fiber 550m) SFP	none	1.00	1.00

[8] Supported by IC695PNS001-Bxxx implementation. Not compatible with IC695PNS001-Axxx.
  For RX3i Sequence of Events application, use in combination with IC695PNS101.

1.8 Glossary

AR	**A**pplication **R**elationship. PROFINET term for a relationship that is established between an IO-Controller/IO-Supervisor and IO-Device. For any data to be exchanged between an IO-Controller/IO-Supervisor and a given IO-Device, an Application Relationship must be established. Within the Application Relationship, various Communication Relationships (CRs) are then established for the different types of data to be exchanged.
Broadcast	In Ethernet, the transmission of a network message to all hosts on the network.
CPU Node	In a PACSystems RX3i PROFINET network, a CPU Node is a node in which a PACSystems RX3i CPU is connected to the PROFINET network.
CR	**C**ommunication **R**elationship. PROFINET term for a channel that is established within an Application Relationship (AR) to transfer specific data between an IO-Controller/IO-Supervisor and a given IO-Device. Multiple CRs are established within an AR to transfer data.
DAP	**D**evice **A**ccess **P**oint. This access point is used to address an IO-Device as an entity.
Gratuitous ARPs	An Address Resolution Protocol (ARP) request sent by the host to resolve its own IP Address.
GSDML	**G**eneral **S**tation **D**escription **M**arkup **L**anguage - definition of PROFINET Device Characteristics.
IOC	PROFINET **IO-C**ontroller
IOD	PROFINET **IO-D**evice
IOCR	**I**nput **O**utput **C**ommunication **R**elationship – describes the type (input/output) and amount of I/O data to be transferred, the sequence of the transfers and the transfer cycle between a PROFINET IO-Controller (or IO-Supervisor) and a PROFINET IO-Device.
IOCS	PROFINET **I**nput/**O**utput **C**onsumer **S**tatus is transmitted on the PROFINET network to provide feedback on Input Data for an IO-controller and Output Data for an IO-device.
IOPS	PROFINET **I**nput/**O**utput **P**rovider **S**tatus is transmitted on the PROFINET network to provide feedback on Output Data for an IO-controller and the Input Data for an IO-device.
IOxS	PROFINET abbreviation for the IOCS and/or IOPS (see above).
LLDP	**L**ink **L**ayer **D**iscovery **P**rotocol. IEEE standardized protocol used by network devices to advertise their identity and capabilities.
LLDPDU	**L**ink **L**ayer **D**iscovery **P**rotocol **D**ata **U**nit.
MAC	**M**edia **A**ccess **C**ontrol address (MAC address)
MAU	**M**edium **A**ttachment **U**nit
MIB	**M**anagement **I**nformation **B**asis
MRC	**M**edia **R**edundancy **C**lient. Within Media Redundancy Protocol, an MRC is responsible for helping the MRM detect breaks/no breaks in the ring.
MRM	**M**edia **R**edundancy **M**anager. Within Media Redundancy Protocol, an MRM is responsible for ensuring that the ring does not have a closed loop, while simultaneously ensuring maximal connectivity between nodes on the ring.
MRP	**M**edia **R**edundancy **P**rotocol. An Ethernet protocol that provides redundant paths for PROFINET-IO cyclic traffic by supporting a ring topology.
Multicast	In Ethernet, the transmission of a network message to all hosts within a host group.
NOS	**N**ame **o**f **S**tation

Glossary, continued

OID	**O**bject **Id**entifier
Phase	If the IOCR Update Period is greater than the Send Clock time, the Update Period is divided into multiple phases where each phase is equal to one Send Clock.
PNC	**P**ROFI**N**ET **C**ontroller. This may be a separate module, e.g. IC695PNC001 for the RX3i family, or a functional component of a product such as the PROFINET controller embedded in the ICRXICTL000, IC695CPE330, IC695CPE400, IC695CPL410, EPSCPE100, or EPSCPE115. Refer to Section 1.4.1.
PNS	**P**ROFI**N**ET **S**canner. Refer to Section 1.4.2.
RDO	**R**ecord **D**ata **O**bject. Services used to read and write structured data stored in a PROFINET IO-Device.
Reduction Ratio	Along with Send Clock determines the Update Period for a PROFINET cyclic data transfer between two devices (see IOCR). The Update Period equals the Reduction Ratio multiplied by the Send Clock time. For example, if the Reduction Ratio is 4 and the Send Clock is 1ms, the Update Period is 4ms.
Remote Node	For an RX3i PROFINET network, a Remote Node is any PROFINET IO-Device, such as a rack of I/O modules with a Remote Scanner or a third party PROFINET IO-Device.
RTA	**R**eal-**T**ime **A**cyclic. A PROFINET-IO Mechanism used to exchange non-periodic data such as alarms.
RTC	**R**eal-**T**ime **C**yclic. A PROFINET-IO Mechanism used to exchange input and output data.
Send Clock	Value between 1 and 128 inclusive in units of 31.25 µs (equivalent to a range of 31.25 µs to 4 ms) used to calculate the Update Period for a PROFINET cyclic data transfer between two devices (see IOCR). The Send Clock is the basis for all other scheduling parameters.
Send Offset	The time to delay a scheduled PROFINET cyclic data transfer frame. Measured in nanoseconds from 0 to 3,999,999. Must be less than the Send Clock time.
SFP	**S**mall **F**orm-factor **P**luggable. Pluggable, hot-swappable transceivers.
SNMP	**S**imple **N**etwork **M**anagement **P**rotocol. UDP-based network protocol that facilitates the exchange of management information between network devices.
SOE	**S**equence **o**f **E**vents: Events detected by input modules are time-stamped and made available to external data collection systems.
Submodule	PROFINET-IO representation of the smallest configurable entity of a PROFINET Module.
SVC_REQ	**S**er**v**i**c**e **Req**uest Function Block. A control system service initiated by the RX3i CPU.
TLV	**T**ype-**L**ength-**V**alue
Unicast	In Ethernet, the transmission of a network message to an individual host.
Update Period	The time between PROFINET cyclic data transfers between an IO-Controller and an IO-Device.
WinLoader	A software utility used to download and install firmware upgrades via a serial port.

1.9 Documentation

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 Hot Standby CPU Redundancy User Manual	GFK-2308
Proficy Machine Edition Logic Developer Getting Started	GFK-1918
PROFINET I/O Devices Secure Deployment Guide	GFK-2904

RX3i Manuals

PACSystems RX3i System Manual	GFK-2314
PACSystems RX3i PROFINET Controller Command Line Interface Manual	GFK-2572
PACSystems RX3i PROFINET Controller User Manual	GFK-2571
PACSystems RX3i CEP PROFINET Scanner User Manual	GFK-2883
PACSystems HART Pass Through User Manual	GFK-2929
PACSystems RX3i Sequence of Events User Manual	GFK-3050
PACSystems RX3i PROFINET Scanner Important Product Information	GFK-2574

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 GE Automation and Controls support website www.geautomation.com.

Chapter 2   LED Operation and Connector Details

This chapter describes:
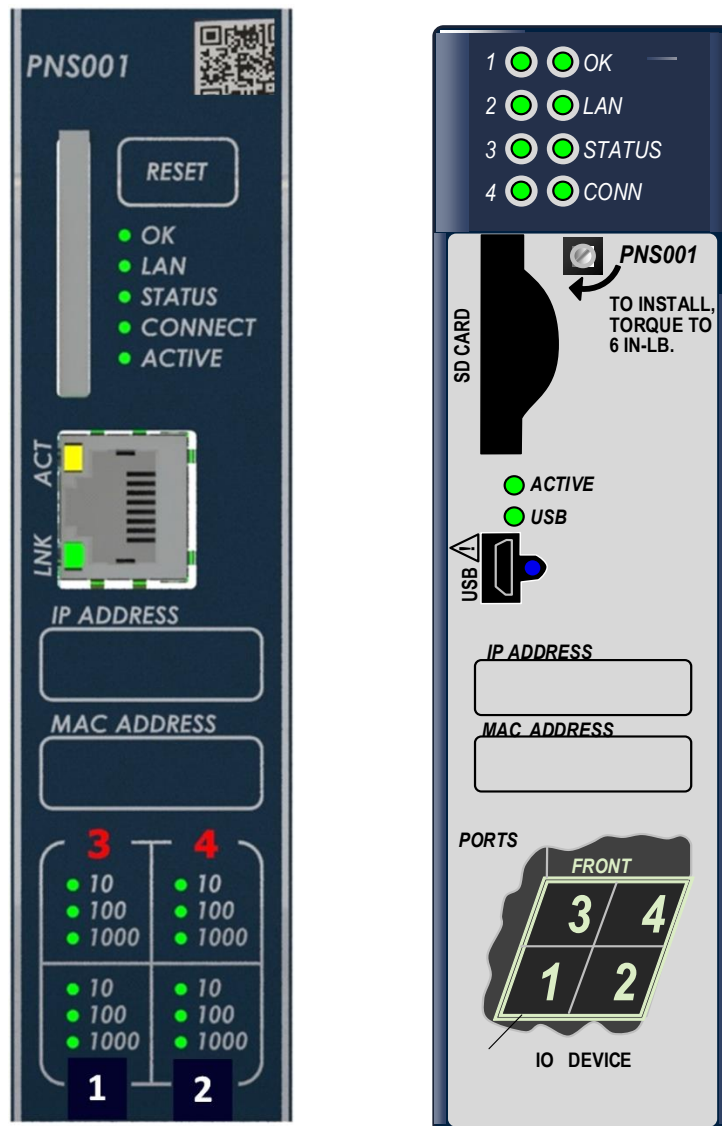
- LEDs
- Ethernet Network Ports
- SD Card Slot
- Front Panel Port

Figure 4: IC695PNS001-Bxxx (left) and IC695PNS001-Axxx (right) LEDs

2.1 Normal Operation of Individual LEDs

2.1.1 OK LED

LED		LED Status
🟢	Green On	PNS OK
⚪	Off	PNS Not OK

2.1.2 LAN LED

The LAN LED indicates access to and activity on the PROFINET network. The LAN LED indicates network packets are being processed by the network interface (not just passing through the embedded switch).

LED		LED Status
🟢	Green Blinking	The corresponding network interface is active.
⚪	Off	The corresponding network interface is not active.

2.1.3 Status LED

The STATUS LED stays green during normal operation.

LED		LED Status
🟢	Green On	Normal operation
🔴	Red Blinking	A MAC address read from non-volatile memory is invalid. Ports with invalid MAC addresses remain disconnected from the Ethernet network

2.1.4 CONNECT LED

The CONNECT LED indicates the status of PROFINET connections.

*This LED is labeled as "CONN" on revisions prior to –Bxxx.

LED		LED Status
🟢	Green On	At least one PROFINET connection (AR) exists with an I/O Controller
🟡	Amber Blinking	No *Device Name* configured.
⚪	Off	No PROFINET connection (AR) exists.

2.1.5   Port LEDs

The PROFINET I/O Scanner has LEDs that indicate link speed, link connection and link activity corresponding to the four possible external switched Ethernet ports. The layout of these LEDs is different depending on the revision of the PNS as shown below.

Revision Axxx:

LED		*LED Status*
●	Blue On	Link connected, 1000 Mbps
◍	Blue Blinking	Port active, 1000 Mbps
●	Green On	Link connected, 100 Mbps
◍	Green Blinking	Port active, 100 Mbps
●	Purple On	Link connected, 10 Mbps
◍	Purple Blinking	Port active, 10 Mbps
○	Off	The associated Ethernet port is not connected to an active link (can be disabled by configuration)
●	Red On	Port 3 and port 4 only. Incompatible SFP plugged into port.

Revision Bxxx or later:

Port Number LED

●	Red, on	Port 3 and 4 only: Error such as incompatible SFP.
○	Off	No Port error.

