

PACSystems Industrial PROFINET Managed Ethernet Switches MRP

APPLICATION GUIDE

GFK-3070B

May 2022

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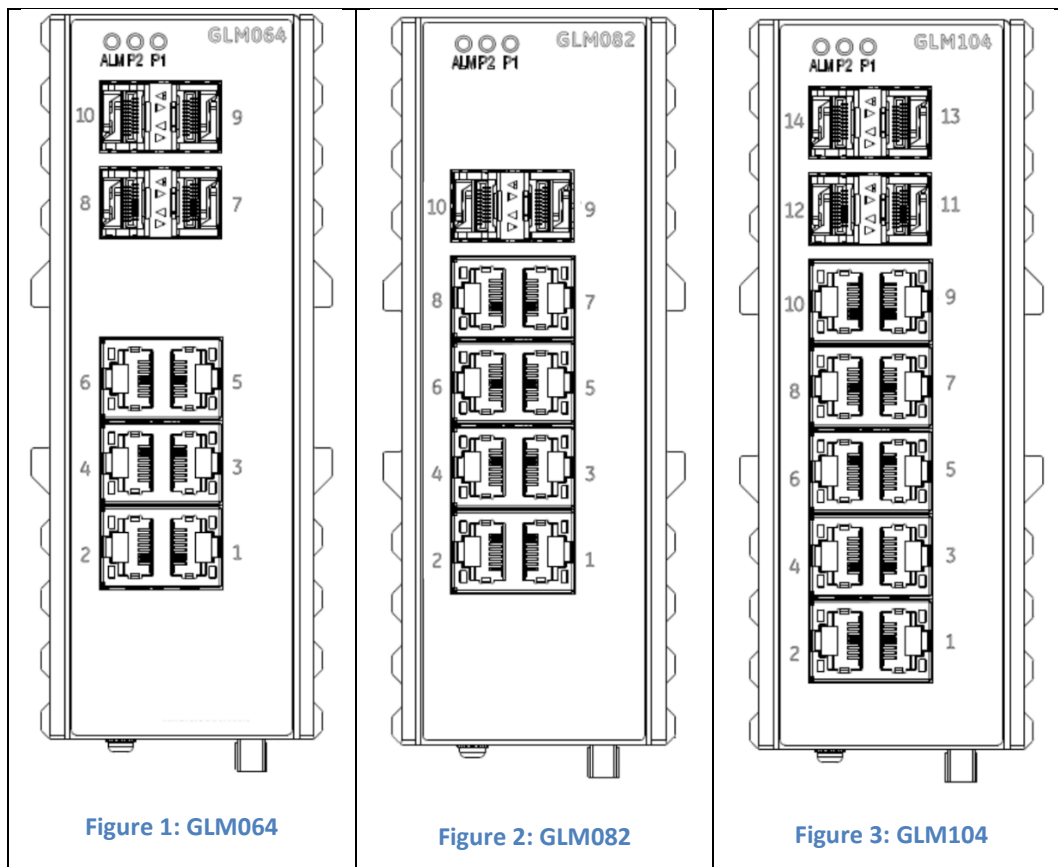
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Section 1 Introduction



The PACSystems GLM series Industrial Ethernet Switches deliver high-quality Ethernet operation over a wide temperature range and can tolerate an extended power input range. These switches are ideal for harsh environments and mission-critical applications. They may be DIN-rail mounted or panel-mounted.

Applications include:

- Virtual LANs (VLANs)
- Access Control List Security (ACL)
- Failover Ring Protection
- Quality of Service (QoS) features
- Internet Group Management Protocol (IGMP)

This document includes a product overview and covers installation, configuration, operation, and diagnostics.

1.1 Revisions in this Manual

Rev	Date	Description
B	May-2022	Updated to correct the details in the PROFINET database of the GLM switch.
A	Jan-2020	Following Emerson's acquisition of this product, changes have been made to apply appropriate branding and registration of the product with required certification agencies. No changes to the material, process, form, fit, or functionality.
-	Aug-2019	<ul style="list-style-type: none"> Initial release.

1.2 PACSystems Documentation

PACSystems Manuals

PACSystems RX3i and RSTi-EP CPU Reference Manual	GFK-2222
PACSystems RX3i and RSTi-EP CPU Programmer's Reference Manual	GFK-2950
PACSystems RX3i and RSTi-EP TCP/IP Ethernet Communications User Manual	GFK-2224
PACSystems TCP/IP Ethernet Communications Station Manager User Manual	GFK-2225
PACSystems Memory Xchange Modules User's Manual	GFK-2300
PACSystems Hot Standby CPU Redundancy User Manual	GFK-2308
PAC Machine Edition Logic Developer Getting Started	GFK-1918
PAC Process Systems Getting Started Guide	GFK-2487
PACSystems RXi, RX3i, RX7i, and RSTi-EP Controller Secure Deployment Guide	GFK-2830
PACSystems RX3i Systems Manual	GFK-2314
PACSystems RX3i Ethernet Network Interface Unit User's Manual	GFK-2439
PACSystems RX3i PROFINET Scanner Manual	GFK-2737
PACSystems RX3i & RSTi-EP PROFINET I/O Controller Manual	GFK-2571
PACSystems Industrial PROFINET Managed Ethernet Switches Important Product Information (IPI)	GFK-3028
PACSystems Industrial PROFINET Managed Ethernet Switches User's Manual	GFK-3030
PACSystems Industrial PROFINET Managed Ethernet Switches CLI Command Reference Guide	GFK-3061
PACSystems Industrial PROFINET Managed Ethernet Switches Web Configuration Tool Guide	GFK-3062
PACSystems Industrial PROFINET Managed Ethernet Switches Secure Deployment Guide (SDG)	GFK-3063
PACSystems Industrial PROFINET Managed Ethernet Switches Installation & Maintenance Requirements	GFK-3098

In addition to these manuals, datasheets and product update documents describe individual modules and product revisions. The most recent PACSystems documentation is available on the Emerson support website. Please see the links provided at the end of this document.

Section 2 Summary Overview

2.1 Overview

This Application Guide provides for the following application scenarios:

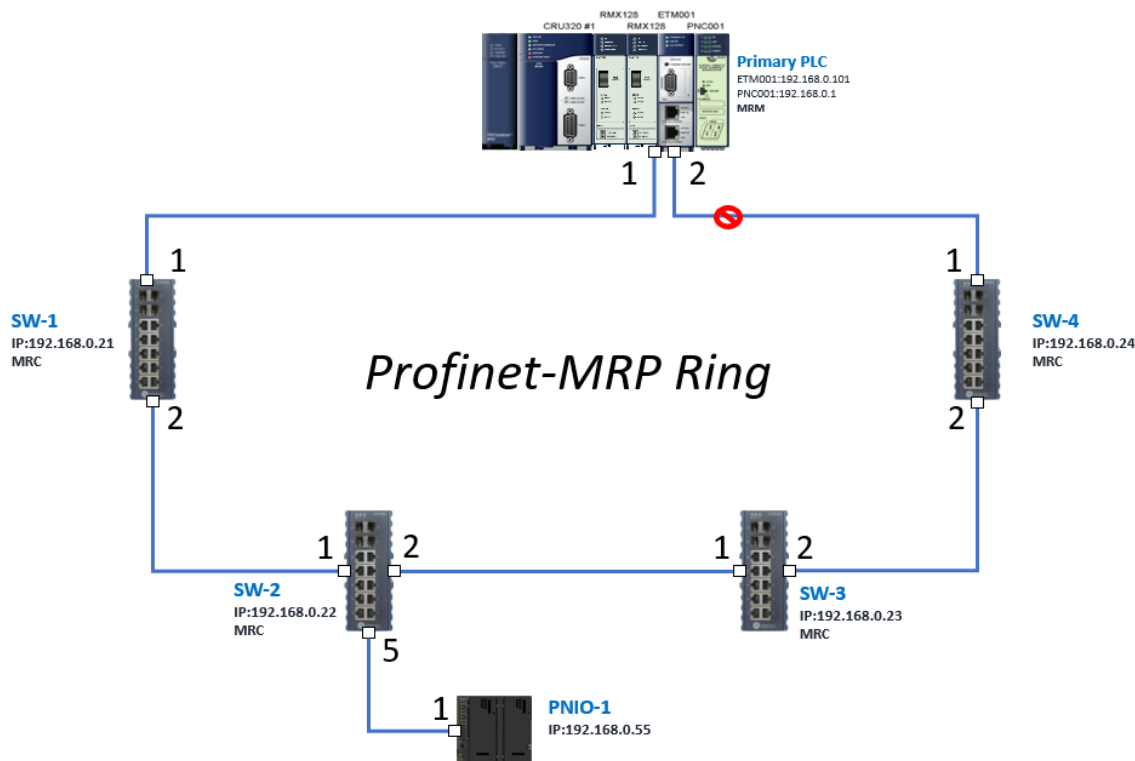
1. Single PROFINET_MRP Ring: In this application scenario, the GLM switch acts in the role of the MRC to cooperate with the manager device, for providing the ring protection.
2. Multiple PROFINET-MRP Ring: In this application scenario, the GLM switch act in the role of the MRC, to expend the ring-protected network without the need for a controller and allow IO-Controller to focus the process control.
3. PROFINET-MRP Main Ring couples multiple PROFINET-MRP Subrings: GLM switch is capable to support communication between two rings connected with each other. The various topologies derived from Dual MRP fit most of the PROFINET applications.
4. Multiple PROFINET MRP Ring and Subring: Via the capability of supporting MRM & MRC roles, the network design can be flexible and cost-effective according to the variant application environment
5. PROFINET-MRP Main Ring couples with coupled two PROFINET-MRP Subring: In the application scenario, the GLM switch is capable of conducting the network protection without IO-C involved.
6. PROFINET System Redundancy: This section will show how to use RingV2 and MRPe to set up the network topology which can support system redundancy and media redundancy.

Network topology, configuration, and implementation of these application scenarios are described in the following sections.

Section 3 Single PROFINET-MRP Ring

3.1 Network Topology

Figure 4: Profnet-MRP Ring



3.2 Hardware Configuration

On the CRU320, the I/O data can be set to “STOP”, “RUN OUTPUT DISABLE” or “RUN I/O Enable” states by a switch imbedded on CRU320. During the configuration, the switches on both 2 CRU320s must be set to “STOP”

3.2.1 Project Open

To start the software PAC Machine Edition, please follow the steps below:

1. Click **Start -> Emerson -> PAC Machine Edition -> PAC Machine Edition**
2. Select the empty project and click **OK**.

3. Set the project name and click **OK**.

Figure 5: Create a new project

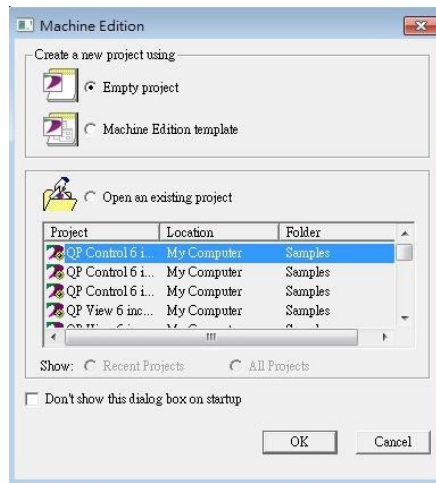
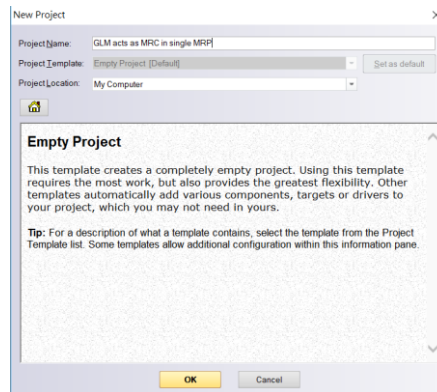


Figure 6: New Project Name

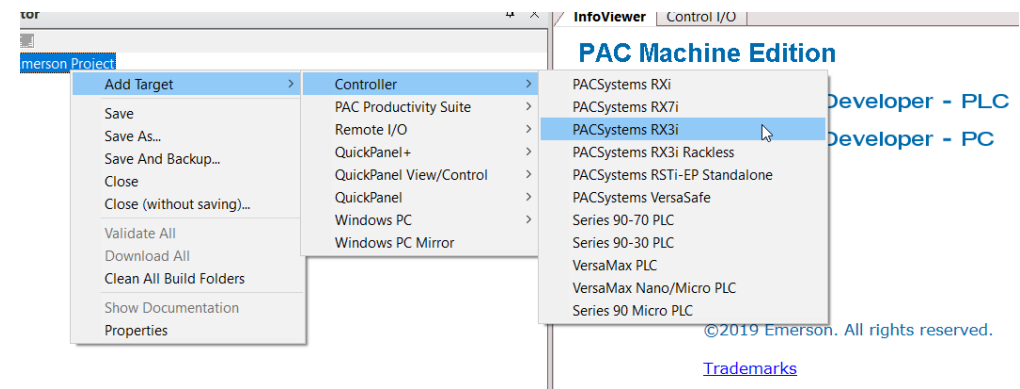


3.2.2 I/O Controller Setting

The next step is to add a target for this project. Click the right button on project name “GLM act as MRC in single MRC group” and select **Add Target -> Controller -> PACSystems RX3i**.

The PACSystems RX3i is the I/O Controller to be tested.

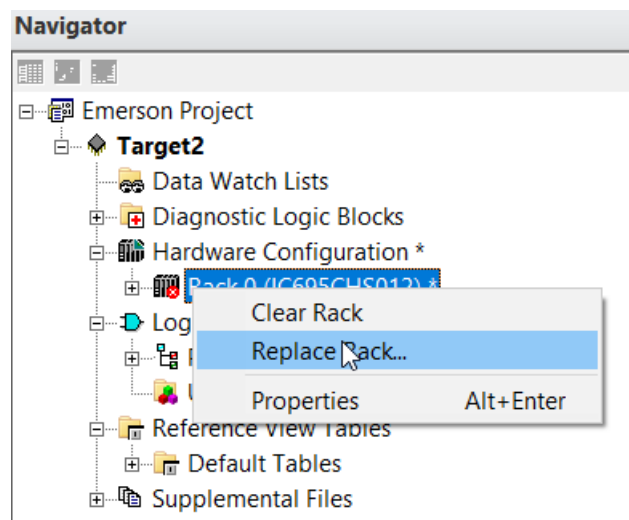
Figure 7: Adding a Target



Originally the I/O Controller is described as the rack with 12 slots, each slot can be regarded as the chassis for device installation such as a power card, communication module, or bus controller. However, there are only 7 chassis that can be used in the I/O Controller CRU320. Thus, replace the rack with 7 slots.

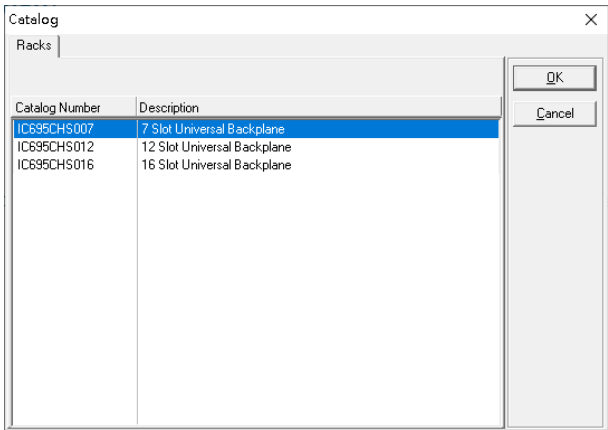
Right-click **Rack 0 (IC695CHS012)** and select **Replace Rack**.

Figure 8: Replace Rack



Select “IC695CHS007” and click OK.

Figure 9: Selecting the Catalog Number



After the rack and the number of slots are defined, select the corresponding devices into the slots according to the I/O Controller. The following picture is the current installation for each device on the I/O Controller.

Figure 10: Current Rack Configuration



From left to right, the installed devices on the I/O Controller are listed in the table below.

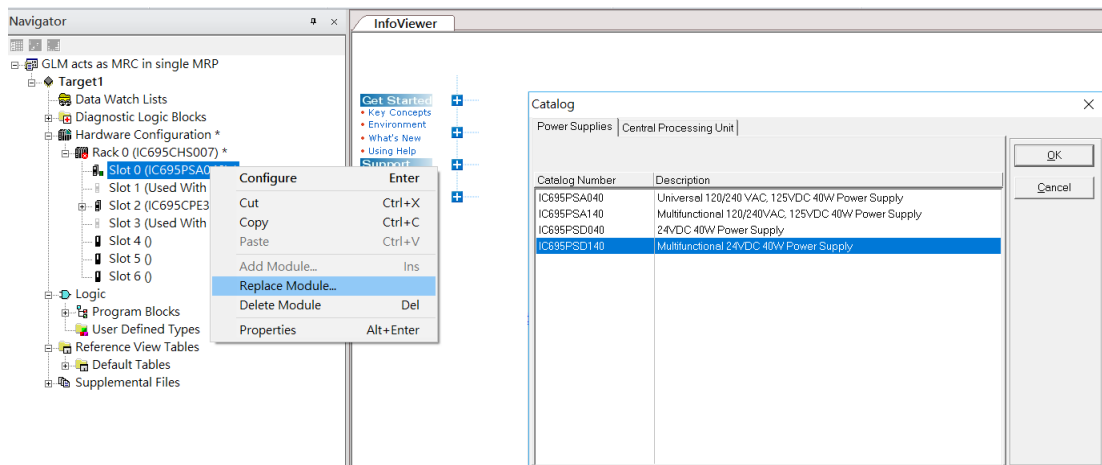
Devices on I/O Controller

Device Type	Device Name	Chassis index
Power Card	PSD140	0
Central Processing Unit	CRU320	1 ~ 2
Communication Module	RMX128	3
Communication Module	RMX128	4
Communication Module	ETM001	5
Bus Controller	PNC001	6

Now, add the module into the slots by the current devices on the I/O Controller, the chassis index is corresponding to the slot index.

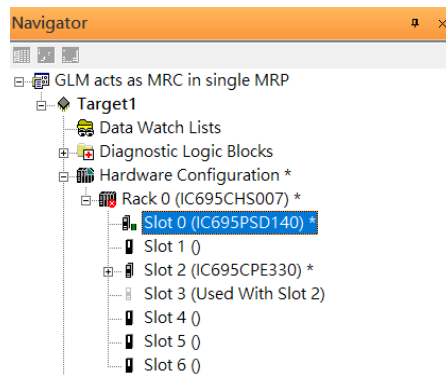
First, replace the power card. Click slot 0 and click the right button, select **Replace Module**, and specify the installed power card, PSD140, then click **OK**.

Figure 11: Replace Module



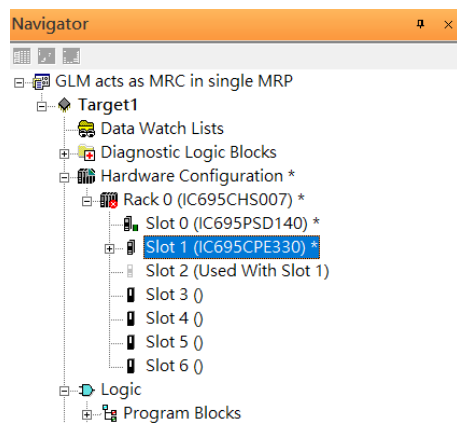
Slot 0 is replaced by the current power card, PSD140.

Figure 12: Target Added



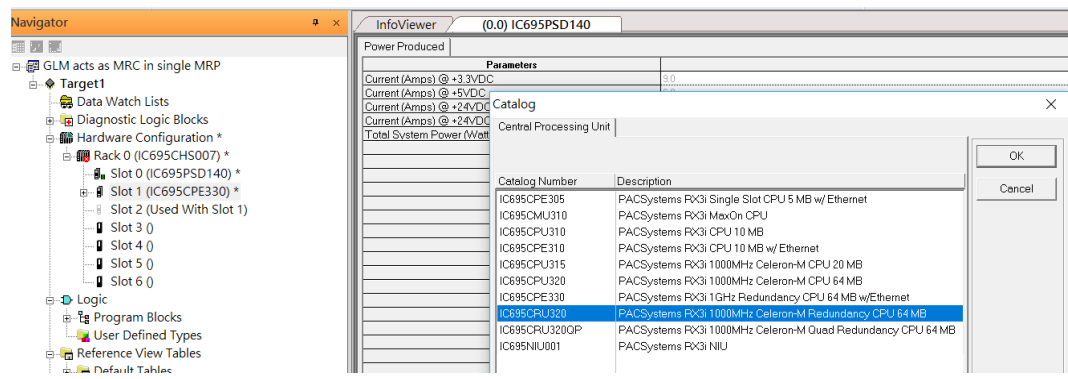
For slot 1 and 2, 2 chassis (1 and 2) is occupied by the Central Processing Unit, CRU320. To integrate slots 1 and 2, pull slot 2 to slot 1. Now slot 2 is cleaned.

Figure 13: Slots 1 and 2



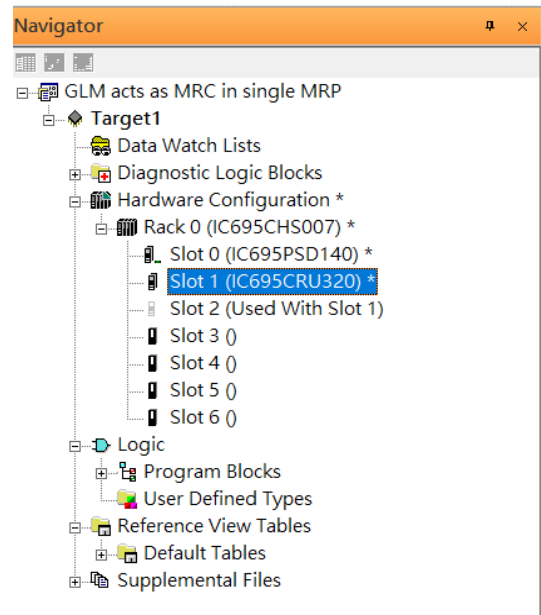
To select the Central Processing Unit, click slot 1 and click the right button, select **Replace Module** to choose CRU320. Then choose **No**.

Figure 14: Catalog Number



Now the CRU320 is specified.

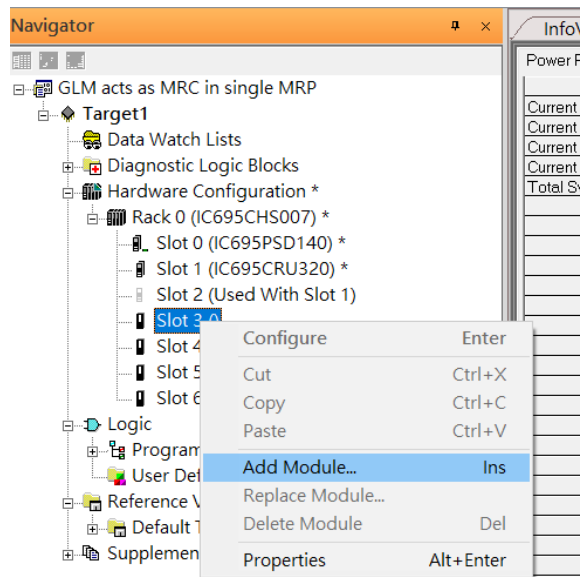
Figure 15: Select the specified target



3.2.2.1 Slot 3

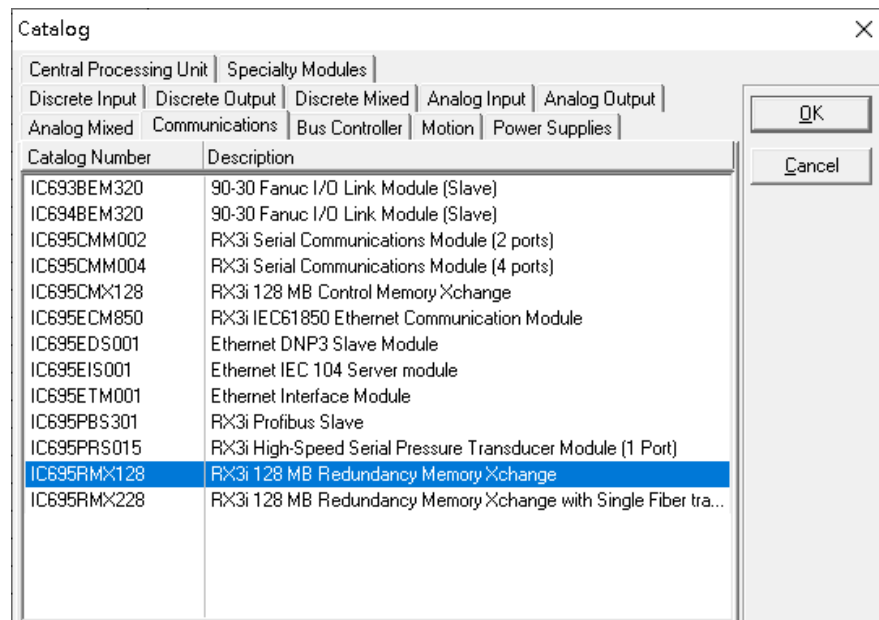
Next is to add the RMX128 module for slot 3. Click the right button on slot 3, and select **Add Module**.

Figure 16: Add Module



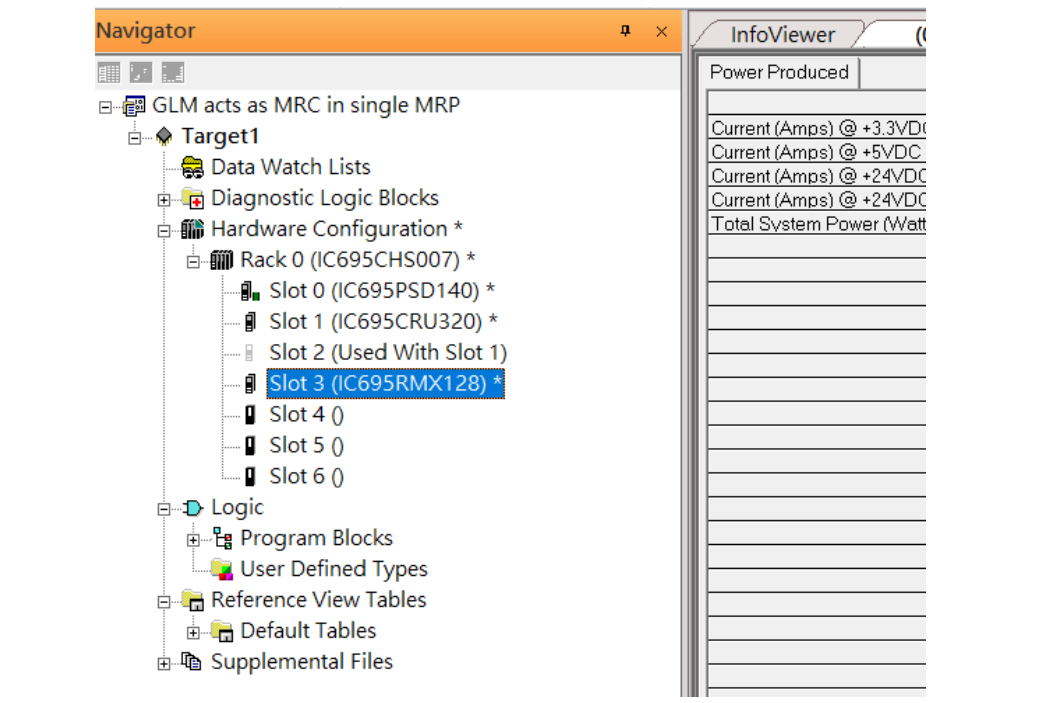
According to the current installation on the I/O Controller, the RMX128 shall be selected. Select **Communications** -> **IC695RMX128** and click OK.

Figure 17: Select the module



Now the RMX128 is ready on slot 3.

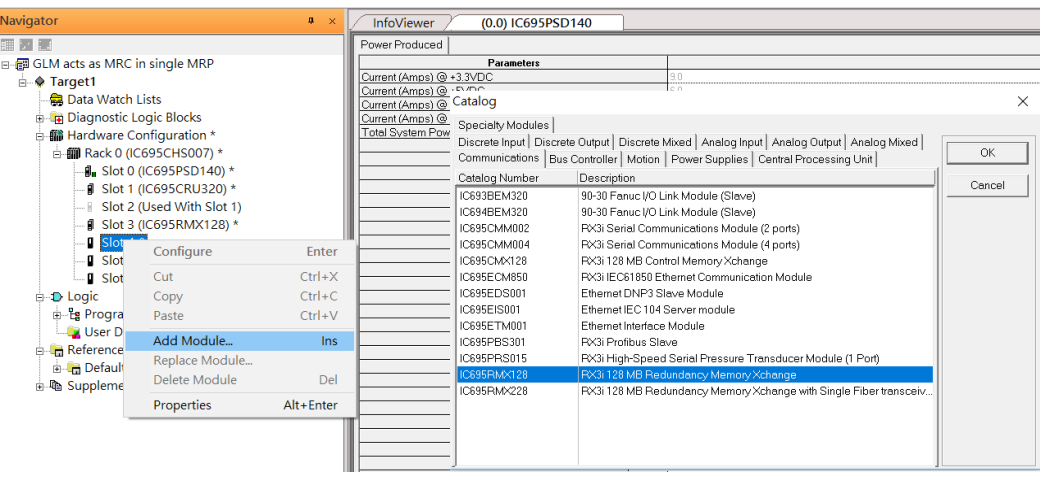
Figure 18: Review the configuration in Slot 3



3.2.2.2 Slot 4

Next, select RMX128 for slot 4. Click the right button on slot 4, select **Add Module**, select **Communications-> IC695RMX128**, and click OK.

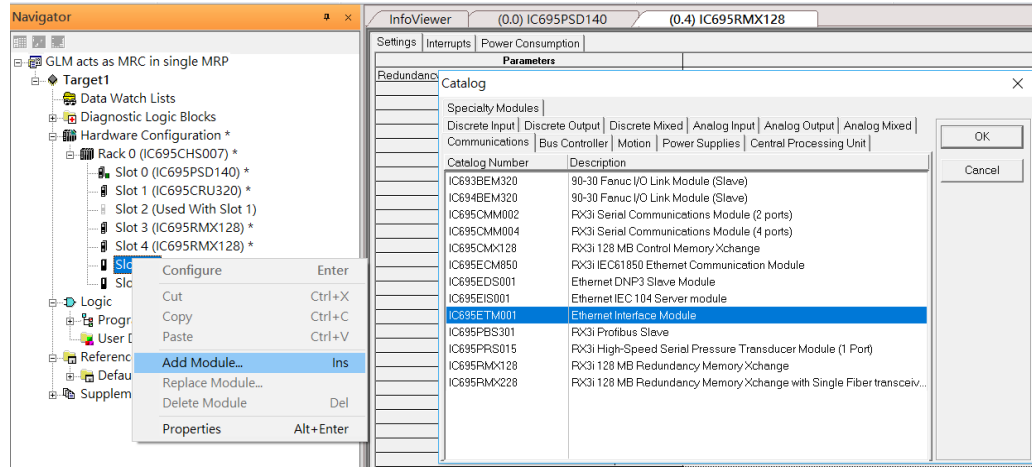
Figure 19: Add Module



3.2.2.3 Slot 5

Next, select ETM001 for slot 5. Click the right button on slot 5, select **Add Module**, select **Communications -> IC695ETM001**, and click **OK**.

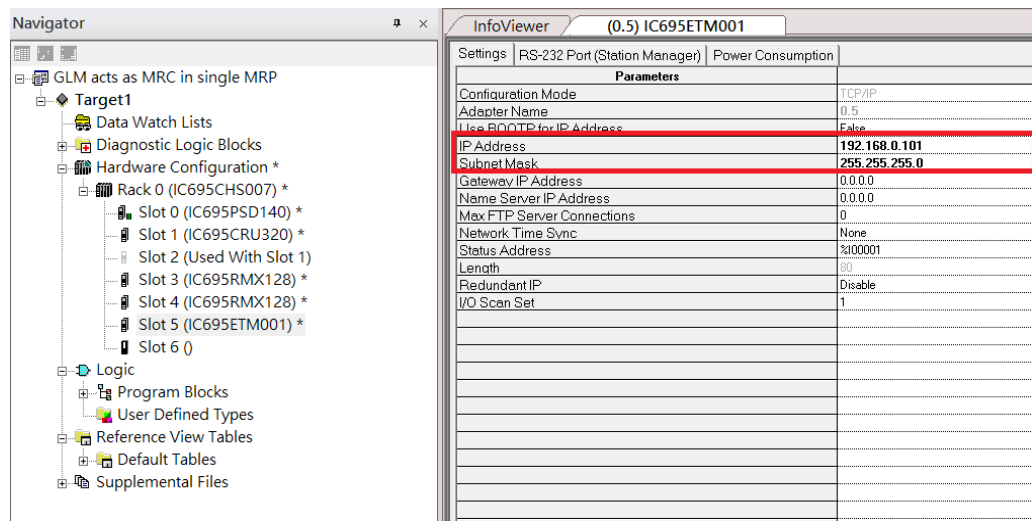
Figure 20: Add Module



It should be noted that the ETM001 is the management device for PAC Machine Edition. The communication interface is the Ethernet network. The IP address and Subnet Mask shall be specified.

In the following picture, the IP address 192.168.0.101 and mask 255.255.255.0 is specified on ETM001.

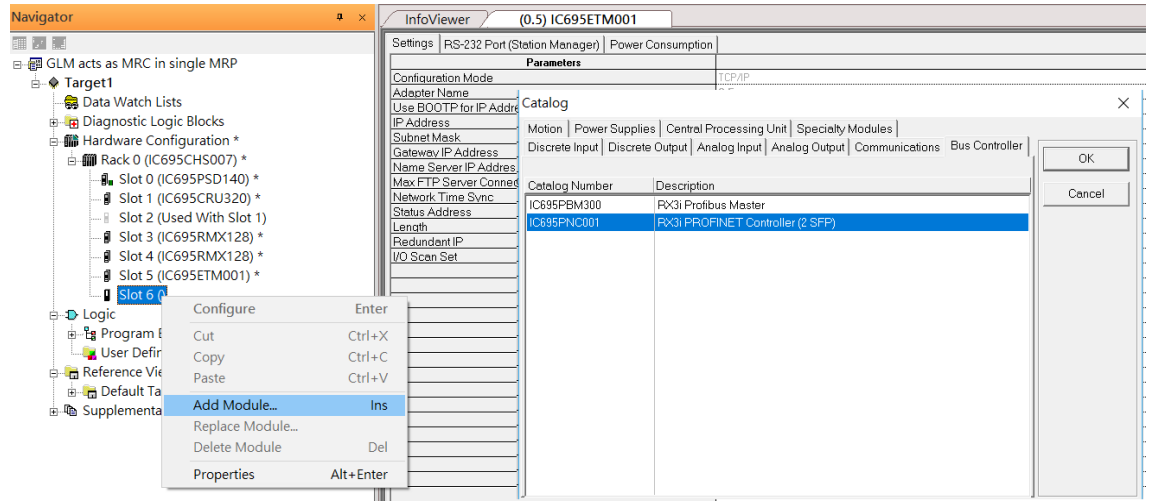
Figure 21: Specify the IP Address



3.2.2.4 Slot 6

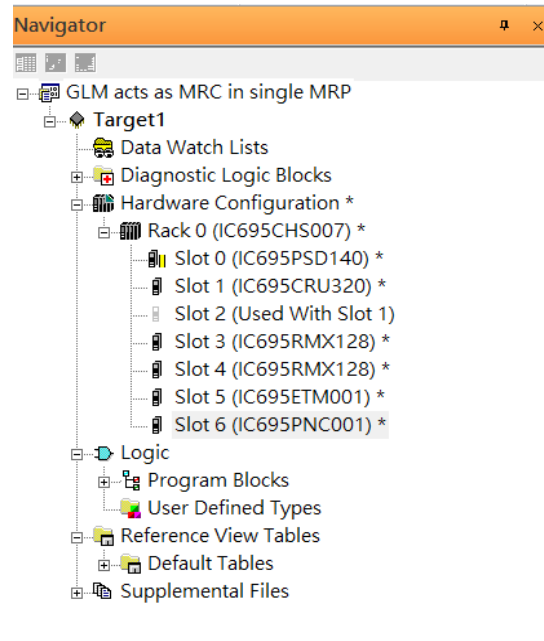
Next, select PNC001 for slot 6. Click slot 6 and click the right button, select **Add Module**, specify the installed Bus Controller, PNC001, and click **OK**

Figure 22: Specify Bus Controller, PNC001



Now all the devices on the I/O Controller are ready on the slots on the rack, the following picture is the current status, and we shall save it.

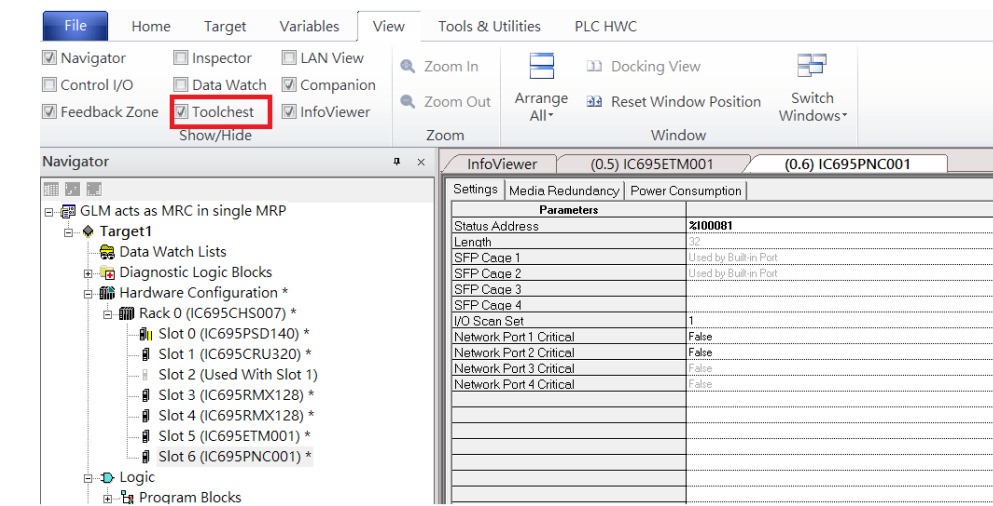
Figure 23: The rack is fully configured



3.2.3 I/O Device Setting

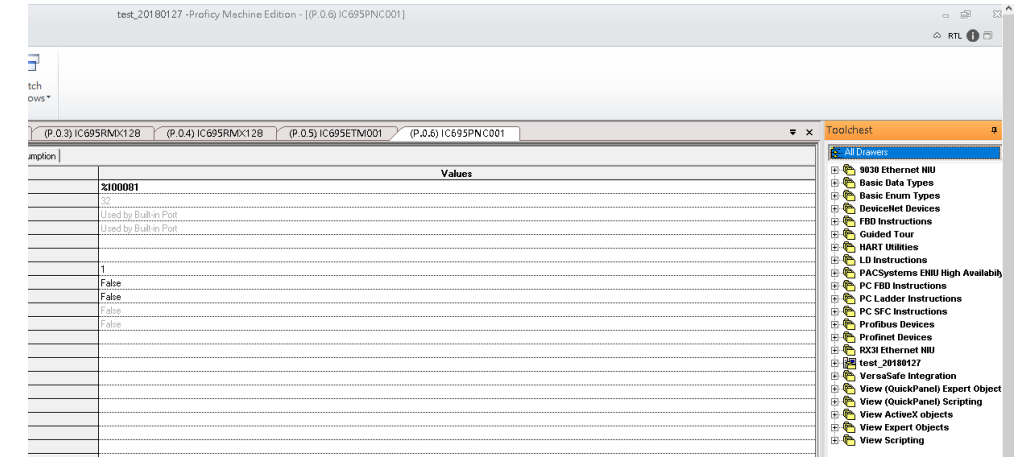
This section introduces the I/O Device integration. To configure the I/O Device, the GSDML file is necessary. Now we create another interface to load the GSDML file by using Toolchest.