1000 Speed LED

●	Green on	Link connected, 1000 Mbps
◍	Green blinking	Port active, 1000 Mbps
○	Off	The associated Ethernet port is not connected to an active link at 1000Mbps

100 Speed LED

●	Green, on	Link connected, 100 Mbps.
◍	Green, blinking	Port active, 100 Mbps
○	Off	The associated Ethernet port is not connected to an active link at 100Mbps

10 Speed LED

●	Green, on	Link connected, 10 Mbps.
◍	Green, blinking	Port active, 10 Mbps
○	Off	The associated Ethernet port is not connected to an active link at 10Mbps

2.1.6　Active LED

The Active LED indicates the Scanner is connected to a PROFINET IO-Controller that is controlling the I/O data for the I/O modules located in the same rack as the PNS001.

LED		LED Status
🟢	Green On	PNS is connected to a PROFINET I/O Controller that is controlling IO Module IO data
⚪	Off	PNS is not connected to a PROFINET I/O Controller or no established connection to an Active I/O Controller

2.1.7　Front Panel LEDs

Revision Axxx USB LED		LED Status
🟢	Green On	A USB cable is connected.
	Green Blinking	The corresponding network interface is active.
⚪	Off	No USB port activity.
Revision Bxxx or later RJ45 LEDs		LED Status
LNK LED		
🟢	Green On	Link established
ACT LED		
🟡	Amber Blinking	Front panel port activity

2.1.8　Special LED Blink Patterns

The PNS's LEDs can operate in tandem to indicate fatal error, module location/identification, microprocessor over temperature, and update conditions, as described below. There is also a startup sequence that tracks the startup processing of the module with the LEDs.

2.1.8.1　Fatal Error Codes

When the PNS encounters a fatal error, it will blink an error code pattern on the OK LED with an Amber color or on the STATUS LED with a Green color. In this mode all LEDs flash Green once to indicate the start of the error code. Next the OK or STATUS LED blinks a 4-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 next significant error digit and so forth. After another brief pause, all LEDs flash Green again and the error code pattern repeats. Repetitions continue indefinitely until the module is power-cycled.

2.1.8.2 Module Identification

The LEDs on a PNS module can be commanded to repeatedly turn ON and OFF in a special sequence, to help locate or identify the module.

Revision Axxx:

- First the green LEDs are turned on in the following circular order: OK, LAN, STATUS, CONN, PORT 4, PORT 3, PORT 2, PORT 1. There is a short delay between turning on each LED.
- The LEDs are then turned off in the same order. There is a short time delay between turning off each LED.

Revision Bxxx or later:

- First the green port speed LEDs are turned on in a circular order. There is a short delay between turning on each LED.
- The LEDs are then turned off in the same order. There is a short time delay between turning off each LED.

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

2.1.8.3 Microprocessor Over Temperature

If the maximum threshold temperature for the PNS's microprocessor is crossed, the PNS goes into power-saving mode. While the PNS is in an over-temperature condition, the following blink patterns are alternated on units Rev. -Axxx:

- PORT "1", PORT "2", and STATUS LEDs turn on RED for 0.5 seconds (all other LEDs off)
- Then PORT "3" and PORT "4" LEDs turn on RED for 0.5 seconds (all other LEDs off)

Rev. -Bxxx unit will turn all LEDs off. The PNS stays in power-saving mode until the temperature drops to a safer level. Once a safe temperature is reached, the PNS module restarts.

Note: Under certain ambient operating temperatures, the PNS may momentarily display the over temperature pattern during power-up while it is calibrating its thermal protection functions. This indication can be ignored.

2.1.8.4 Firmware Update

While the PNS Rev. -Axxx is in firmware update mode, the OK, LAN, and STATUS LEDs blink Green for 0.5 seconds and then off for 0.5 seconds in unison. During firmware update operation, the ports are disabled, so all of the PORT LEDs are off and the CONNECT LED is off. The USB LED operates normally displaying the condition of the USB port.

2.1.8.5 Internal Update

Some changes from a firmware update are applied to the system on the next power up. During this internal update process, the STATUS and LAN LEDs blink Green for 0.5 seconds and then off for 0.5 seconds in unison. At the completion of the internal update process, the PNS restarts and should power up normally.

2.1.8.6 Power-up LED Patterns

At power-up, the LEDs show the patterns described below. The LEDs also blink diagnostic patterns for certain operating errors and for module identification. See the section on *Special LED Blink Patterns* above for a description of the special blink patterns.

Step	LED/Blink Pattern	Description
1	All LEDs off	Initial state
2	ACTIVE LED solid green	Normal operation
3	CONNECT LED solid green	Normal operation
4	STATUS LED solid green	Normal operation
5	LAN LED solid green	Normal operation
	OK LED blinks amber with special blink code	Fatal initialization or diagnostics Failure; Hardware Module Identity Information not available.
	STATUS LED blinks green with special blink code	Fatal initialization failure.
	STATUS and LAN LEDs blink green in unison (1 Hz)	Internal update in process following a firmware update. Unit should complete update and restart automatically.
6	OK LED solid green	Normal operation. Power-up completed.
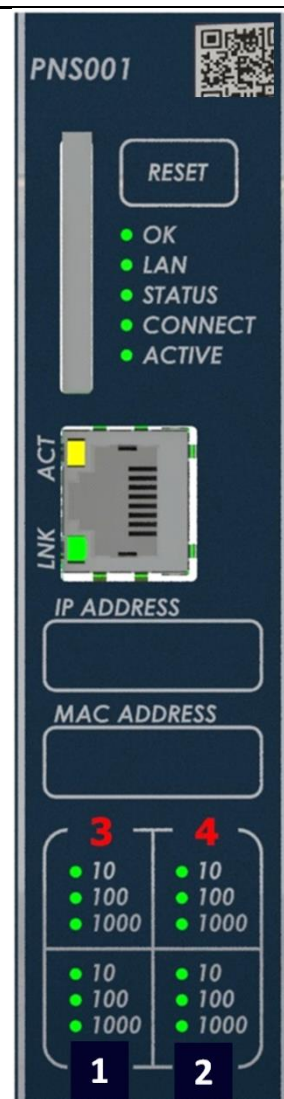
Figure 5: IC695PNS001 LEDs

Note: Under certain ambient operating temperatures, the PROFINET Scanner may momentarily display the over temperature pattern during power up, while it is calibrating its thermal protection functions. This indication can be ignored. For details, refer to the section *Microprocessor Over Temperature* above.

2.2 Ethernet Network Ports

The four external Ethernet ports (two RJ45 and two SFP Cages) are on the bottom of the module. Figure 6 shows the underside view of the RX3i PNS. Ports 1 and 2 are standard RJ45 connectors. Ports 3 and 4 are Small Form-factor Pluggable (SFP) ports.
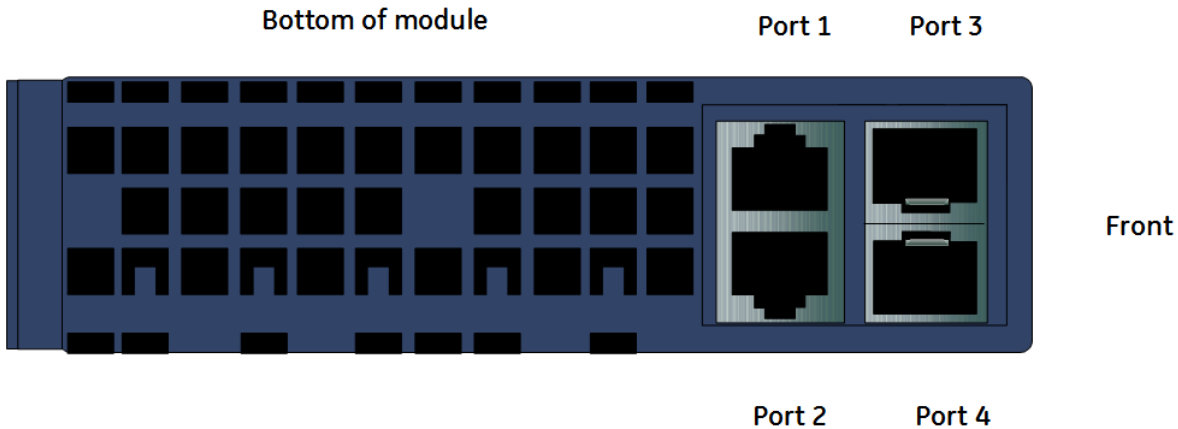
Figure 6: Underside of IC695PNS001 Showing Ethernet Ports

The two RJ45 ports provide 10/100/1000 Mbps copper interfaces. The two SFP cages accommodate user-supplied SFP devices, which can support a number of different media types. Refer to Section 3.5, *SFP Modules for Ethernet Ports*, for additional information about SFPs.

The two RJ45 ports support CAT5e/6 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 all of the four external ports.

Devices connected to the PROFINET Scanner ports should have Ethernet Autonegotiation enabled. The Ethernet ports can be disabled to support requirements such as IT policies for unused ports. Disabled ports do not establish a link on their Ethernet network. RX3i PNS modules and other participating modules can be connected in a daisy chain/line, or star topology. The ports can also be configured to limit their advertised Autonegotiation setting. This can be used to force a copper interface to establish a link at 100 Mbps rather than 1 Gbps to have quicker link change detection during MRP operation.

⚠️ **Caution**	Multiple ports on the Ethernet Interface must not be connected, directly or indirectly, to the same device so as to form a circular network.

⚠️ **Caution**	Port disable settings are non-volatile. If an SFP port is configured as the only enabled port and that SFP is removed, the RX3i Scanner will not be accessible until an SFP is returned to that port.

2.3 SD Card Slot

The SD Card Slot, located on the front of the PROFINET Scanner, can be used to transfer the *Device Name* from a different PROFINET Scanner without the need for a configuration tool such as PME to commission the new hardware. A card is not required to be present. Refer to Section 4.3.1, *Transferring the Device Name with an SD Card* for more details.

Note that when installing an SD Card, the label should face to the left with the write-protect (Lock) switch to the bottom for revisions Axxx. The label should face to the right for revisions Bxxx. The card should enter easily and click when fully inserted. The spring action will return the card back slightly from its fully depressed position. Do not force the card into the slot as that can damage the unit. To release the card, press the card in again until it clicks, and the spring action will eject the card out enough to easily grab hold of it.

SD and SDHC capacity cards are supported. An SD Card can be formatted as either FAT12 or FAT16 per the SD Card standard and an SDHC card should be formatted using FAT32 per the SD Card standard. SDXC cards may be used in Rev. -Bxxx units, but must be formatted as FAT32, not exFAT.

2.4 Front Panel Port

The front panel port, located on the front of the PROFINET Scanner, can be used to connect a computer for firmware updates for the PROFINET Scanner.

Revisions Axxx:

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 Section 3.7, *Installing the USB Port Driver (revision –Axxx only)*.

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

Revisions Bxxx:

An RJ45 connector supports 10/100/1000Mbps Ethernet connections for updating firmware using a web browser.

The default settings for the front panel Ethernet port are IP Address 0.0.0.0, Subnet Mask 0.0.0.0, and Gateway IP 0.0.0.0. They can be adjusted through the PROFINET IO Device configuration. The front panel Ethernet port is a different adapter than the switched port, so its setting may not be on the same subnet as the PROFINET switched port. If the front panel is assigned an IP Address on the same subnet as the switched PROFINET ports, the front port will default back to 0.0.0.0 when the configuration is processed.

The current settings of the front port Ethernet port may be queried using a DCP tool. The front port will return a name based on the PROFINET IO Device name and the current settings for the front panel port. The front port Ethernet port settings are not configurable through DCP.

Chapter 3 Installation

This chapter provides instructions for installing PACSystems RX3i PROFINET Controller modules.

- Pre-Installation check
- Power Requirements
- Hot insertion and removal
- Removing the backplane knockout
- Module installation and removal
- Port connections
- Installing SFP devices
- Installing the USB Port Driver
- Firmware updates

For additional information about system installation, also refer to the *PACSystems RX3i Systems Manual,* GFK-2314.

3.1 Pre-Installation Check

Upon receiving your RX3i equipment, carefully inspect all shipping containers for damage. If any part of the system is damaged, notify the carrier immediately. The damaged shipping container should be saved as evidence for inspection by the carrier.

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

After unpacking the RX3i equipment, record all serial numbers. Serial numbers are required if you should need to contact Customer Care during the warranty period. All shipping containers and all packing material should be saved should it be necessary to transport or ship any part of the system.

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

If you need technical help, contact Technical Support. For phone numbers and email addresses, see the Contactpage in the front of this manual.

3.2 Installation in Hazardous Areas

EQUIPMENT LABELED WITH REFERENCE TO CLASS I, GROUPS A, B, C & D, DIV. 2 HAZARDOUS LOCATIONS IS SUITABLE FOR USE IN CLASS I, DIVISION 2, GROUPS A, B, C, D OR NON-HAZARDOUS LOCATIONS ONLY.

Warning	EXPLOSION HAZARD - SUBSTITUTION OF COMPONENTS MAY IMPAIR SUITABILITY FOR CLASS I, DIVISION 2.

Warning	EXPLOSION HAZARD - WHEN IN HAZARDOUS LOCATIONS, TURN OFF POWER BEFORE REPLACING OR WIRING MODULES.

Warning	EXPLOSION HAZARD - DO NOT CONNECT OR DISCONNECT EQUIPMENT UNLESS POWER HAS BEEN SWITCHED OFF OR THE AREA IS KNOWN TO BE NON-HAZARDOUS.

Warning	EXPLOSION HAZARD - USB PORT IS ONLY FOR USE IN NON-HAZARDOUS LOCATIONS, DO NOT USE UNLESS AREA IS KNOWN TO BE NON-HAZARDOUS.

3.2.1   ATEX Marking for -Bxxx

⟨Ex⟩ II 3 G   Ex nA IIC T5 X Ta: -25C - 60C

3.2.2   ATEX Marking for -Axxx

⟨Ex⟩ II 3 G   Ex nA IIC T5 X Ta: 0C - 60C

3.3 Module Installation

3.3.1   Power Requiremnents

More than one power supply may be required to support some configurations. To determine the loading within the PNS rack, refer to the *Module Load Requirement* section in the *PACSystems RX3i System Manual*, GFK-2314. Calculate the separate 3.3 Vdc and 5 Vdc needs of the modules within the rack, and select power supplies accordingly.

3.3.2   Hot Insertion and Removal

The PNS Module does not support hot insertion or removal. Turn power off at the rack before removing or inserting a PNS.

Certain I/O Modules within the rack may be removed and/or inserted while the rack is powered up. Refer to Section 5.3, *Hot Swap of I/O Modules*.

For a full discussion of this topic, refer to the *Hot Insertion and Removal* section in the *PACSystems RX3i System Manual*, GFK-2314.

3.3.3   Removing the Backplane Knockout

The PNS can be installed in slot 1 or slot 2 of a 7-, 12-, or 16-slot RX3i Universal Backplane (IC695CHS007, CHS012 or CHS016), or in slot 6 of a 7-slot RX3i Universal Backplane. It may not be located in the same rack as an RX3i CPU module. For details, refer to the *PACSystems RX3i System Manual*, GFK-2314.

For revision Axxx PNS modules, the rear of the PNS module has an exposed heat sink and backplane connector. Before inserting the module into the backplane, remove the plastic knockout in the slot into which the module will be placed. This is not required for revision Bxxx or later modules. The installation slot must match the slot selected for the module in the Proficy Machine Edition (PME) hardware configuration.
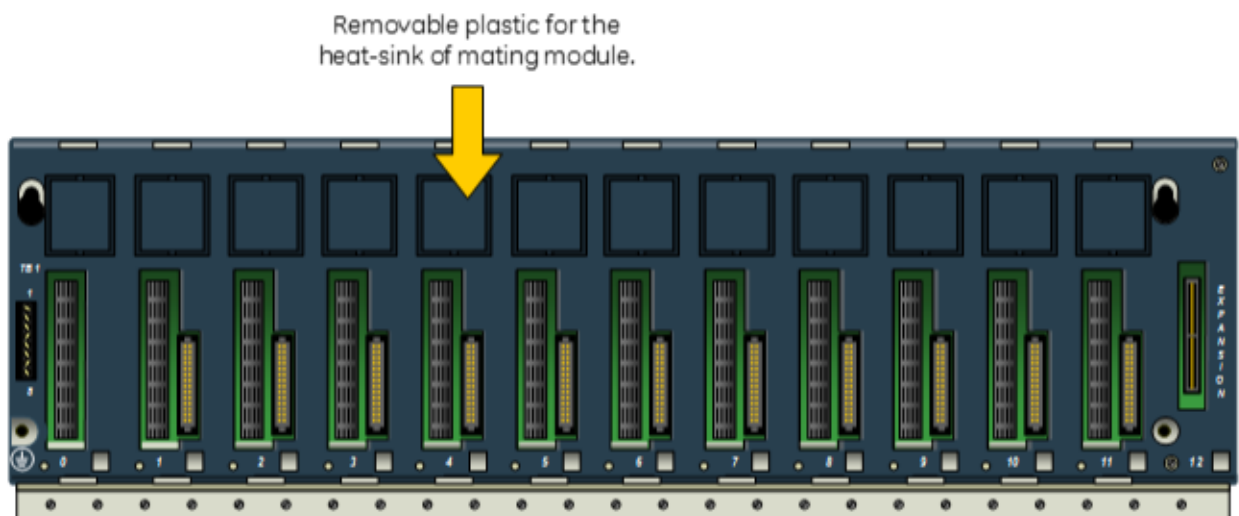
Figure 7: RX3i Backplane showing Removable Plastic Knockout

3.3.4 Module Installation

- RX3i rack power must be turned off. The PNS does not support insertion/removal while power is applied to the rack.

- Holding the module firmly, align the module with the correct slot and connector.

- Engage the module's rear pivot hook in the notch on the top of the backplane (1).

- Swing the module down (2) until the module's connector engages the backplane's backplane connector.

- Visually inspect the module to be sure it is properly seated.

- Secure the bottom of the module to the backplane using the machine screws provided with the module (3).

- For revision -Axxx modules, tighten the heat sink screw on the front of the module in the threaded hole in the back plate to 6 in-lbs (0.68 Nm), using a flat-tip screwdriver.
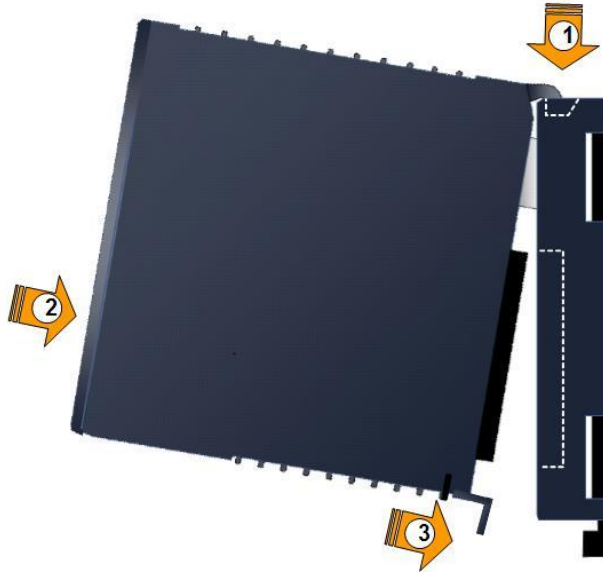
Figure 8: Install Module into RX3i Backplane

3.3.5 Module Removal

- RX3i rack power must be turned off.

- For revision -Axxx modules, loosen the heat sink screw on the front of the module to release the heat sink from the backplane's aluminum back plate.

- Loosen the screws at the bottom of the module (1).

- Pivot the module upward until its connector is out of the backplane (2).

- Lift the module up and away from the backplane to disengage the pivot hook (3).
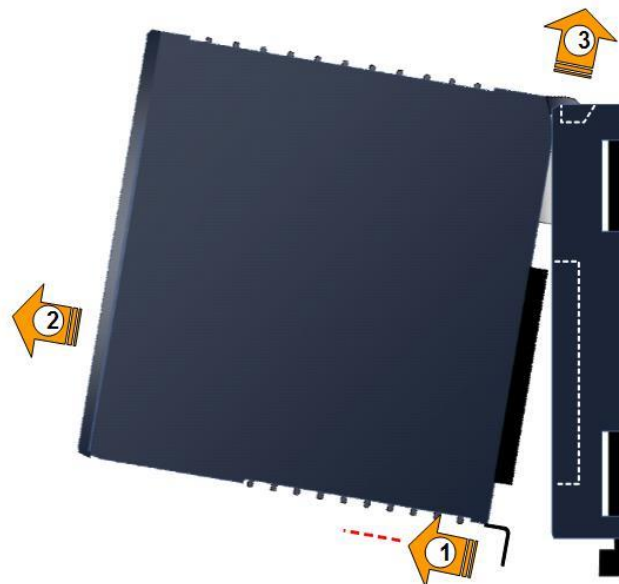
Figure 9: Remove Module from RX3i Backplane

3.4 Replacing a PROFINET Scanner

If a PNS module needs to be replaced for any reason, follow these steps to commission a replacement module.

Note: If the replacement PNS module has no assigned *Device Name* (the CONNECT LED is blinking Amber slowly), the network cabling can be plugged back in and the name assigned over the PROFINET network.

However, if the replacement PNS module already has an assigned *Device Name,* there will be a risk of a duplicate *Device Name* on the network. This condition cannot be tolerated by the PROFINET Controller. This situation can be avoided by transferring the *Device Name* from the installed PNS to the replacement PNS via the SD Card prior to connecting the replacement unit to the PROFINET network.

If there is a possibility of duplicate *Device Name*s or duplicate IP Addresses existing on the network, these should be assigned before inserting the replacement PNS into a working PROFINET network. The *Device Name* and *IP Address* settings can be updated offline (for example, in an office setting).

Use the Proficy Machine Edition DCP Tool to store the *Device Name* to the RX3i SD Card installed in the PNS SD slot. Avoid hand-editing *Device Name* files contained on the SD Card. Storing an illegal name to the RX3i PNS will prevent it from connecting to its PROFINET Controller until a valid *Device Name* is stored.

3.4.1 Method 1 – Using the SD Card

1) Remove power from the PNS module. This should be done before network cabling is removed, especially in the case of fiber connections.
2) Remove network cabling from the module.
3) Remove the SD Card from the module.
4) Remove the module.
5) Install the replacement PNS module.
6) Insert the SD Card from Step 3) in the replacement PNS module.
7) Connect network cabling to the replacement PNS module.
8) Apply power to the replacement PNS module hardware. The PROFINET IO-Controller will update any IP Address settings automatically when it connects.

3.4.2 Method 2 – Using the DCP Tool

Refer to Section 4.3, *Assigning Device Names*.

1) Remove power from the PNS module. This should be done before network cabling is removed, especially in the case of fiber connections.
2) Remove network cabling from the module
3) Remove the module.
4) Install the replacement PNS module.
5) Connect network cabling to the replacement PNS module.
6) Apply power to the replacement PNS module hardware.
7) Using the utility PROFINET DCP click on the *Refresh Device List* command button.
8) Highlight the row representing the newly installed PNS.
9) Click on the *Edit Device* command button and type in the *Device Name*.
10) Click on the *Set Device Name* command button.

3.5 SFP Modules for Ethernet Ports

Refer to Chapter 2 of the *PACSystems RX3i PROFINET Controller User Manual*, GFK-2571.

3.6 External Switch VLAN Priority Settings

Refer to Chapter 4 of the *PACSystems RX3i PROFINET Controller User Manual*, GFK-2571.

3.7 Installing the USB Port Driver (revision –Axxx only)

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

With the provided installation files accessible on either a local or network drive, connect the computer's USB port to the USB port on the PNS module to be upgraded. 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 PNS module.

Note: When connecting the USB cable to the PNS, you may receive a warning for installing a driver that has not passed Windows Logo testing. This warning should be ignored. Because each PNS has a different serial number, the operating system recognizes each driver installation as different.