Figure 24: Toolchest location



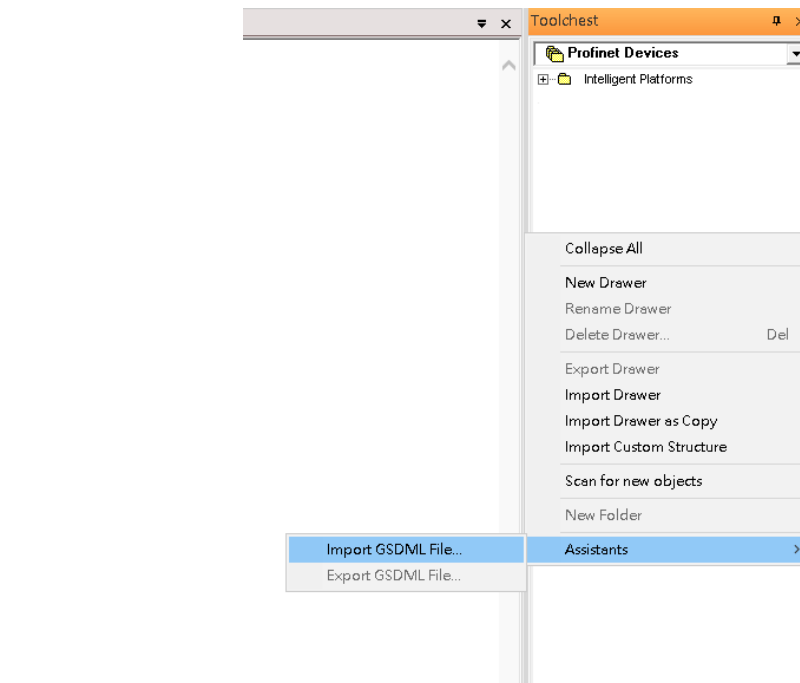
As shown in the following picture, a new interface is created on the right-hand side, and select **Profinet Devices**.

Figure 25: Toolchest Interface



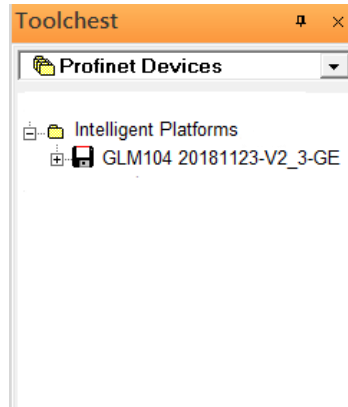
Click right button, select **Assistants-> Import GSDML File**. Select the GSDML File.

Figure 26: Import GSDML File



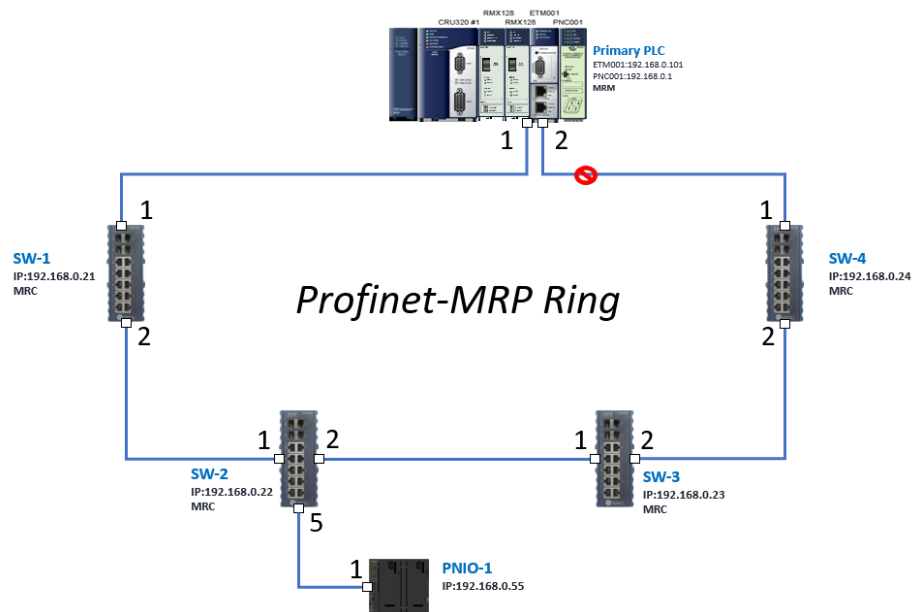
Then the corresponding I/O Device of the GSDML File is added to the Toolchest.

Figure 27: Locate the GSDML file in the Toolchest



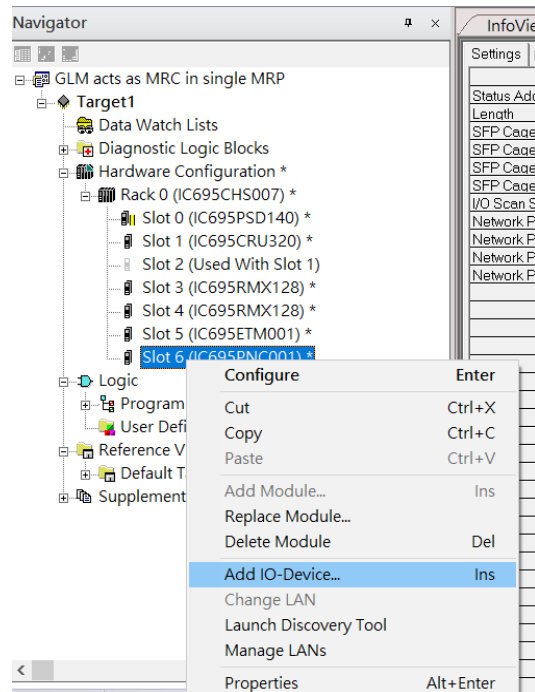
In this application setup, there are five I/O devices and one I/O controller. I/O devices are 4 switches and one Emerson VersaMax PROFINET I/O Scanner.

Figure 28: PROFINET-MRP Ring Application



The I/O Device is connected to the Bus Controller on the I/O Controller. Click slot 6 and click the right button to add the I/O Device on the PNC001.

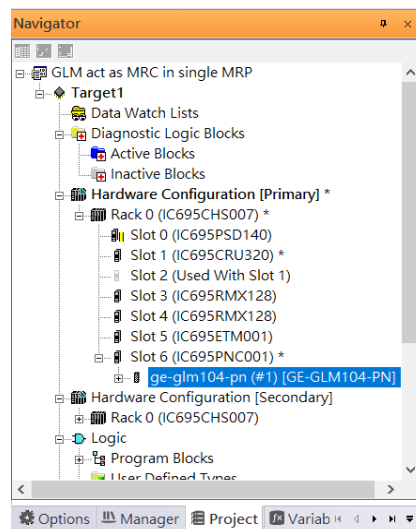
Figure 29: Add I/O Device



Select the specified I/O Service **GLM0104 20181123-V2_3-GE -> GE-GLM104-PN** and click **OK**.

Now the I/O device GLM104(SW1) is ready and is a sub-slot on PNC001.

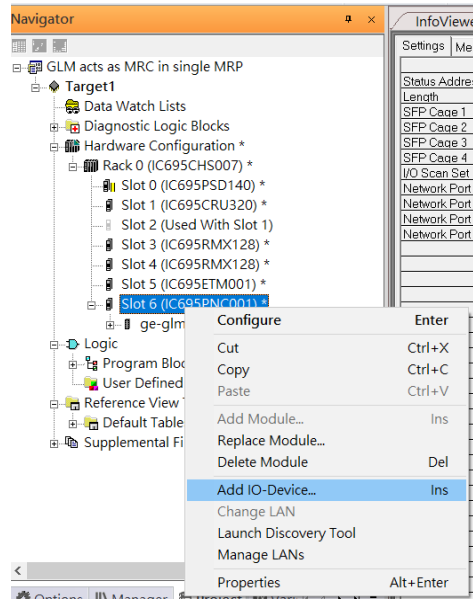
Figure 30



3.2.3.1 SW2

Then add the second I/O device in the PNC001.

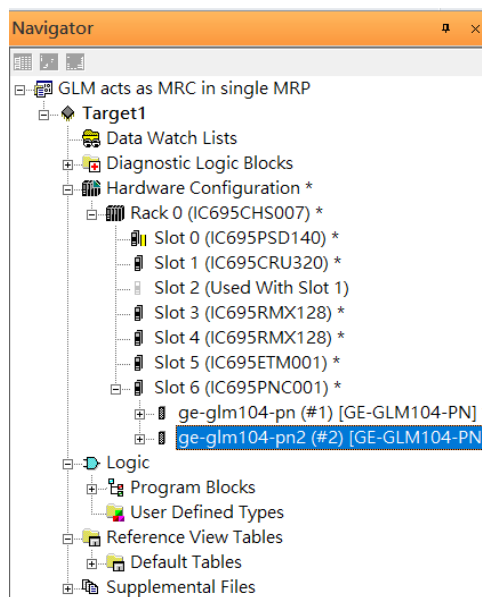
Figure 31



Select the specified I/O Service **GLM0104 20181123-V2_3-GE -> GE-GLM104-PN** and click **OK**.

Now the I/O device GLM104(SW2) is ready and is a sub-slot on PNC001.

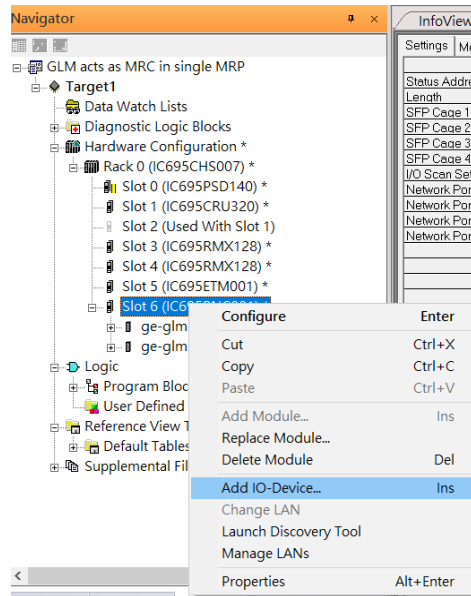
Figure 32: Sub-slot Configuration



3.2.3.2 SW3

Then add the third I/O device in the PNC001.

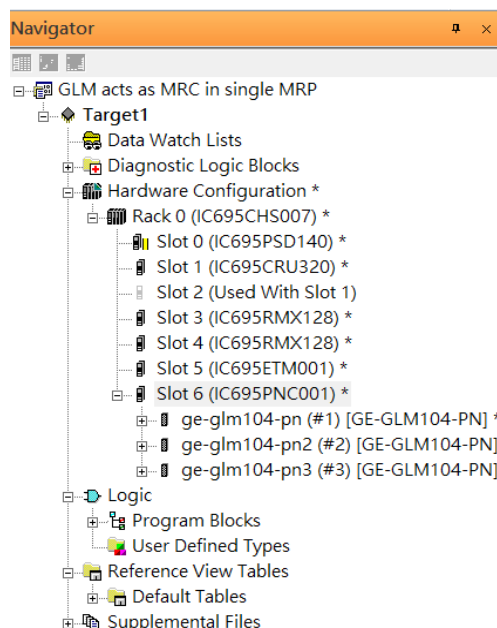
Figure 33: Adding third I/O Device



Select the specified I/O Service **GLM0104 20181123-V2_3-GE -> GE-GLM104-PN** and click **OK**.

Now the I/O device GLM104(SW3) is ready and is a sub-slot on PNC001.

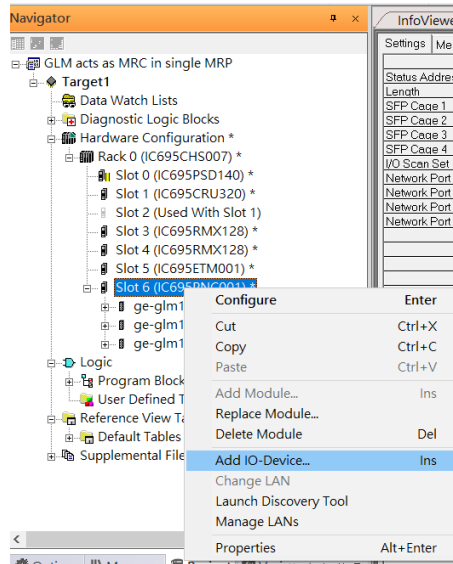
Figure 34: GLM104 (SW4)



3.2.3.3 SW4

Then add the fourth I/O device in the PNC001.

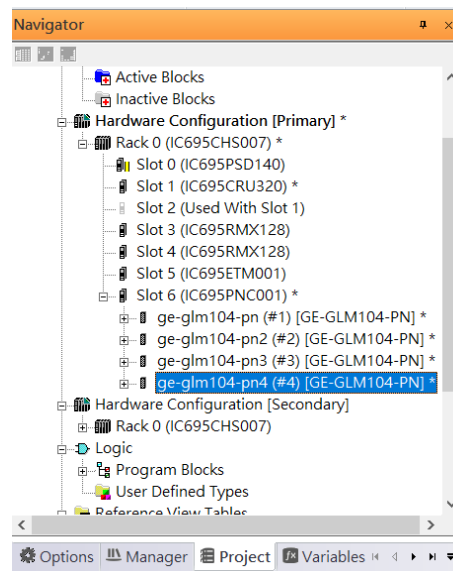
Figure 35: Add the fourth I/O device



Select the specified I/O Service-> GLM0104 20181123-V2_3-GE -> GE-GLM104-PN and click OK.

Now the I/O device GLM104(SW4) is ready and is a sub-slot on PNC001.

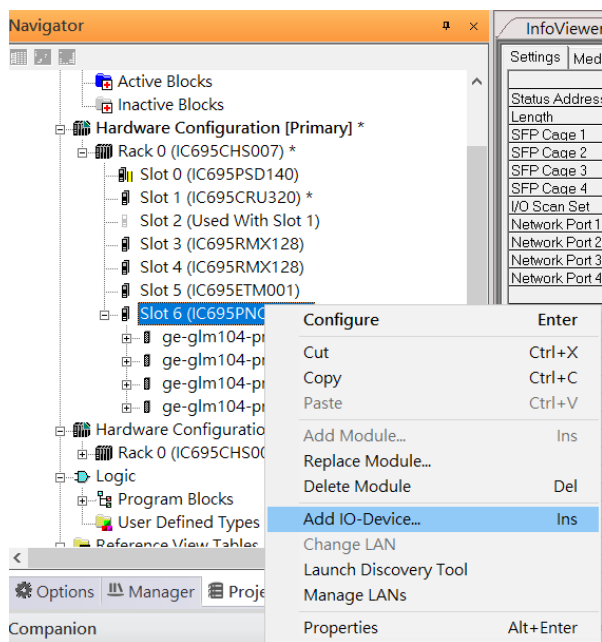
Figure 36: GLM104 (SW4)



3.2.3.4 SW5

Then add the fifth I/O device in the PNC001.

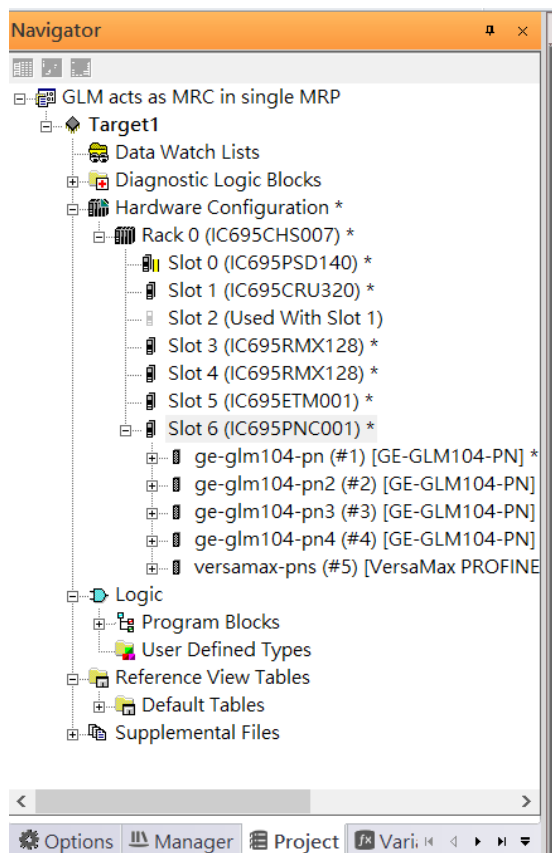
Figure 37: Add the Fifth I/O Device



Select the specified I/O Service-> VersaMaxPNS 20130426-V2_3-GEIP -> VersaMax PROFINET IO Scanner (2 RJ-45 Copper connectors) and click OK.

Now the I/O device VersaMax PROFINET IO Scanner is ready and is a sub-slot on PNC001.

Figure 38: PNC001

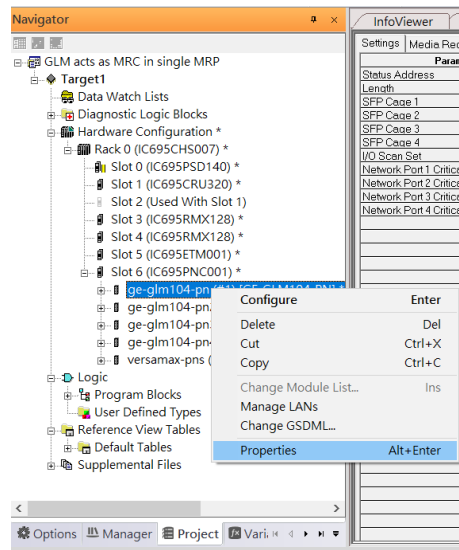


3.2.4 DCP Set Command

To configure the setting or monitor the status of the I/O Device, the communication interface is also based on an Ethernet network. We can specify the IP address and the device name from I/O Controller via the DCP (Discovery and Configuration Protocol).

Under slot 6, PNC001, select the I/O Device, ge-glm104-pn, and click the right button. Select **Properties**, see the following figure:

Figure 39: Open Properties



In this table, the I/O Device name can be specified in the field **Device Name**, and the IP address can be set in the field **IP address**. We modify the device name to “ge-glm104-pn-sw-1” and IP address to “192.168.0.21” then we use I/O Device Discovery Tool to observe an I/O Device and set I/O Device’s name to “ge-glm104-pn-sw-1” later.

Figure 40: Setting IP Address

Inspector	
ID-Device	
Device Number	1
Update Rate (ms)	128
Reference Variable	<None>
Network Identification	
ID LAN	LAN01
Device Name	ge-glm104-pn-sw-1
Device Description	
IP Address	192.168.0.21
General	
GSDML	GSDML-V2.3-GE-GLM104-20181123.xml
Device Type	GE-GLM104-PN
Device Access Point ID	GE-GLM104-PN
Group ID References	True

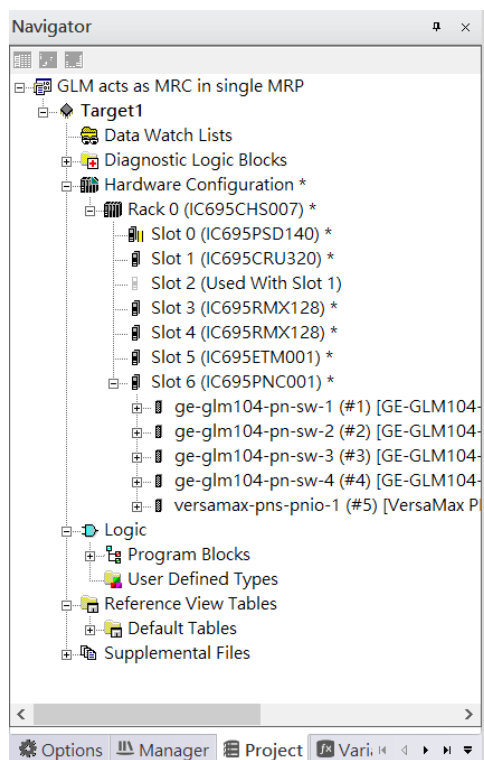
3.2.4.1 GLM104-PN2 through VERSAMAX-PNS-PNIO-1

Repeat this process and for the remaining I/O Devices. Use the table below to define the device name and IP address for each I/O device:

I/O Device	IP Address	Device Name
GLM10-PN	192.168.0.21	ge-glm104-pn-sw-1
GLM10-PN2	192.168.0.22	ge-glm104-pn-sw-2
GLM10-PN3	192.168.0.23	ge-glm104-pn-sw-3
GLM10-PN4	192.168.0.24	ge-glm104-pn-sw-4
VERSAMAX-PNIO	192.168.0.55	versamax-pns-pnio-1

Now all the devices have changed their device name and IP address like the following picture.

Figure 41: All Device Names and IP Addresses Have Been Set

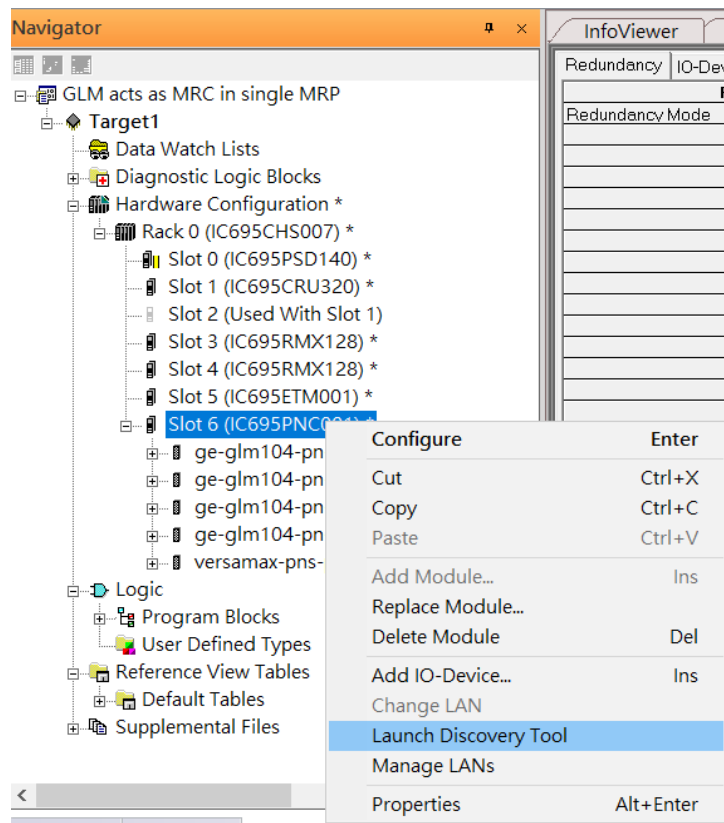


3.2.5 I/O Device Scan

The PAC Machine Edition also supports the function to scan the connected I/O Devices. First, the observed I/O Device shall be connected to the ETM001 on the **Primary** hardware configuration, then using the function **Launch Discovery Tool**.

Note: Before we finish downloading the configuration to CRU320, need to unplug the block port according to the hardware topology to avoid a loop.

Figure 42: Launch Discovery Tool



The tool is shown in the following picture, then press **Refresh Device List**.

Figure 43: Device Discovery State

Then the connected I/O Device is listed in the following table.

Figure 44: Identify I/O Device

Status	Device Name	IP Address	Vendor	Device Type
?	ge-glm104-pn	192. 0. 2. 1	GE Intelligent Platforms, Inc.	GE-GLM104-PN
?	ge-glm104-pn	192. 0. 2. 1	GE Intelligent Platforms, Inc.	GE-GLM104-PN
?	ge-glm104-pn	192. 0. 2. 1	GE Intelligent Platforms, Inc.	GE-GLM104-PN
?	ge-glm104-pn	192. 0. 2. 1	GE Intelligent Platforms, Inc.	GE-GLM104-PN
✓	iolan-controller01	192.168. 0. 1	GE Intelligent Platforms, Inc.	IC695PNC001
?	versamax-pns	192.168. 1. 55	GE Intelligent Platforms, Inc.	IC200PNS001

There are I/O Devices and their status is in “Not assigned”. We need to change their device name to and IP address. Use **Identify Device** to make sure which device we set according to the hardware topology. Then start to set SW-1 device name and IP address.

Click **Edit Device**, set Device Name to “ge-glm104-pn-sw-1” and click the **Set Device Name** button, then set IP Address to “192.168.0.21”, Subnet Mask to “255.255.255.0” and click **Set IP Information** button.

Figure 45: Edit Device Properties

The screenshot shows a window titled "GLM104-PN Properties". It contains several sections for configuring a device. The top section displays read-only information: Vendor Name (Intelligent Platforms), Vendor ID (015A), MAC Address (00-05-65-72-FB-D0), Device ID (0104), Device Type (GE-GLM104-PN), and Device Role (Device). There is an "Identify Device" button. Below this is a "Device Name" section with a text input field containing "ge-glm104-pn-sw-1" and a "Set Device Name" button. The next section is "IP Address", which includes input fields for "IP Address" (192.168.0.21), "Subnet Mask" (255.255.255.0), and "Gateway" (0.0.0.0), along with a "Set IP Information" button. At the bottom of the main area is a "Reset device to factory settings" section with a "Reset Device" button. A large empty text area is located below the IP settings. An "Exit" button is at the very bottom of the window.

Follow the above steps for each of the I/O devices. Use the table below to set the values for each device.

Device Name	IP Address	Subnet Mask
ge-glm104-pn-sw-1	192.168.0.21	255.255.255.0
ge-glm104-pn-sw-2	192.168.0.22	255.255.255.0
ge-glm104-pn-sw-3	192.168.0.23	255.255.255.0
ge-glm104-pn-sw-4	192.168.0.24	255.255.255.0
versamax-pns-pnio-1	192.168.0.55	255.255.255.0

After assigning Device Name and IP Address correctly, the Status will be in “Assigned” status.

Figure 46: Status is set to Assigned

InfoViewer

(P.0.6) IC695PNC001

(P.0.6.9.0) IC200PNS001

PROFINET DCP - Direct Connection

Connection Settings

Connection: Ethernet 8

Refresh Device List

LAN: LAN01

Status: No Errors

Status	Device Name	IP Address	Vendor	Device Type
✓	ge-glm104-pn-sw-1	192.168. 0. 21	Intelligent Platforms	GE-GLM104-PN
✓	ge-glm104-pn-sw-2	192.168. 0. 22	Intelligent Platforms	GE-GLM104-PN
✓	ge-glm104-pn-sw-3	192.168. 0. 23	Intelligent Platforms	GE-GLM104-PN
✓	ge-glm104-pn-sw-4	192.168. 0. 24	Intelligent Platforms	GE-GLM104-PN
✓	iolan-controller01	192.168. 0. 1	Intelligent Platforms	IC695PNC001
✓	versamax-pns-pnio-1	192.168. 0. 55	Intelligent Platforms	IC200PNS001

Filters (6/6)

✓ Assigned

✓ Assigned with errors

✓ Not assigned

Selection Properties

MAC Address: 00-09-91-56-C3-0E

Device Role: Device

Vendor ID: 015A

Device ID: 0003

IP Address: 192.168.0.55

Subnet Mask: 255.255.255.0

Gateway: 0.0.0.0

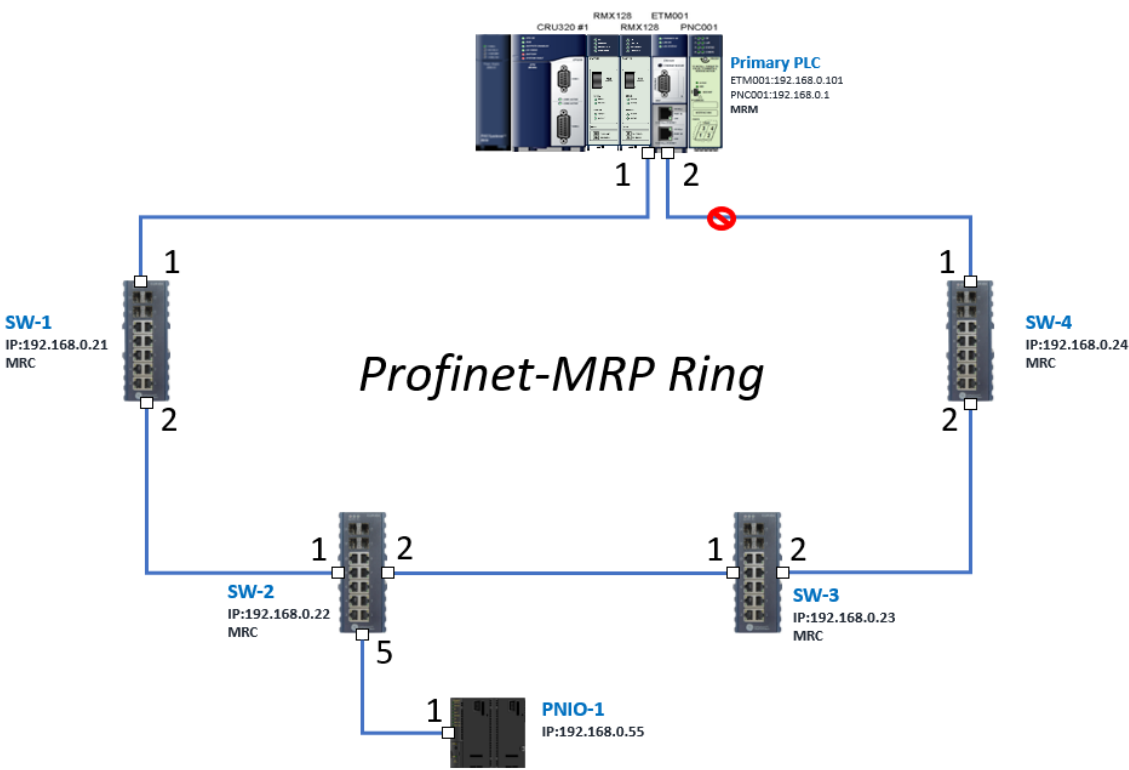
Identify Device

Edit Device

3.2.6 MRP Setting

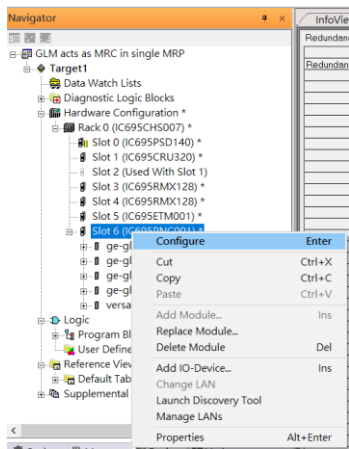
Setting MRP for I/O controller and I/O devices according to the following figure.

Figure 47: Profinet-MRP Ring Configuration



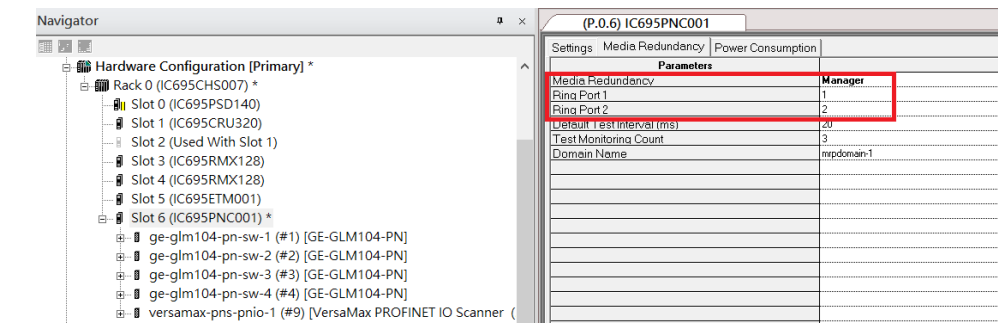
In order to enable the MRP function in the I/O controller, click the right button and choose **Configure**.

Figure 48: Configuring I/O Controller



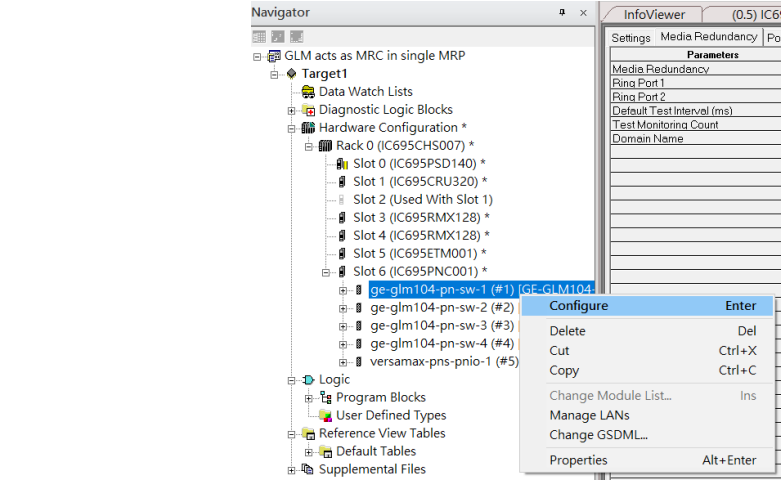
Enable the MRP function by changing the value of **Media Redundancy** to **Manager** and select **Ring Port 1** to **1**, and **Ring Port 2** to **2**.

Figure 49: Configuring Ring Port 1 and 2



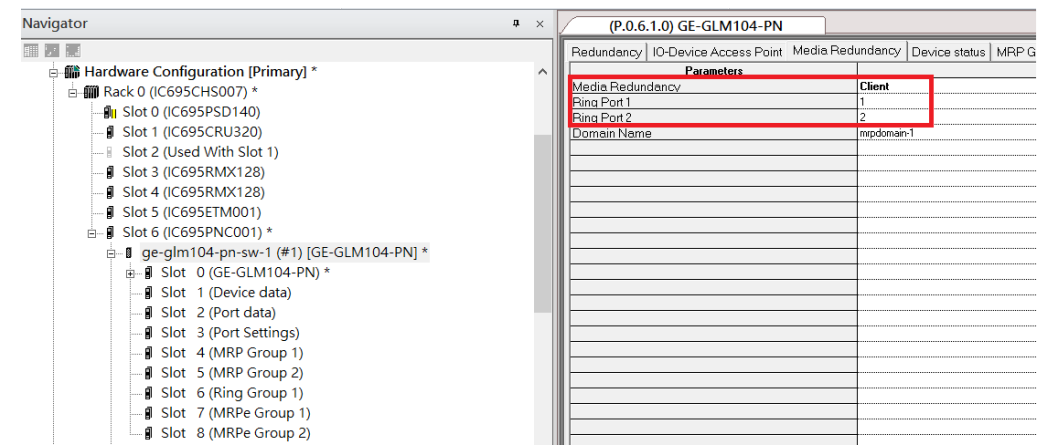
In order to enable the MRP function in SW1, click the right button and choose **Configure**. It will show **Media Redundancy** on the right window.

Figure 50: Configuring Properties for SW1



Enable MRP function by changing the value of “Media Redundancy” to the client and select **Ring Port 1** to **1**, **Ring Port 2** to **2**.

Figure 51: Setting Ring Port 1 and Ring Port 2 on SW1



Repeat these steps for SW2-SW4.

3.2.7 Network Setting

To establish the communication to the I/O Controller from PAC Machine Edition, the interface of the I/O Controller shall be specified.

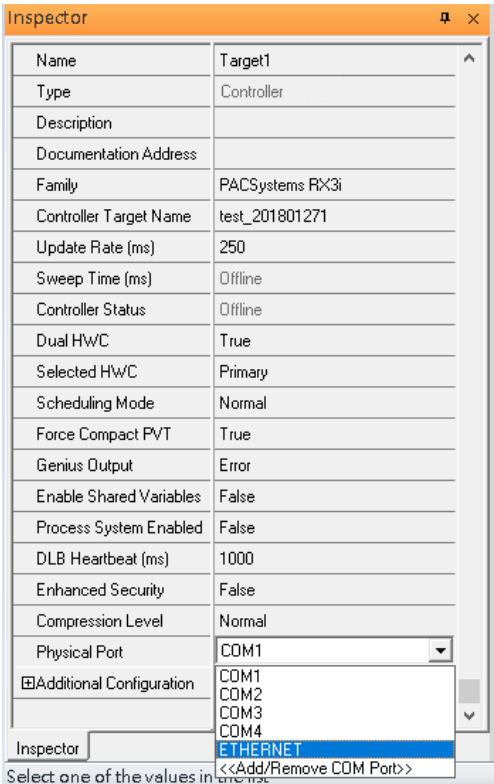
It should be noted that there is only 1 I/O Controller (Primary or Secondary) able to communicate with PAC Machine Edition. Therefore, there are 3 rules of communication that are defined.

I/O Controller Communication Rule

Rule	Description
1	The communicated I/O Controller shall be specified. Click primary or secondary hardware configuration, click the right button, and select Set as Selected HWC
2	During the communication, the cable shall be connected to the ETM001 in specified hardware (Primary or Secondary)
3	Specify the interface and IP address for communicated I/O Controller

For rule 3, click **Target 1** and select **Property**, and select **Physical Port** to **Ethernet**.

Figure 52: Physical Port Configuration



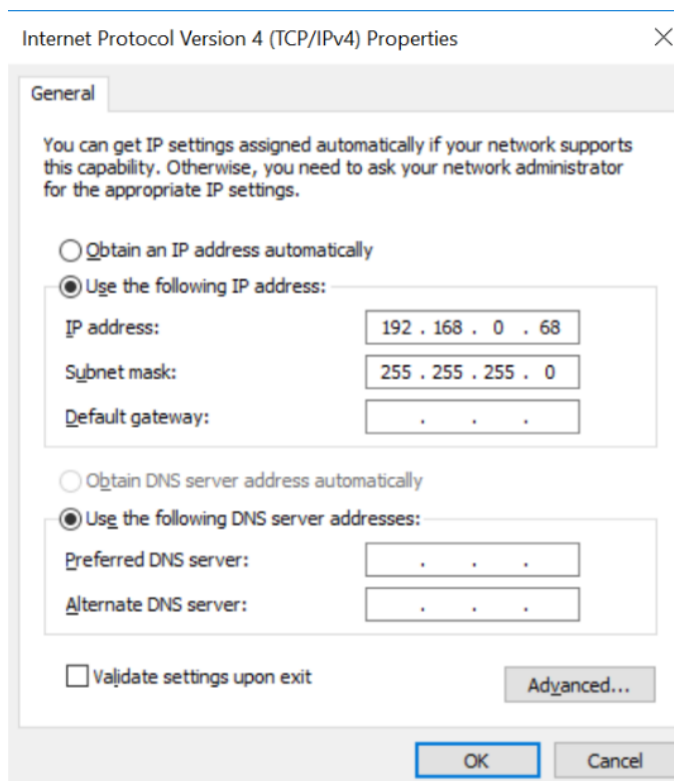
Also, the IP address of communicated I/O Controller shall be set. Here the **Primary** setting is shown.

Note, that the specified IP address is set as the IP address on ETM001.

3.2.8 PC Network

The IP address of the PC with PAC Machine Edition shall be set in the same network area.

Figure 53: Configuring IP Address of PC with PME

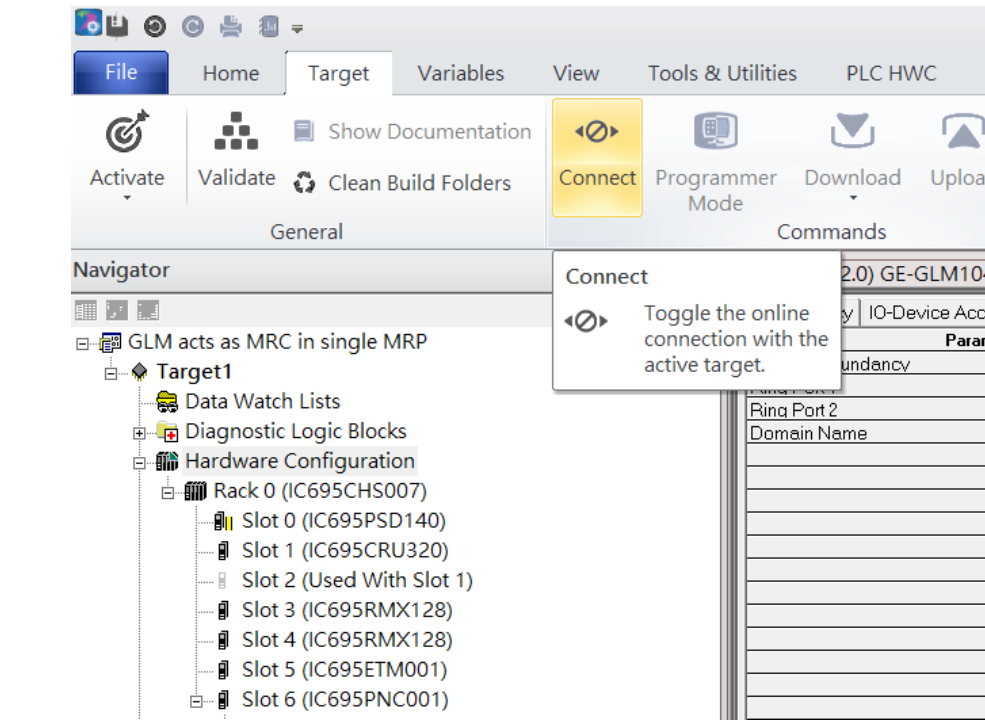


Note: For ETM configuration, please consult GFK-2224 PACSystems Rx3i TCP/IP Ethernet Communications User Manual

3.3 Implementation

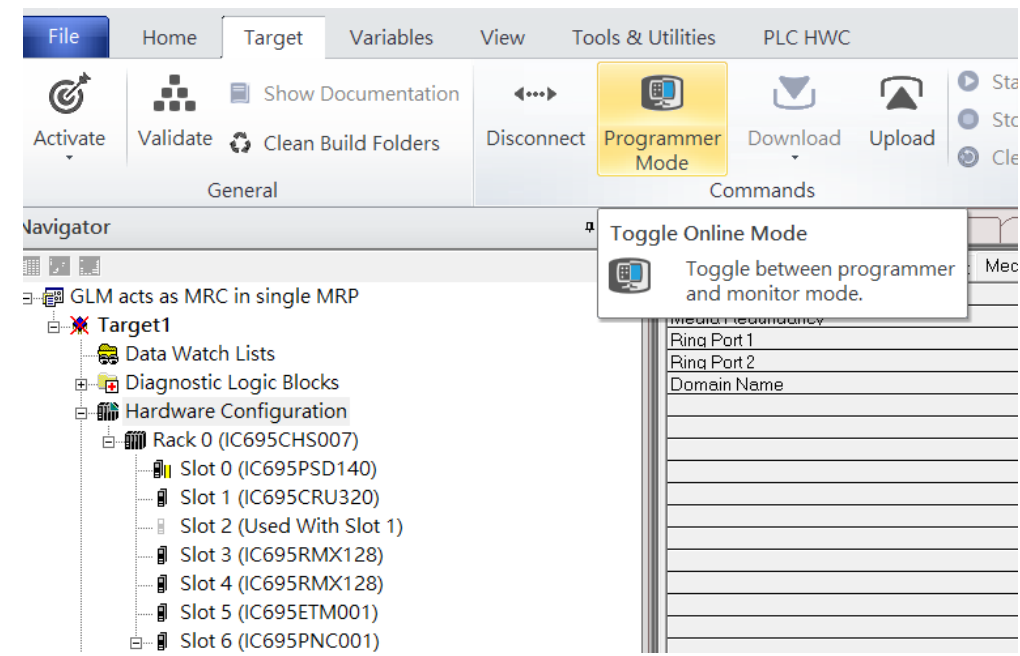
To download the configuration to hardware, the following steps shall be applied.
First, press the **Connect** icon.

Figure 54: Connecting to Target



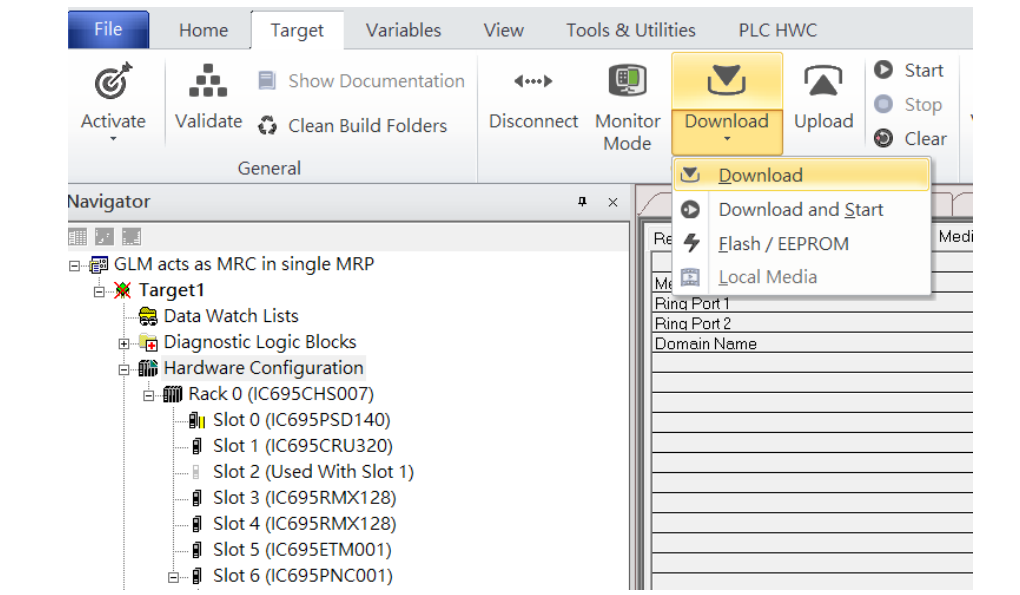
Then press the icon **Programmer Mode**.

Figure 55: Programmer Mode



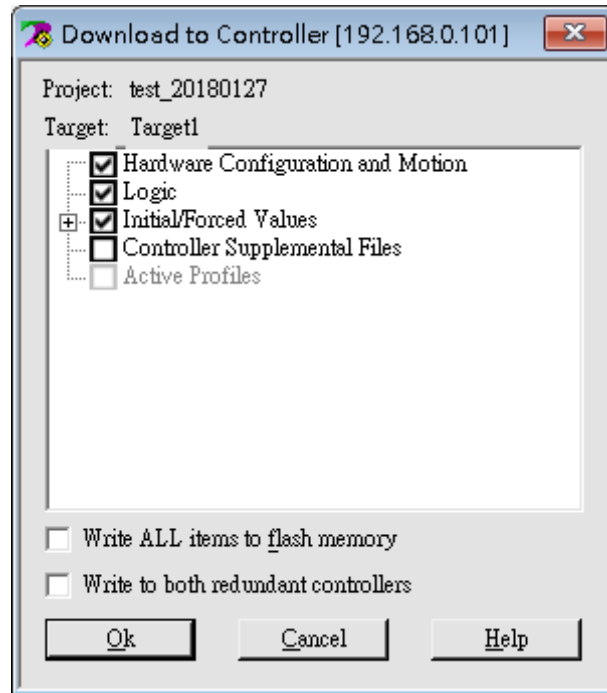
Then press the icon **Download** and select **Download**.

Figure 56: Download



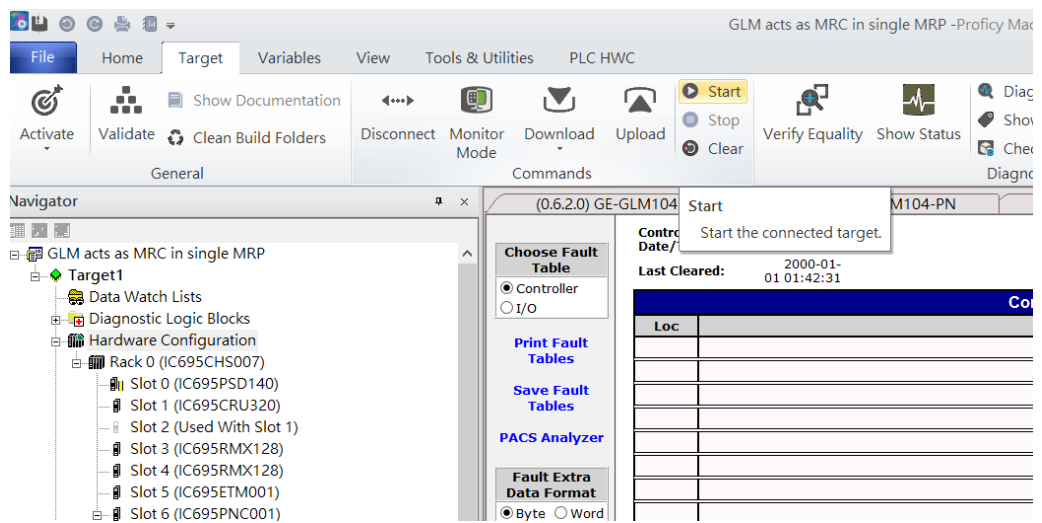
Then the dialogue is appeared to make sure the initialization procedure, select **OK**.

Figure 57: Download to Controller



After downloading completely, press the icon **Start** to active PLC. Note: After downloading completely, switch CRU320 to **Run I/O Enable** and select **OK**. If PLC has started successfully, a message “The Controller was successfully started”.

Figure 58: Start



Section 4 Multiple PROFINET-MRP Ring

4.1 Network Topology

Figure 59: Multiple PROFINET-MRP Ring

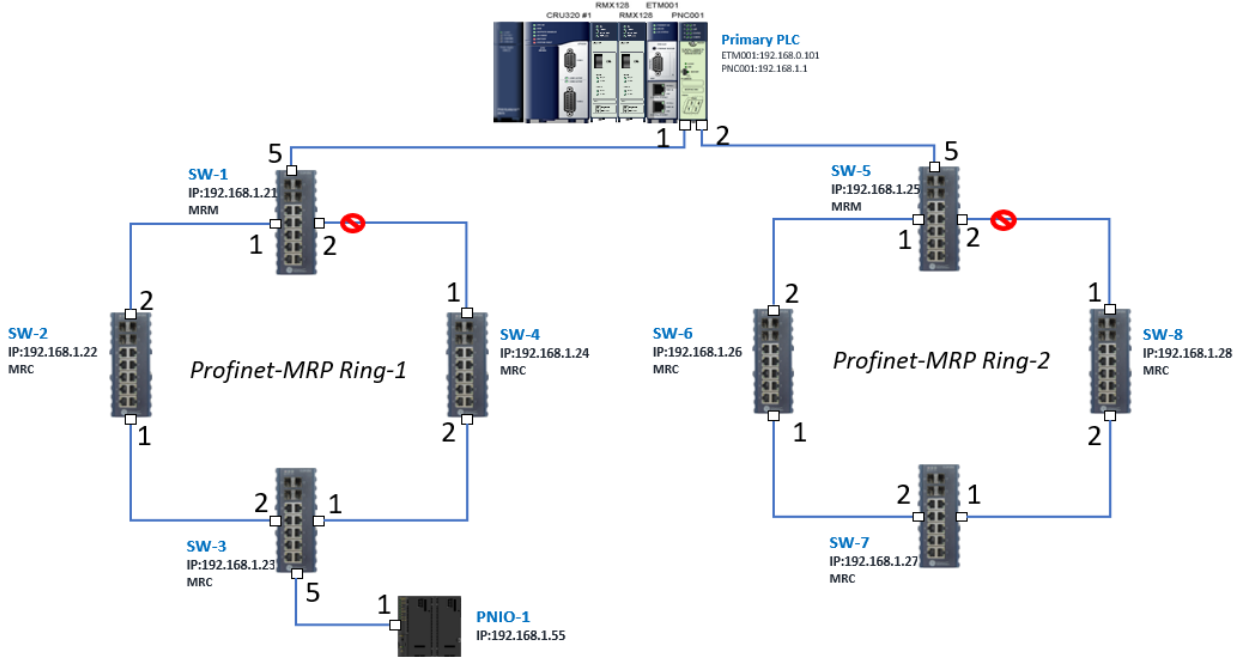


Figure 60

4.2 Hardware Configuration

On the CRU320, the I/O data can be set to **STOP**, **RUN OUTPUT DISABLE** or **RUN I/O Enable** states by a switch embedded on CRU320. During the configuration, the switches on both 2 CRU320s must be set to **STOP**.

4.2.1 Project Open

To start the software PAC Machine Edition, please follow the steps below:

1. Click **Start -> Emerson -> PAC Machine Edition -> PAC Machine Edition**
2. Select the empty project and click **OK**.
3. Set the project name and click **OK**.

Figure 61: Create a new project

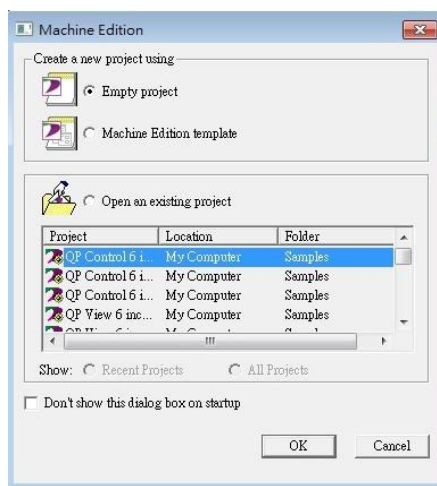
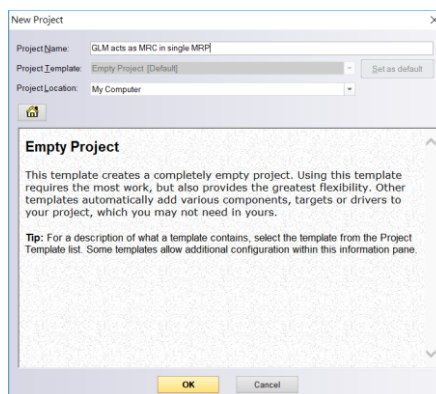


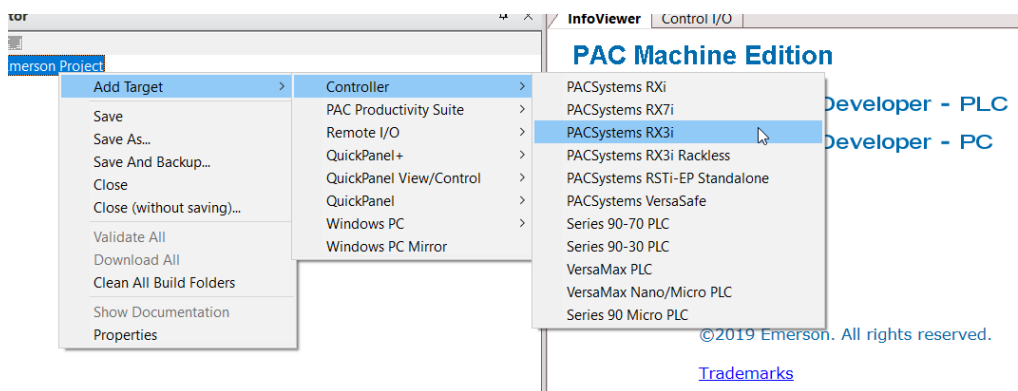
Figure 62: New Project Name



4.2.2 I/O Controller Setting

The next step is to add a target for this project. Click the right button on project name “GLM act as MRC in single MRC group” and select **Add Target -> Controller-> PACSystems RX3i**. The PACSystems RX3i is the I/O Controller to be tested. See the following picture.

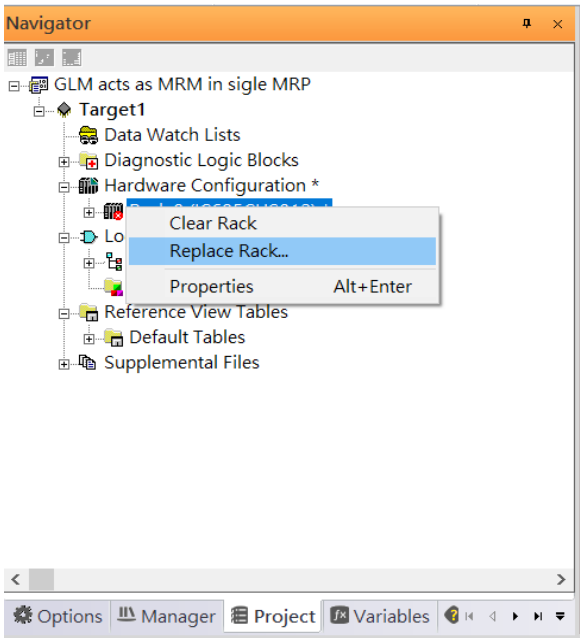
Figure 63: Adding a Target to Project



Originally the I/O Controller is described as the rack with 12 slots, each slot can be regarded as the chassis for device installation such as a power card, communication module, or bus controller. However, there are only 7 chassis that can be used in the I/O Controller CRU320. Thus, replace the rack with 7 slots.

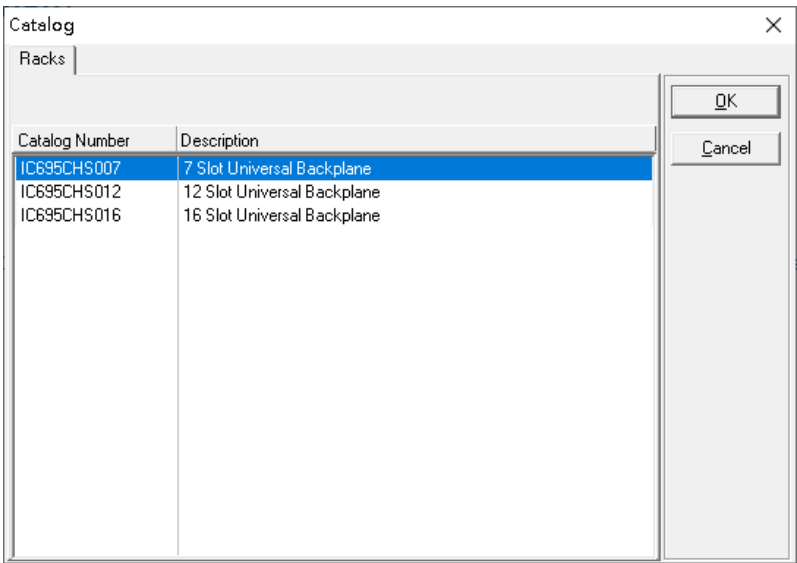
Click the right button on “Rack 0 (IC695CHS012)” and select **Replace Rack**.

Figure 64: Replace Rack



Select “IC695CHS007” and click **OK**.

Figure 65: Select CHS007



After the rack and the number of slots are defined, select the corresponding devices into the slots according to the I/O Controller. The following picture is the current installation for each device on the I/O Controller

Figure 66: Rack Configuration for this Use Case



From left to right, the installed devices on the I/O Controller are

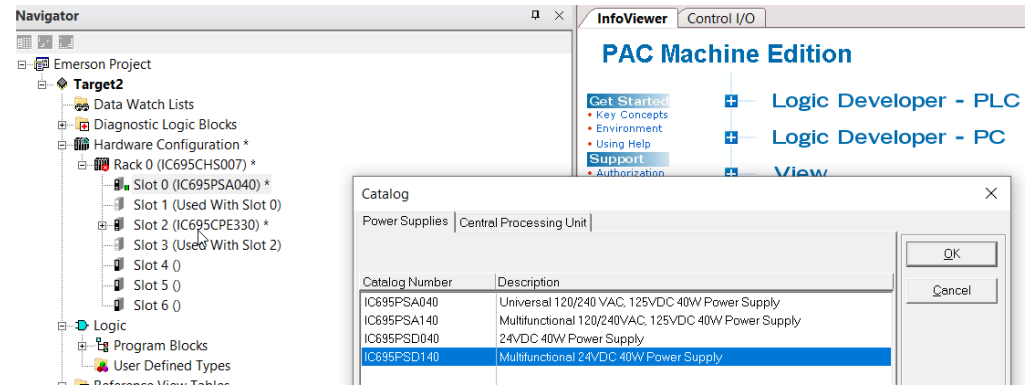
Devices on I/O Controller

Device Type	Device Name	Chassis index
Power Card	PSD140	0
Central Processing Unit	CRU320	1 ~ 2
Communication Module	RMX128	3
Communication Module	RMX128	4
Communication Module	ETM001	5
Bus Controller	PNC001	6

Now, add the module into the slots by the current devices on the I/O Controller, the chassis index is corresponding to the slot index.

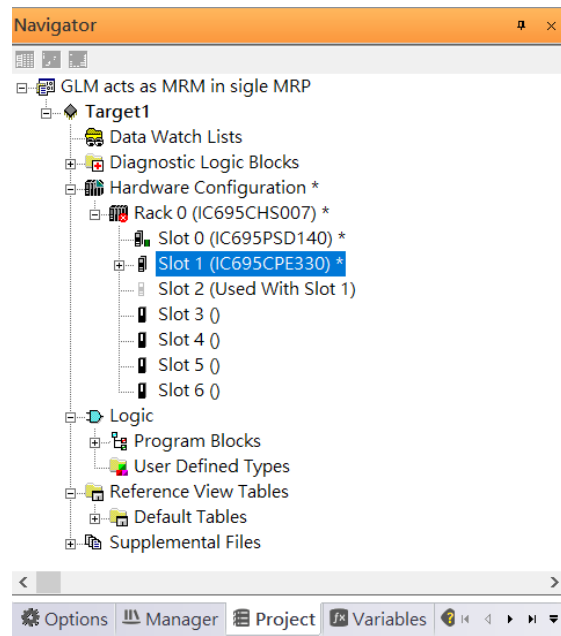
First, replace the power card. Click slot 0 and click the right button, select **Replace Module**, and specify the installed power card, PSD140, then click **OK**.

Figure 67: Specifying the power card for Slot 0



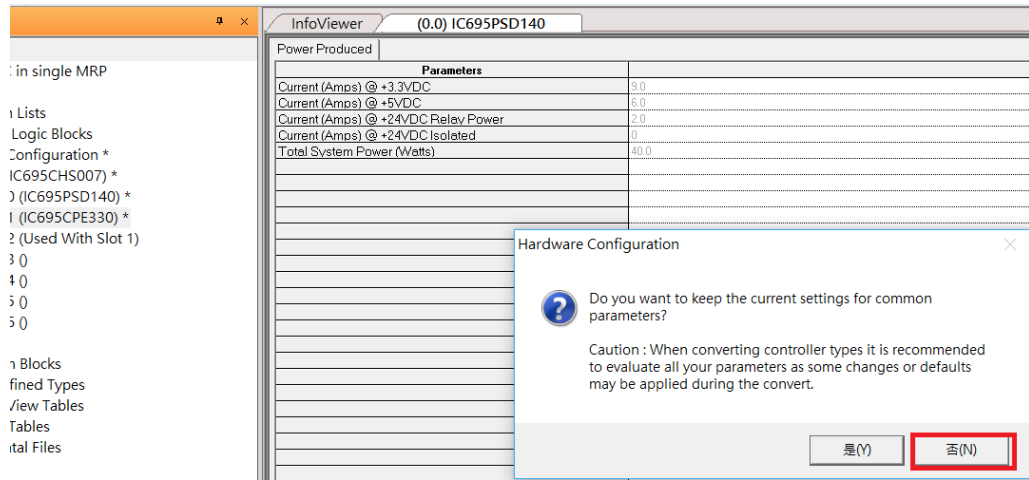
For slot 1 and 2, 2 chassis (1 and 2) is occupied by the Central Processing Unit, CRU320. To integrate slots 1 and 2, pull slot 2 to slot 1. Slot 2 is now clear.

Figure 68: Integrating Slot 1 and 2



To select the Central Processing Unit, click slot 1 and click the right button, select **Replace Module ...]** to choose CRU320. When asked if you want to keep the current settings for common parameters, choose **No**.

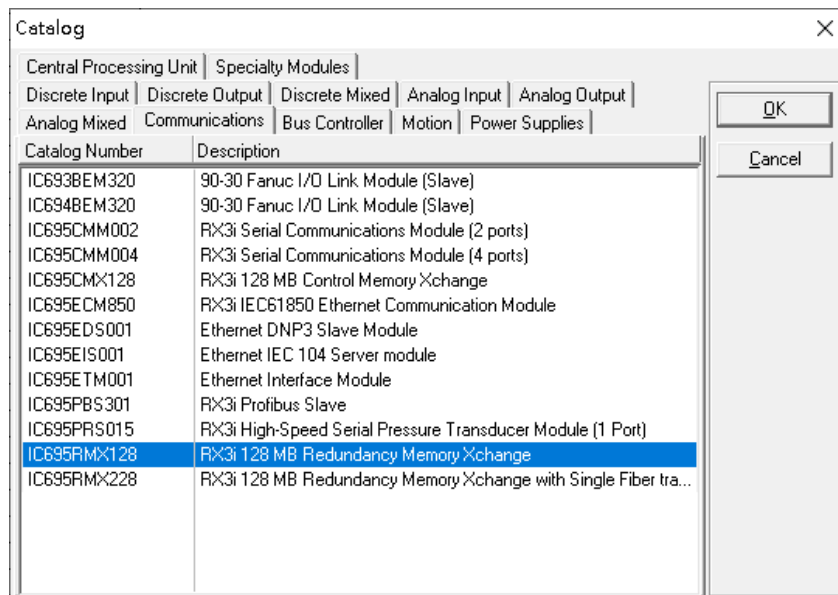
Figure 69: Dismissing Common Parameters



Next is to add the RMX128 module for slot 3. Click the right button on slot 3, and select **Add Module**.

According to the current installation on the I/O Controller, the RMX128 shall be selected. Select **Communications** -> **IC695RMX128** and click **OK**.

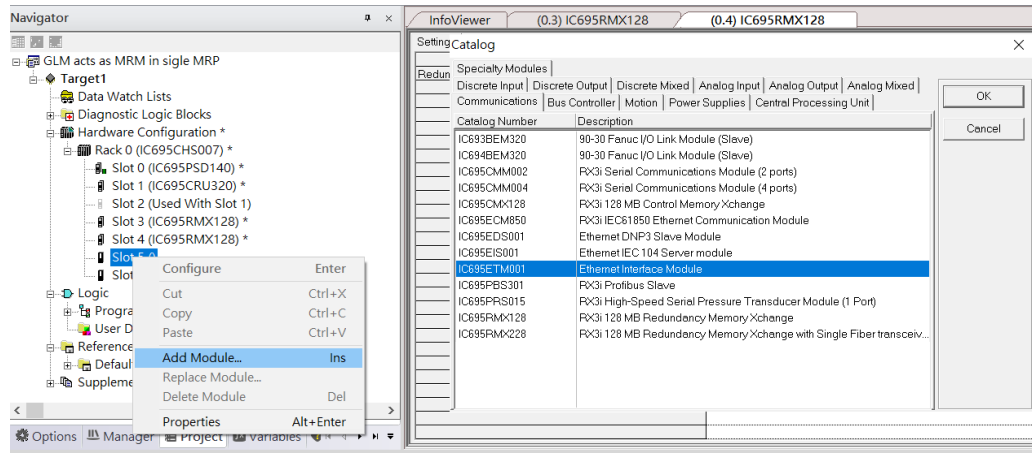
Figure 70: Selecting RMX128



Once the RMX128 is ready on slot 3, select RMX128 for slot 4 by repeating the steps for slot 3.

Next, configure slot 5 with the ETM001.

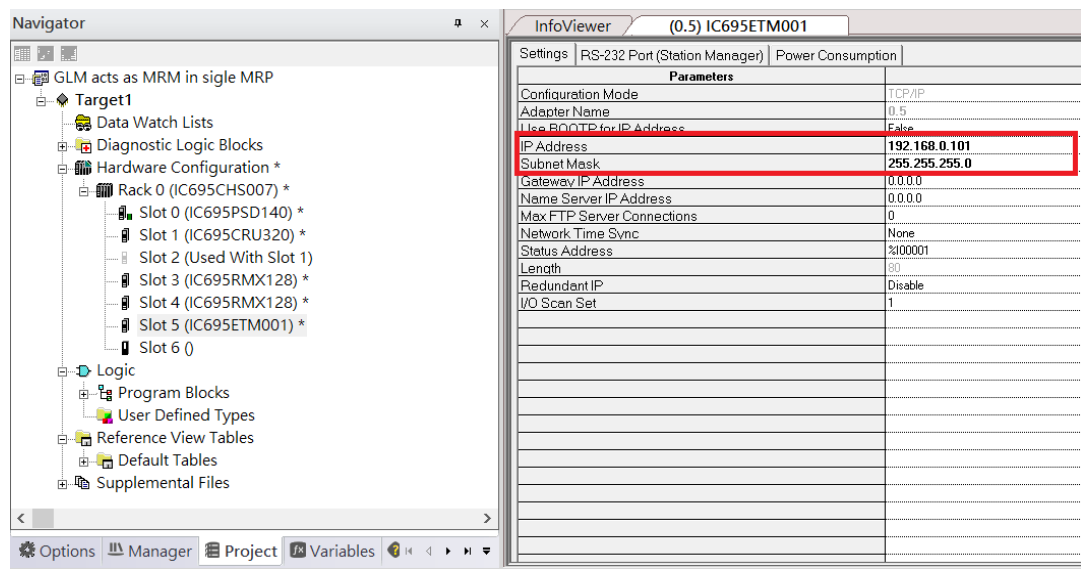
Figure 71: Configuring Slot 5 with an ETM001 module.



It should be noted that the ETM001 is the management device for PAC Machine Edition. The communication interface is the Ethernet network. The IP address and subnet mask shall be specified.

In the following picture, the IP address 192.168.0.101 and subnet mask 255.255.255.0 is specified on ETM001.

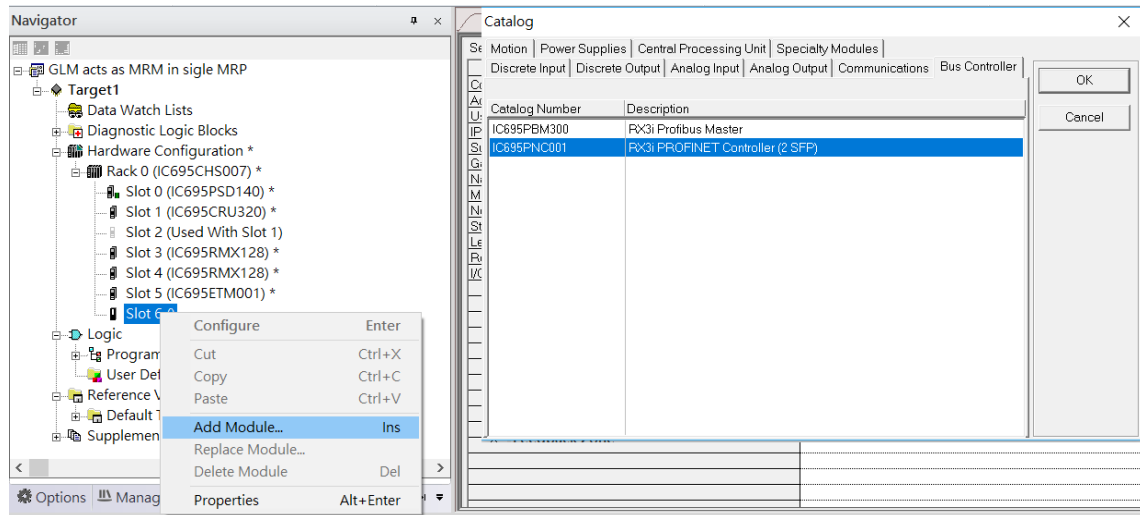
Figure 72: Configuring the IP Address and Subnet Mask on the ETMETM001



Next, select PNC001 for slot 6.

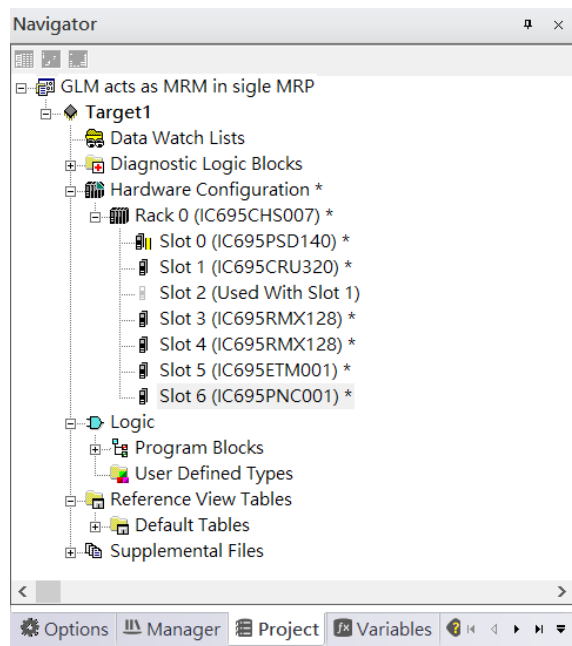
Click slot 6 and click the right button, select **Add Module**, specify the installed Bus Controller, PNC001, and click **OK**.

Figure 73: Configure Slot 6 for PNC001



Now all the devices on the I/O Controller are ready on the slots on the rack, the following picture is the current status, and we shall save it.

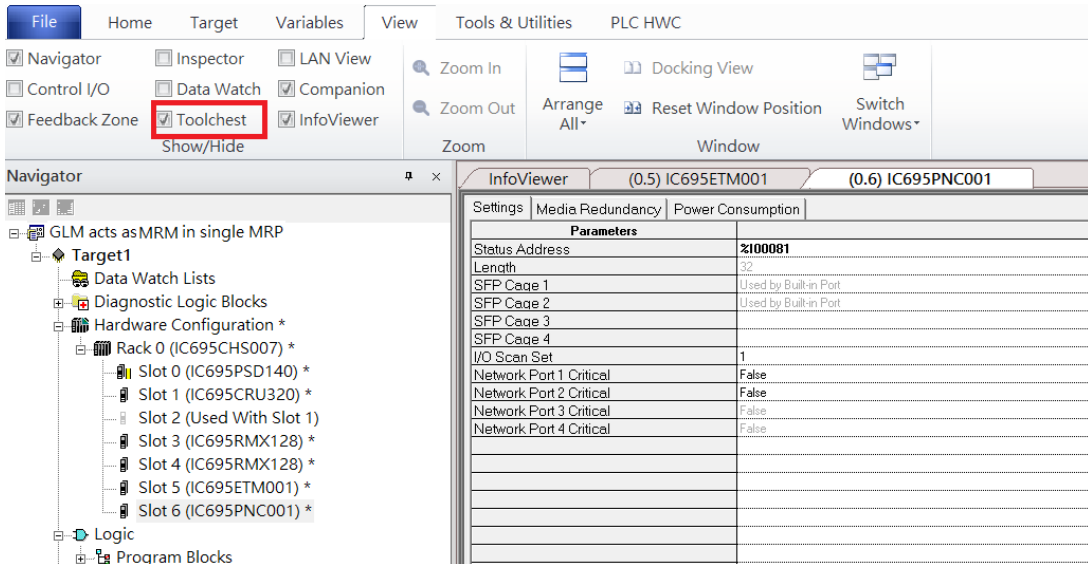
Figure 74: Final Rack Configuration



4.2.3 I/O Device Setting

This section introduces the I/O Device integration. To configure the I/O Device, the GSDML file is necessary. Now we create another interface to load the GSDML file by using Toolchest.

Figure 75: Toolchest feature



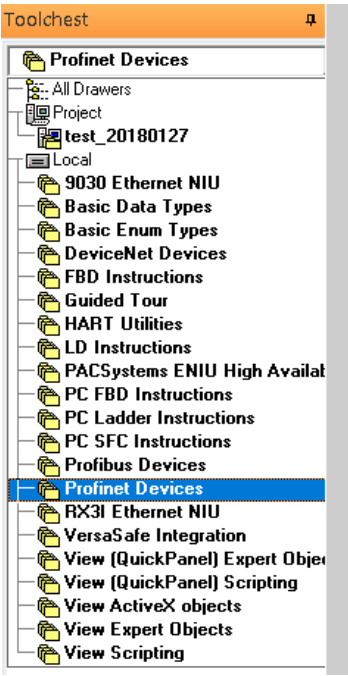
As shown in the following picture, the interface is created on the right-hand side.

Figure 76: Default Toolchest Interface Location



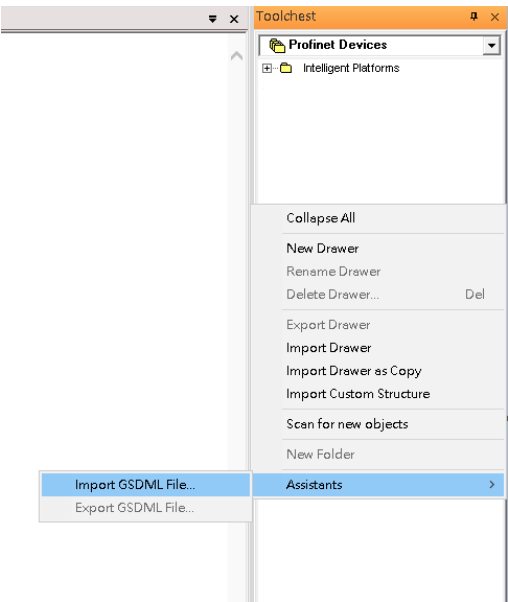
Select Profinet Devices from the Toolchest.

Figure 77: Profinet Devices



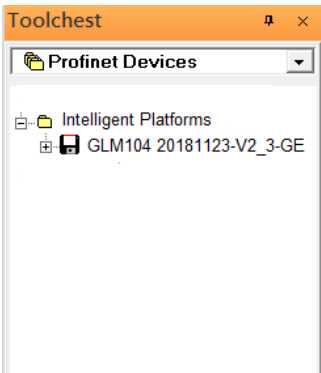
Click right button, select Assistants -> Import GSDML File ...

Figure 78: Importing the GSDML File



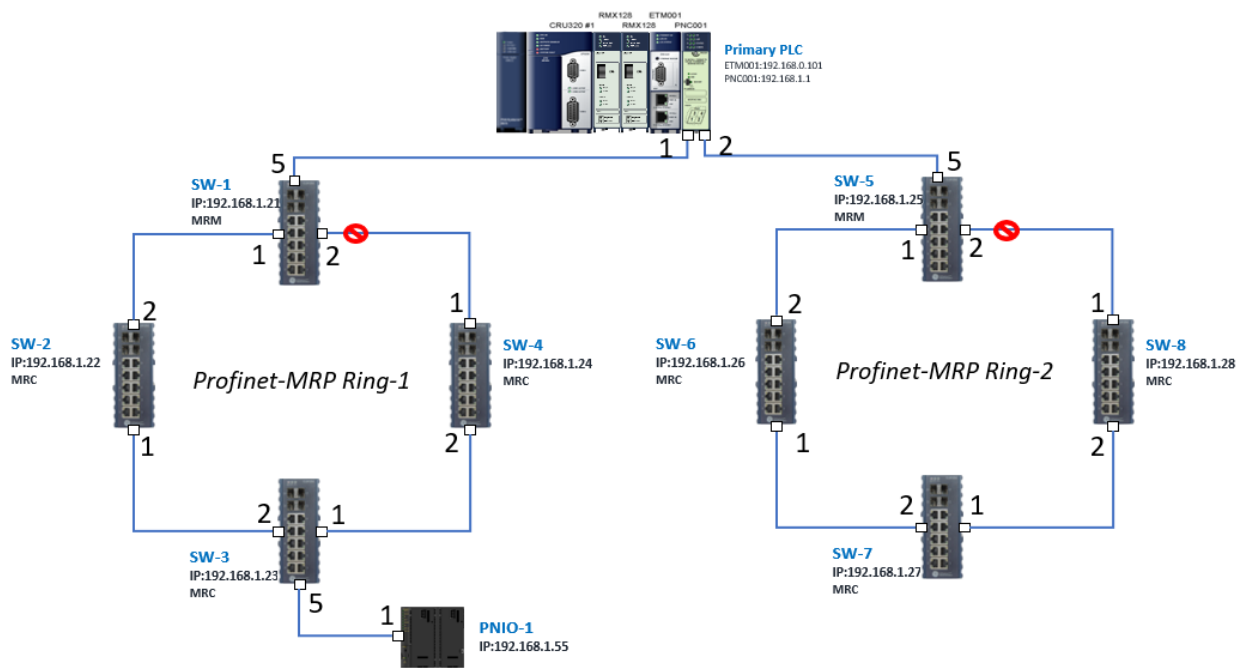
Select the GSDML File to open. The corresponding I/O Device of the GSDML File is added in the Toolchest.