3.8 Firmware Updates

Rev. -Axxx:

Note: The RX3i PNS does not prevent initiation of firmware update when it is actively connected to an I/O Controller. When the PNS enters firmware update mode, the PNS and its modules go to their I/O default modes. During the update, the PNS does not drive module outputs or send inputs to the I/O Controller. When the firmware update is completed and the PNS is rebooted, its previous connections are re-established and control resumes. Refer to section 2.1.8.6 *Power-up LED Patterns.*

The PNS 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 PNS module blinks its LEDs in a special pattern as described previously, and its Ethernet ports are not operational.

If the PNS has experienced a fatal error, the module goes to an LED blink-code error condition and does not communicate with WinLoader, causing WinLoader to return a timeout failure indication. The module must be power-cycled before reattempting the update.

Rev. -Bxxx:

Rev. -Bxxx: and later hardware supports firmware update through an embedded web interface. This interface can be accessed through the front panel Ethernet port or the switched PROFINET ports.

Since firmware updates can occur from a remote location, updates are only allowed if one of the following conditions is met:

- there is no PROFINET connection to the PNS,
- the active PROFINET connection reports the CPU is in STOP mode, or
- the control bit of the PNS has been set to allow updates while in run mode.

If one of these conditions is not true, then the update request is not allowed and an error message is presented on the web page.

3.8.2   Setting the Firmware Update Password

The webpage update password has no default setting. The user must be present in front of the PNS unit to set the password and a password must be configured before any firmware update is possible. A previous or lost password can be overwritten through the same process.

From the default page, select the Administrator button and choose Reset Password.
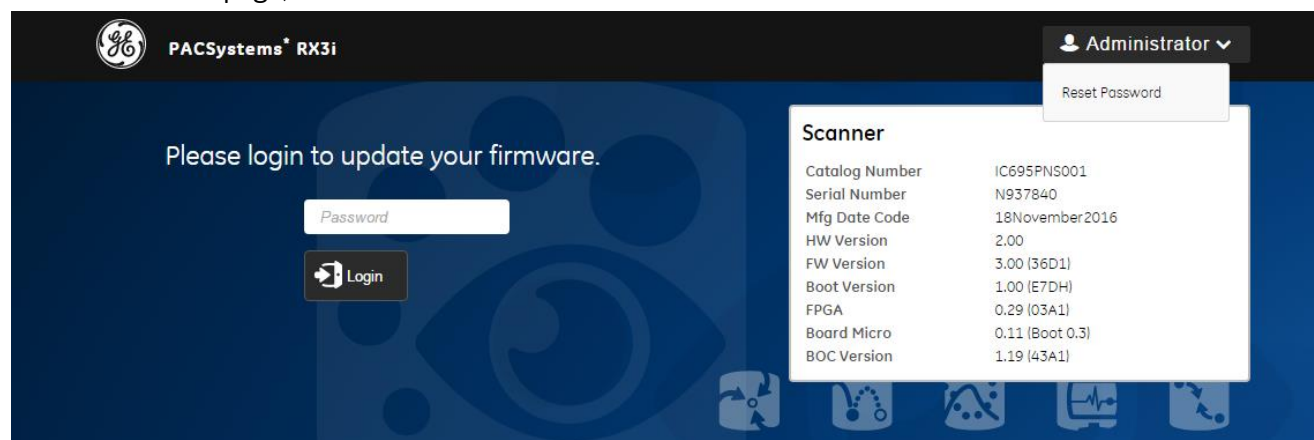
Figure 10: Select Reset Password

The page will transition to a secure (https) connection using a security certificate generated by the PNS unit. The web browser may warn that the connection is not private or secure since the PNS does not provide the web browser a certificate signed by a registered root of trust.
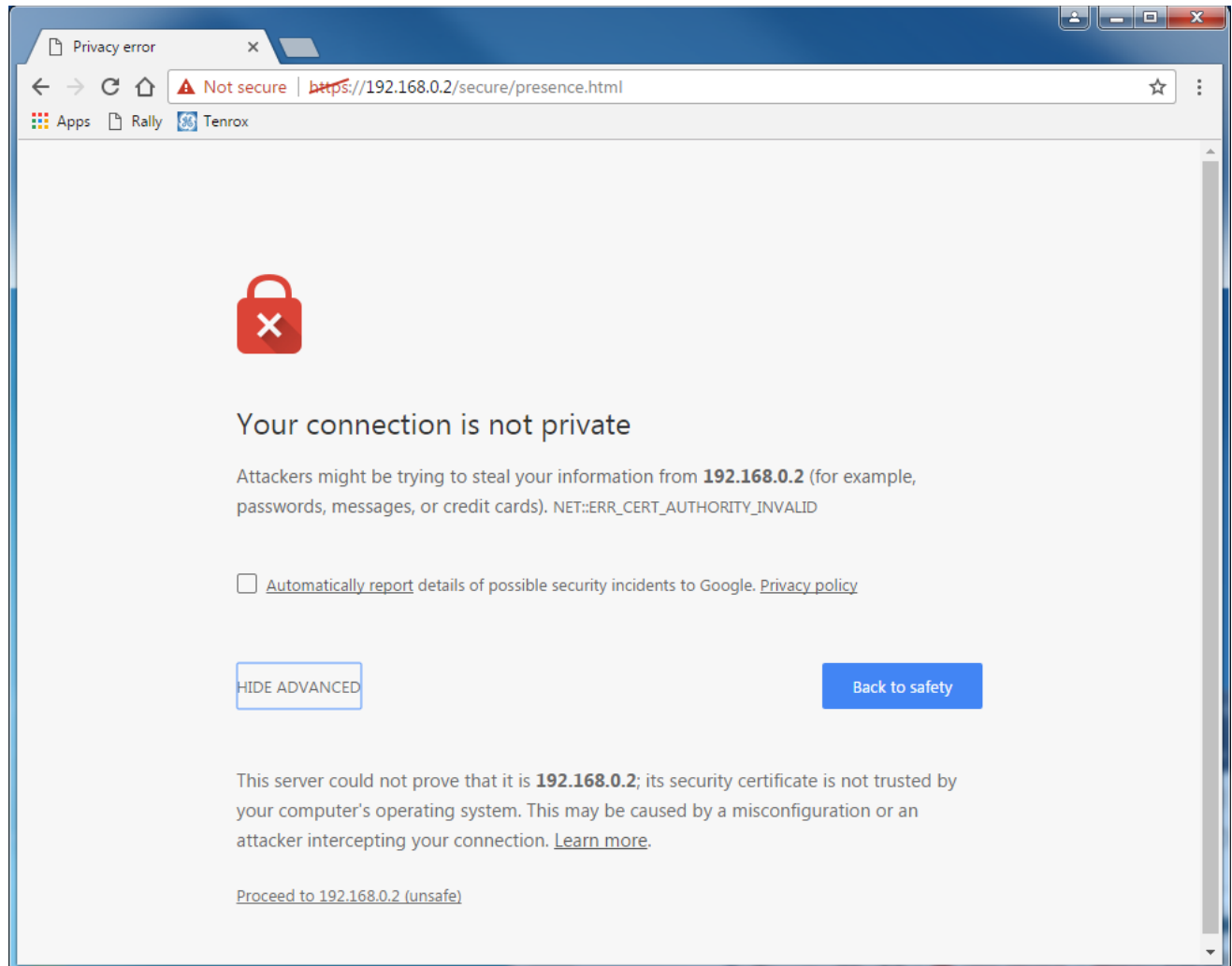
Figure 11: Privacy Warning

After dismissing these warnings, the next page requires the user to press and release the Reset button while on the page, so the user knows they are communicating with the unit in question.
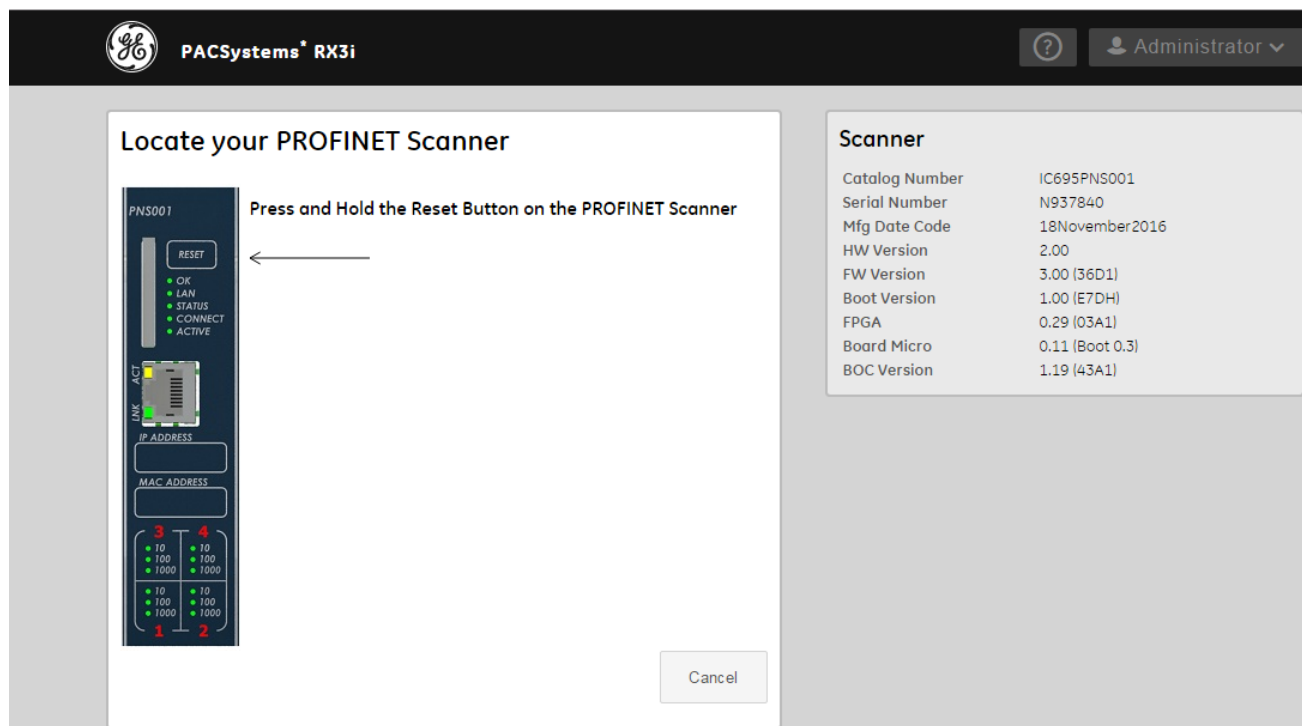
Figure 12: Locate Device

Once the user, has complete this step, the page changes to allow the user to set the new password.
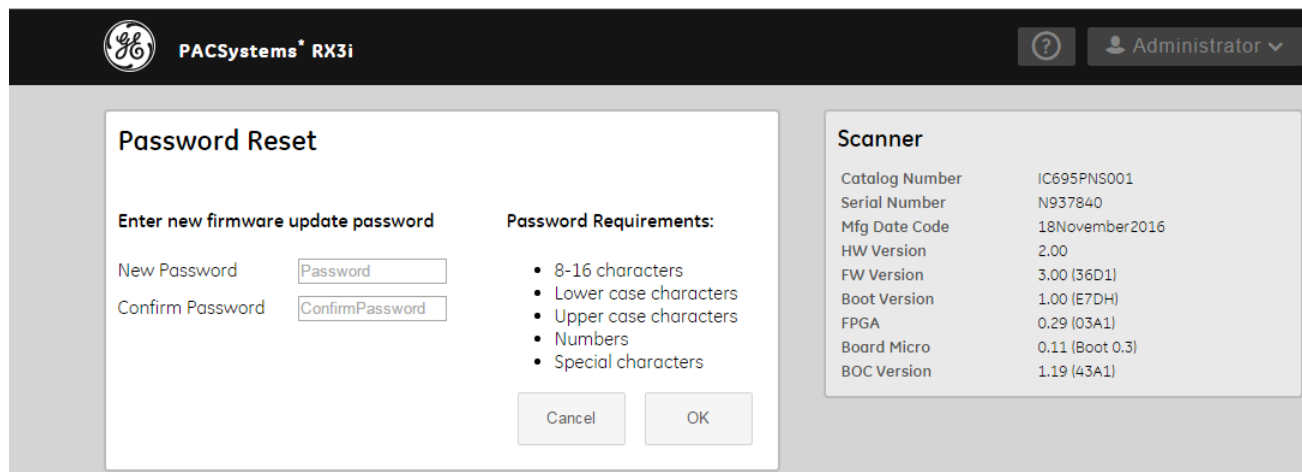
Figure 13: Set New Password

As shown on the webpage, passwords must be:

- 8-16 characters,
- include at least one lower case letter,
- include at least one upper case letter,
- include at least one number, and
- include at least one special character (!"#%&'()*+,-./:;< = >?@[\]^_`{|}~)

The password must be entered a second time to confirm it was entered as desired. The password is saved in non-volatile storage, so it only needs to be configured once.

Chapter 4   Configuration

This chapter explains how to configure a PROFINET IO-Device consisting of an RX3i PROFINET Scanner and the I/O modules located in its rack into a PACSystems RX3i system controlled by an RX3i CPU. Additional information about RX3i configuration is available in other PACSystems documentation (refer to Section 1.9, *PACSystems Manuals*) and in the Logic Developer online help.

This chapter discusses the following topics:

- Configuration Overview
    - o   Basic Configuration Steps
    - o   Configuration Tools
- Adding an RX3i PROFINET Scanner to a LAN
    - -   Configuring RX3i PROFINET Scanner
    - -   Adding RX3i Modules to a Remote Node
        - o   Adding a Power Supply
        - o   Adding and Configuring an Ethernet Port
        - o   Configuring Module Parameters
        - o   Configuring Analog Modules that have DIP Switches
        - o   Configuring Analog Modules that have Jumpers
- • Assigning *Device Names*
    - -   Transferring the IO-Device Name with an SD Card
- After the Configuration is Stored to the PROFINET Controller

4.1 Configuration Overview

The RX3i PNS receives its configuration from a connected PROFINET Controller (PNC), which has been configured by a PROFINET configuration tool. The GSDML files required for configuring the PROFINET Scanner (PNS) are provided with Proficy Machine Edition. For other PROFINET configuration tools, the PNS GSDML must be imported. The GSDML file for the RX3i PNS can be obtained at www.geautomation.com. PNS001 GSDML files are also included in all RX3i firmware upgrade kits.

Note: For details on using the Proficy 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 PROFINET Controller Manual*, GFK 2571.

4.1.1 Basic Configuration Steps

The basic configuration steps are:

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

  PROFINET Scanners 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.

- Configure the parameters of the RX3i PROFINET Scanner.
- Configure the communications properties of the PROFINET I/O Controller and RX3i
- PROFINET Scanner.
- Add RX3i/Series 90-30 modules to the RX3i PROFINET Scanner.
- Configure the parameters of the modules.
- When the configuration is ready, use a DCP tool to assign a *Device Name* to the RX3i PROFINET Scanner 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 PNS module must support IO-Devices configured with GSDML V2.3 files.

The *Proficy Machine Edition PLC Logic Developer* programmer is used to create and download the configuration for an RX3i PROFINET network and its devices.

4.2 Adding an IO-Device to a PROFINET LAN

Use the PROFINET I/O configuration tool to add an IO-Device to the LAN:

- In the case of an IO-Device consisting of a rack of RX3i I/O modules, that rack must contain an RX3i Scanner PNS001 as its head-end. For SOE applications, use PNS101 instead.
- In the case of an IO-Device consisting of a remote drop of RX3i I/O modules, but no RX3i I/O rack, the CEP001 acts as the head-end unit. For product details, refer to the *PACSystems RX3i CEP PROFINET Scanner User Manual*, GFK-2883.
- In the case of an IO-Device consisting of a rack of VersaMax I/O modules, that rack must contain a VersaMax Scanner IC200PNS001 or IC200PNS002 as its head-end. For product details, refer to the *VersaMax PROFINET Scanner Manual*, GFK-2721.

4.2.1 Adding an RX3i PROFINET Scanner to the PROFINET LAN

Begin this process by importing the GSDML file corresponding to the PNS001 module and its associated RX3i I/O Rack. Fourteen versions of this GSDML file are available, based

1) on the size of the host RX3i I/O Rack backplane,
2) upon which slot in that rack the PNS will occupy, and
3) whether it is Rev. -Bxxx hardware or not.

Apart from these three aspects, the GSDML files are otherwise identical. Select and import the version that corresponds to your application. The only difference in the Rev. -Bxxx hardware options on the initial release is the configuration option for the front panel Ethernet port. Rev. -Bxxx hardware will work with the selections for Rev. -Axxx, but the configuration for the front panel Ethernet port and newer features will not be available. So, if Rev. -Bxxx hardware is used to replace an existing Rev. -Axxx installation, the previous configuration will work without additional configuration upgrades.

Once the IO-Device is created, the slot occupied by the PNS is fixed and cannot be altered. If the application requires that the PNS be moved to a different slot, a new IO-Device must be created (using the process described in this section) and the original IO-Device must be removed from the configuration.

Note: For IC695PNS101 configuration, refer to the *PACSystems RX3i Sequence of Events User Manual*, GFK-3050.

There are two ways to add a RX3i PNS device:

1. From right-click on the PROFINET Controller in PME HWC Navigator:

   In this case (Figure 14), the user

   a) selects *Add IO-Device* and the GSDML (RX3iPNS yyyymmdd-V2_3-GEIP) is expanded, showing 14 selections.
   b) These selections are ordered by rack slot size under GE Intelligent Platforms / GSDML version.

      i. The first 12-slot selection shows the following in the Description field "PROFINET IO Scanner Module in slot 1 of a 12-Slot Universal Backplane used to scan PACSystems RX3i modules".

      ii. The second 12-slot selection shows the following in the Description field "PROFINET IO Scanner Module (IC695PNS001-BAxx or later hardware) in slot 1 of a 12-Slot Universal Backplane used to scan PACSystems RX3i modules". This is the selection that applies to the -Bxxx hardware.

      iii. For items specific to IC695PNS101, refer to the *PACSystems RX3i Sequence of Events User Manual*, GFK-3050.
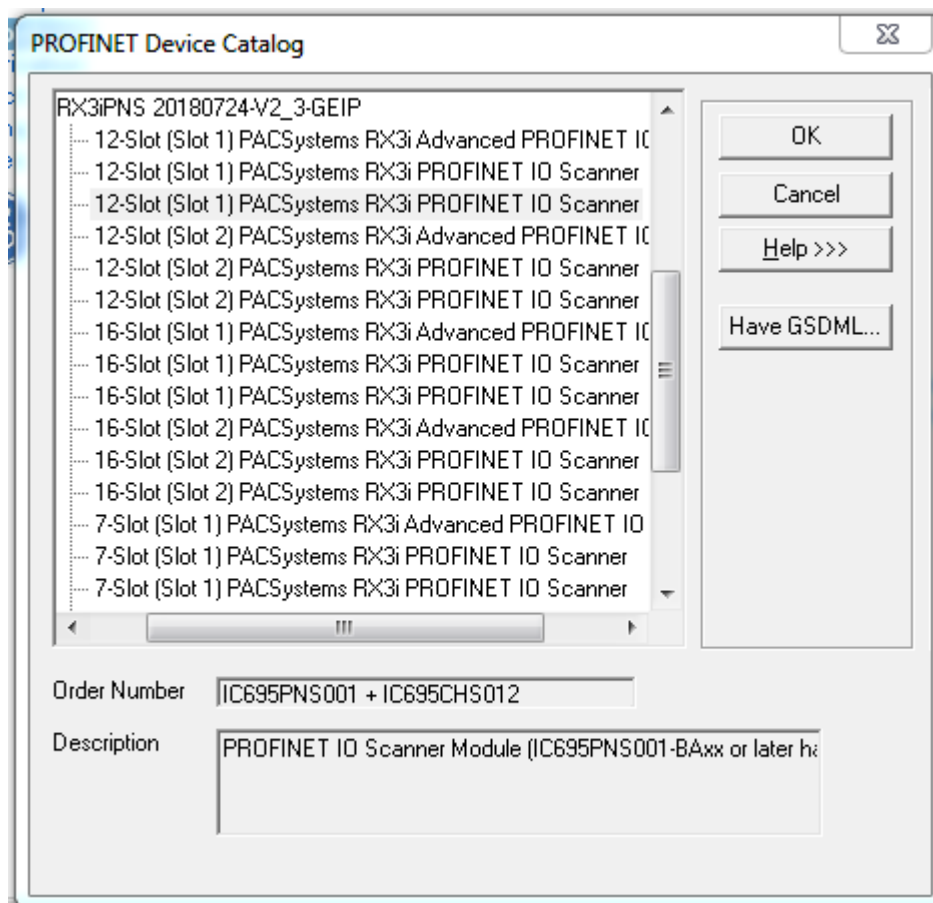
Figure 14: Add Device from Catalog

2. From Toolchest:

   In this case (Figure 15), the GSDML (RX3iPNS yyyymmdd-V2_3-GEIP) in in the Toolchest / Profinet Devices / GE Intelligent Platforms drawer is ordered

   a) by GSDML version and then
   b) by Hardware Type, which has
      i. 7 Device options ("fxParts") ending (SW_2_2_0 HW: 1) followed by
      ii. 7 Device options ("fxParts") ending (SW_2_2_0 HW: 2).
         HW: 2 refers to -Bxxx hardware or later.
      iii. For IC695PNS101, there are additional listings. Refer to the *PACSystems RX3i Sequence of Events User Manual*, GFK-3050.

   Once selected, these GSDMLs Device options can be dragged to the HWC in order to add the corresponding device.
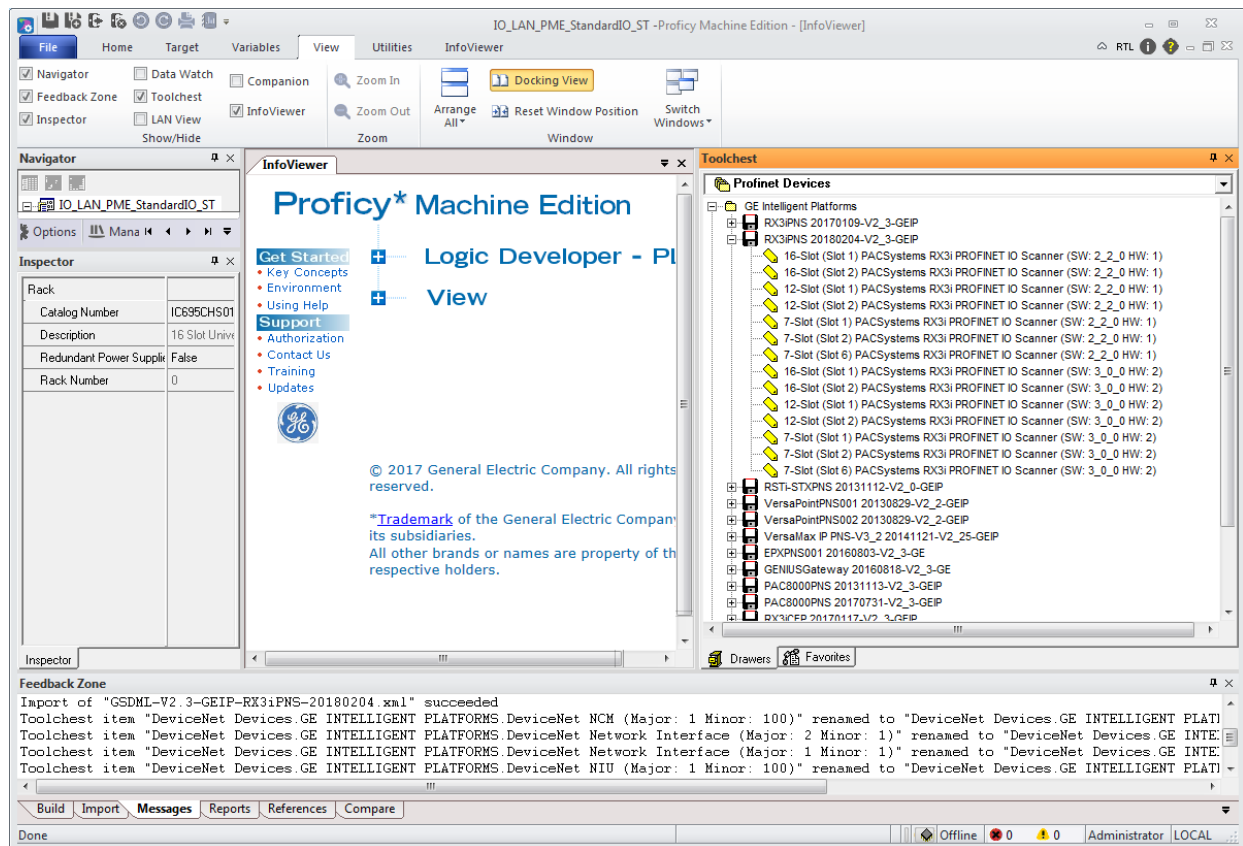

Figure 15: Add Device using Toolchest

4.2.2 *Configuring an RX3i PROFINET Scanner*

The PROFINET I/O Scanner is automatically assigned 32 bits of Status data and 32 bits of Control data. These should be mapped to the I/O Controller's memory. For definitions of these bits, refer to Section 5.2.1, *PROFINET Scanner Status and Control Data*.