Figure 79: GSDML File Added to the Toolchest



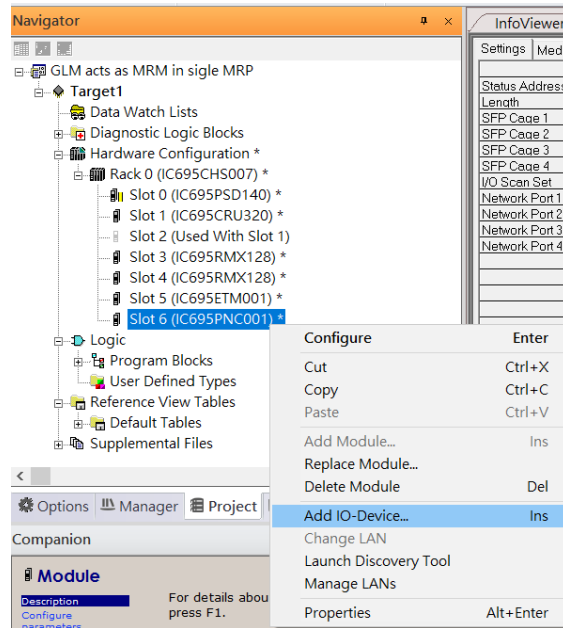
In this document, there are nine I/O devices and one I/O controller. I/O devices are eight switches and one Emerson VersaMax PROFINET I/O Scanner.

Figure 80: Multiple PROFINET-MRP Rings



The I/O Device is connected to the Bus Controller on the I/O Controller. Click slot 6 and click the right button to add the I/O Device on the PNC001.

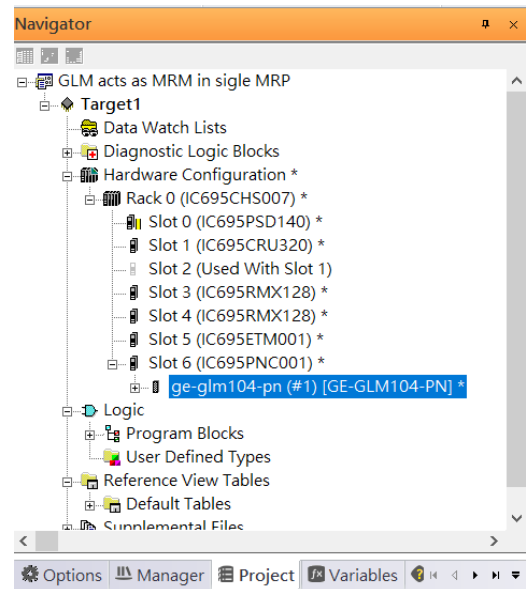
Figure 81: Add the I/O Device on PNC001



Select the specified I/O Service-> GLM0104 20181123-V2_3-GE -> GE-GLM104-PN and click OK.

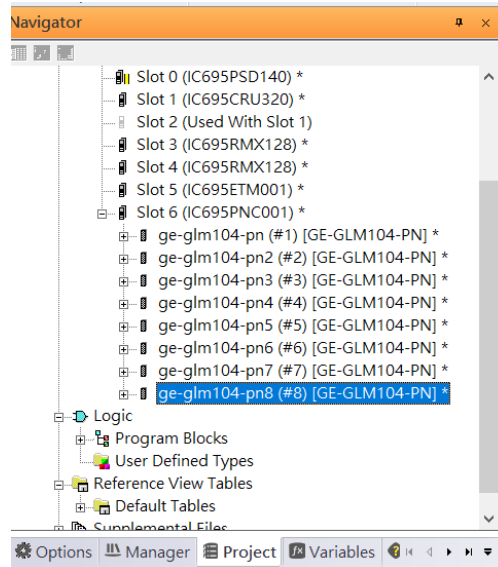
Now the I/O device GLM104(SW1) is ready and is a sub-slot on PNC001.

Figure 82: SW1 is Configured with GLM104-PN



Repeat this process to add the second through the eighth I/O devices to the PNC001. The final results will look like the figure below:

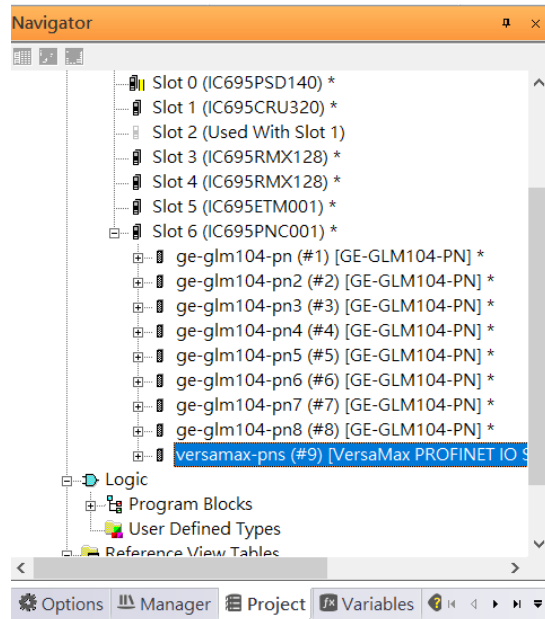
Figure 83: Eight I/O Devices Added to the PNC001



Finally, add the ninth I/O device in the PNC001. This will be the VersaMax PROFINET IO Scanner.

Now the I/O device VersaMax PROFINET IO Scanner is ready and is a sub-slot on PNC001.

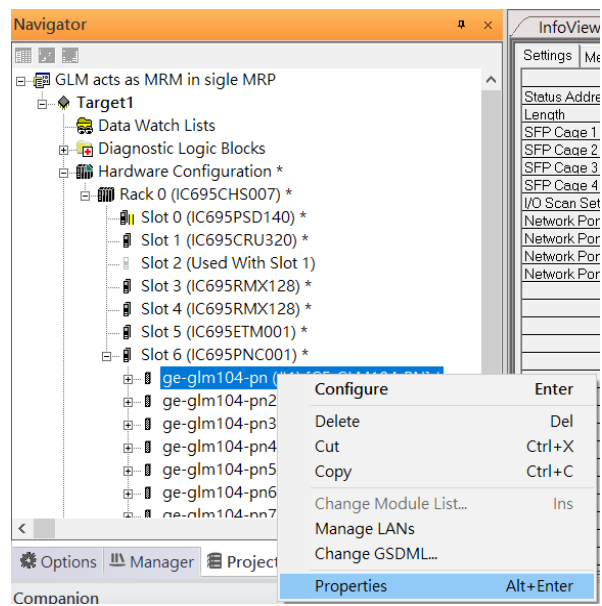
Figure 84: All Nine I/O Devices Added to the PNC001



4.2.4 DCP Set Command

To configure the setting or monitor the status of the I/O Device, the communication interface is also based on an Ethernet network. We can specify the IP address and the device name from I/O Controller via the DCP (Discovery and Configuration Protocol).
Under slot 6, PNC001, select the I/O Device, ge-glm104-pn, and click the right button.
Select **Properties**, see the following picture.

Figure 85: Opening the first I/O Device's Properties



In this table, the I/O Device name can be specified in the field **Device Name**, and the IP address can be set in the field **IP address**. We modify the device name to “ge-glm104-pn-sw-1” and IP address to “192.168.0.21” then we use I/O Device Discovery Tool to observe the I/O Device and set I/O Device’s name to “ge-glm104-pn-sw-1”.

Figure 86: Device Name in "Network Identification"

The screenshot shows a software window titled "Inspector" with a close button (X) in the top right corner. The window is divided into two main sections. The top section, labeled "IO-Device", contains the following fields and values:

- Device Number: 2
- Update Rate (ms): 128
- Reference Variable: <None>

The bottom section, labeled "Network Identification", contains the following fields and values:

- IO LAN: LAN01
- Device Name: ge-glm104-pn-sw-2
- Device Description: (empty)
- IP Address: 192.168.0.22

Below these sections is a "General" section with the following fields and values:

- GSDML: GSDML-V2.3-GE-GLM104-20181123.xml
- Device Type: GE-GLM104-PN
- Device Access Point ID: GE-GLM104-PN
- Group IO References: True

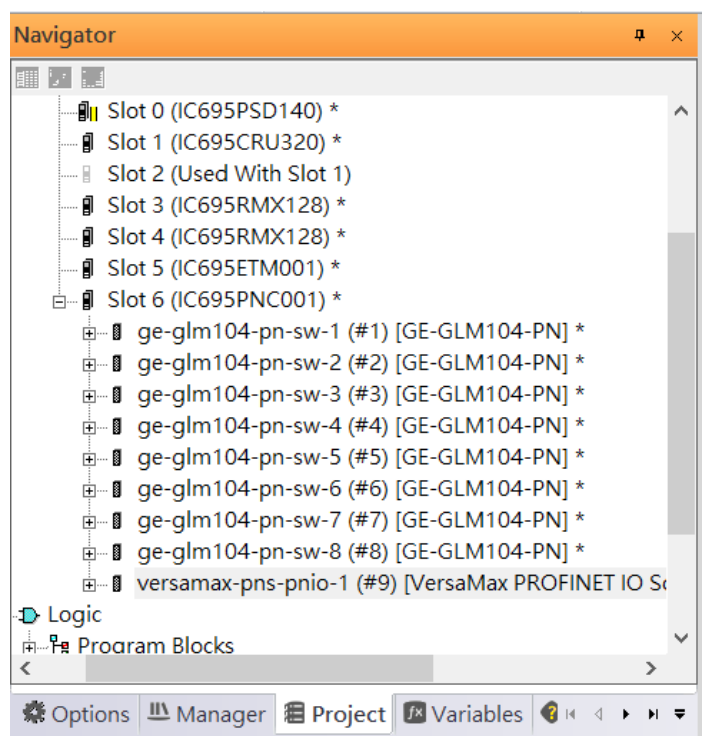
At the bottom of the window, there is a tab labeled "Inspector".

Repeat these steps and use the following table to configure the parameters for the I/O Devices:

Device Name	IP Address	Device Name (Network Identification)
ge-glm104-pn-sw-1	192.168.0.21	ge-glm104-pn-sw-1
ge-glm104-pn-sw-2	192.168.0.22	ge-glm104-pn-sw-2
ge-glm104-pn-sw-3	192.168.0.23	ge-glm104-pn-sw-3
ge-glm104-pn-sw-4	192.168.0.24	ge-glm104-pn-sw-4
ge-glm104-pn-sw-5	192.168.0.25	ge-glm104-pn-sw-5
ge-glm104-pn-sw-6	192.168.0.26	ge-glm104-pn-sw-6
ge-glm104-pn-sw-7	192.168.0.27	ge-glm104-pn-sw-7
ge-glm104-pn-sw-8	192.168.0.28	ge-glm104-pn-sw-8
versamax-pns-pnio-1	192.168.0.55	versamax-pns-pnio-1

When complete, the rack configuration will look like the figure below:

Figure 87: Fully Configured Rack

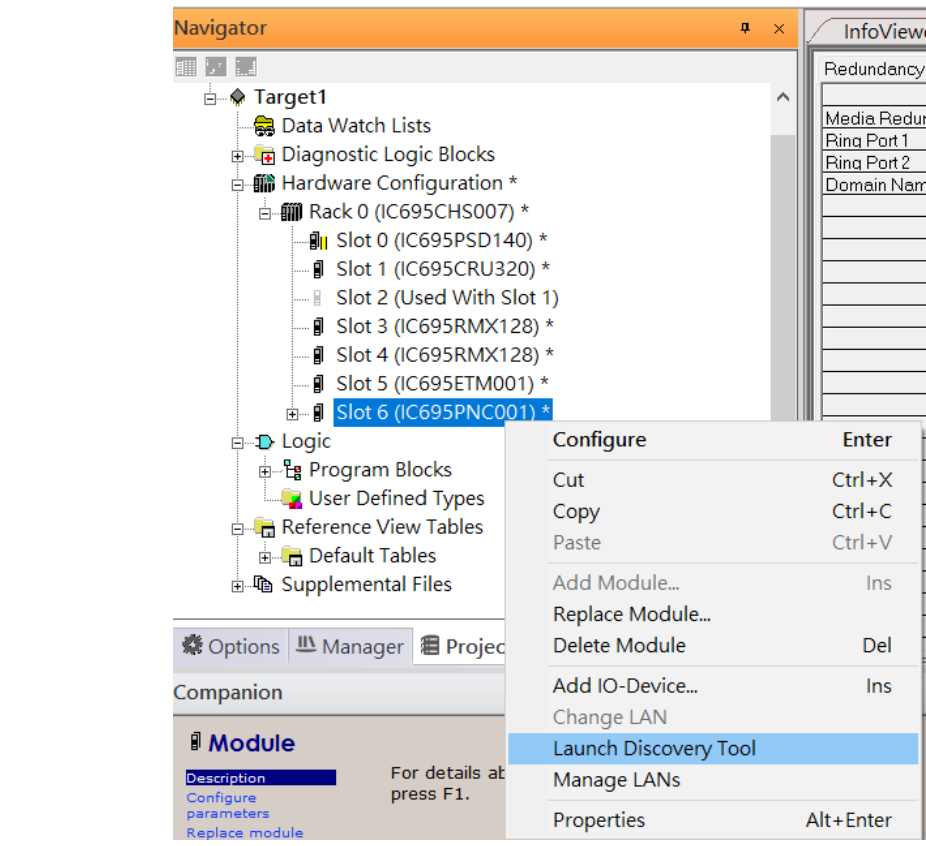


4.2.5 I/O Device Scan

The PAC Machine Edition also supports the function to scan the connected I/O Devices. First, the observed I/O Device shall be connected to the ETM001 on the **Primary** hardware configuration, then using the function **Launch Discovery Tool**.

Note: Before downloading the configuration to CRU320, the user will need to unplug the block port according to the hardware topology to avoid a loop.

Figure 88: Launch Discovery Tool



The tool is shown in the following picture, then press **Refresh Device List** and locate the connected I/O Device in the table.

Figure 89: Refreshing Device List

There are I/O Devices and their status is in “Not assigned”. We need to change their device name to and IP address. Use **Identify Device** to make sure which device we set according to the hardware topology. Then start to set SW-1 device name and IP address.

Click **Edit Device**, set Device Name to **ge-glm104-pn-sw-1** and click the **Set Device Name** button, then set IP Address to **192.168.0.21**, Subnet Mask to **255.255.255.0** and click the **Set IP Information** button.

Figure 90: Setting Properties of Device

Follow the above steps for each of the I/O devices. Use the table below to set the values for each device.

Device Name	IP Address	Subnet Mask
ge-glm104-pn-sw-1	192.168.0.21	255.255.255.0
ge-glm104-pn-sw-2	192.168.0.22	255.255.255.0
ge-glm104-pn-sw-3	192.168.0.23	255.255.255.0
ge-glm104-pn-sw-4	192.168.0.24	255.255.255.0
ge-glm104-pn-sw-5	192.168.0.25	255.255.255.0
ge-glm104-pn-sw-6	192.168.0.26	255.255.255.0
ge-glm104-pn-sw-7	192.168.0.27	255.255.255.0
ge-glm104-pn-sw-8	192.168.0.28	255.255.255.0
versamax-pns-pnio-1	192.168.0.55	255.255.255.0

After assigning Device Name and IP Address correctly, the Status will be in “Assigned” status.

Figure 91: Assigned Devices

The screenshot shows the InfoViewer application window. The title bar indicates the connection is (0.6.7.0) GE-GLM104-PN. The main window is titled 'PROFINET DCP - Direct Connection'. Under 'Connection Settings', the connection is set to 'Ethernet 8' and the LAN is 'LAN01'. The status is 'No Errors'. A table lists the discovered devices, all of which are marked with a green checkmark, indicating they are assigned. The table columns are Status, Device Name, IP Address, Vendor, and Device Type. The devices listed are ge-glm104-pn-sw-1 through ge-glm104-pn-sw-8, iolan-controller01, and versamax-pns-pnio-1. Below the table, there are filters (10/10) showing 'Assigned' is selected. To the right, 'Selection Properties' are displayed for the selected device, including MAC Address, Device Role, Vendor ID, Device ID, IP Address, Subnet Mask, and Gateway. Buttons for 'Identify Device' and 'Edit Device' are also visible.

Status	Device Name	IP Address	Vendor	Device Type
✓	ge-glm104-pn-sw-1	192.168.0.21	GE Intelligent Platforms, Inc.	GE-GLM104-PN
✓	ge-glm104-pn-sw-2	192.168.0.22	GE Intelligent Platforms, Inc.	GE-GLM104-PN
✓	ge-glm104-pn-sw-3	192.168.0.23	GE Intelligent Platforms, Inc.	GE-GLM104-PN
✓	ge-glm104-pn-sw-4	192.168.0.24	GE Intelligent Platforms, Inc.	GE-GLM104-PN
✓	ge-glm104-pn-sw-5	192.168.0.25	GE Intelligent Platforms, Inc.	GE-GLM104-PN
✓	ge-glm104-pn-sw-6	192.168.0.26	GE Intelligent Platforms, Inc.	GE-GLM104-PN
✓	ge-glm104-pn-sw-7	192.168.0.27	GE Intelligent Platforms, Inc.	GE-GLM104-PN
✓	ge-glm104-pn-sw-8	192.168.0.28	GE Intelligent Platforms, Inc.	GE-GLM104-PN
✓	iolan-controller01	192.168.0.1	GE Intelligent Platforms, Inc.	IC695PNC001
✓	versamax-pns-pnio-1	192.168.0.55	GE Intelligent Platforms, Inc.	IC200PNS001

Filters (10/10): ☒ Assigned, ☒ Assigned with errors, ☒ Not assigned

Selection Properties:

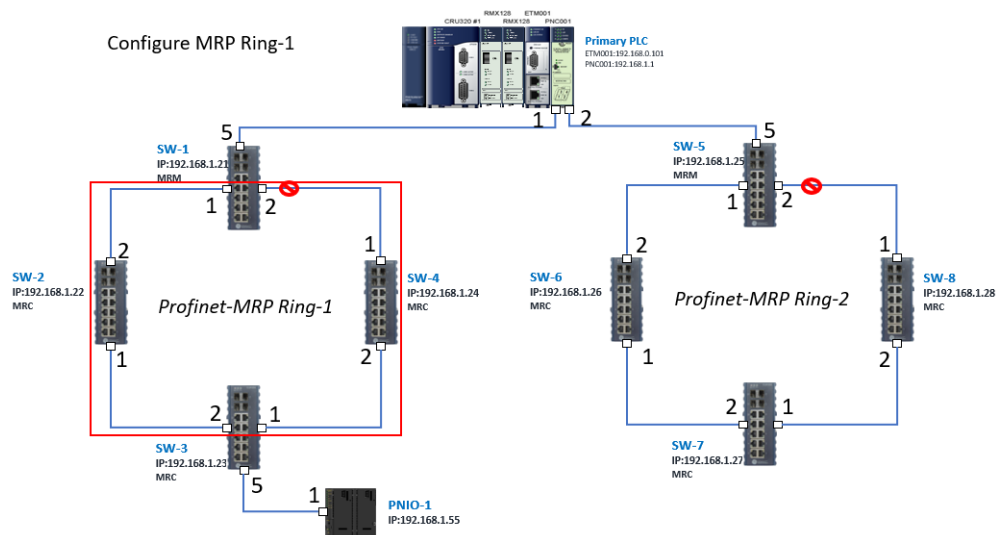
MAC Address: 00-09-91-56-C3-0E
Device Role: Device
Vendor ID: 015A
Device ID: 0003
IP Address: 192.168.0.55
Subnet Mask: 255.255.255.0
Gateway: 0.0.0.0

Buttons: Identify Device, Edit Device

4.2.6 MRP Setting

To being, we will configure the MRP outlined in the red box of the Profinet MRP Ring-1 configuration

Figure 92: Configuring MRP Ring-1

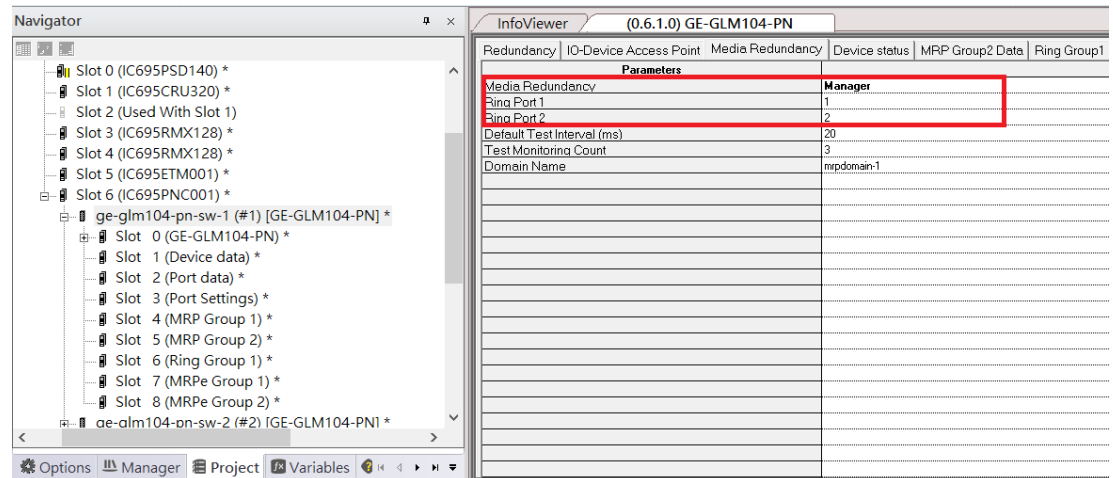


In order to enable the MRP function in SW1, right-click the target and choose **Configure**.

Enable the MRP function by changing the value of **Media Redundancy** to the **manager** and set **Ring Port 1** to 1, and **Ring Port 2** to 2.

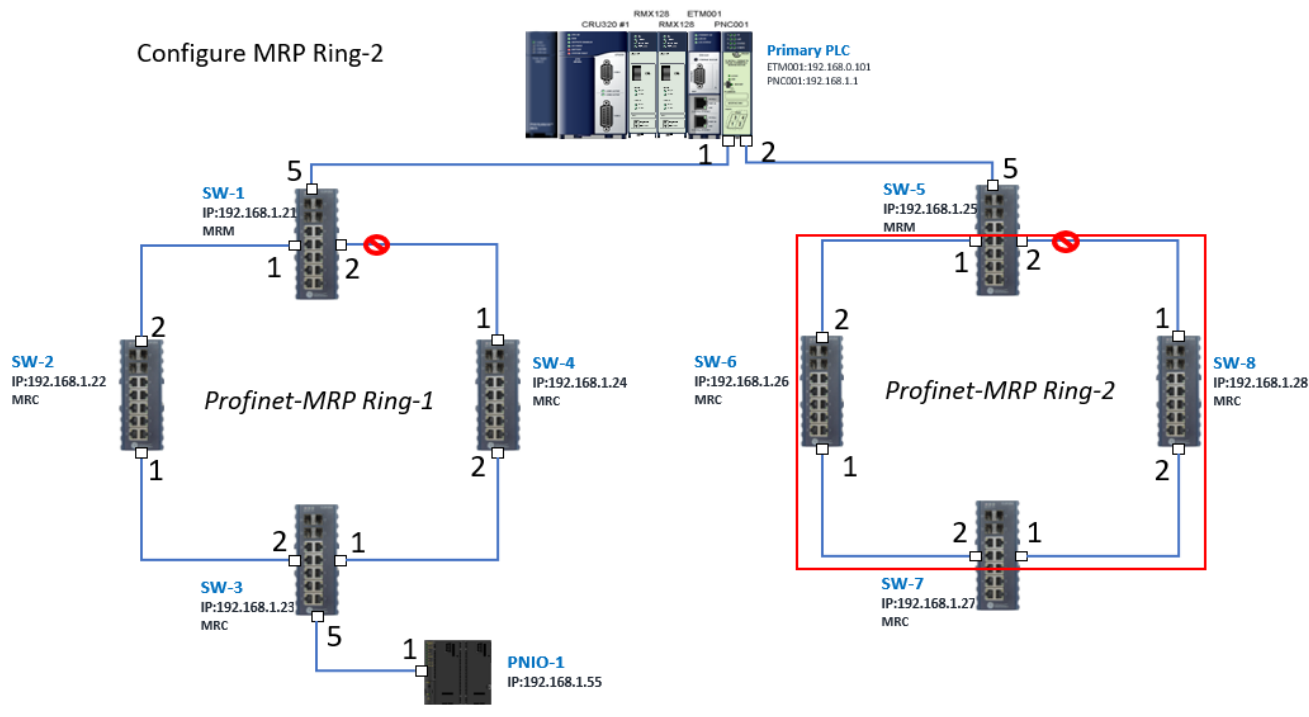
Repeat these sets to enable the MRP function for SW2-SW4.

Figure 93: Configuring Medi Redundancy Parameters



Repeat the steps above to configure the MRP outlined in the red box of the Profinet MRP Ring-2 configuration.

Figure 94: Configuring MRP Ring-2



4.2.7 Network Setting

To establish the communication to the I/O Controller from PAC Machine Edition, the interface of the I/O Controller shall be specified.

It should be noted that there is only 1 I/O Controller (Primary or Secondary) able to communicate with PAC Machine Edition. Therefore, there are 3 rules of communication that are defined.

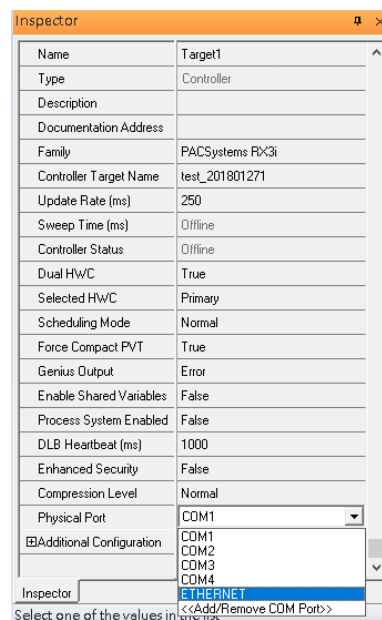
I/O Controller Communication Rule

Rule	Description
1	The communicated I/O Controller shall be specified. Click primary or secondary hardware configuration, click the right button, and select Set as Selected HWC .
2	During the communication, the cable shall be connected to the ETM001 in specified hardware (Primary or Secondary)
3	Specify the interface and IP address for communicated I/O Controller

For rule 3, click **Target 1** and Select **Property**.

In the **Inspector** pane, change the value of **Physical Port** to **Ethernet**.

Figure 95: Changing the Physical Port Parameter



Also, the IP address of communicated I/O Controller shall be set. Here the **Primary** setting is shown.

Note, that the specified IP address is set as the IP address on ETM001.

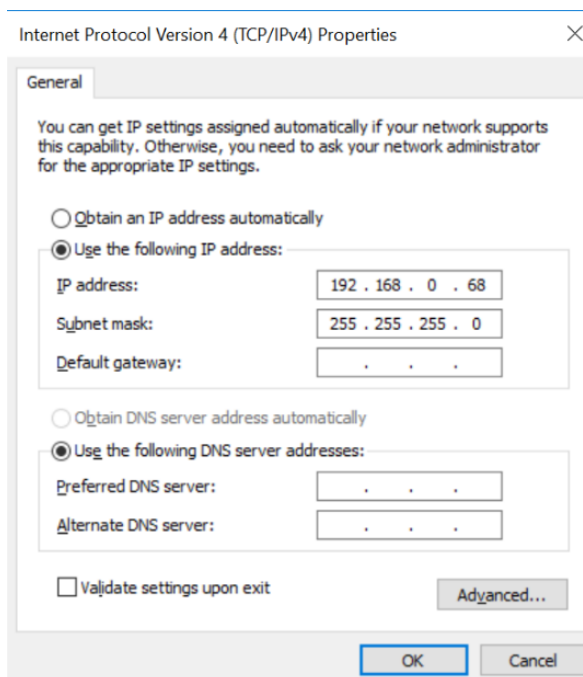
Figure 96: Specified IP Address Appears

Inspector	
Name	Target1
Type	Controller
Description	
Documentation Address	
Family	PACSystems RX3i
Controller Target Name	test_201801271
Update Rate (ms)	250
Sweep Time (ms)	Offline
Controller Status	Offline
Dual HWC	True
Selected HWC	Primary
Scheduling Mode	Normal
Force Compact PVT	True
Genius Output	Error
Enable Shared Variables	False
Process System Enabled	False
DLB Heartbeat (ms)	1000
Enhanced Security	False
Compression Level	Normal
Physical Port	ETHERNET
IP Address	192.168.0.101
Additional Configuration	

4.2.8 PC Network

The IP address of the PC with PAC Machine Edition shall be set in the same network area.

Figure 97: Setting the IP Address of the PC with PME

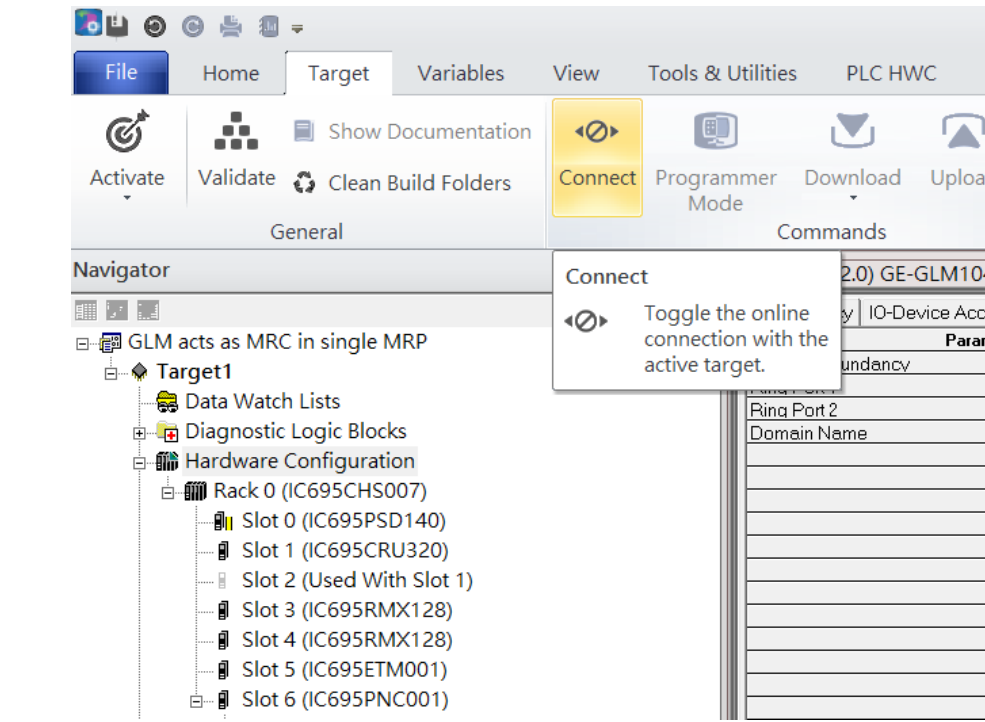


Note: For ETM configuration, please consult GFK-2224 PACSystems Rx3i TCP/IP Ethernet Communications User Manual

4.3 Implementation

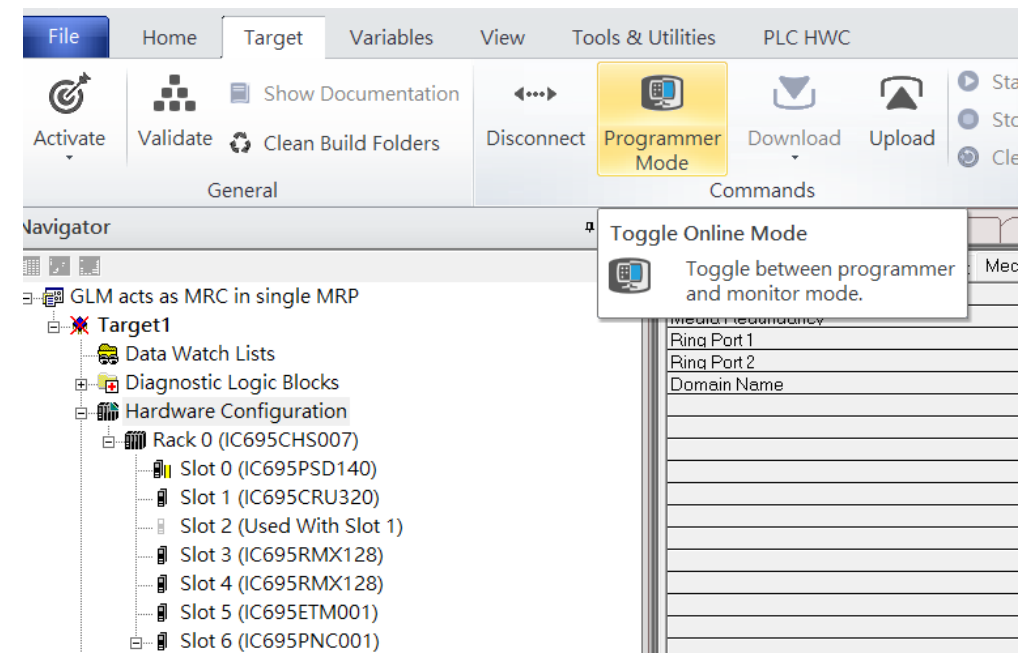
To download the configuration to hardware, the following steps shall be applied.
First, press the **Connect** icon.

Figure 98: Connecting to Target



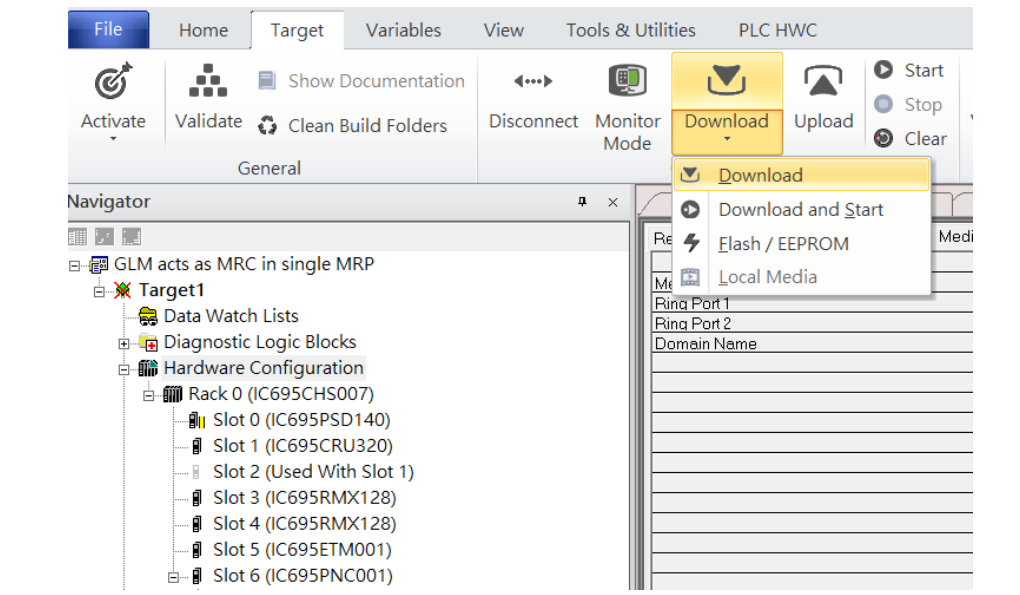
Then press the icon **Programmer Mode**.

Figure 99: Programmer Mode



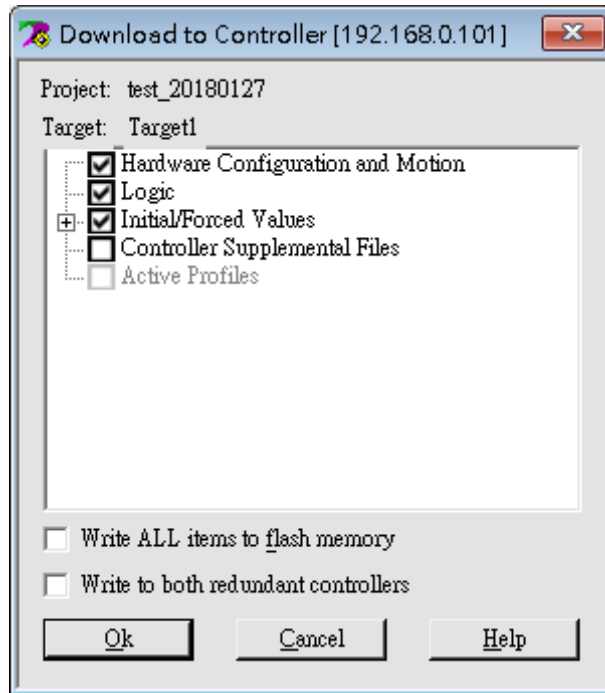
Then press the icon **Download** and select **Download**.

Figure 100: Download



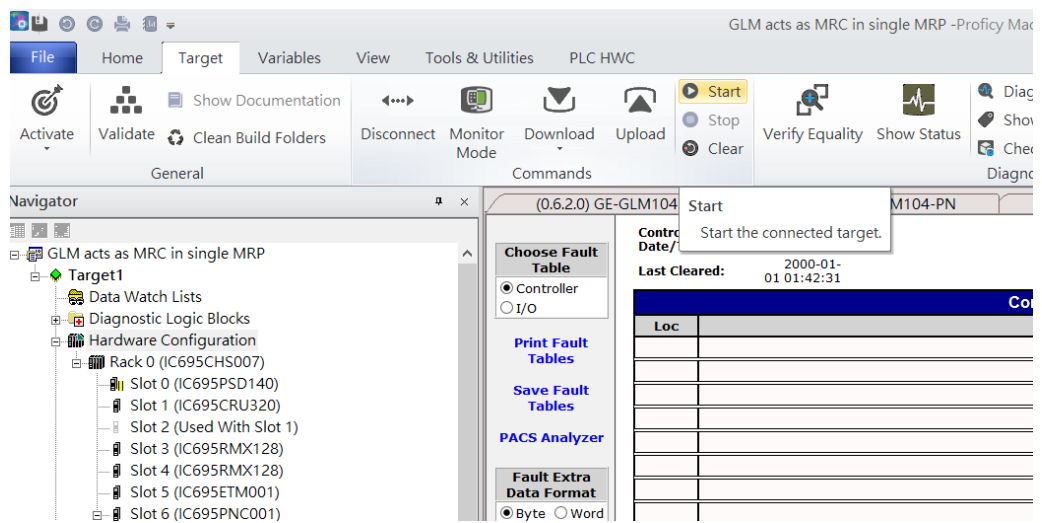
Then the dialogue is appeared to make sure the initialization procedure, select **OK**.

Figure 101: Download to Controller



After downloading completely, press the icon **Start** to active PLC. Note: After downloading completely, switch CRU320 to **Run I/O Enable** and select **OK**. If PLC has started successfully, a message “The Controller was successfully started”.