The PROFINET Controller (PNC) to which the PNS is connected determines the state of the inputs whenever the PNS is unable to provide them. This could happen when the PNS is not powered on, not connected to the network, or there is a network or configuration issue such that the PNC cannot communicate with the PNS. PNCs available from GE Automation and Controls support defaulting inputs to *Force Off* or *Hold Last State* values until PROFINET communications are restored.

Configure the network parameters of a PNS (IP Address, subnet mask, and gateway) so that each device on the PROFINET network has a unique IP Address. The PNC will configure the network parameters for the PNS during the Connect sequence.

When the network parameters are set with the DCP tool, they will be maintained over a power-cycle while no PNC is connected. If a PNC is connected and the network parameters configured for the PNS do not match the currently retentive parameters stored on the device (those set using a DCP Tool), then the PNC will assign the configured network parameters to the PNS for immediate use during the connection process. This will have the effect of overwriting 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 PNS is subsequently power-cycled without a PNC connected, the PNS will power up with the default network settings because network settings configured by the PNC are not retentive. In order to maintain settings over a power-cycle without a PNC connected, the network settings assigned by the PNC must match the network settings configured with the DCP Tool.

The rate of data exchange on the PNS is usually configured in PME configuration tools. The PNS supports update rates from 1 ms to 512 ms. 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 PNC. Refer to the section on PNC Loading in the *PACSystems RX3i PROFINET Controller User Manual*, GFK-2571. It is possible to have better performance at 2 ms, 4 ms or greater periods than at 1 ms depending on the overall system requirements, design, and loading. The duration of data indicating very brief states or conditions should be taken into consideration in choosing the correct setting.

4.2.2.1 Media Redundancy Parameters

For a full discussion of PROFINET Redundant Media and interactions with the controlling RX3i CPU, refer to Chapter 6 of the *PACSystems RX3i PROFINET Controller User Manual*, GFK-2571.

By default, the PROFINET Scanner is not set up for Media Redundancy. If the PROFINET Scanner will be a Media Redundancy Client (MRC), use Proficy Machine Edition to configure the related parameters, as follows. For the PNS module itself, select the module 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 Media Redundancy tab of the associated PROFINET Controller.

4.2.2.2 System Redundancy Parameters

The Redundancy tab selects whether or not the PNS is to be redundantly controlled.

Figure 16: Select System Redundancy Parameters in PME

When the PNS supports PROFINET System Redundancy and is configured in an HSB CPU Redundancy system, the Programmer defaults the Redundancy Mode parameter to *HSB CPU Redundancy*. Refer to the *PACSystems Hot Standby CPU Redundancy User's Manual,* GFK-2308G or later, for detailed information on setting up a Hot Standby Redundancy system.

When the PNS does not support PROFINET System Redundancy or is not configured in an HSB CPU Redundancy system, the PNS Programmer defaults the Redundancy Mode parameter to *None*. This selects simplex operation.

To configure a redundancy-capable PNS for simplex operation within an HSB CPU Redundancy system, change the Redundancy Mode parameter from *HSB CPU Redundancy* to *None*.

Transfer List

All redundantly controlled I/O must be included in the CPU's I/O transfer list. Note that once the HSB CPU Redundancy Mode is set, Proficy Machine Edition automatically expands the Primary CPU's input transfer list to include all redundantly controlled PROFINET inputs as reference addresses are being assigned. Proficy Machine Edition also automatically expands the Primary CPU's output transfer list to include all redundantly controlled PROFINET outputs.

The configuration should be stored to both the Primary and Secondary racks before attempting to control any I/O in the RX3i PNS.

Changing a Redundant PNS Configuration

Changes to the device's configuration on either the Primary while the Secondary is running or the Secondary while the Primary is running will cause a Loss of Device I/O fault on the controller that is being updated. The controller with the changed configuration will be prevented from re-connecting as long as a non-matching connection exists with the device from any controller.

To make changes to the PNS configuration once the system is running, refer to the *PACSystems Hot Standby CPU Redundancy User's Manual,* GFK-2308, and follow the procedure *Download a Modified Configuration to a Redundancy System – Stopping the Process.*

4.2.3   Module Parameters

Rev -Bxxx: GSDML options support the assignment of the front panel Ethernet port IP Address, Subnet mask, and Gateway IP address on the Module Parameters tab.

The Advanced PROFINET IO Scanner (PNS101) supports the *Max IO Scan of 1ms* parameter. This parameter is used in conjunction with the RX3i Sequence of Events application. Refer to the *PACSystems RX3i SoE User Manual*, GFK-3050, for additional information.

4.2.4   Adding RX3i Modules

For a list of modules, power supplies and backplanes that can be used with an RX3i PROFINET Scanner I/O Device, refer to Section 1.7. Select the slot in the rack into which a particular module will be placed, then select the catalog number for that module from the drop-down list provided.

4.2.4.1   Adding a Power Supply

Some power supplies occupy two slots in the backplane. When adding a two-slot power supply to an RX3i Scanner configuration, it should be configured in the left-most slot occupied by the module, and nothing configured for the other slot. For example, when installing an IC695PSA140 power supply in slots 0 and 1 in the backplane, it is configured in slot 0 and nothing is configured in slot 1. Because both slots of a two-slot power supply must fit within the rack, a 2- slot power supply cannot be placed in the last non-expansion slot of a rack.

Adding power supplies to the configuration sets up power supply alarms. Loss of Module alarms will be triggered if the power supply is configured but not working, or configured in the wrong subslot. These power supplies have no configurable parameters, but their power supply and GSDML details can be viewed by double-clicking on a power supply icon or right-clicking and selecting Configure.

4.2.4.2   Adding and Configuring an Ethernet Port

SFP modules may be added to the RX3i PNS by selecting the desired SFP module type from the available SFP module list and assigning it to Port 3 or Port 4. Refer to Section 3.5, *SFP Modules for Ethernet Ports* for more details.

To add an SFP module to a PNS: using Proficy Machine Edition, right-click the slot containing the PNS and select *Change Submodule List* (Figure 17) to display a dialog box that will present a list of supported SFP modules.
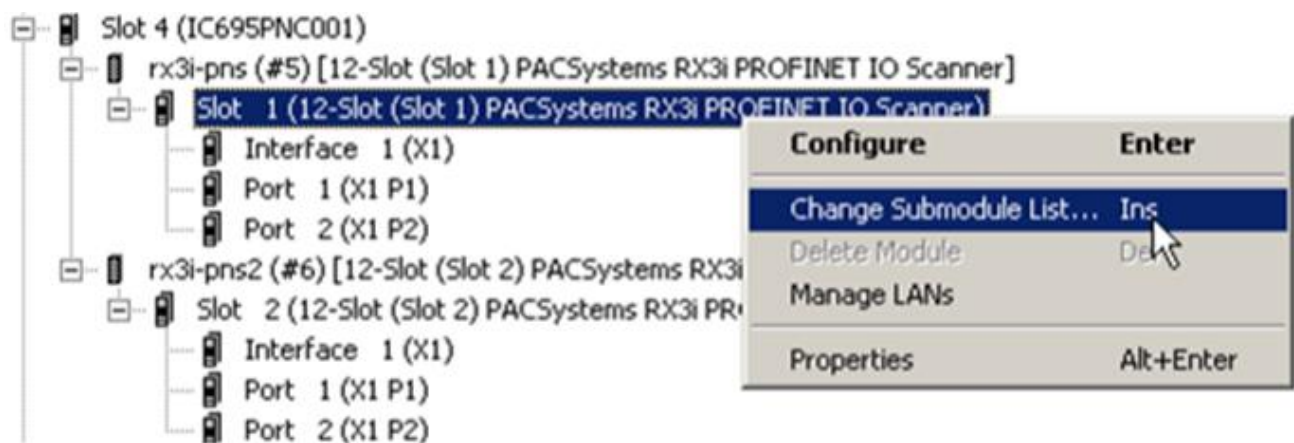
Figure 17: Change Submodule List produces list of Eligible SFP Modules

The RX3i PNS001 supports setting a port to

- Automatic (Auto-negotiation enabled),
- a designated fixed speed, or
- Disabled.

Automatic enables auto-negotiation for the widest range of options supported by the port.

Designated speed options limit the auto-negotiation to that one setting such as limiting a 1 Gbps connection to 100 Mbps.

The *Disabled* setting powers down the port so that it does not establish any link.

All ports, including empty, unconfigured SFP cages, are set to *Automatic* by default.

Once an SFP port is populated with an SFP device, the PNS001 will treat that port as *present*. RJ45 ports are always treated as *present*.

The PNS001 rejects configurations that disable all *present* ports. This rejection causes the Scanner to fail to establish a connection. For example, if no SFP modules are *present* and a configuration is attempted which disables the two built-in RJ45 ports, that configuration does not connect. A configuration which disables the two built-in RJ45 ports, but has an SFP module configured which is not *present* also does not connect. In this last example, once an SFP module is installed in the specified port, the port will become *present*, the configuration becomes valid and a connection can be established.

<table>
<tr>
<td>⚠️
Caution</td>
<td>The port delivering the configuration can be disabled by a new configuration and that setting stored to non-volatile storage. Be sure to understand the network topology before disabling Ethernet ports.</td>
</tr>
</table>

<table>
<tr>
<td>⚠️
Caution</td>
<td>Port disable settings are non-volatile. If an SFP port is configured as the only enabled port and that SFP is removed, the RX3i Scanner will not be accessible until an SFP is reinserted into that port.</td>
</tr>
</table>

4.2.4.3 Configuring Modules with Submodules

Certain PACSystems RX3i I/O Modules (such as the Analog Module in Figure 18) have configurable parameters that must be selected prior to operation. Proficy Machine Edition indicates an error on the module until its submodule-level configuration has been completed, as described below.

Figure 18: Analog Module with Configurable Parameters

To complete this level of configuration, right-click the slot containing the I/O Module and select *Change Submodule List*. This opens a dialog box that presents a list of submodule options. For example, an analog module which employs jumpers to determine its functional voltage or current range would require an equivalent submodule-level setting to be selected in PME.