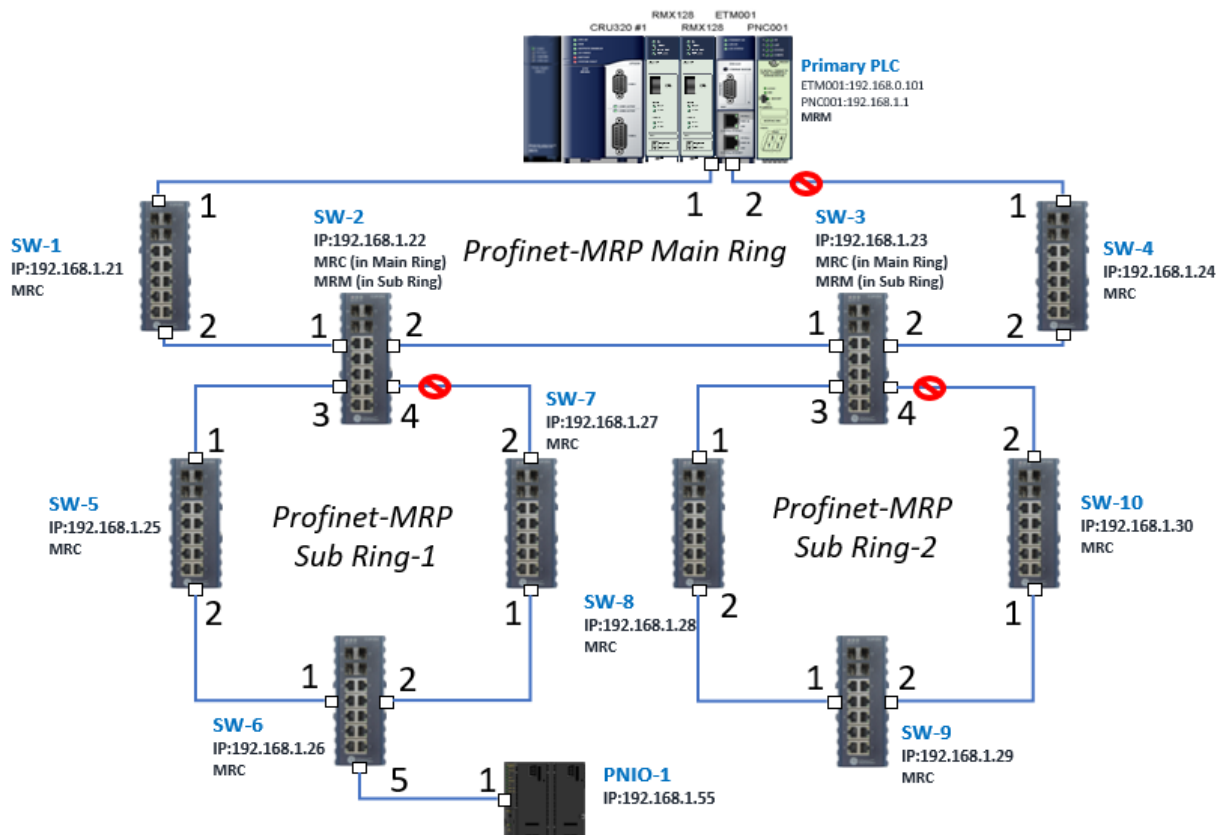
Figure 102: Start



Section 5 PROFINET-MRP Main Ring Couples Multiple PROFINET-MRP Subrings

5.1 Network Topology

Figure 103: PROFINET-MRP Main Ring couples multiple PROFINET-MRP Subrings



5.2 Hardware Configuration

On the CRU320, the I/O data can be set to “STOP”, “RUN OUTPUT DISABLE” or “RUN I/O Enable” states by a switch imbedded on CRU320. During the configuration, the switches on both 2 CRU320s must be set to “STOP”

5.2.1 Project Open

To start the software PAC Machine Edition, please follow the steps below:

4. Click **Start -> Emerson -> PAC Machine Edition -> PAC Machine Edition**
5. Select the empty project and click **OK**
6. Set the project name and click **OK**.

Figure 104: Create a new project

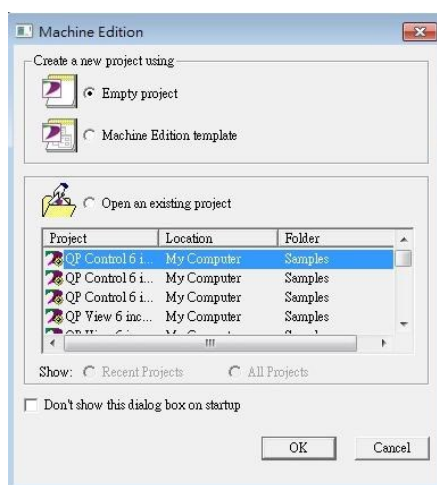
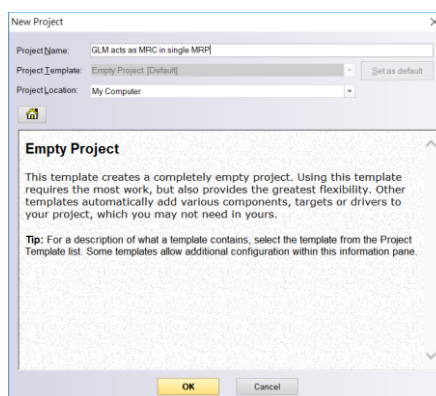


Figure 105: New Project Name



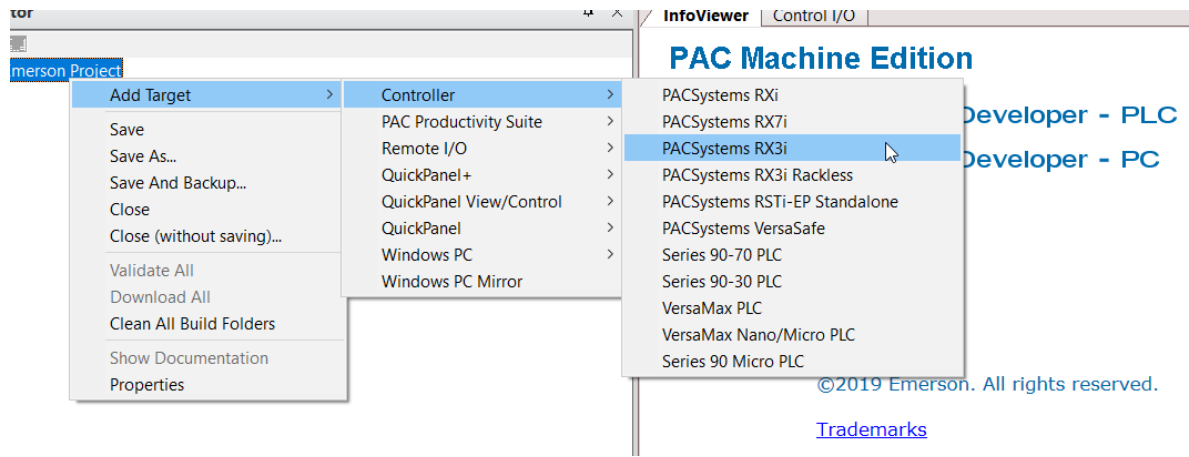
5.2.2 I/O Controller Setting

The next step is to add a target for this project.

Click the right button on project name **GLM** to act as MRC in a single MRC group and select **Add Target -> Controller -> PACSystems RX3i**.

The PACSystems RX3i is the I/O Controller to be tested. See the following picture.

Figure 106: Add Controller

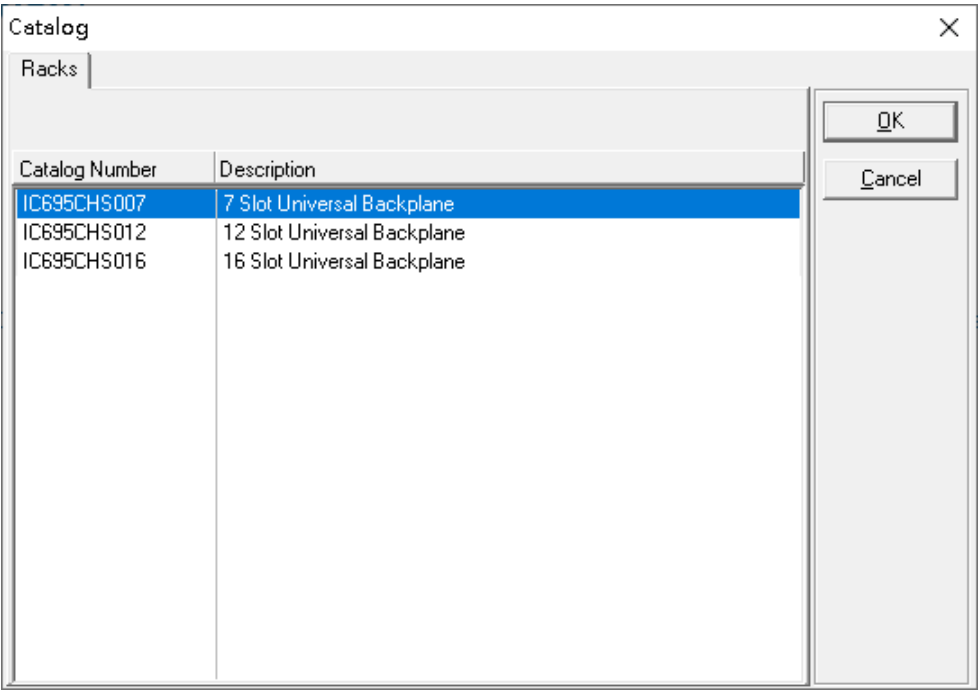


Originally the I/O Controller is described as the rack with 12 slots, each slot can be regarded as the chassis for device installation such as a power card, communication module, or bus controller. However, there are only 7 chassis that can be used in the I/O Controller CRU320. Thus, replace the rack with 7 slots.

Click the right button on "Rack 0 (IC695CHS012)" and select **Replace Rack**.

Select **IC695CHS007** and click **OK**.

Figure 107: Selecting IC695CHS007



After the rack and the number of slots are defined, select the corresponding devices into the slots according to the I/O Controller. The following picture is the current installation for each device on the I/O Controller

Figure 108: Rack Configuration



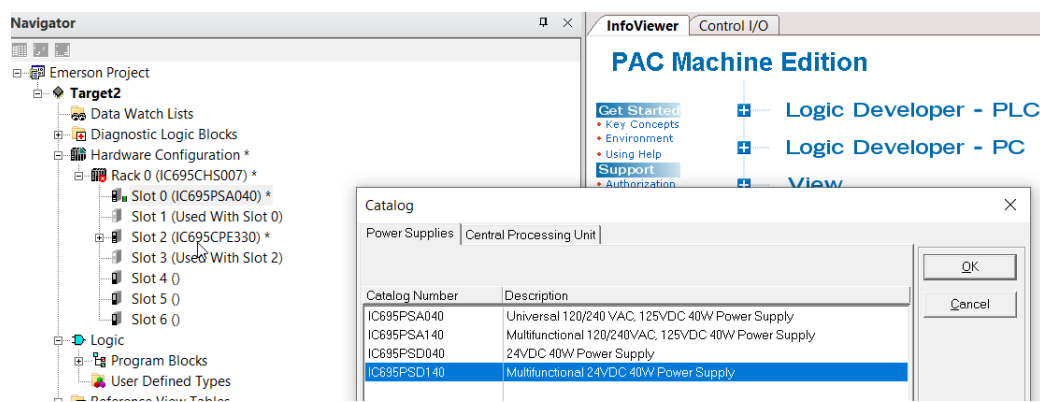
From left to right, the installed devices on the I/O Controller are

Devices on I/O Controller

Device Type	Device Name	Chassis index
Power Card	PSD140	0
Central Processing Unit	CRU320	1 ~ 2
Communication Module	RMX128	3
Communication Module	RMX128	4
Communication Module	ETM001	5
Bus Controller	PNC001	6

Now, add the module into the slots by the current devices on the I/O Controller, the chassis index is corresponding to the slot index. First of all, replace the power card. Click slot 0 and click the right button, select **Replace Module**, and specify the installed power card, PSD140, then click **OK**.

Figure 109: Replace Module



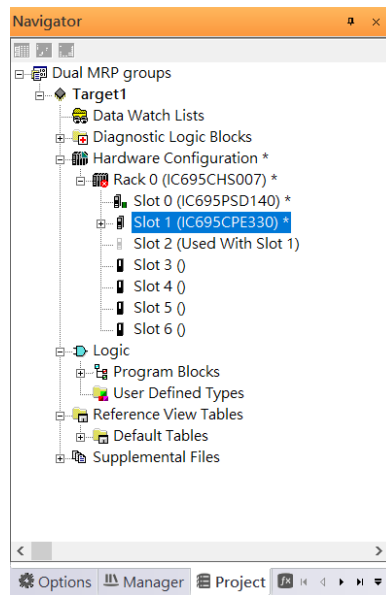
Slot 0

Slot 0 is replaced by the current power card, PSD140.

Slot 1 and 2

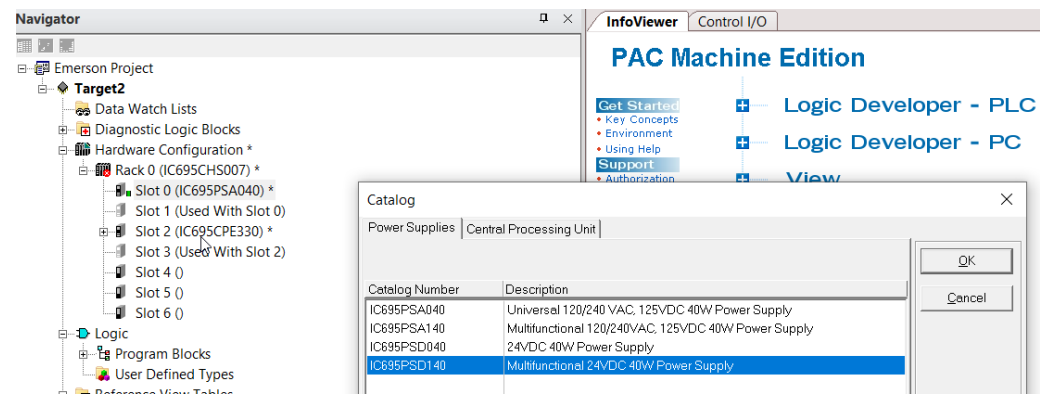
For slot 1 and 2, 2 chassis (1 and 2) is occupied by the Central Processing Unit, CRU320. To integrate slots 1 and 2, pull slot 2 to slot 1. Now slot 2 is cleaned.

Figure 110: Integrate Slot 1 and 2



To select the Central Processing Unit, click slot 1 and click the right button, select **Replace Module** to choose CRU320. Then choose **No**.

Figure 111: Replace Module

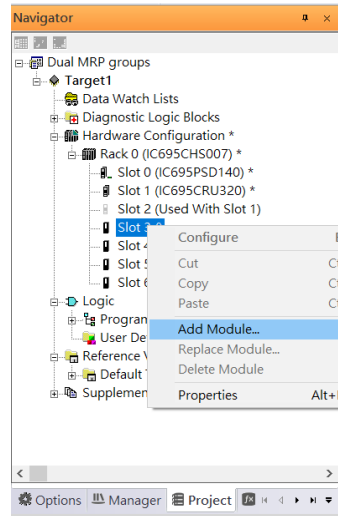


5.2.2.1 Slot 3

Next is to add the RMX128 module for slot 3

Click the right button on slot 3, and select **Add Module**.

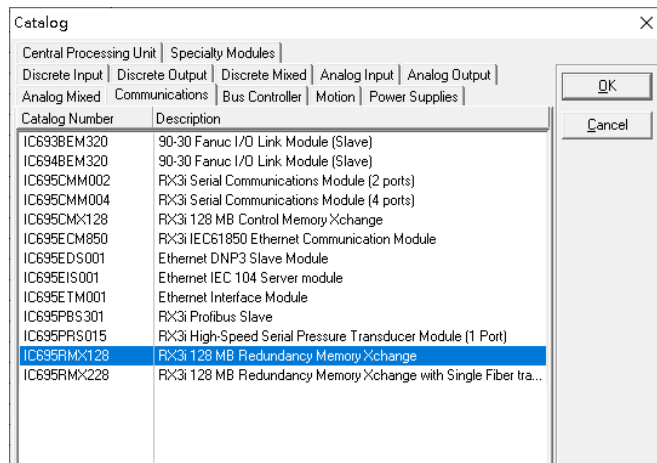
Figure 112: Add Module



According to the current installation on the I/O Controller, select the RMX28 module.

Select **Communications** -> **IC695RMX128** and click **OK**. The RMX128 is now ready configured on slot 3.

Figure 113: RMX128



5.2.2.2 Slot 4

Repeat these steps to add an RMX128 module to slot 4.

5.2.2.3 Slot 5

Next, select the ETM001 for slot 5.

Click the right button on slot 5, select **Add Module**, select **Communications IC695ETM00**, and click **OK**.

It should be noted that the ETM001 is the management device for PAC Machine Edition. The communication interface is the Ethernet network. The IP address and Subnet Mask shall be specified.

In the following picture, the IP address 192.168.0.101 and mask 255.255.255.0 is specified on ETM001.

Figure 114: ETM001 Parameters

The screenshot shows the PACSystems software interface. On the left, the **Navigator** pane displays a project tree under **Target1**. The **Hardware Configuration** section is expanded, showing **Rack 0 (IC695CHS007) *** with slots 0 through 6. **Slot 5 (IC695ETM001) *** is selected. On the right, the **InfoViewer** pane shows the configuration for **(0.5) IC695ETM001**. The **Parameters** tab is active, displaying a table of settings. The **IP Address** is set to **192.168.0.101** and the **Subnet Mask** is set to **255.255.255.0**, both of which are highlighted with a red rectangular box. Other parameters include **Configuration Mode** (TCP/IP), **Adapter Name** (0.5), **Use BOOTP for IP Address** (False), **Gateway IP Address** (0.0.0.0), **Name Server IP Address** (0.0.0.0), **Max FTP Server Connections** (0), **Network Time Sync** (None), **Status Address** (%I00001), **Length** (80), **Redundant IP** (Disable), and **I/O Scan Set** (1).

Parameters	
Configuration Mode	TCP/IP
Adapter Name	0.5
Use BOOTP for IP Address	False
IP Address	192.168.0.101
Subnet Mask	255.255.255.0
Gateway IP Address	0.0.0.0
Name Server IP Address	0.0.0.0
Max FTP Server Connections	0
Network Time Sync	None
Status Address	%I00001
Length	80
Redundant IP	Disable
I/O Scan Set	1

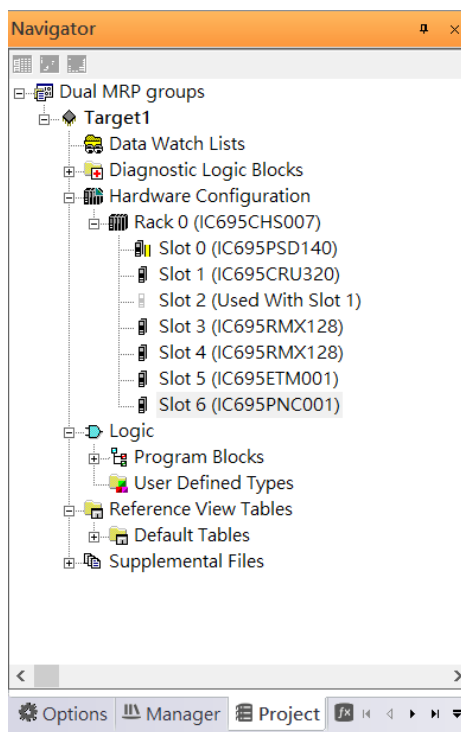
5.2.2.4 Slot 6

Next, select PNC001 for slot 6.

Click slot 6 and click the right button, select **Add Module** to specify the installed Bus Controller, PNC001, and click **OK**.

Now all the devices on the I/O Controller are ready on the slots on the rack, the following picture is the current status, and we shall save it.

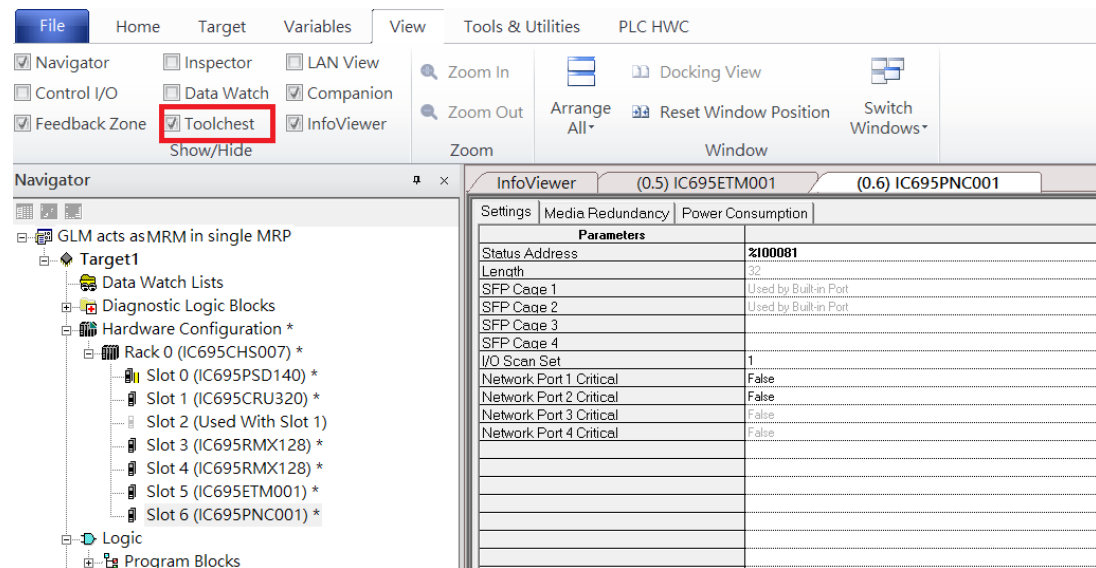
Figure 115: Configured Rack



5.2.3 I/O Device Setting

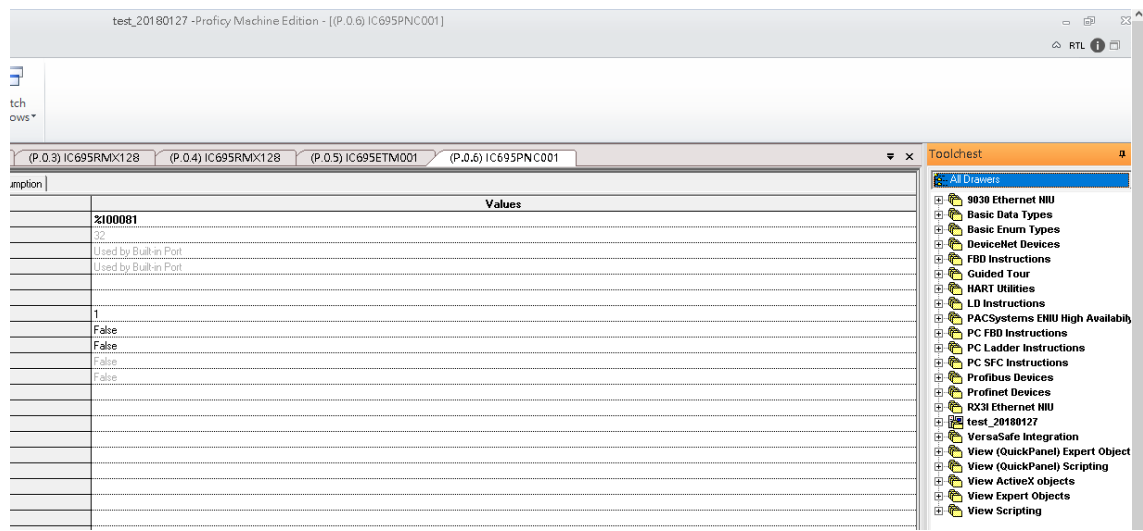
This section introduces the I/O Device integration. To configure the I/O Device, the GSDML file is necessary. Now we create another interface to load the GSDML file by using Toolchest.

Figure 116: Toolchest feature



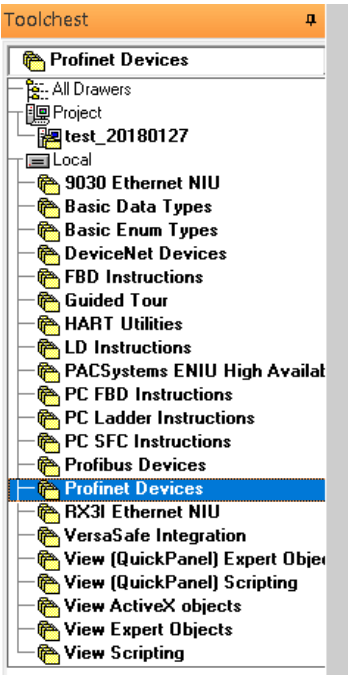
As shown in the following picture, the interface is created on the right-hand side.

Figure 117: Default Toolchest Interface Location



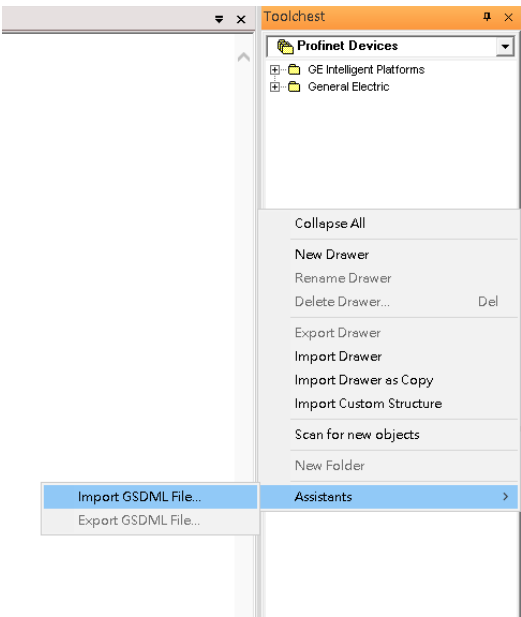
Select Profinet Devices from the Toolchest.

Figure 118: Profinet Devices



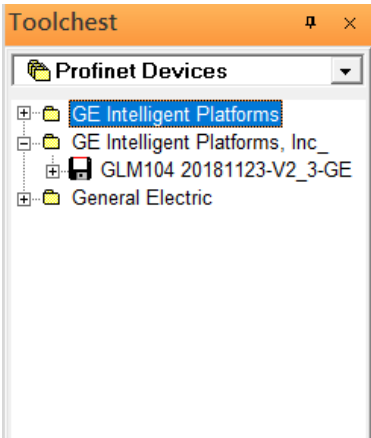
Click right button, select Assistants -> Import GSDML File ...

Figure 119: Importing the GSDML File



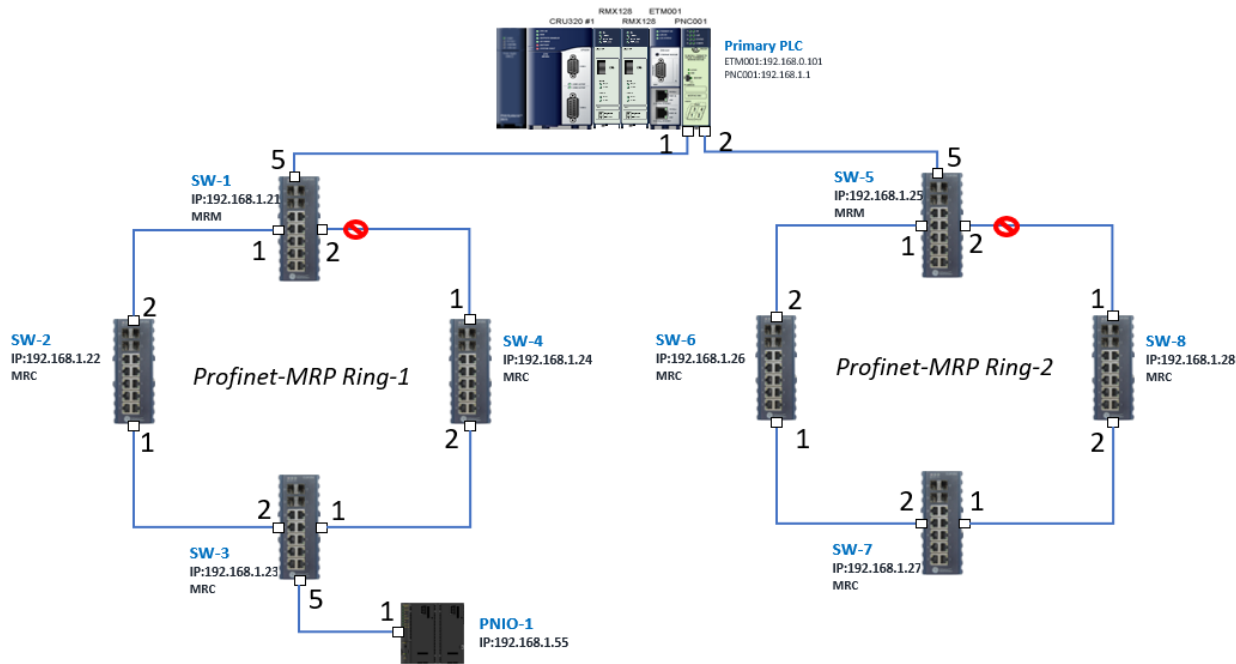
Select the GSDML File to open. The corresponding I/O Device of the GSDML File is added in the Toolchest.

Figure 120: GSDML File Added to the Toolchest



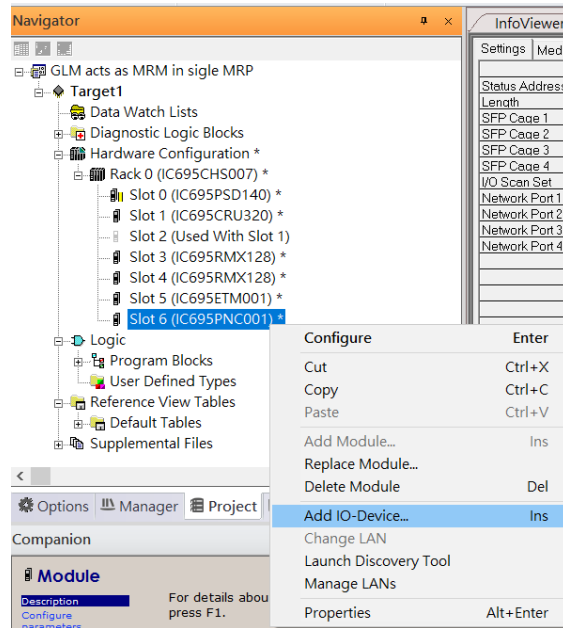
In this document, there are nine I/O devices and one I/O controller. I/O devices are eight switches and one Emerson VersaMax PROFINET I/O Scanner.

Figure 121: Multiple PROFINET-MRP Rings



The I/O Device is connected to the Bus Controller on the I/O Controller. Click slot 6 and click the right button to add the I/O Device on the PNC001.

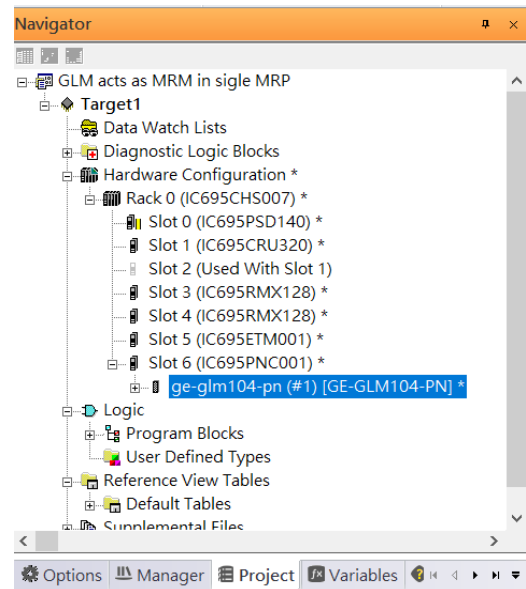
Figure 122: Add the I/O Device on PNC001



Select the specified I/O Service-> GLM0104 20181123-V2_3-GE-> GE-GLM104-PN and click OK.

Now the I/O device GLM104(SW1) is ready and is a sub-slot on PNC001.

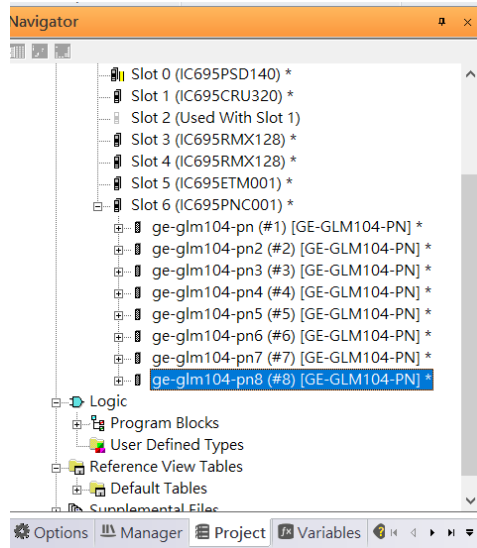
Figure 123: SW1 is Configured with GLM104-PN



5.2.3.1 GLM104-PN2 through GLM104-PN8

Repeat this process to add the second through the eighth I/O devices to the PNC001. The final results will look like the figure below:

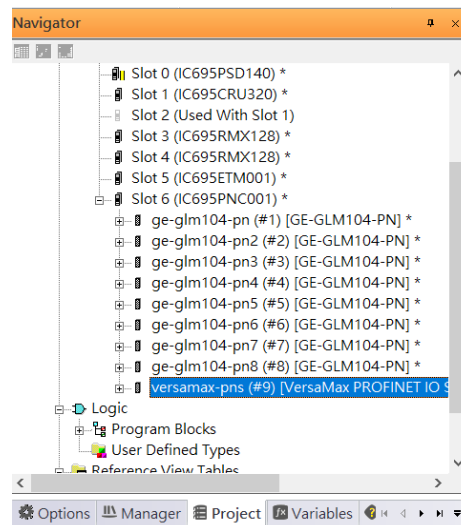
Figure 124: Eight I/O Devices Added to the PNC001



Finally, add the ninth I/O device in the PNC001. This will be the VersaMax PROFINET IO Scanner.

Now the I/O device VersaMax PROFINET IO Scanner is ready and is a sub-slot on PNC001.

Figure 125: All Nine I/O Devices Added to the PNC001



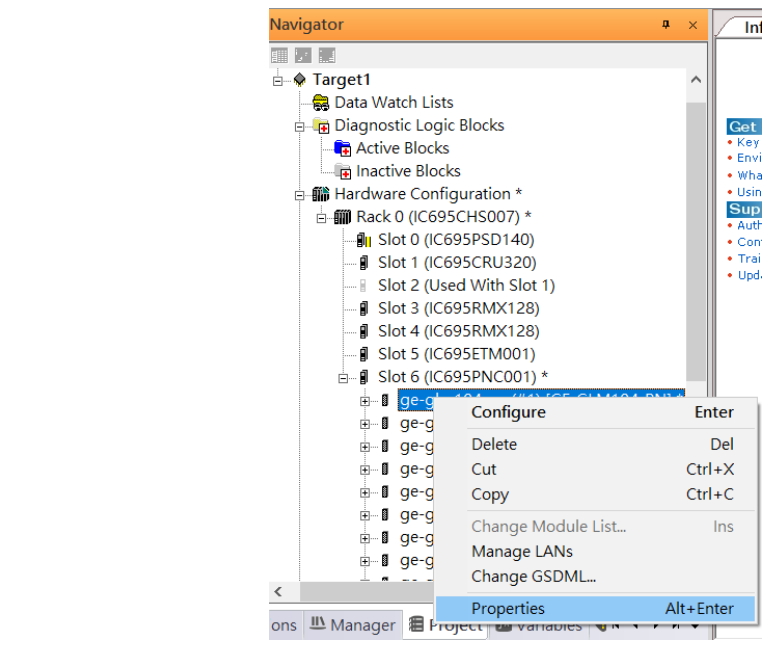
5.2.4 DCP Set Command

To configure the setting or monitor the status of the I/O Device, the communication interface is also based on an Ethernet network. We can specify the IP address and the device name from I/O Controller via the DCP (Discovery and Configuration Protocol).

5.2.4.1 GLM104-PN

Under slot 6, PNC001, select the I/O Device, ge-glm104-pn, and click the right button. Select **Properties**, see the following picture.

Figure 126: Properties

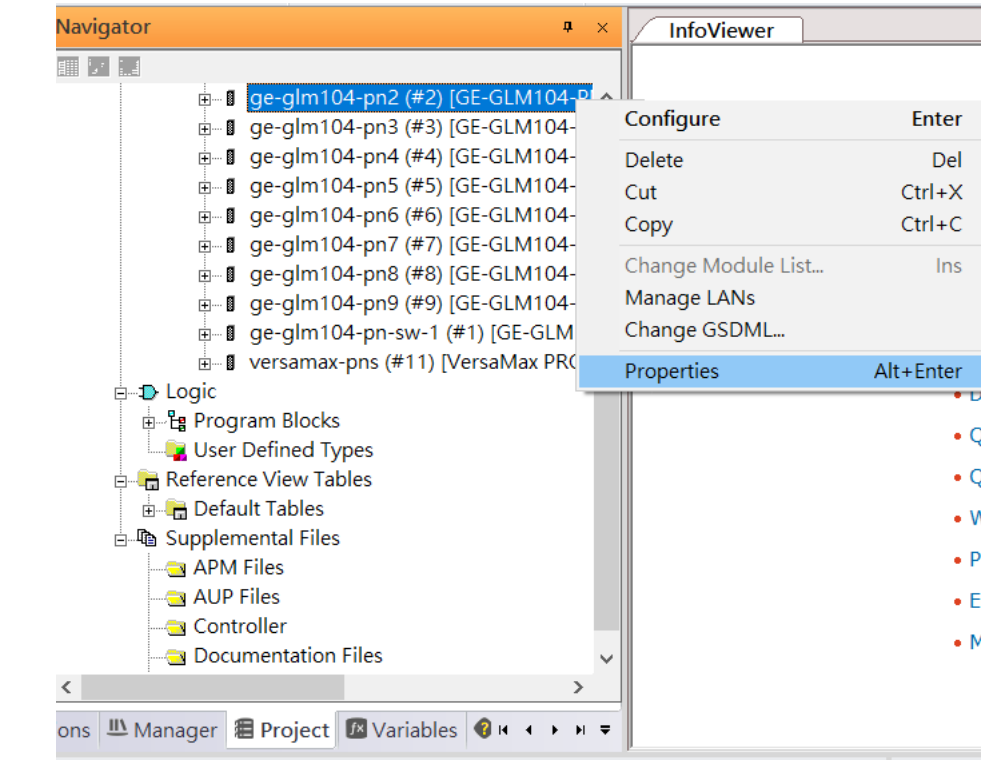


In this table, the I/O Device name can be specified in the field **Device Name**, and the IP address can be set in the field **IP address**. We modify the device name to “ge-glm104-pn-sw-1” and IP address to “192.168.0.21” then we use I/O Device Discovery Tool to observe an I/O Device and set I/O Device’s name to “ge-glm104-pn-sw-1”.

5.2.4.2 GLM104-PN2

Under slot 6, PNC001, select the I/O Device, ge-glm104-pn2, and click the right button. Select **Properties**, see the following picture.

Figure 127: Properties



We modify the device name to “ge-glm104-pn-sw-2” and IP address to “192.168.0.22” then we use I/O Device Discovery Tool to observe an I/O Device and set I/O Device’s name to “ge-glm104-pn-sw-2” later.