4.2.4.4   Configuring Modules with Multiple Modes of Operation

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

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.
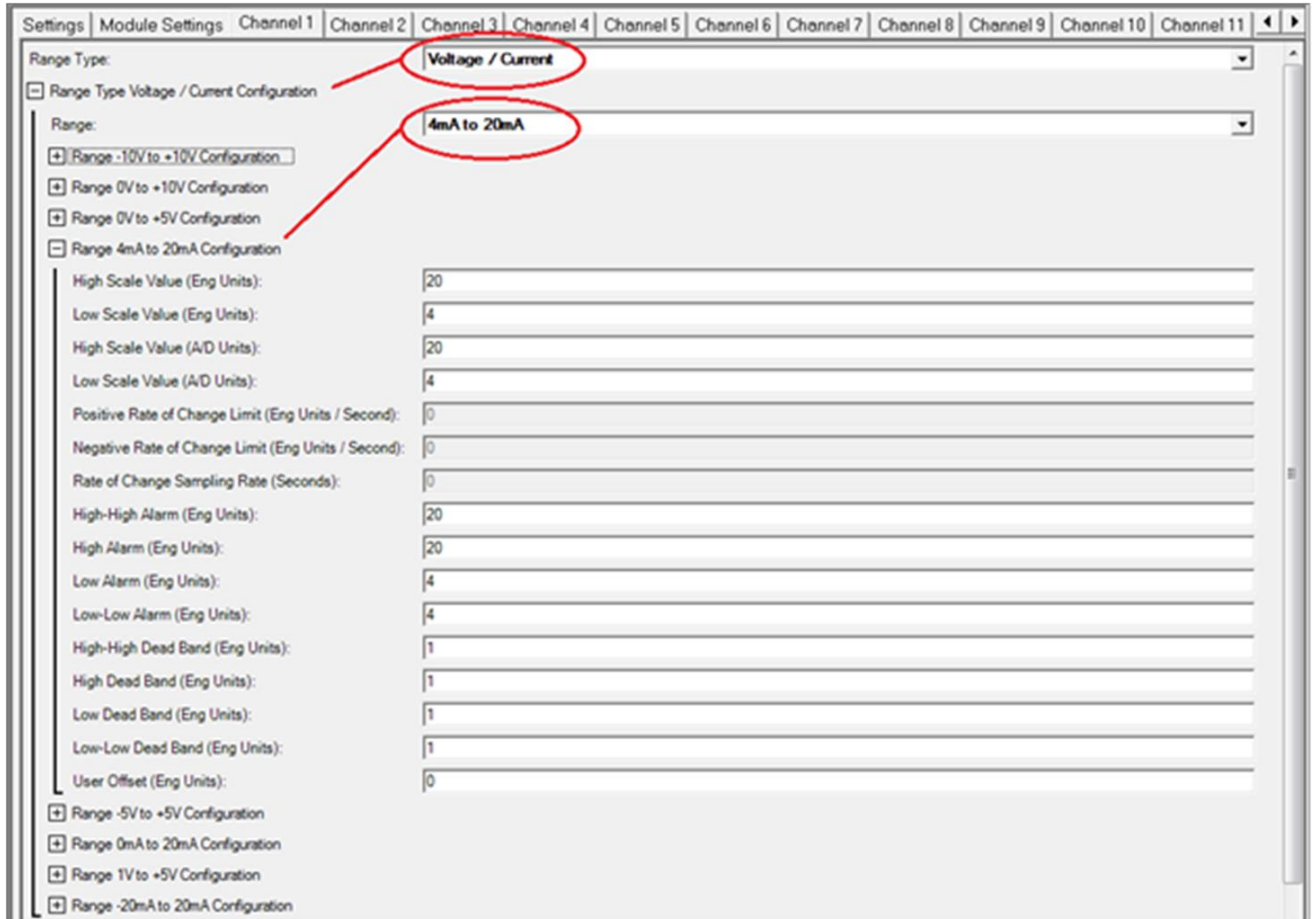
Figure 19: Analog Module with Multiple Possible Option Settings

Whenever multiple options are available, only those parameters 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 parameters. If the active setting is collapsed and not visible, it is still active and its values are used for the module configuration.

4.2.4.5 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 whenever connection to an IO-Controller is lost. A switch selects between *Force Off* and *Hold Last State*. This setting applies to all outputs on the module.

The documentation for each such module lists any additional requirements for *Hold Last State* to operate correctly. For some modules, field power must be maintained on the PACSystems backplane in order 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 the default behavior of its outputs, the hardware default is to turn outputs off.

4.2.4.6 Configuring Modules that have Jumpers

Certain 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 +10 Vdc to -10 Vdc analog input or a 4-20 mA analog input depending on a jumper setting. The IC69xALG390 is another example: it uses a jumper rather than a DIP switch to determine whether to *Force Off* or *Hold Last State*.

Jumper settings are latched when the module is powered up, so the jumper setting cannot be altered during operation. The module itself must experience a power cycle for an altered jumper setting to have effect.

4.2.5 Support for Analog Modules with HART Features

PNS001 firmware version 2.30 and later supports the HART Pass Through feature of a number of modules, as listed in Section 1.7. HART-compatible PNC001 and compatible RX3i CPU versions are also required. Refer to the *PACSystems HART Pass Through User Manual*, GFK-2929.

PNS001 firmware version 2.41 added support for the *Remote Get HART Device Information* COMMREQ. Using this COMMREQ, information from a HART device connected to an RX3i Analog Module located in a rack controlled by an RX3i PROFINET Scanner may be read into the user application. Refer to the *PACSystems RX3i System Manual*, GFK-2314M or later, for details concerning this COMMREQ.

PNS001 does not support HART variables at time of publication.

4.2.6 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 to the individual module datasheet for detailed parameter information.

Catalog #	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
IC695ALG106	Isolated Analog Current/Voltage Input Module – 6-Channel	GFK-2482
IC695ALG112	Isolated Analog Current/Voltage Input Module – 12-Channel	GFK-2482
IC695ALG312	Isolated Thermocouple Input Module – 12-Channel	GFK-2500
IC695ALG412	Isolated High-Speed Thermocouple Input Module – 12-Channel	GFK-2578
IC695ALG508	Analog Isolated RTD Input Module – 8-Channel	GFK-2501
IC695ALG600	Universal Analog Input Module – 8-Channel	GFK-2348
IC695ALG608	Analog Current/Voltage Input Module – 8-Channel	GFK-2372
IC695ALG616	Analog Current/Voltage Input Module – 16-Channel	GFK-2372
IC695ALG626	Analog Current/Voltage Input Module – 16-Channel with HART	GFK-2372
IC695ALG628	Analog Current/Voltage Input Module – 8-Channel with HART	GFK-2372
IC694MDL660	Digital Input Module (when configured with SoE submodule)	GFK-2379
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
IC695HSC304	High-Speed Counter Module – 4 Counters	GFK-2441
IC695HSC308	High-Speed Counter Module - 8 Counters	GFK-2441

4.2.6.1   RX3i PROFINET Scanner Configuration Validation

Certain elements of configuration data are validated by the RX3i PROFINET Scanner upon receipt. The following table indicates the configuration validations performed by the PNS on behalf of the indicated I/O modules. If the scanner detects an invalid configuration for a given module, the module transitions to module default operation. At the PLC CPU, this will result in the corresponding point faults being energized.

If any 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 has been stored.

Catalog #	Rules
IC695MDL664	1. Pulse test diagnostic 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.
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.
IC695ALG508 IC695ALG600	1. – 5. Same as C695ALG112 6. The Lead Resistance Compensation must be set to disabled for RTD 2-wire operation.
IC695ALG106 IC695ALG112 IC695ALG312 IC695ALG412 IC695ALG608 IC695ALG616 IC695ALG626 IC695ALG628	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 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 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*

Catalog #	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
IC695ALG808	1. -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.
IC695HSC304 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 also 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, the range is 1 to 2147483647. 4. To be used as a counter Setpoint Output an External Output must be configured as Setpoint(s) on the Outputs Tab.

4.2.6.2   Basic Module Parameters

The module parameters define how the PNC scans and stores the module's data. The number of address ranges varies by module and submodule. 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.

Input Data / Output Data	The address in the I/O 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 *PACSystems RX3i System Manual*, GFK-2314, or the appropriate User's Manual for more details about the data of each I/O Module.

4.3 Assigning Device Names

After the PROFINET Scanner 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 *Device Name* to each IO-Device. The name of each device on the LAN must match the hardware configuration resident in the PROFINET IO-Controller. This step is required before downloading the configuration from the PROFINET IO-Controller; otherwise the PROFINET IO-Controller will be unable to connect to the devices on its network and will be unable to deliver configuration data to those IO-Devices.

The DCP tool must be connected directly to the PROFINET IO-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 non-volatile settings such as IP Address, subnet mask, and gateway mask to the factory defaults. A *Reset to Factory DCP* command also clears all Ethernet port settings such as port disabling. This defaults all ports to *Enabled* with Auto-negotiation on.

4.3.1 Transferring the Device Name with an SD Card

To allow replacement hardware to be commissioned without requiring a DCP Tool, the PROFINET *Device Name* can be written to an SD Card and then transferred to replacement hardware via the SD Card.

To write the *Device Name* to an SD Card, the SD Card must be inserted into the PNS when the DCP Tool assigns a *Device Name* to the PNS. An assignment of a *Device Name* using a DCP Tool writes that name to both the SD Card and the non-volatile storage in the PNS. If the card is subsequently removed, the PNS maintains its *Device Name* from its internal non-volatile storage memory.

If a PNS is powered up with an SD Card inserted that is programmed with a valid, non-blank *Device Name*, that PNS will read the *Device Name* on the SD Card and update its non-volatile storage with that *Device Name*.

An SD Card without a *Device Name* (such as a new, un-programmed SD Card) will not affect the PNS at power-up. The PNS will power up and use the *Device Name* settings present in its internal non-volatile storage.

If an SD Card is present on a PNS when a DCP *Reset to Factory* command is issued from the DCP Tool, the *Device Name* on the SD Card will be erased. The DCP *Reset to Factory* command is a method to remove a *Device Name* from an SD Card.

4.4 After the Configuration is Stored to the PROFINET Controller

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

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

A PROFINET Controller delivers configuration data to an IO-Device whenever it establishes (or re-establishes connection) with that IO-Device. In the case of the IO-Device being a PNS:

- If all connections are lost, the PNS retains the most recent configuration received since it was last powered up.

- If a PNS has not been configured since being powered up, it remains in its hardware default condition.

- Whenever the PROFINET connection is re-established and a configuration is sent to the PNS, the PNS cross-checks the configuration data; if the configuration has changed, the PNS applies the new configuration.

If there are differences between the expected, configured modules and the modules physically present in the PNS rack when a connection is established, the PNS transmits appropriate Alarm messages to the PROFINET Controller. Refer to Chapter 6, *Diagnostics* for more detail.

Chapter 5   Operations

This chapter describes:

- Power-up
- I/O Scanning
- Hot Swap of I/O Modules
- Firmware Updates

5.1 Power-up

When power is applied to the PNS module, it loads a firmware image. During the power-up process, the module 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 power-up, the amber OK LED blinks a unique pattern indicating the nature of the failure.

If the module encounters a hardware failure, invalid firmware image, or the power-up diagnostics fail, the module will not become operational or may enter firmware update mode. Cycling power to the module may restore operation. Refer to Section 6.3, *Fatal Error Handling* for more details.

Non-volatile settings such as the PROFINET Device Name, Ethernet network configuration, and Ethernet Port disable settings are activated before a PROFINET connection is allowed.

5.2 I/O Scanning

5.2.1 PROFINET Scanner Status and Control Data

The RX3i PNS001 provides 32 bits of input status data and receives 32 bits of output control data.

The application program in the control system in which the PROFINET Controller is resident should contain code that will monitor the input status bits from the PNS module.

5.2.1.1 Output Control Bits

Rev -Axxx hardware: The 32 bits of control output assigned to the PNS module are reserved for future use.

Rev -Bxxx and later hardware: The 32-bits of control output assigned to the PNS module allow the IO Controller to dynamically control aspects of the scanner's operation. All control bits are active high. Bit 1 is the least significant bit.

Bit #	Name	Description
1	FW Update in Run	A value of 1 allows the webpage firmware update to continue (and restart the PNS disrupting IO) while the PNS IO is actively controlled.
2–32	Reserved	Set to 0

5.2.1.2   Input Status Bits

The 32 bits of input status assigned to the PNS module provide information about the scanner. All status bits are active high. Bit 1 is the least significant bit.

Bit #	Name	Description
1	Module OK	Indicates the health of the module. A value of 0 indicates the module is powering up or has failed. A value of 1 indicates the module is functioning properly.
2	Reserved	Set to 0
3	Port1 Link Up	1 = port is connected to another device and is communicating.
4	Port2 Link Up	0 = port is not connected to another device, or the port has some sort of error preventing communications.
5	Port3 Link Up	
6	Port4 Link Up	
7–10	Reserved	Set to 0
11	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.
12	MRP Role	Indicates the MRP role the PNS is operating as when MRP is enabled. A value of 0 indicates that the PNS is currently an MRP Client. A value of 1 indicates that the PNS is currently an MRP Manager, however the PNS does not currently support MRP Manager configuration. If MRP is not enabled, then this bit will be set to zero.
13	Clock Sync'd	PNS101-only. The internal clock has been sync'd to the IRIG-B clock source. This bit may take up to 90 seconds to turn on after IRIG-B clock available. PNS001: Set to 0
14	SoEs Avail	PNS101-only. SoE Records are available for upload. PNS001: Set to 0
15–32	Reserved	Set to 0

5.2.2   *Data Coherency*

The RX3i PNS provides coherency at a submodule basis only. This means that output data from a single I/O Controller for multiple modules in the PNS rack might not be applied by the PNS during the same output scan. Likewise, input data from all modules read in a single PNS input scan may not be produced by the PNS during the same PROFINET I/O cycle.

5.2.3   *Sampling Rate*

The PROFINET Device Update Rate should be taken into consideration with regard to I/O devices in a Scanner rack. I/O data that changes quickly, such as status bits that represent an event in a module and are only set for one scan of the module, may be missed if the update period spans multiple scans of the module. In some cases, other functionality may be utilized to capture momentary events. For example, High-Speed Counter Over Range, Under Range, Overflow, and Underflow status conditions can be latched by configuring an unused counter to mirror the operating counter and assigning the event condition as a strobe source. The corresponding strobe status and acknowledge bits may be used to monitor and acknowledge the condition.

5.2.4   *Differences from Main (CPU) Rack*

The following CPU operations are not supported or exhibit different behavior than when used with I/O modules in a CPU rack.

5.2.4.1   Interrupts

Interrupts are not supported for I/O modules in a PNS rack. Service Requests that disable, enable, suspend, or resume interrupts have no effect. Interrupt driven Logic blocks cannot be used with I/O modules in a PNS rack, and interrupt status bits should be ignored.

5.2.4.2   Do I/O and Suspend I/O

Do I/O and Suspend I/O operations are limited to updating or suspending the data between the CPU and PNC. The PROFINET I/O scan is not altered (that is, DO_IO data is not exchanged with the PNS any faster than the PROFINET update rate allows).

5.2.5   Output Control

If an output module has not been configured since being powered up, it remains in its hardware default condition. If an output module has been configured, the configuration will specify the output action when communication with the I/O Controller is lost. This is typically one of the following:

- transition to the zero state
- default to a specified state or value, or
- hold the last given state or value.

5.2.5.1   Simplex Connections

For simplex PROFINET connections (one I/O Controller connection to the RX3i PNS), communications with the I/O Controller are lost when no message has been received from the I/O Controller in a number of I/O Update periods (typically three).

5.2.5.2   Redundancy Connections

For PROFINET system redundancy connections, the configured output action is applied immediately by the PNS whenever the controlling Primary connection is lost and no matching Backup connection is established. A Primary connection is lost if no message is received from the Primary IO-Controller within a defined number of I/O Update periods.

If the Primary connection is lost in PROFINET system redundancy but a matching Backup connection exists, outputs are held at their last given value for a period of time to allow the Backup connection to be switched into the Primary role. The period allowed is calculated by the configuration tool. (Proficy Machine Edition uses the CPU sweep rate, I/O Update Rate, network loading, and values from the GSDML to generate this value). If the Backup connection does not switch to Primary within this period, the RX3i PNS terminates the connection and follows the rules for when no connections exist. If the Backup connection is lost during this period, outputs immediately follow the rules for when no connections exist.

For a full discussion of PROFINET Redundancy and interactions with the controlling RX3i CPU, refer to Chapter 6 of the *PACSystems RX3i PROFINET Controller User Manual*, GFK-2571.

5.3 Hot Swap of I/O Modules

If an I/O module is removed while power is applied to the I/O rack (hot extracted), the resident PNS detects the removal and generates a PROFINET *Pull Alarm*. When the PNS is connected to a PACSystems PNC, the *Pull Alarm* is reported as a *Loss of I/O Module* fault. At the RX3i Controller, all point faults corresponding to the missing module will have the Fault Contact asserted.

When an I/O module is hot inserted into its rack, the PNS 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 PNS 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* PLC Fault in RX3i systems. Fault Contacts corresponding to the mismatched module remain in the Fault (on) state.
- If a module is inserted while the PNS 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 comply with the conditions outlined in the *Hot Insertion and Removal* section in the *PACSystems RX3i System Manual*, GFK-2314.

Note: The PNS module should not be installed or removed while power is applied to the system. System power must be removed before installing or removing the module.

Chapter 6   Diagnostics

This chapter describes:
- Configuration Faults
- Version Information
- Fatal Error Handling
- Connection Troubleshooting

6.1 Configuration Faults

If there are differences between the expected, configured modules and the I/O modules physically present in the PNS rack, and/or differences between the expected and detected slot locations, the PROFINET Scanner indicates those differences back to the PROFINET Controller once a connection is established.

- If an I/O module is configured, but is not present or operational in the rack, the PNS indicates the difference to the PROFINET Controller, and the Controller generates an alarm to the CPU. When used with a PACSystems CPU, a *Loss of Module* fault is reported and all point faults corresponding to the missing module will have the Fault Contact on.

- If an I/O module is configured but does not match the module present in the designated slot, the PNS indicates the mismatch as part of the configuration sequence and the PNC generates an alarm to the CPU. When used with a PACSystems CPU, a *System Configuration Mismatch* fault is reported and all point faults corresponding to the module will have the Fault Contact on.

- If the I/O module configured matches the module installed in the assigned slot, but the module itself has submodule options that relate to DIP Switch or jumper settings on the hardware and the physical settings do not match the configuration, the PNS indicates a mismatch at the submodule level to the PNC which generates an alarm to the CPU. When used with a PACSystems CPU, a *System Configuration Mismatch* fault is reported and all point faults corresponding to the affected module will have the Fault Contact on.

- If the physical module matches the configured module, but the configuration for the module is unacceptable, the module itself rejects the configuration and energizes point faults until the configuration is corrected. Many modules blink their OK LED in the event they reject the configuration. Refer to Section 4.2.6.1, *RX3i PROFINET Scanner Configuration Validation* which specifies the rules different modules use to validate their configuration.

- If an SFP module is configured but a different SFP is present (and that SFP is a supported SFP), the PNS will allow the installed SFP to become operational. The PNS identifies the difference to the PNC in the connection messaging sequence, and the PNC generates an alarm to the CPU. The SFP module operates fully as if no difference had been detected. When used with a PACSystems CPU, a *Valid Module Substitution* fault is reported.

- If an I/O module is installed but not included in the PNS configuration, no problem is reported. The module is ignored by the PNS and defaults itself.

- If an SFP is installed but not included in the PNS configuration, default operation is enabled and active.

6.2 Version Information

The RX3i PROFINET Scanner supports the standard PROFINET Identification and Maintenance (I&M) functions. I&M0 Revision information is returned for the PNS slot with the information for the PROFINET Scanner. Rev -Bxxx hardware and later provide version information on the default webpage.

Please consult the documentation for your IO-Controller and configuration tool for how to access I&M data. For PACSystems PROFINET I/O Controllers, this is available under the Explore PROFINET Networks option in Proficy Machine Edition (for details, refer to this topic in the applicable PROFINET Controller User's Manual).

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 front panel ethernet port. After successful power-up of the PROFINET Scanner, only catastrophic errors are treated as fatal. When a fatal error occurs, the PROFINET scanner blinks an error code on its LEDs (refer to Section 2.1.8.1, *Fatal Error Codes*).

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

Problem	Indication	Action
Hardware failure Invalid firmware	• All LEDs off and the module is unresponsive, or • The STATUS LED is solid Green and is the only LED that is on.	Return the module to GE Automation and Controls.
Power-up diagnostics/hardware initializations failures that are considered fatal	LED Fatal Error blink code	Note the blink code and contact Customer Service
Catastrophic error during operation	LED Fatal Error blink code	Note the blink code and contact Customer Service

6.4 Connection Troubleshooting

A PROFINET IO-Device can be challenging to troubleshoot if a connection to the PROFINET IO-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 Proficy Machine Edition. The PROFINET IO-Controller and PROFINET IO-Devices should appear in both tools.

- Verify the spelling of a *Device Name* in the DCP return value from the IO-Device versus the corresponding *Device Name* in the PROFINET Controller configuration. Verify the PROFINET IO-Controller configuration matches the configuration actually active in the IO-Controller.

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

- Invalid configurations will 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 IO-Device cannot be PINGed from the PROFINET IO-Controller's network location, the problems are more likely to exist in the network or in the DCP settings for the IO-Device (i.e. the IO-Device has an incorrect *Device Name* or no IP Address) than in the IO-Device configuration.

- Verify the MRP Ring ports selected. If MRP is configured to use Ethernet ports that are not available, then the connection will fail. This may be an MRP Ring port configured for a removable port (SFP) that is not present, or an MRP Ring port configured for a removable port (SFP) that is malfunctioning. Disabling MRP Client during debugging may help identify SFP problems.

Appendix A PROFINET Specifications

Release 2.00 of the RX3i PROFINET I/O Scanner supports PROFINET v2.3 Class A I/O Device with the clarifications listed below. For version-specific updates, refer to the Important Product Information document provided with your module

A-1 PROFINET Protocol Support

RTC Real time Cyclic Protocol: RT_CLASS_1

DCP Discovery and Configuration Protocol

CL-RPC Connectionless Remote Procedure Call

LLDP Link Layer Discovery Protocol – transmission only

MRP Media Redundancy Protocol – Client only

A-2 Technical Data

API	Single API (0) used.
Number of Application Relations (ARs) supported	2 (1 backup and 1 primary forming a redundant-AR set or 1 simplex)
Maximum length of cyclic input data	1440 bytes
Maximum length of output data	1440 bytes
Alarm Types	Pull, Plug, PlugWrong
DCP	Get/Set/Identify supported. Only *All* and *Name of Station* filters supported.
Identification & Maintenance	I&M Data (I&M0 only)
Context Management	by CL-RPC
Minimum cycle time	1 ms
Ethernet rate	100/1000 Mbps full duplex with auto-negotiation

A-3 Limitations

The following features are not supported in release 3.00.

A-3.1 PACSystems Features

Alarms

Command Feedback data

COMMREQ commands targeted at I/O Modules in the RX3i rack under the control of the PNS001. Exception: PNS Release 2.41 adds support for the *Remote Get HART Device Information COMMREQ*.

Alarms on Hot Swap of SFP modules

Firmware update of I/O Modules

Interrupts from I/O Modules

A-3.2 PROFINET Features

Autoconfiguration

Configure In Run

DCP Hello service

DHCP

Diagnostic Alarms

DNS (Domain Name Service protocol)

FastStartUp

IRT (Isochronous Real Time Protocol)

Multicast communication

PROFIenergy Profile

PROFIsafe Profile

PROFINET CBA

PTCP (Precision Transparent Clock Protocol)

RT over UDP

Shared I/O device

SNMP (Simple Network Management Protocol)

Substitute Data

Supervisor-AR

Only one Input-CR and one Output-CR are supported per AR.

1. *Remote Get HART Device Information COMMREQ* operation is described in the *PACSystems RX3i System Manual*, GFK-2314M.
2. A UDFB that automates the COMMREQ control logic is available for download from the GE support website. (Article ID: 000017816)
   https://ge-ip.force.com/communities/en_US/Download/Remote-Get-HART-Device-Information-COMMREQ-UDFB