Figure 128: Device Name

Inspector	
I/O Device	
Device Number	2
Update Rate (ms)	128
Reference Variable	<None>
Network Identification	
IO LAN	LAN01
Device Name	ge-glm104-pn-sw-2
Device Description	
IP Address	192.168.0.22
General	
GSDML	GSDMLV2.3-GE-GLM104-20181123.xml
Device Type	GE-GLM104-PN
Device Access Point ID	GE-GLM104-PN
Group IO References	True

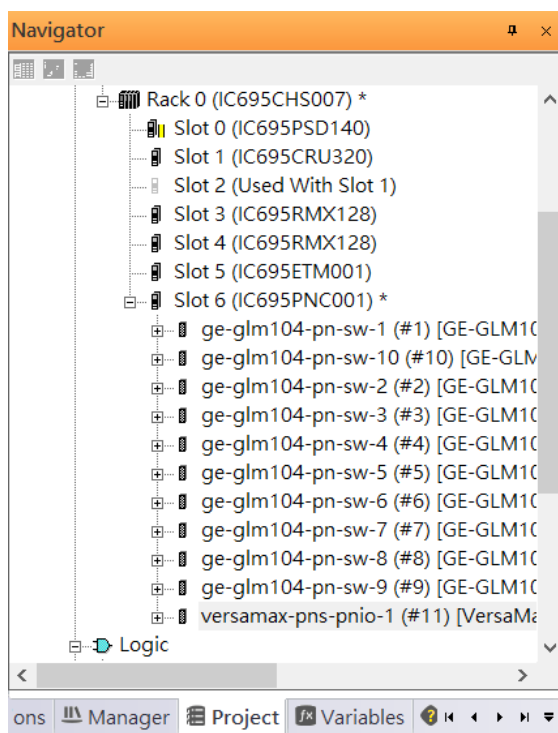
5.2.4.3 GLM10-PN3 through GLM-PN10

Repeat this process and for the remaining I/O Devices. Use the table below to define the device name and IP address for each I/O device:

I/O Device	IP Address	Device Name
GLM10-PN	192.168.0.21	ge-glm104-pn-sw-1
GLM10-PN2	192.168.0.22	ge-glm104-pn-sw-2
GLM10-PN3	192.168.0.23	ge-glm104-pn-sw-3
GLM10-PN4	192.168.0.24	ge-glm104-pn-sw-4
GLM10-PN5	192.168.0.25	ge-glm104-pn-sw-5
GLM10-PN6	192.168.0.26	ge-glm104-pn-sw-6
GLM10-PN7	192.168.0.27	ge-glm104-pn-sw-7
GLM10-PN8	192.168.0.28	ge-glm104-pn-sw-8
GLM10-PN9	192.168.0.29	ge-glm104-pn-sw-9
GLM10-PN10	192.168.0.30	ge-glm104-pn-sw-10
VERSAMAX-PNIO	192.168.0.55	versamax-pns-pnio-1

Now all the devices have been changed their device name and IP address like the following picture.

Figure 129:Finished Configuration

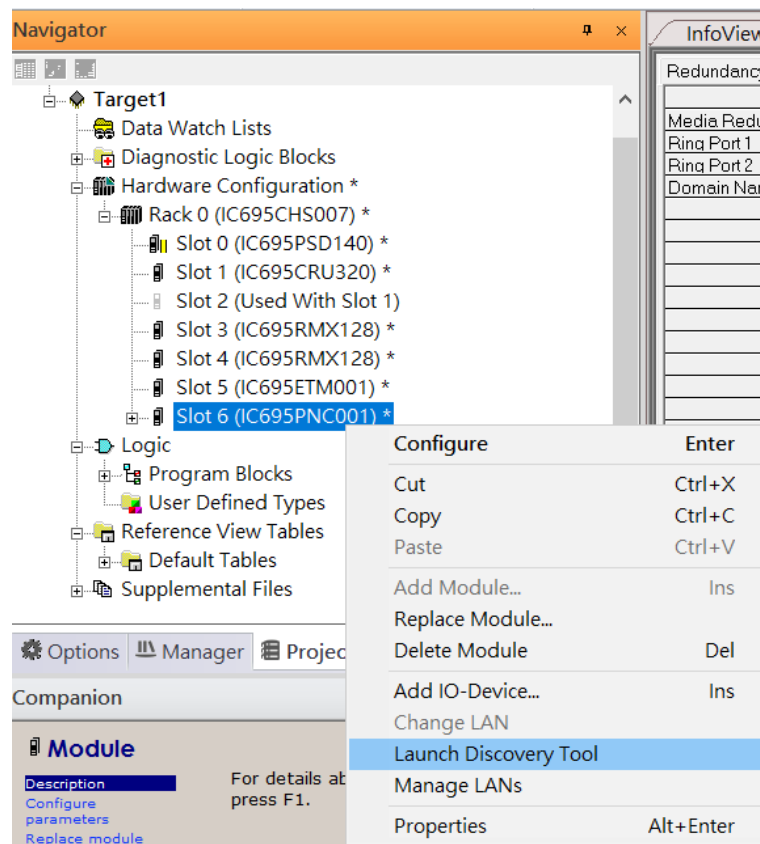


5.2.5 I/O Device Scan

The PAC Machine Edition also supports the function to scan the connected I/O Devices. First, the observed I/O Device shall be connected to the ETM001 on the **Primary** hardware configuration, then using the function **Launch Discovery Tool**.

Note: Before we finish downloading the configuration to CRU320, need to unplug the block port according to the hardware topology to avoid a loop.

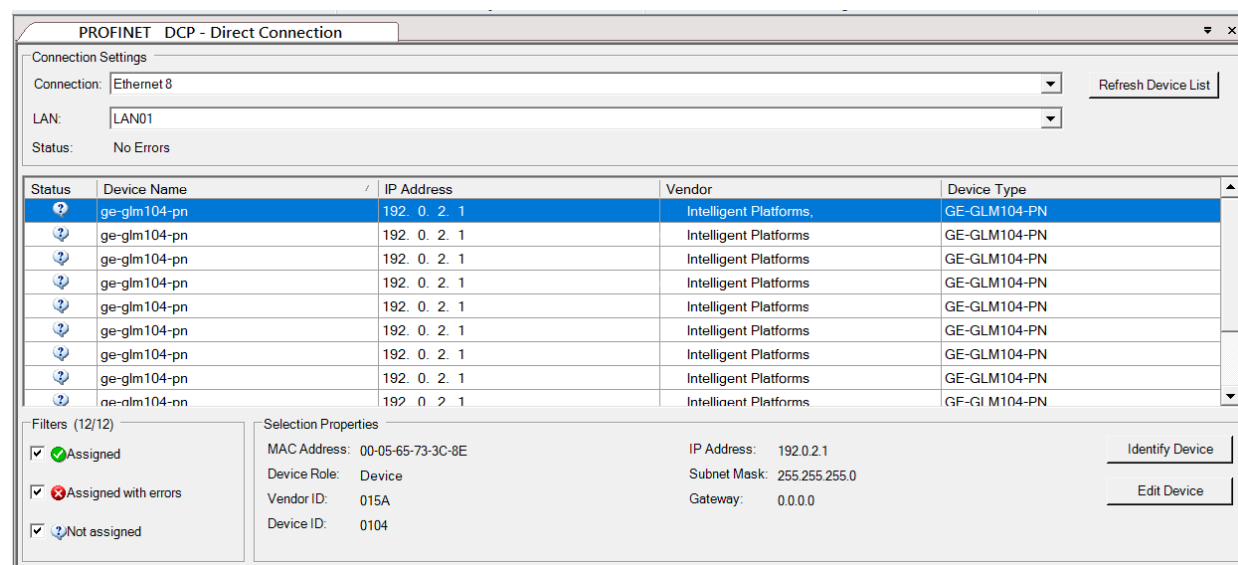
Figure 130: Launch Discovery Tool



The tool is shown in the following picture, then press **Refresh Device List**.

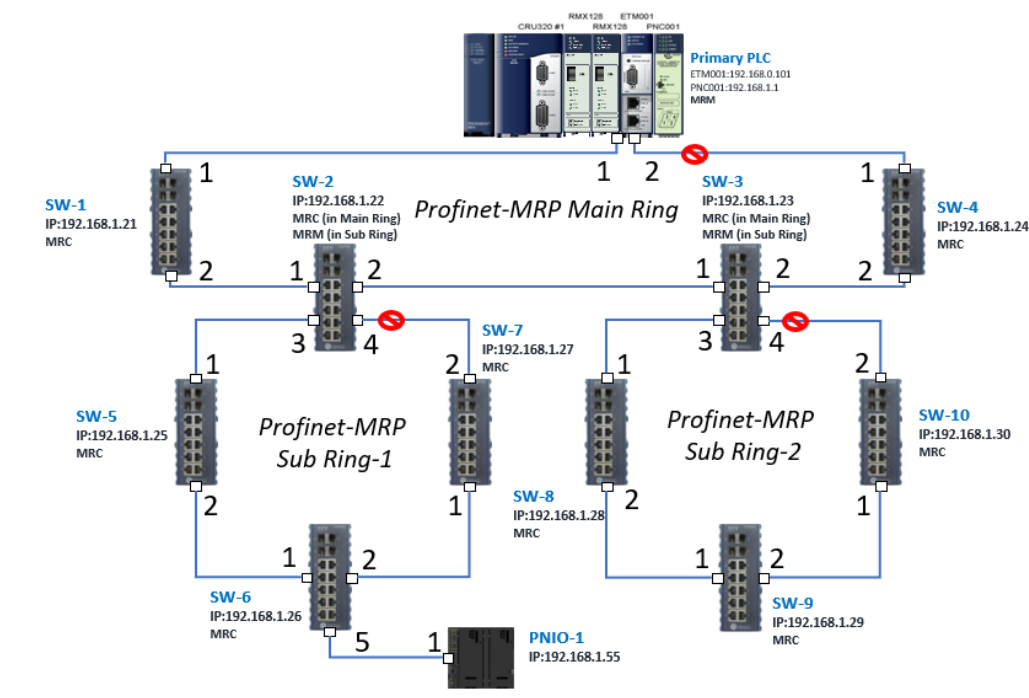
Then the connected I/O Device is listed in the following table.

Figure 131: Select the Target I/O Device



There are I/O Devices and their status is in “Not assigned”. We need to change their device name to and IP address. Use **Identify Device** to make sure which device we set according to the hardware topology. Then start to set SW-1 device name and IP address.

Figure 132: Configuration Overview



Click **Edit Device**, set Device Name to **ge-glm104-pn-sw-1** and click the Set Device Name button, then set IP Address to **192.168.0.21**, Subnet Mask to **255.255.255.0** and click the **Set IP Information** button.

Figure 133: Setting Device Parameters

Repeat these steps for all I/O devices. Follow the table below to ensure that all devices receive the appropriate values.

Device Name	IP Address	Subnet Mask
ge-glm104-pn-sw-1	192.168.0.21	255.255.255.0
ge-glm104-pn-sw-2	192.168.0.22	255.255.255.0
ge-glm104-pn-sw-3	192.168.0.23	255.255.255.0
ge-glm104-pn-sw-4	192.168.0.24	255.255.255.0
ge-glm104-pn-sw-5	192.168.0.25	255.255.255.0
ge-glm104-pn-sw-6	192.168.0.26	255.255.255.0
ge-glm104-pn-sw-7	192.168.0.27	255.255.255.0
ge-glm104-pn-sw-8	192.168.0.28	255.255.255.0
ge-glm104-pn-sw-9	192.168.0.29	255.255.255.0
ge-glm104-pn-sw-10	192.168.0.30	255.255.255.0
Versamax-PNS-PNIO-1	192.168.0.55	255.255.255.0

After assigning Device Name and IP Address correctly, the Status will be in “Assigned” status.

Figure 134: Device Name and IP Addresses Assigned

PROFINET DCP - Direct Connection

Connection Settings

Connection: Ethernet 8

Refresh Device List

LAN: LAN01

Status: No Errors

Status	Device Name	IP Address	Vendor	Device Type
✓	ge-glm104-pn-sw-1	192.168. 0. 21	Intelligent Platforms, Inc.	GE-GLM104-PN
✓	ge-glm104-pn-sw-10	192.168. 0. 30	Intelligent Platforms, Inc.	GE-GLM104-PN
✓	ge-glm104-pn-sw-2	192.168. 0. 22	Intelligent Platforms, Inc.	GE-GLM104-PN
✓	ge-glm104-pn-sw-3	192.168. 0. 23	Intelligent Platforms, Inc.	GE-GLM104-PN
✓	ge-glm104-pn-sw-4	192.168. 0. 24	Intelligent Platforms, Inc.	GE-GLM104-PN
✓	ge-glm104-pn-sw-5	192.168. 0. 25	Intelligent Platforms, Inc.	GE-GLM104-PN
✓	ge-glm104-pn-sw-6	192.168. 0. 26	Intelligent Platforms, Inc.	GE-GLM104-PN
✓	ge-glm104-pn-sw-7	192.168. 0. 27	Intelligent Platforms, Inc.	GE-GLM104-PN
✓	ge-glm104-pn-sw-8	192.168. 0. 28	Intelligent Platforms, Inc.	GE-GLM104-PN
✓	ge-glm104-pn-sw-9	192.168. 0. 29	Intelligent Platforms, Inc.	GE-GLM104-PN
✓	iolan-controller01	192.168. 0. 1	Intelligent Platforms, Inc.	IC695PNC001
✓	versamax-pns-pnio-1	192.168. 0. 55	Intelligent Platforms, Inc.	IC200PNS001

Filters (12/12)

☒ Assigned
 ☒ Assigned with errors
 ☒ Not assigned

Selection Properties

MAC Address: 00-05-65-72-FB-D0

Device Role: Device

Vendor ID: 015A

Device ID: 0104

IP Address: 192.168.0.21

Subnet Mask: 255.255.255.0

Gateway: 0.0.0.0

Identify Device

Edit Device

5.2.6 MRP Setting

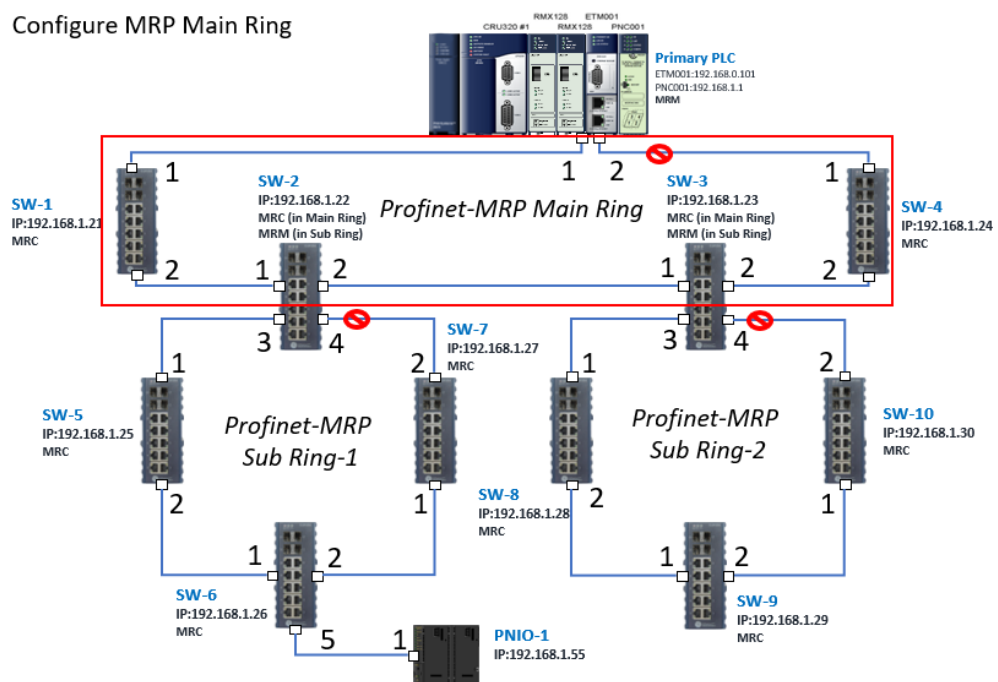
The steps to enable MRP functionality on the I/O controller and I/O devices will be the same for all components in the figure below. Refer to this section to configure SW1-SW10.

5.2.6.1 SW1 through SW4

We will be setting MRP for the I/O controller and I/O devices highlighted in the red box below.

Figure 135: MRP Setting for Main Ring

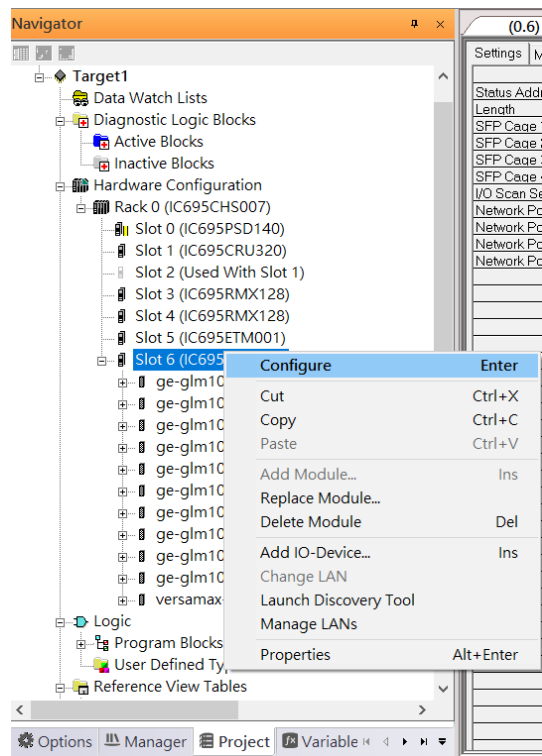
Configure MRP Main Ring



In order to enable the MRP function in the I/O controller, right-click on the target I/O controller or I/O device and choose **Configure**.

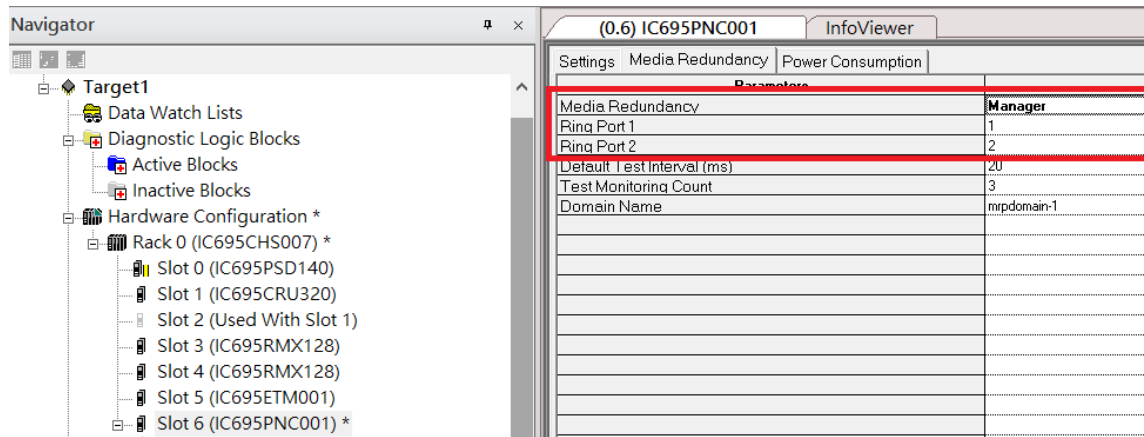
It will show **Media Redundancy** on the right window.

Figure 136: Configure the Target I/O Controller



Enable the MRP function by changing the value of **Media Redundancy** to **Manager** and select **Ring Port 1** to **1**, and **Ring Port 2** to **2**. Repeat these steps for all SW slots in the main ring.

Figure 137: Media Redundancy Parameters

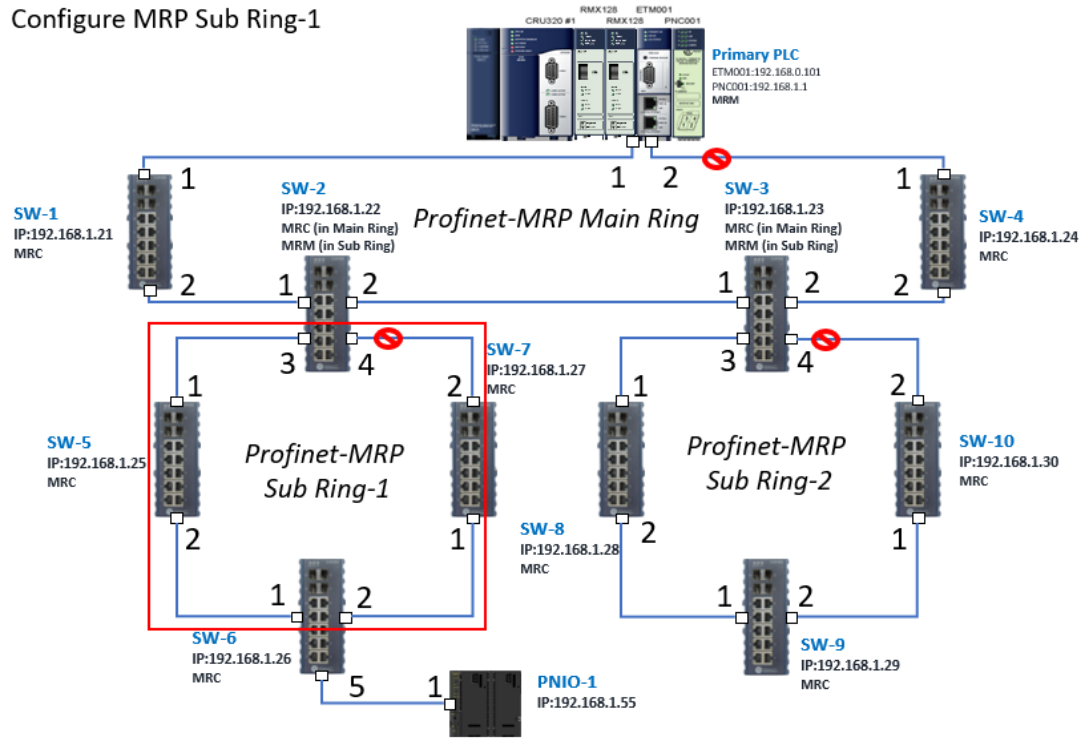


5.2.6.2 SW5 through SW7

Next, configure the MRP in Profinet MRP Sub Ring-1 (highlighted in the red box below). Refer to the steps outlined in Section 5.2.6.1 to enable MRP functionality for SW5-SW7.

Figure 138: PROFINET-MRP Sub-Ring1

Configure MRP Sub Ring-1

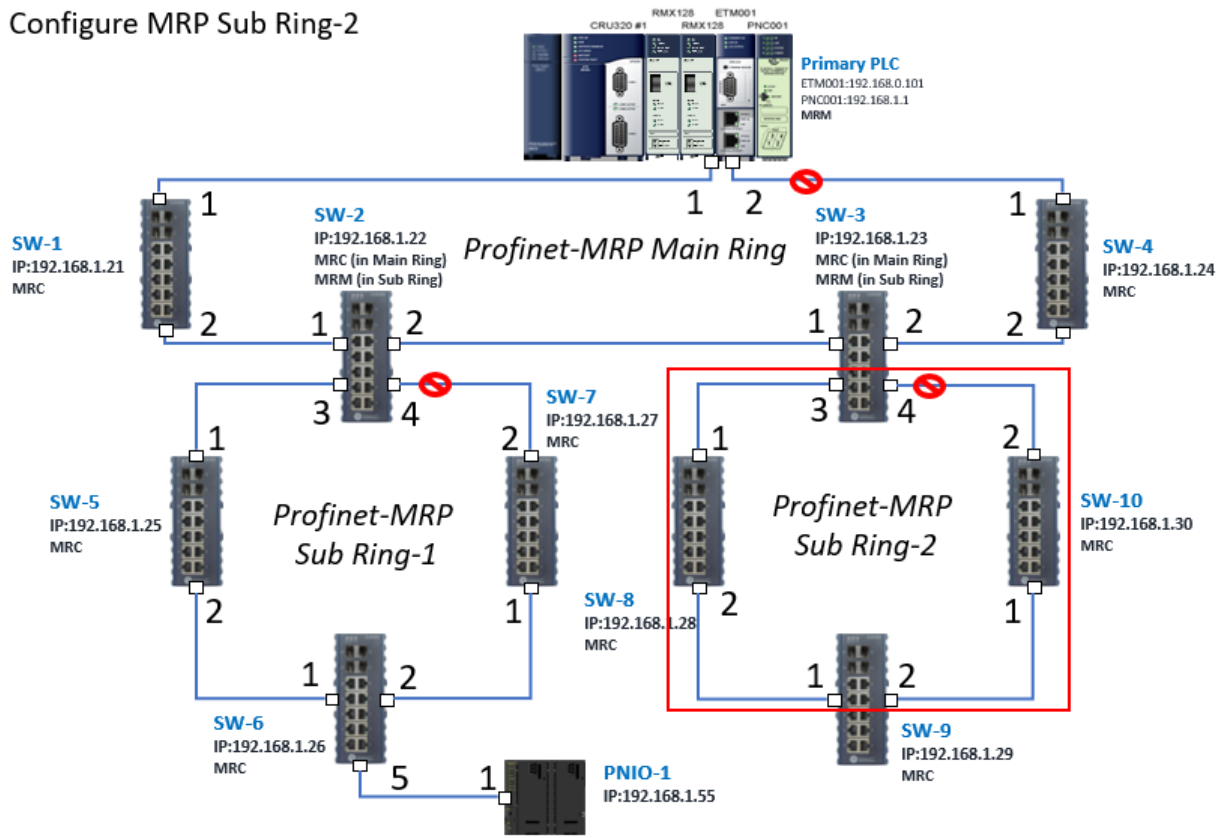


5.2.6.3 SW8 through SW10

Next, configure the MRP in Profinet MRP Sub Ring-2 (highlighted in the red box below). Refer to the steps outlined in Section 5.2.6.1 to enable MRP functionality for SW8-SW10.

Figure 139: MRP Sub Ring-2

Configure MRP Sub Ring-2



5.2.7 Network Setting

To establish the communication to the I/O Controller from PAC Machine Edition, the interface of the I/O Controller shall be specified.

It should be noted that there is only 1 I/O Controller (Primary or Secondary) able to communicate with PAC Machine Edition. Therefore, there are 3 rules of communication that are defined.

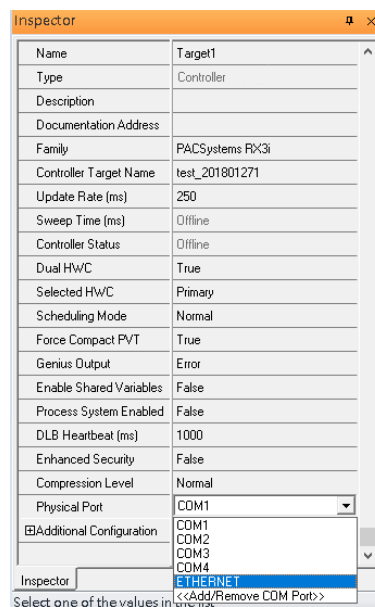
I/O Controller Communication Rule

Rule	Description
1	The communicated I/O Controller shall be specified. Click primary or secondary hardware configuration, click the right button, and select Set as Selected HWC .
2	During the communication, the cable shall be connected to the ETM001 in specified hardware (Primary or Secondary)
3	Specify the interface and IP address for communicated I/O Controller

For rule 3, click **Target 1** and Select **Property**.

In the **Inspector** pane, change the value of **Physical Port** to **Ethernet**.

Figure 140: Changing the Physical Port Parameter



Also, the IP address of communicated I/O Controller shall be set. Here the **Primary** setting is shown.

Note, that the specified IP address is set as the IP address on ETM001.

Figure 141: Specified IP Address Appears

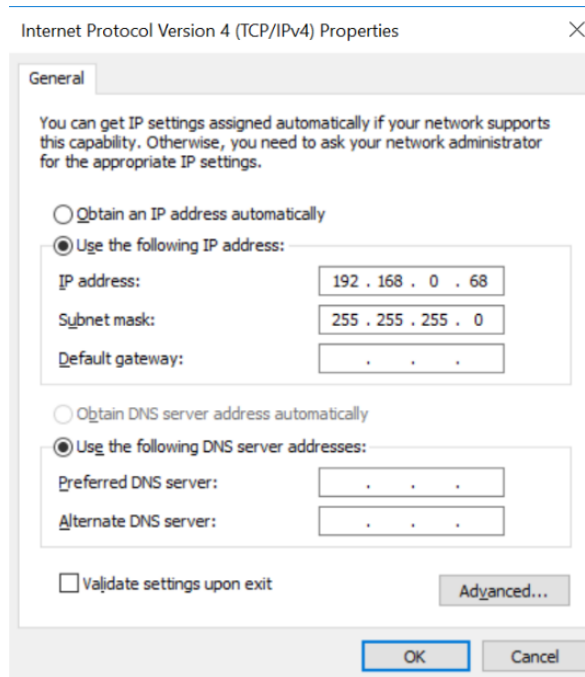
The screenshot shows a software window titled "Inspector" with a table of configuration parameters for a device named "Target1". The parameters include Name, Type, Description, Documentation Address, Family, Controller Target Name, Update Rate (ms), Sweep Time (ms), Controller Status, Dual HWC, Selected HWC, Scheduling Mode, Force Compact PVT, Genius Output, Enable Shared Variables, Process System Enabled, DLB Heartbeat (ms), Enhanced Security, Compression Level, Physical Port, and IP Address. The "IP Address" field is highlighted in red and contains the value "192.168.0.101". Below the table is a section for "Additional Configuration".

Name	Target1
Type	Controller
Description	
Documentation Address	
Family	PACSystems RX3i
Controller Target Name	test_201801271
Update Rate (ms)	250
Sweep Time (ms)	Offline
Controller Status	Offline
Dual HWC	True
Selected HWC	Primary
Scheduling Mode	Normal
Force Compact PVT	True
Genius Output	Error
Enable Shared Variables	False
Process System Enabled	False
DLB Heartbeat (ms)	1000
Enhanced Security	False
Compression Level	Normal
Physical Port	ETHERNET
IP Address	192.168.0.101
Additional Configuration	

5.2.8 PC Network

The IP address of the PC with PAC Machine Edition shall be set in the same network area.

Figure 142: Setting the IP Address of the PC with PME

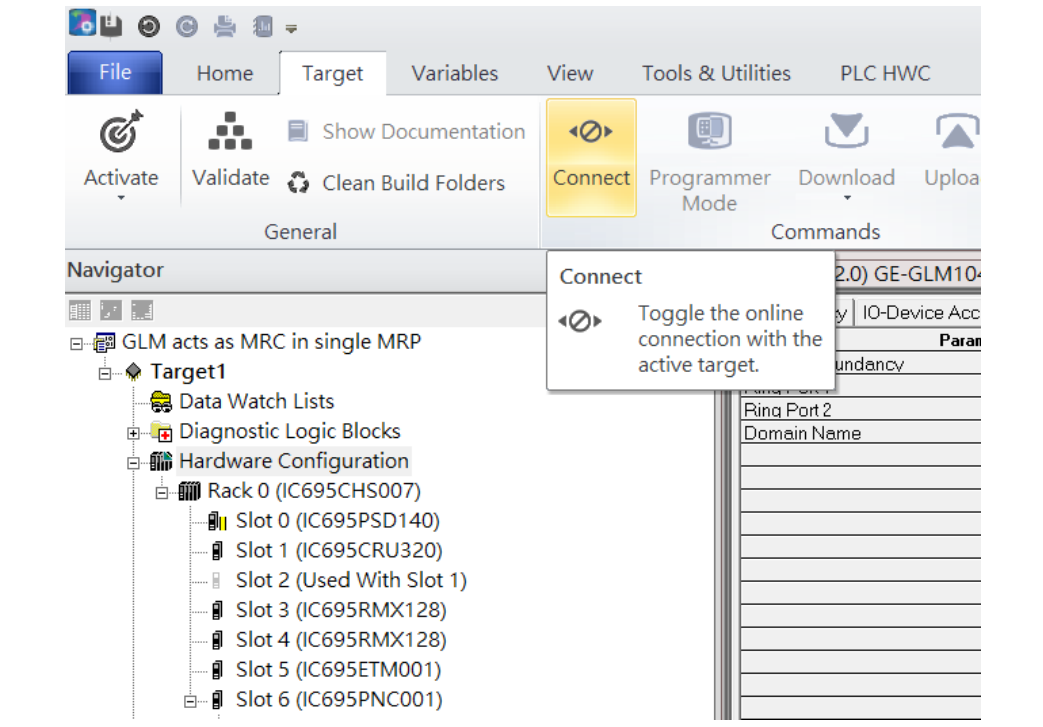


Note: For ETM configuration, please consult GFK-2224 PACSystems Rx3i TCP/IP Ethernet Communications User Manual

5.3 Implementation

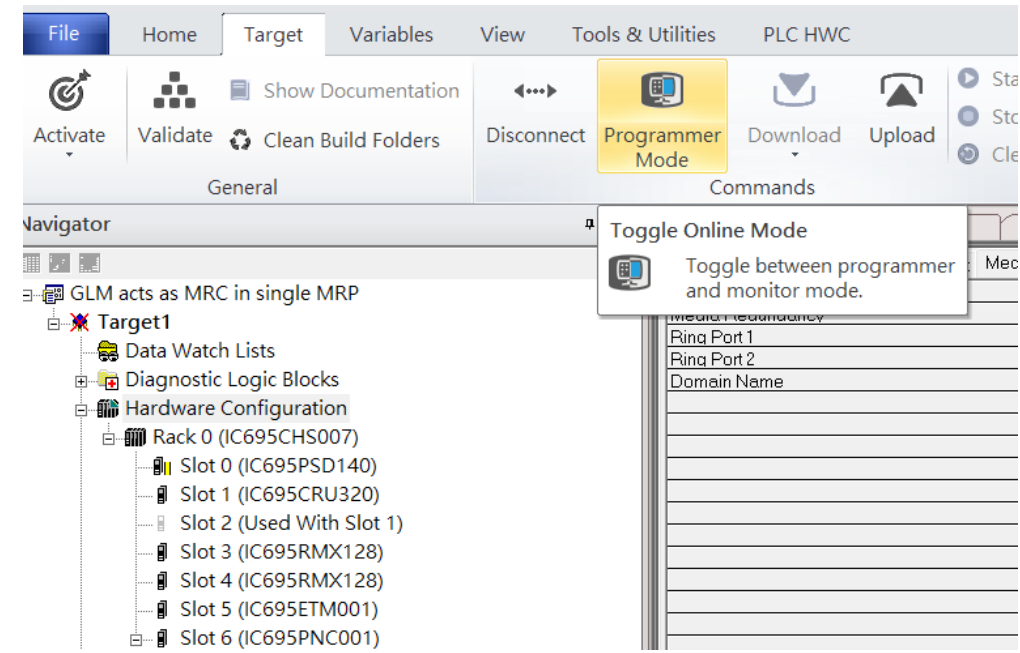
To download the configuration to hardware, the following steps shall be applied.
First, press the **Connect** icon.

Figure 143: Connecting to Target



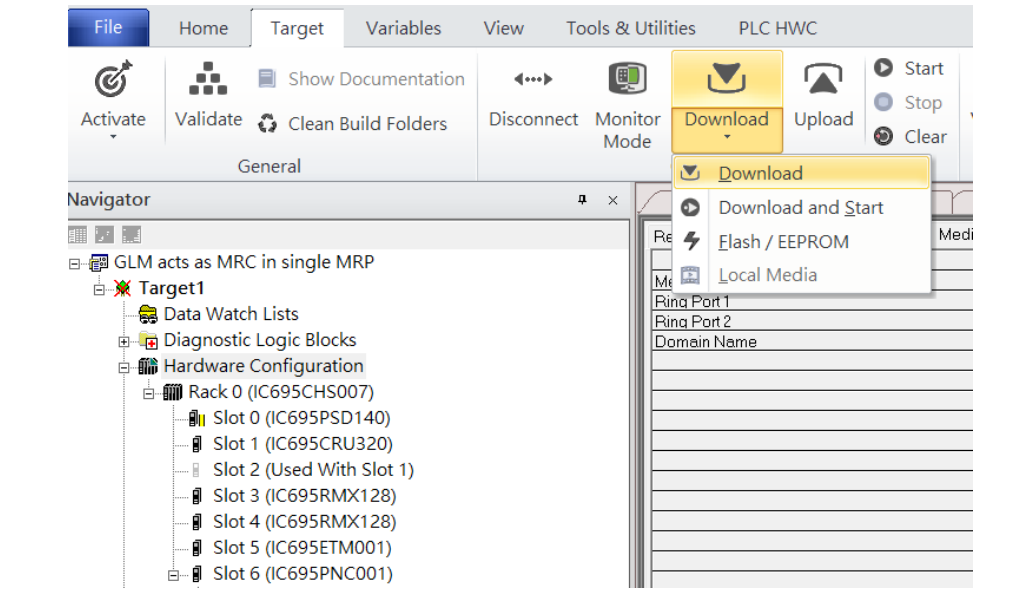
Then press the icon **Programmer Mode**.

Figure 144: Programmer Mode



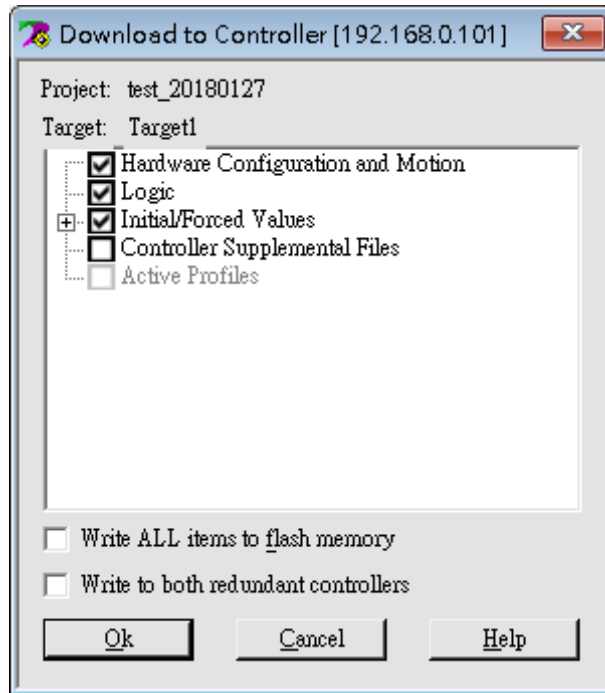
Then press the icon **Download** and select **Download**.

Figure 145: Download



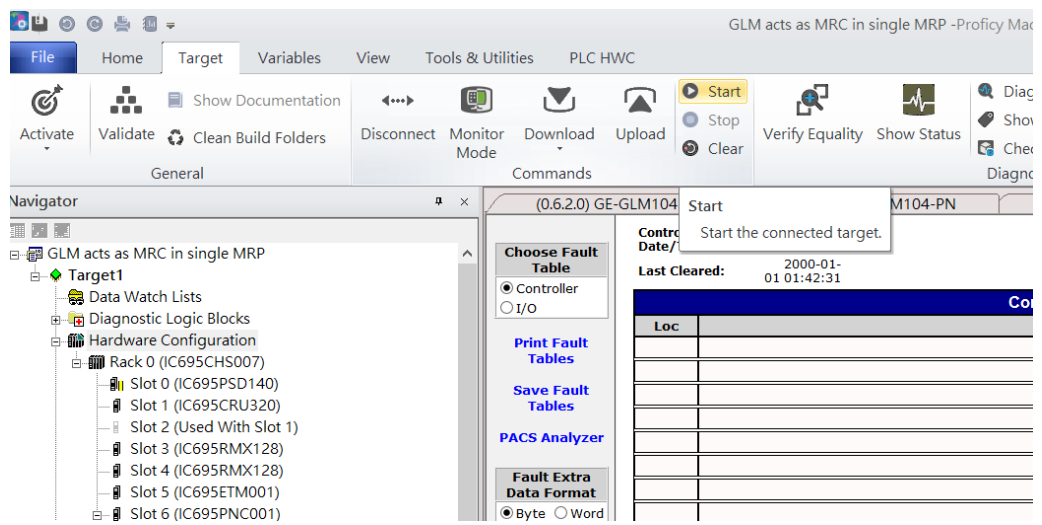
Then the dialogue is appeared to make sure the initialization procedure, select **OK**.

Figure 146: Download to Controller



After downloading completely, press the icon **Start** to active PLC. Note: After downloading completely, switch CRU320 to **Run I/O Enable** and select **OK**. If PLC has started successfully, a message “The Controller was successfully started”.

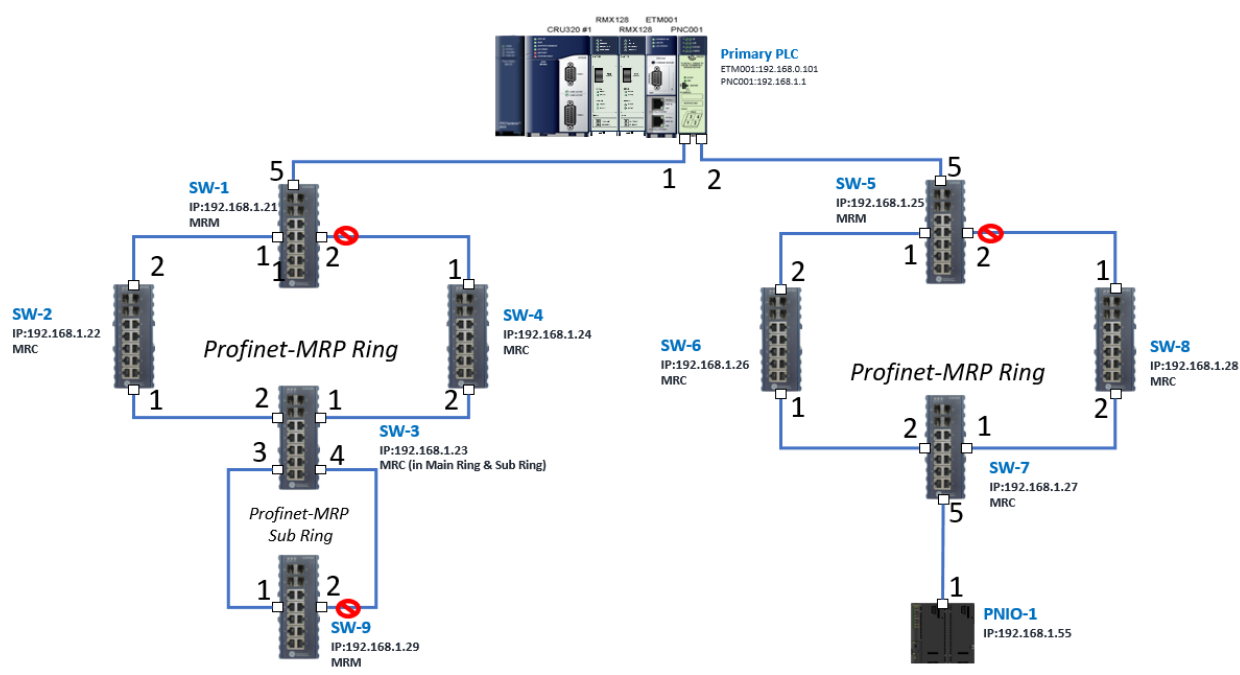
Figure 147: Start



Section 6 Multiple PROFINET MRP Ring and Subring

6.1 Network Topology

Figure 148: Multiple PROFINET MRP Ring and Subring



6.2 Hardware Configuration

On the CRU320, the I/O data can be set to “STOP”, “RUN OUTPUT DISABLE” or “RUN I/O Enable” states by a switch embedded on CRU320.

During the configuration, the switches on both 2 CRU320s must be set to “STOP”

6.2.1 Project Open

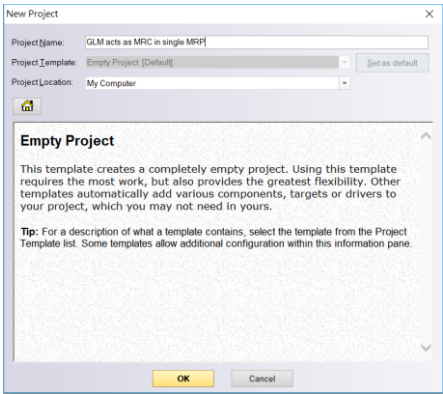
To start the software PAC Machine Edition, please follow the steps below:

1. Click **Start -> Emerson -> PAC Machine Edition -> PAC Machine Edition**
2. Select the empty project and click **OK**.
3. Set the project name and click **OK**.

Figure 149: Create a new project



Figure 150: New Project Name



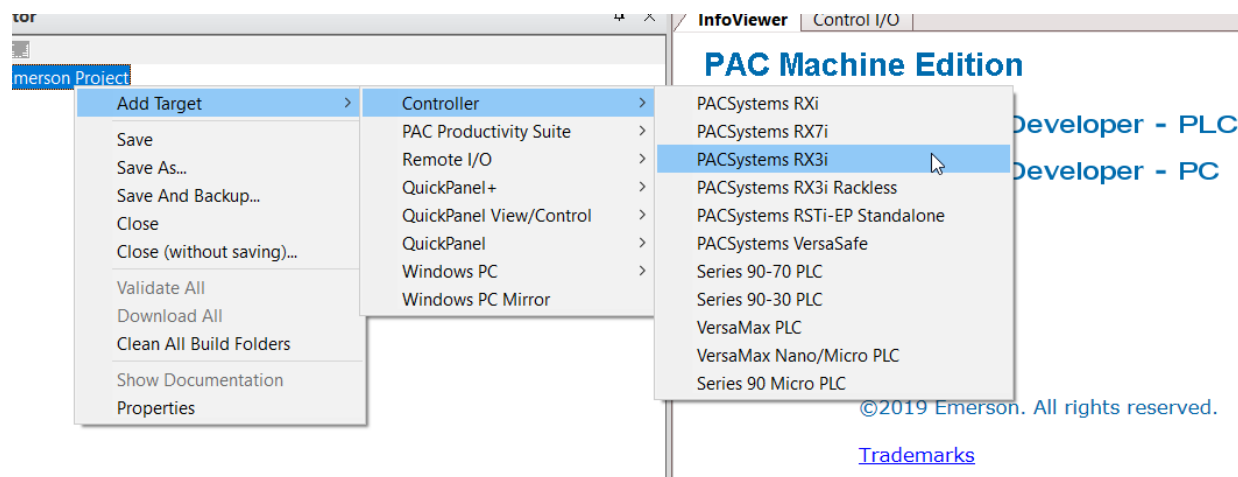
6.2.2 I/O Controller Setting

The next step is to add a target for this project.

Click the right button on project name **GLM to act as MRC in a single MRC group** and select **Add Target -> Controller-> PACSystems RX3i**.

The PACSystems RX3i is the I/O Controller to be tested. See the following figure:

Figure 151: Adding an I/O Controller

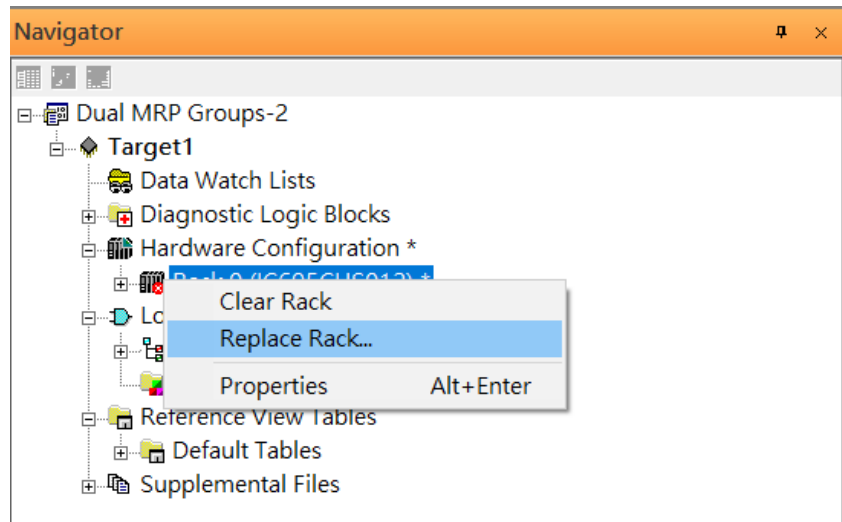


Originally the I/O Controller is described as the rack with 12 slots, each slot can be regarded as the chassis for device installation such as a power card, communication module, or bus controller.

However, there are only 7 chassis that can be used in the I/O Controller CRU320. Thus, replace the rack with 7 slots.

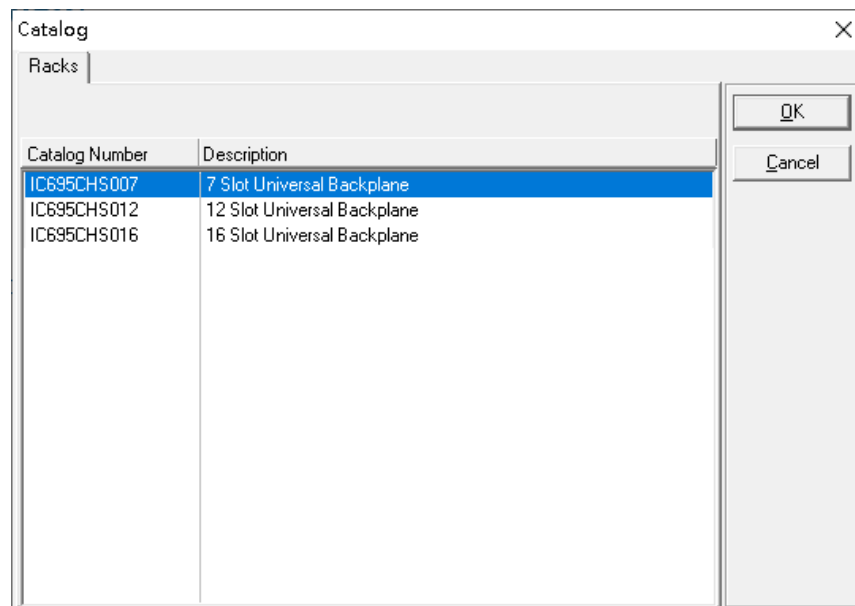
Click the right button on **Rack 0 (IC695CHS012)** and select **Replace Rack...**

Figure 152: Replace Rack



Select "IC695CHS007" and click **OK**.

Figure 153: Select CHS007



After the rack and the number of slots are defined, select the corresponding devices into the slots according to the I/O Controller. The following picture is the current installation for each device on the I/O Controller

Figure 154: Rack Configuration for this Application



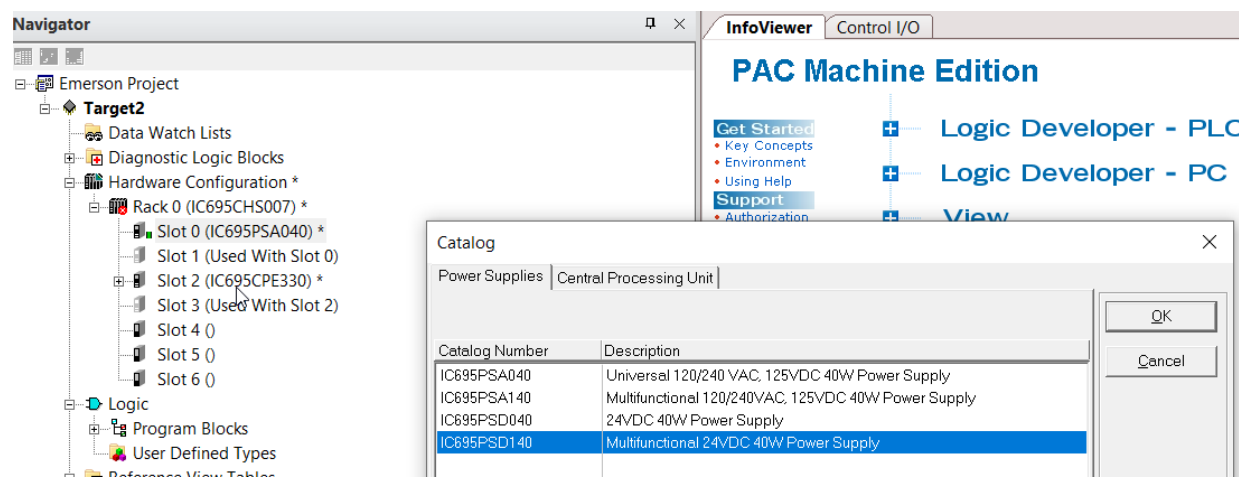
From left to right, the installed devices on the I/O Controller are

Device Type	Device Name	Chassis index
Power Card	PSD140	0
Central Processing Unit	CRU320	1 ~ 2
Communication Module	RMX128	3
Communication Module	RMX128	4
Communication Module	ETM001	5
Bus Controller	PNC001	6

Now, add the module into the slots by the current devices on the I/O Controller, the chassis index is corresponding to the slot index.

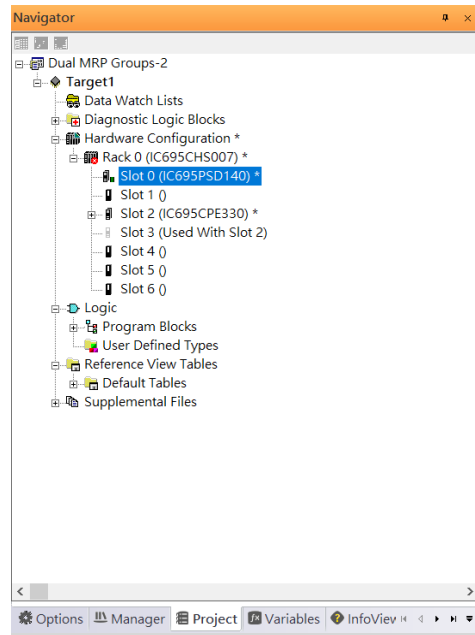
First, replace the power card. Click slot 0 and click the right button, select **Replace Module**, and specify the installed power card, PSD140, then click **OK**.

Figure 155: Replace Module



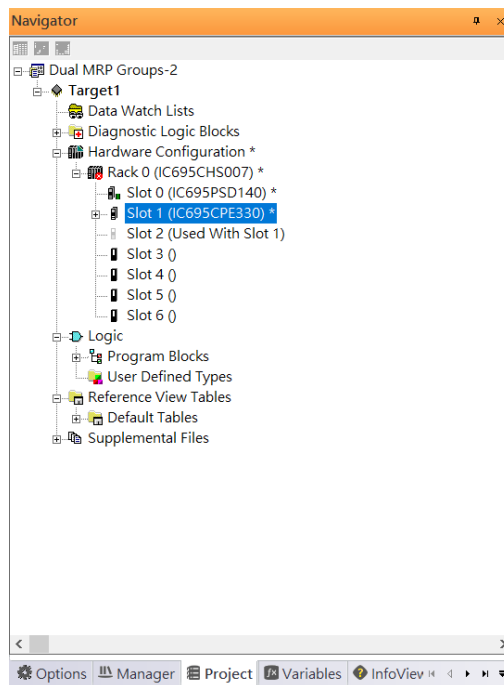
Slot 0 is replaced by the current power card, PSD140.

Figure 156: PSD140



For slot 1 and 2, 2 chassis (1 and 2) is occupied by the Central Processing Unit, CRU320. To integrate slots 1 and 2, pull the slot 2 to slot 1

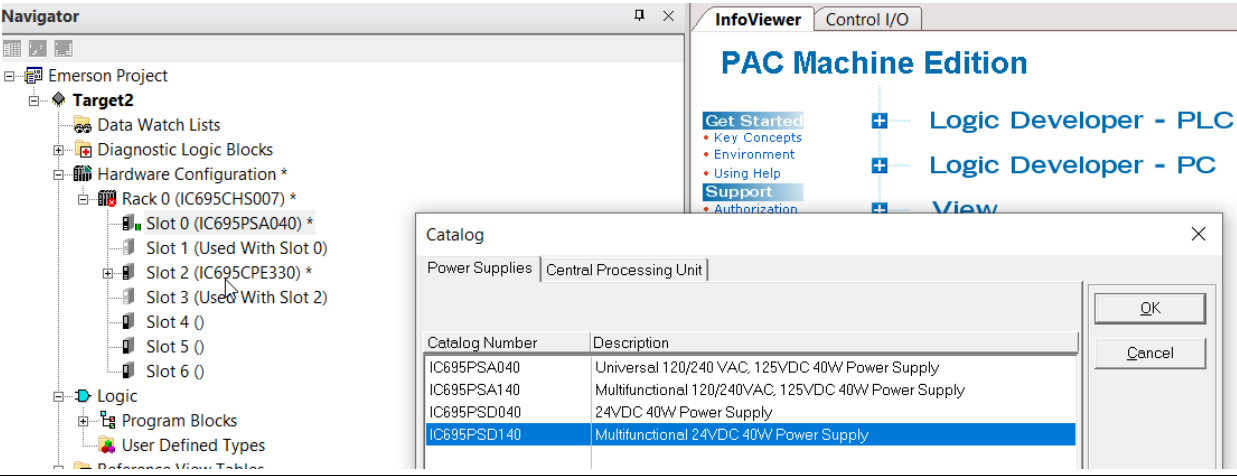
Figure 157: Slots 1 and 2 are Integrated



Now slot 2 is clear.

To select the Central Processing Unit, click slot 1 and click the right button, select **Replace Module** to choose CRU320, and select **No**. Now the CRU320 is specified.

Figure 158: Replace Module

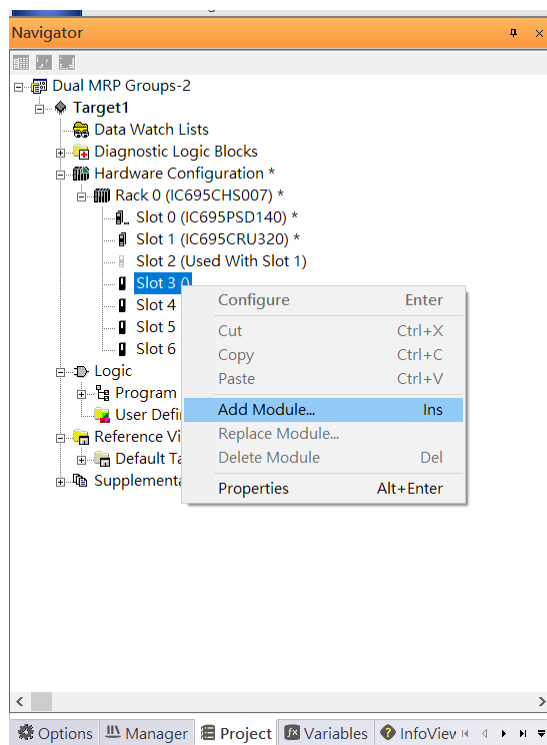


6.2.2.1 Slot 3

Next, add the RMX128 module for slot 3.

Click the right button on slot 3, and select **Add Module**.

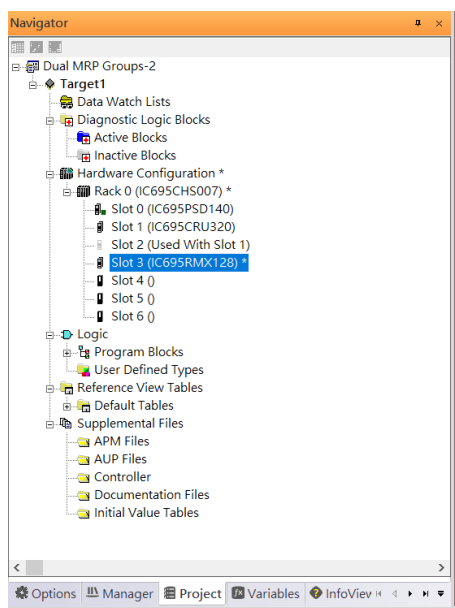
Figure 159: Add Module



According to the current installation on the I/O Controller, the RMX128 shall be selected.
Select **Communications** -> **IC695RMX128** and click OK.

Now the RMX128 is ready on slot 3.

Figure 160: RMX128 Assigned to Slot 3



6.2.2.2 Slot 4

Next, repeat these steps to set the RMX128 for slot 4.

Click the right button on slot 4, select **Add Module**, select **Communications** -> **IC695RMX128**, and click **OK**.

6.2.2.3 Slot 5

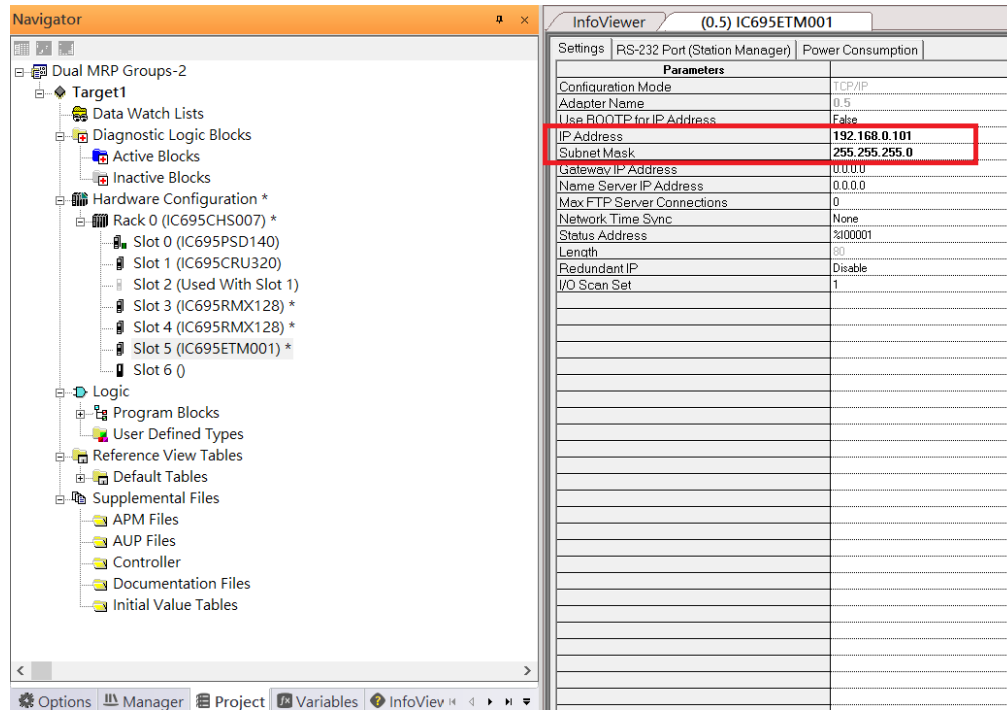
Repeat these steps to select the ETM001 for slot 5.

Click the right button on slot 5, select **Add Module**, select **Communications** -> **IC695ETM001**, and click **OK**.

It should be noted that the ETM001 is the management device for PAC Machine Edition. The communication interface is the Ethernet network. The IP address and Subnet Mask shall be specified.

In the following picture, the IP address 192.168.0.101 and mask 255.255.255.0 is specified on ETM001.

Figure 161: ETM001 Configured Parameters



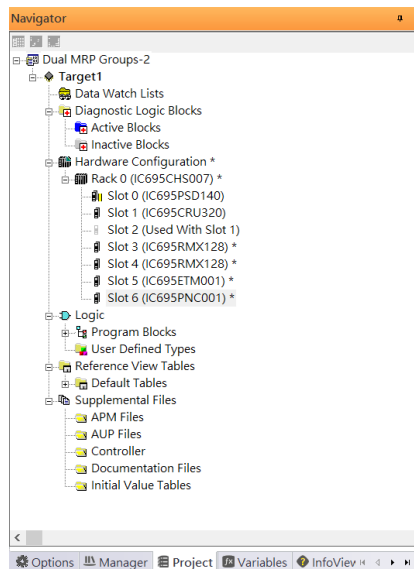
6.2.2.4 Slot 6

Next, select PNC001 for slot 6.

Click slot 6 and click the right button, select **Add Module**, specify the installed Bus Controller, PNC001, and click **OK**.

Now all the devices on the I/O Controller are ready on the slots on the rack, the following picture is the current status, and we shall save it.

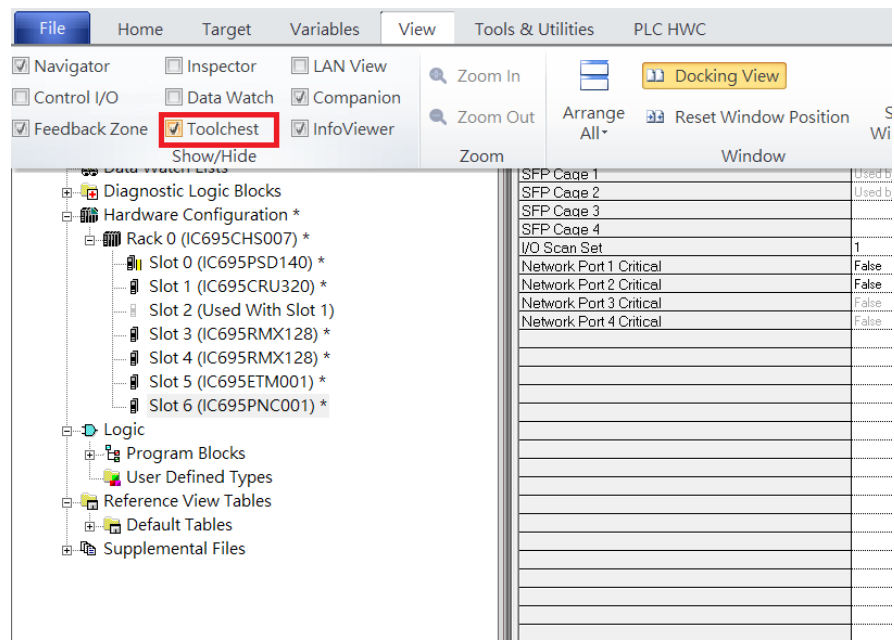
Figure 162: Final Configuration



6.2.3 I/O Device Setting

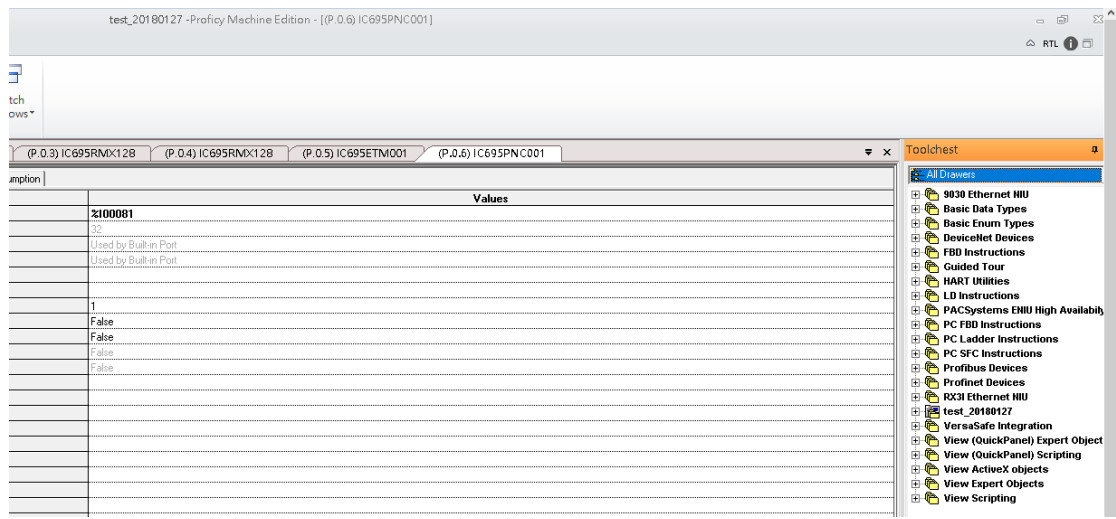
This section introduces the I/O Device integration. To configure the I/O Device, the GSDML file is necessary. Now we create another interface to load the GSDML file by using Toolchest.

Figure 163: Location of Toolchest button



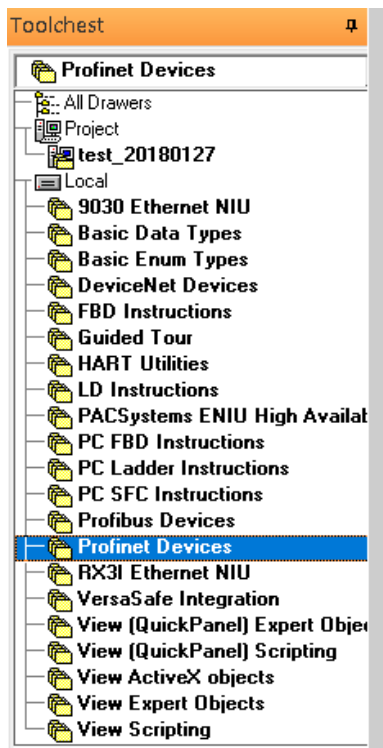
As shown in the following picture, a new interface is created on the right-hand side.

Figure 164: Toolchest Panel



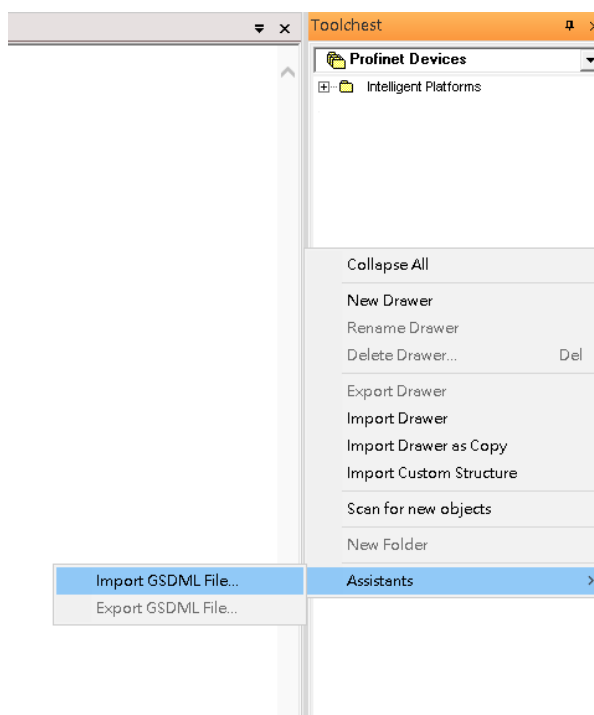
Select Profinet Devices.

Figure 165: Select Profinet Devices from the Toolchest



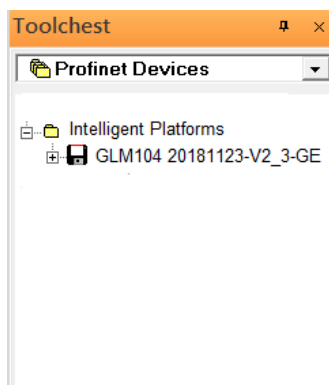
Right-click and select **Assistants** -> **Import GSDML File** and select the target file.

Figure 166: Select the GSDML File



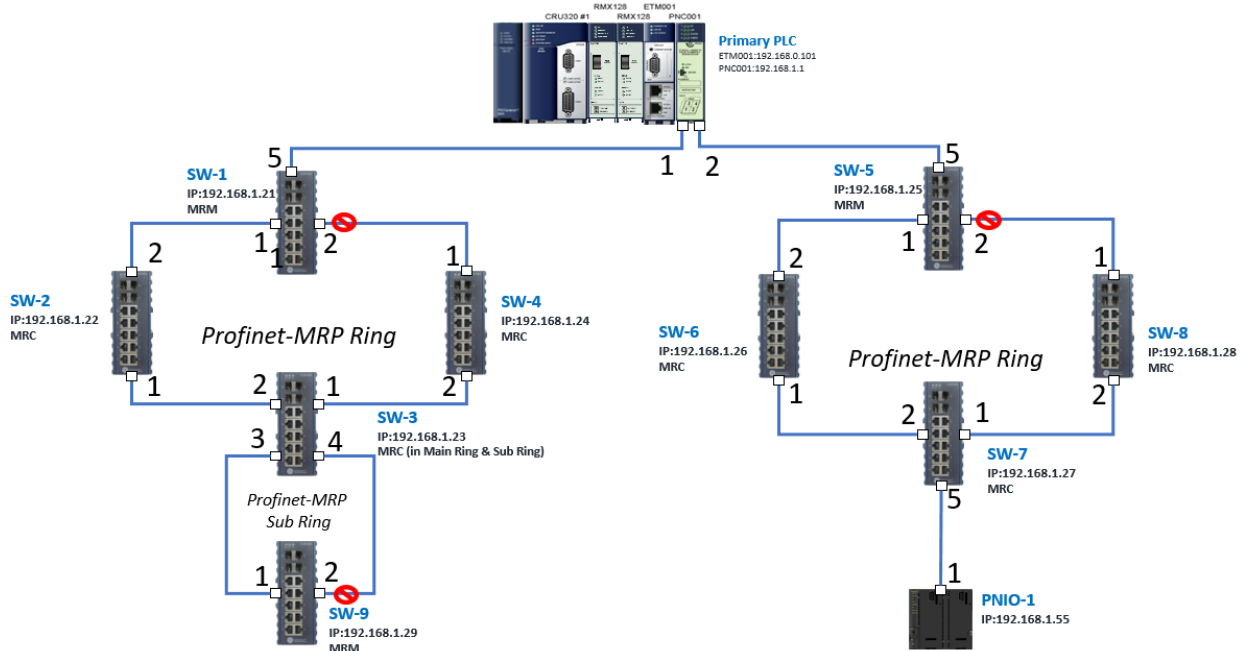
Then the corresponding I/O Device of the GSDML File is added to the **Toolchest**.

Figure 167: Imported GSDML File



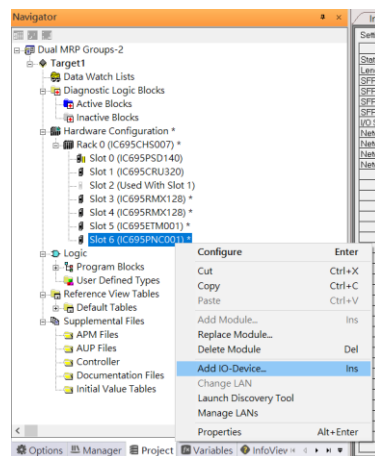
In this section, there are ten I/O devices and one I/O controller. I/O devices are nine switches and one Emerson VersaMax PROFINET I/O Scanner.

Figure 168: PROFINET-MRP Main Ring couples multiple PROFINET-MRP Subrings



The I/O Device is connected to the Bus Controller on the I/O Controller. Click slot 6 and click the right button to add the I/O Device on the PNC001.

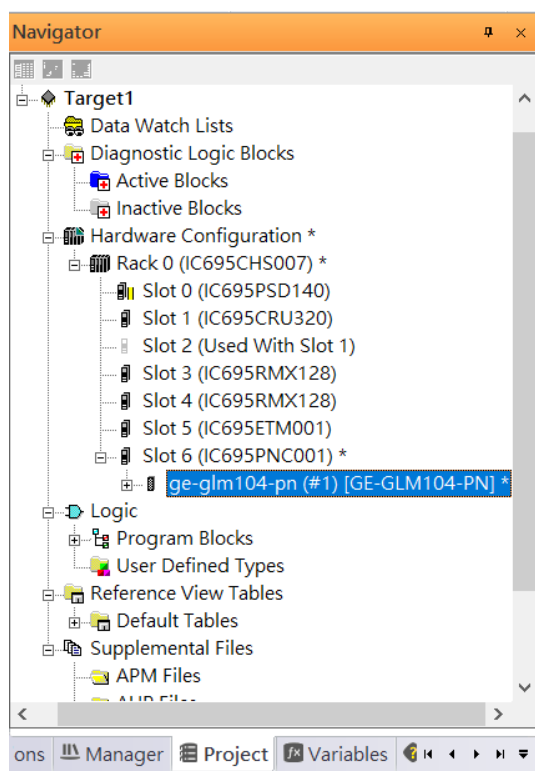
Figure 169: Add I/O Device



Select the specified I/O Service-> GLM0104 20181123-V2_3-GE -> GE-GLM104-PN and click OK.

Now the I/O device GLM104(SW1) is ready and is a sub-slot on PNC001.

Figure 170: GLM104 (SW1)

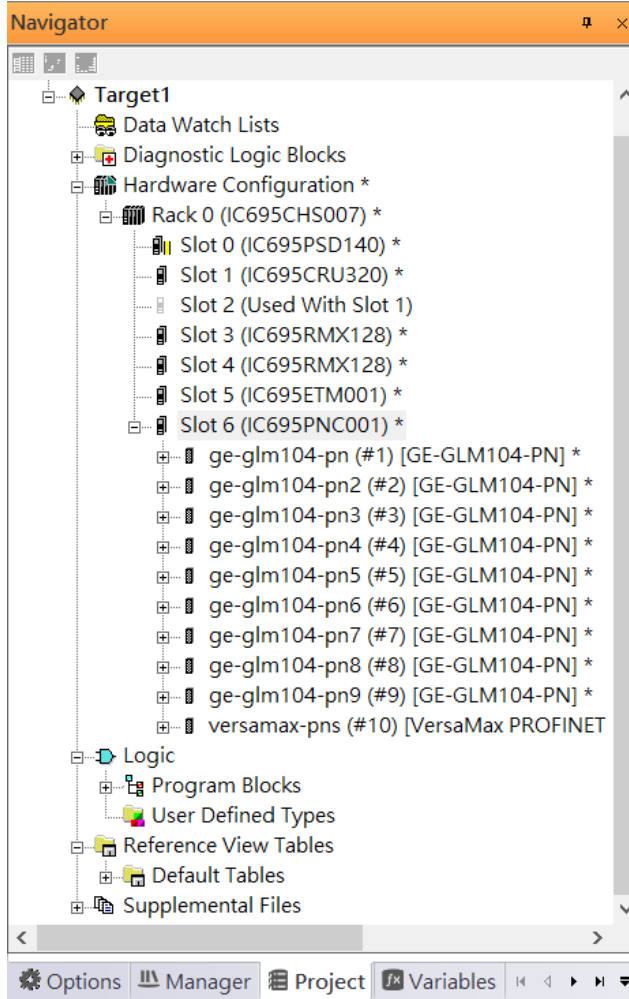


6.2.3.1 SW2 – SW10

Repeat this process to add the second through the tenth I/O devices to the PNC001. The final results will look like the figure below:

Now the I/O device VersaMax PROFINET IO Scanner is ready and is a sub-slot on PNC001.

Figure 171: Completed Configuration

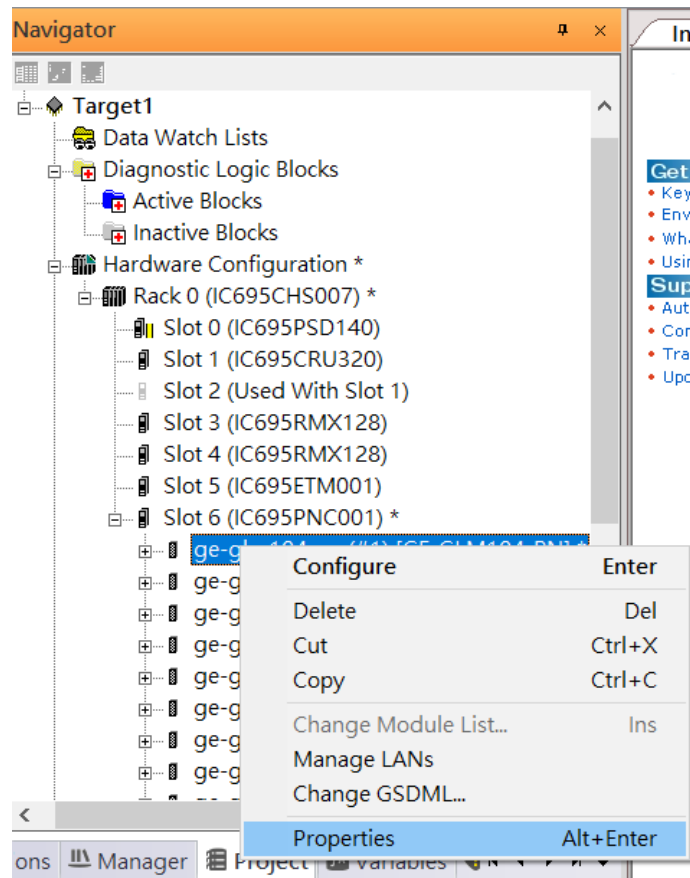


6.2.4 DCP Set Command

To configure the setting or monitor the status of the I/O Device, the communication interface is also based on an Ethernet network. We can specify the IP address and the device name from I/O Controller via the DCP (Discovery and Configuration Protocol).

Under slot 6, PNC001, select the I/O Device, ge-glm104-pn, and click the right button. Select **Properties**, see the following picture.

Figure 172: Select Properties



In this table, the I/O Device name can be specified in the field **Device Name**, and the IP address can be set in the field **IP address**. We modify the device name to “ge-glm104-pn-sw-1” and IP address to “192.168.0.21” then we use I/O Device Discovery Tool to observe an I/O Device and set I/O Device’s name to “ge-glm104-pn-sw-1”.

Inspector	
I/O Device	
Device Number	1
Update Rate (ms)	128
Reference Variable	<None>
ENetwork Identification	
I/O LAN	LAN01
Device Name	ge-glm104-pn-sw-1
Device Description	
IP Address	192.168.0.21
General	
GSDML	GSDML-V2.3-GE-GLM104-20181123.xml
Device Type	GE-GLM104-PN
Device Access Point ID	GE-GLM104-PN
Group I/O References	True

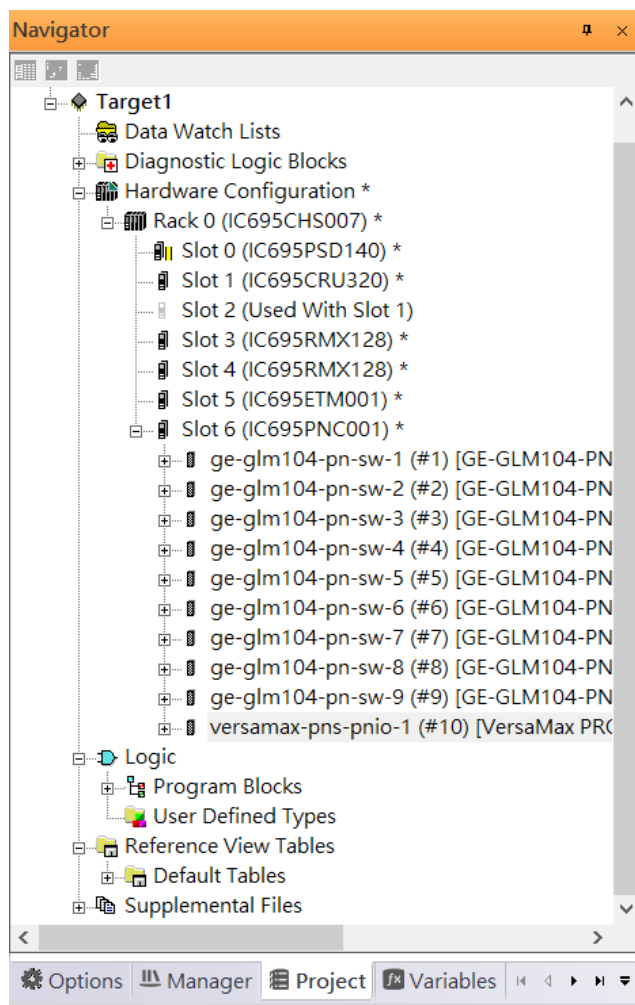
6.2.4.1 GLM104-PN2 through VERSAMAX-PNS-PNIO-1

Repeat this process and for the remaining I/O Devices. Use the table below to define the device name and IP address for each I/O device:

I/O Device	IP Address	Device Name
GLM10-PN	192.168.0.21	ge-glm104-pn-sw-1
GLM10-PN2	192.168.0.22	ge-glm104-pn-sw-2
GLM10-PN3	192.168.0.23	ge-glm104-pn-sw-3
GLM10-PN4	192.168.0.24	ge-glm104-pn-sw-4
GLM10-PN5	192.168.0.25	ge-glm104-pn-sw-5
GLM10-PN6	192.168.0.26	ge-glm104-pn-sw-6
GLM10-PN7	192.168.0.27	ge-glm104-pn-sw-7
GLM10-PN8	192.168.0.28	ge-glm104-pn-sw-8
GLM10-PN9	192.168.0.29	ge-glm104-pn-sw-9
GLM10-PN10	192.168.0.30	ge-glm104-pn-sw-10
VERSAMAX-PNIO	192.168.0.55	versamax-pns-pnio-1

Now all the devices have been changed their device name and IP address like the following picture.

Figure 173: Completed Configuration

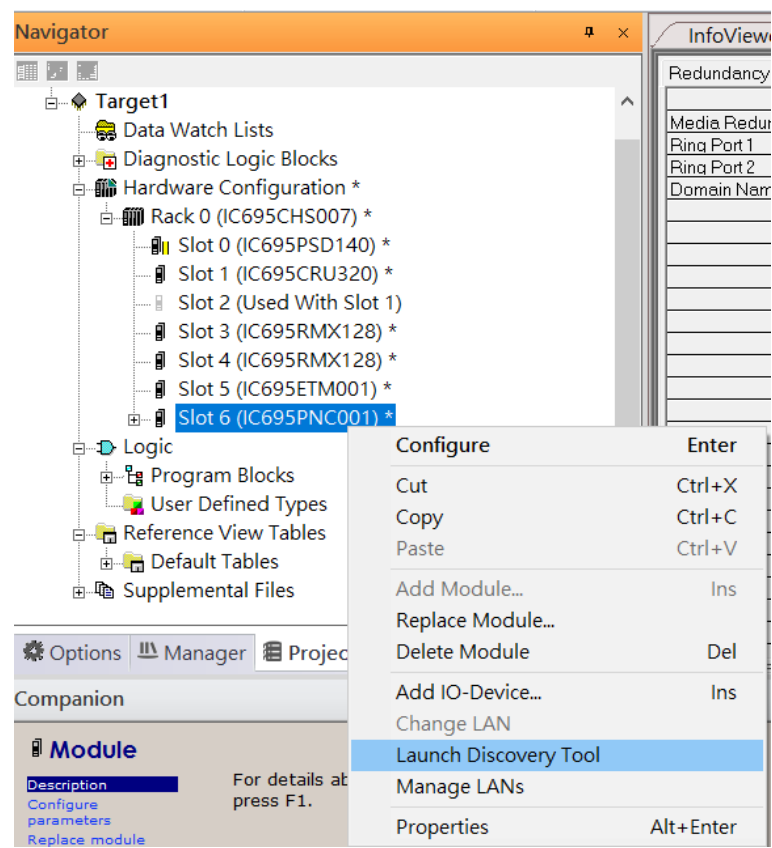


6.2.5 I/O Device Scan

The PAC Machine Edition also supports the function to scan the connected I/O Devices. First, the observed I/O Device shall be connected to the ETM001 on the **Primary** hardware configuration, then using the function **Launch Discovery Tool**.

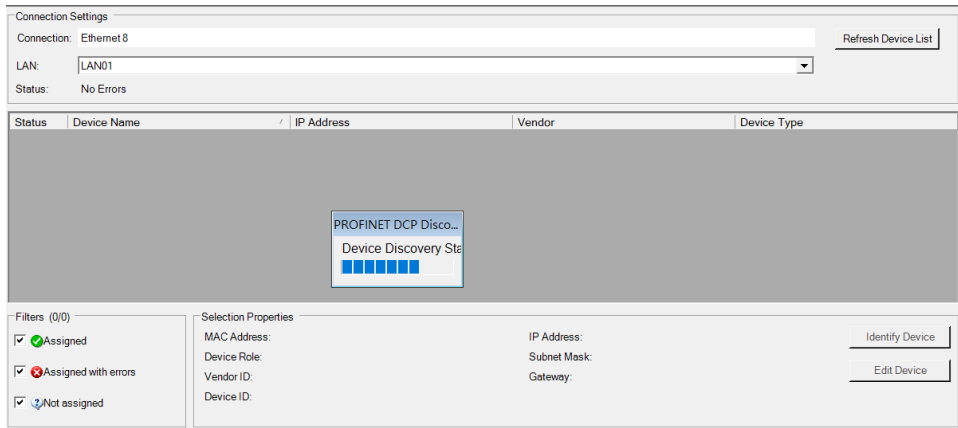
Note: Before we finish downloading the configuration to CRU320, need to unplug the block port according to the hardware topology to avoid a loop.

Figure 174: Launch Discovery Tool



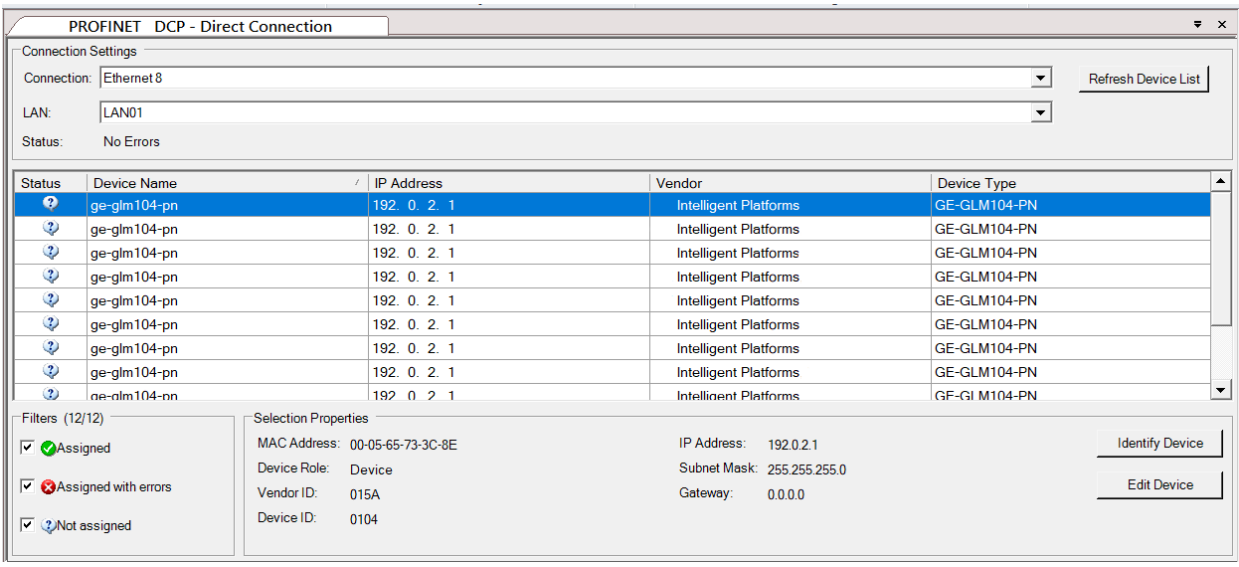
The tool is shown in the following picture, then press **Refresh Device List**.

Figure 175: Refresh Device List



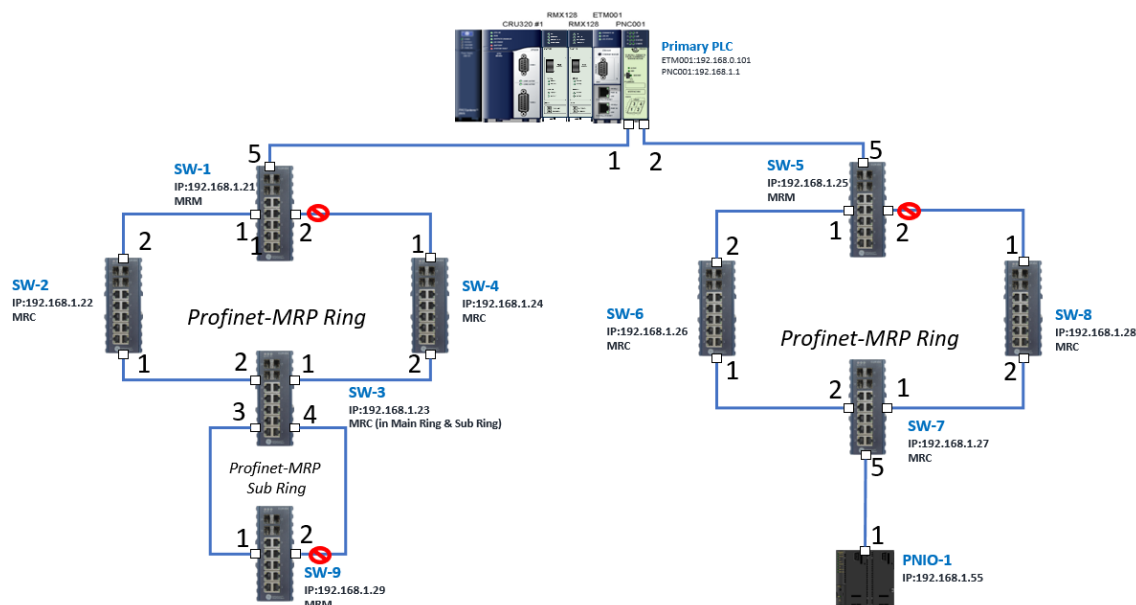
Then the connected I/O Device is listed in the following table.

Figure 176: Identify Device



There are I/O Devices and their status is in “Not assigned”. We need to change their device name to and IP address. Use **Identify Device** to make sure which device we set according to the hardware topology. Then start to set SW-1 device name and IP address.

Figure 177: Multiple PROFINET MRP Ring and Subring



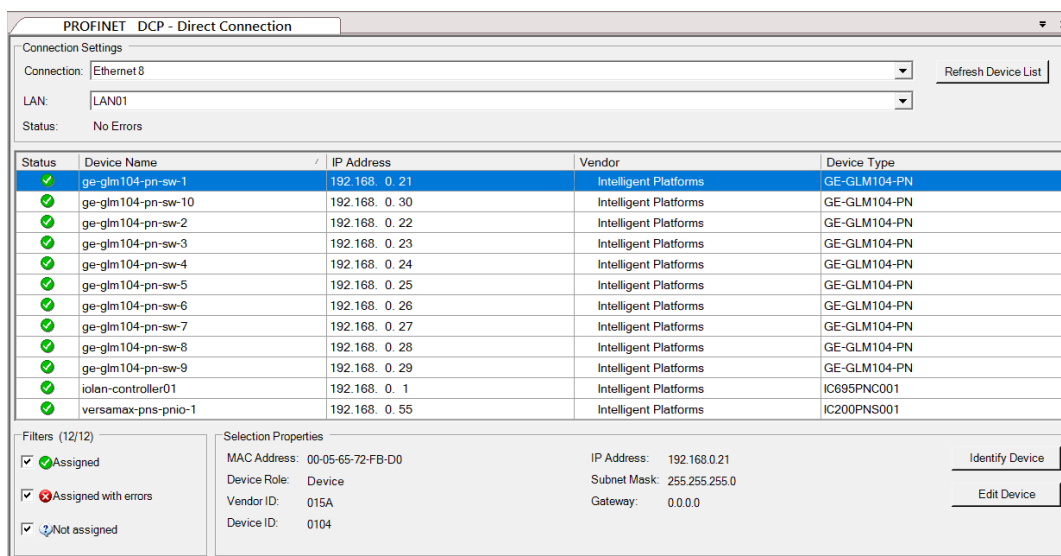
Click **Edit Device**, set Device Name to “ge-glm104-pn-sw-1” and click the **Set Device Name** button, then set IP Address to “192.168.0.21”, Subnet Mask to “255.255.255.0” and click **Set IP Information** button.

Repeat these steps for all I/O devices. Follow the table below to ensure that all devices receive the appropriate values.

Device Name	IP Address	Subnet Mask
ge-glm104-pn-sw-1	192.168.0.21	255.255.255.0
ge-glm104-pn-sw-2	192.168.0.22	255.255.255.0
ge-glm104-pn-sw-3	192.168.0.23	255.255.255.0
ge-glm104-pn-sw-4	192.168.0.24	255.255.255.0
ge-glm104-pn-sw-5	192.168.0.25	255.255.255.0
ge-glm104-pn-sw-6	192.168.0.26	255.255.255.0
ge-glm104-pn-sw-7	192.168.0.27	255.255.255.0
ge-glm104-pn-sw-8	192.168.0.28	255.255.255.0
ge-glm104-pn-sw-9	192.168.0.29	255.255.255.0
ge-glm104-pn-sw-10	192.168.0.30	255.255.255.0
Versamax-PNS-PNIO-1	192.168.0.55	255.255.255.0

After assigning Device Name and IP Address correctly, the Status will be in “Assigned” status.

Figure 178: Device Name and IP Addresses Assigned



6.2.6 MRP Setting

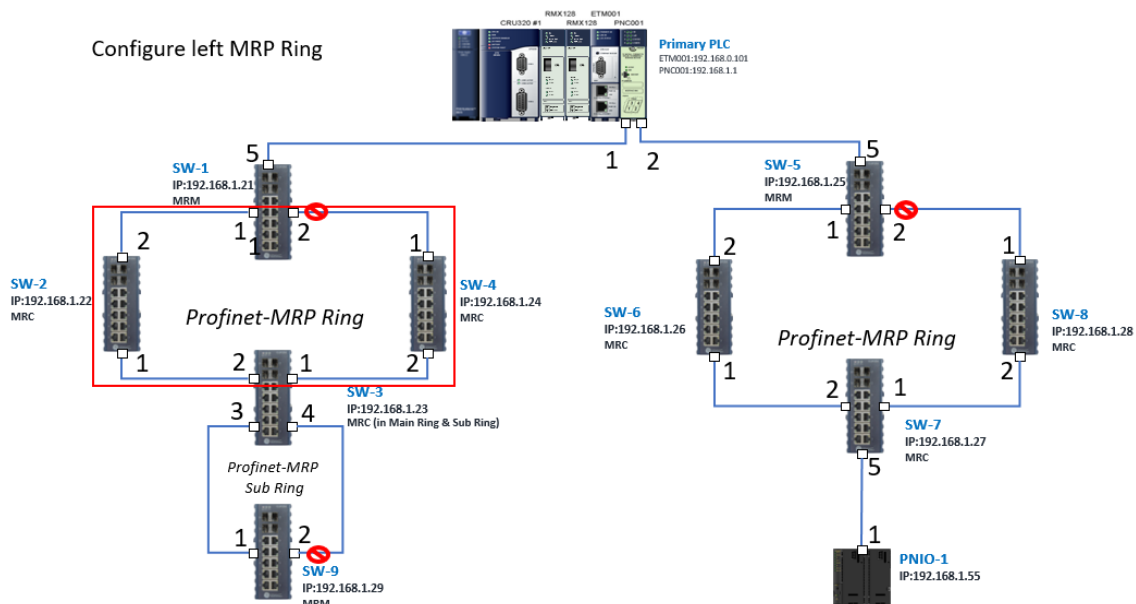
The steps to enable MRP functionality on the I/O controller and I/O devices will be the same for all components in the figure below. Refer to this section to configure SW1-SW10.

6.2.6.1 SW1 through SW4

We will be setting MRP for the I/O controller and I/O devices highlighted in the red box below.

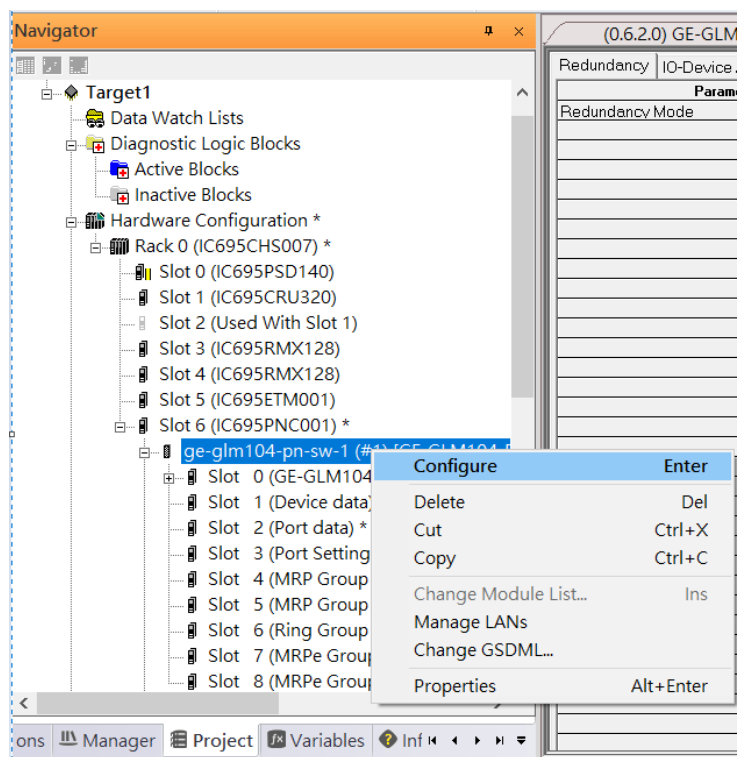
First, configure the MRP in Profinet MRP Main Ring.

Figure 179: Configuring the Main Ring



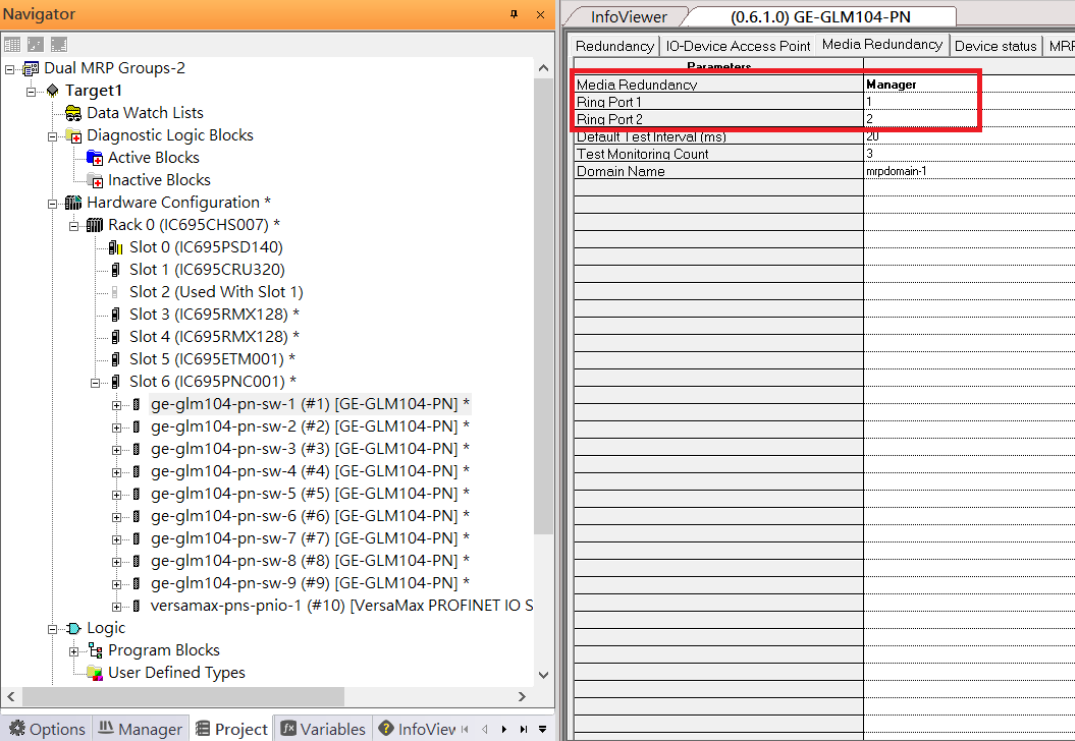
In order to enable the MRP function in SW1, click the right button and choose **Configure**. It will show “Media Redundancy” on the right window.

Figure 180: Configure SW1



Enable MRP functionality by changing the value of “Media Redundancy” to the manager and select **Ring Port 1** to 1, and **Ring Port 2** to 2.

Figure 181: Configuring the Media Redundancy Parameters



The screenshot shows the PACSystems software interface. The Navigator pane on the left displays a hierarchical tree of components. The InfoViewer pane on the right shows the 'Media Redundancy' parameters for a GE-GLM104-PN device. A red box highlights the 'Ring Port 1' and 'Ring Port 2' settings, both set to 1 and 2 respectively.

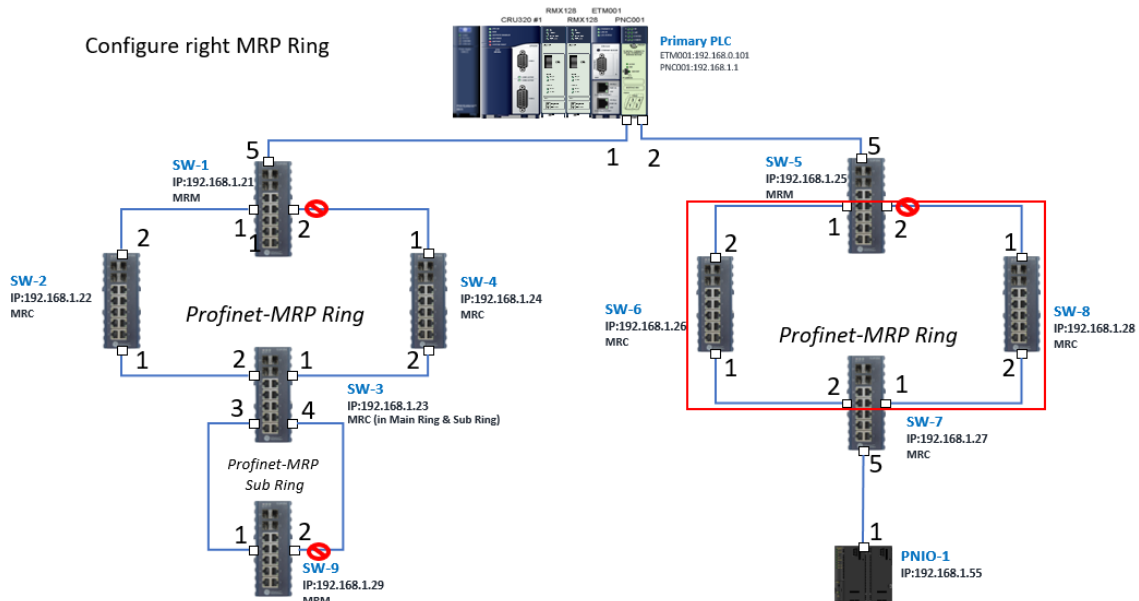
Parameter	Manager
Media Redundancy	1
Ring Port 1	2
Ring Port 2	20
Default Test Interval (ms)	3
Test Monitoring Count	mrpdomain-1
Domain Name	

Repeat these steps to enable MRP functionality for SW2, SW3, and SW4.

6.2.6.2 SW5 through SW8

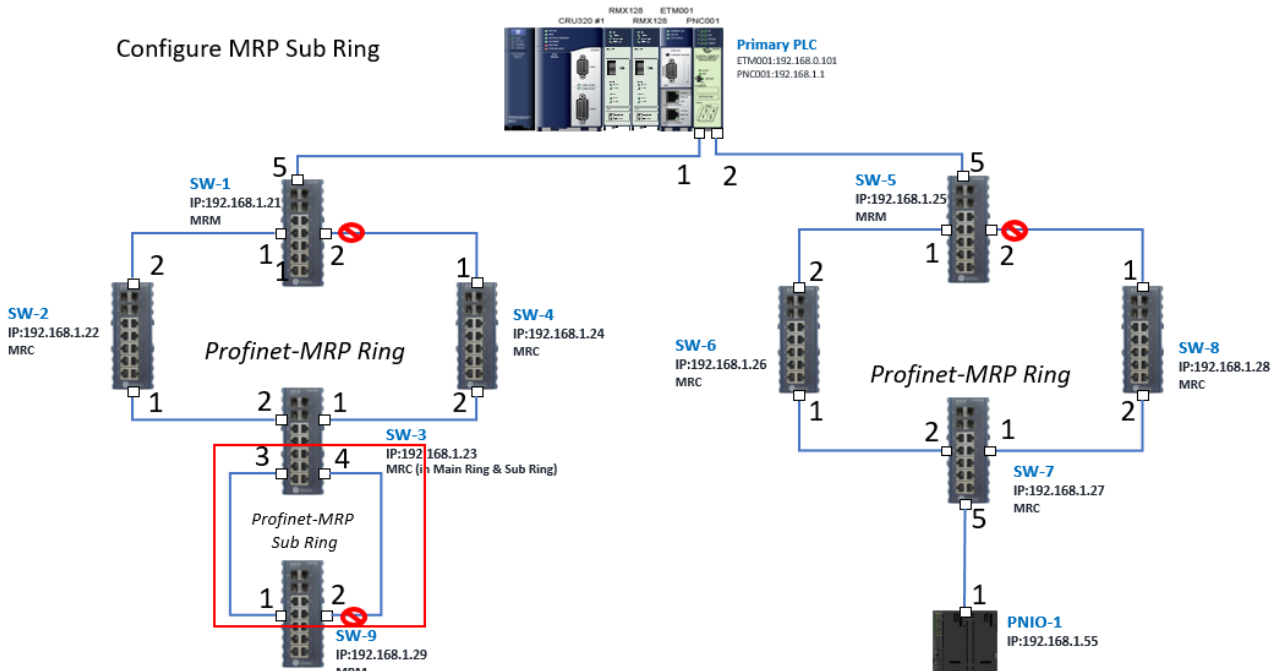
Next, configure the MRP in Profinet MRP Ring-2 (highlighted in the red box below). Refer to the steps outlined in Section 6.2.6.1 to enable MRP functionality for SW5-SW7.

Figure 182: SW5 - SW8

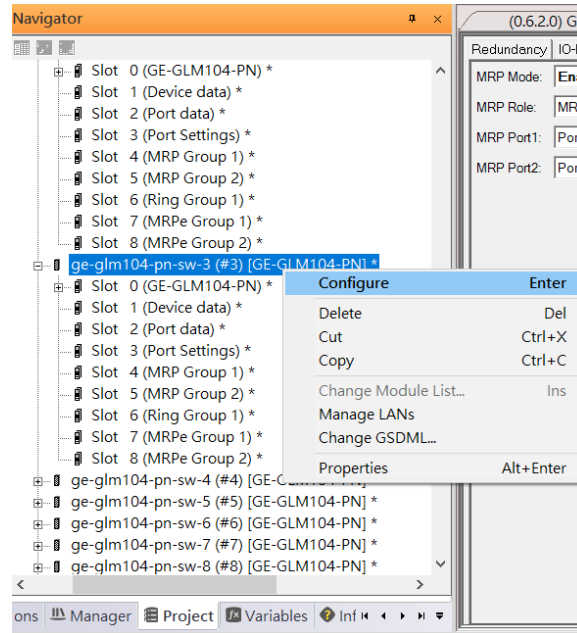


6.2.6.3 SW3 (Ports 3 and 4) and SW9

Next, configure the MRP in the Profinet MRP Sub ring (in the box).

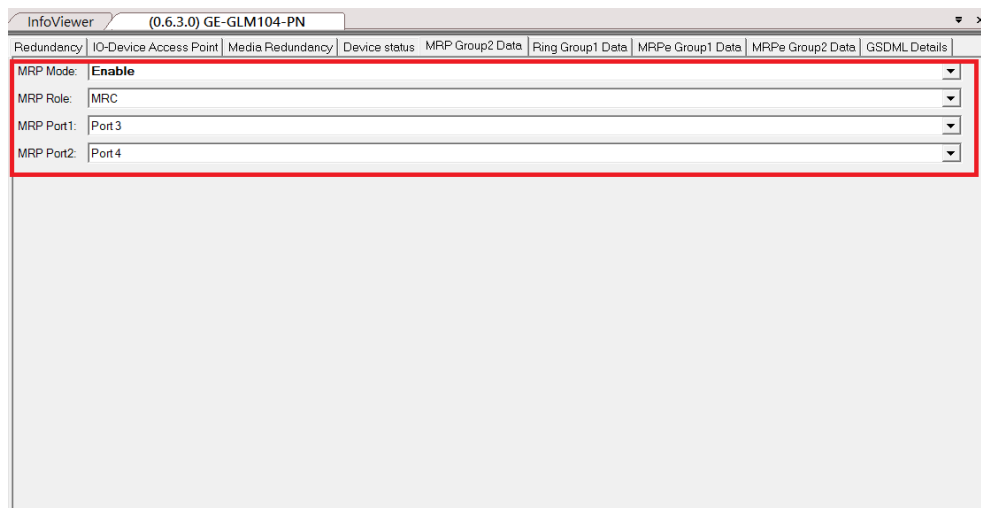


In order to enable the MRP function in SW3, click the right button and choose **Configure**.
It will show “Media Redundancy” on the right window.



Enable the MRP function by changing the value of “MRP Group2 Data” to the client and select **MRP Port 1 to 3**, and **MRP Port 2 to 4**.

Figure 183: SW3 Ports



To enable the MRP function in SW9, click the right button and choose **Configure**.

Enable the MRP function by changing the value of “Media Redundancy” to the client and select **Ring Port 1 to 1**, **Ring Port 2 to 2**.

6.2.7 Network Setting

To establish the communication to the I/O Controller from PAC Machine Edition, the interface of the I/O Controller shall be specified.

It should be noted that there is only 1 I/O Controller (Primary or Secondary) able to communicate with PAC Machine Edition. Therefore, there are 3 rules of communication that are defined.

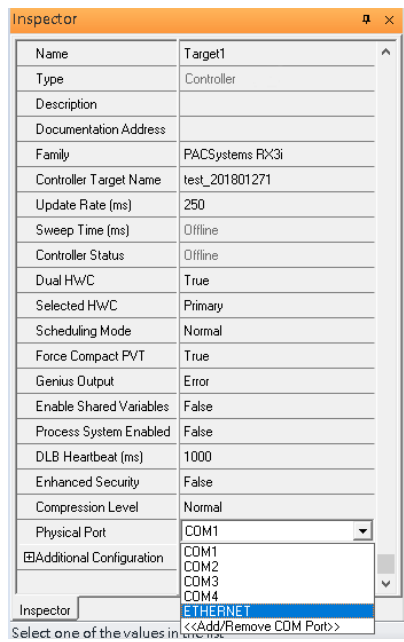
I/O Controller Communication Rule

Rule	Description
1	The communicated I/O Controller shall be specified. Click primary or secondary hardware configuration, click the right button, and select Set as Selected HWC .
2	During the communication, the cable shall be connected to the ETM001 in specified hardware (Primary or Secondary)
3	Specify the interface and IP address for communicated I/O Controller

For rule 3, click **Target 1** and Select **Property**.

In the **Inspector** pane, change the value of **Physical Port** to **Ethernet**.

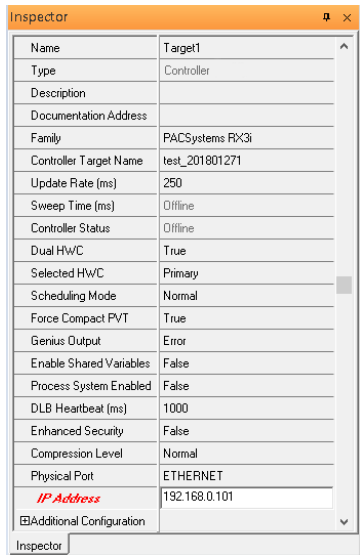
Figure 184: Changing the Physical Port Parameter



Also, the IP address of communicated I/O Controller shall be set. Here the **Primary** setting is shown.

Note, that the specified IP address is set as the IP address on ETM001.

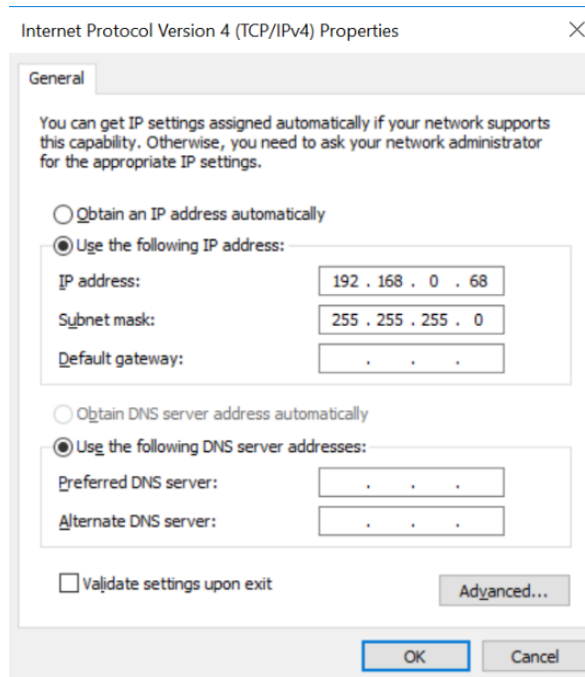
Figure 185: Specified IP Address Appears



6.2.8 PC Network

The IP address of the PC with PAC Machine Edition shall be set in the same network area.

Figure 186: Setting the IP Address of the PC with PME

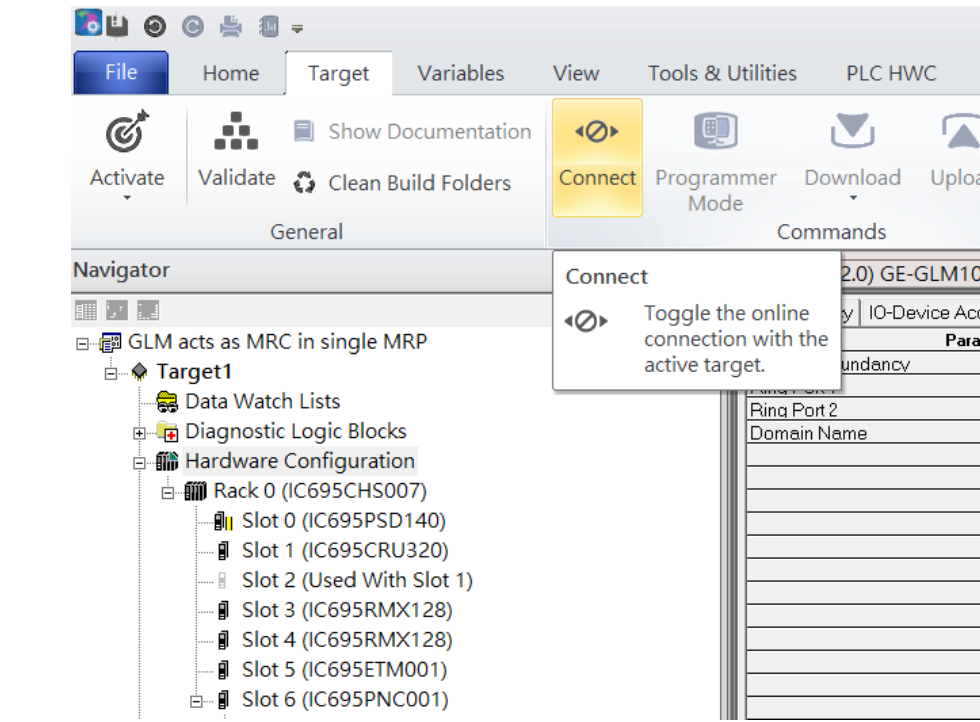


Note: For ETM configuration, please consult GFK-2224 PACSystems Rx3i TCP/IP Ethernet Communications User Manual

6.3 Implementation

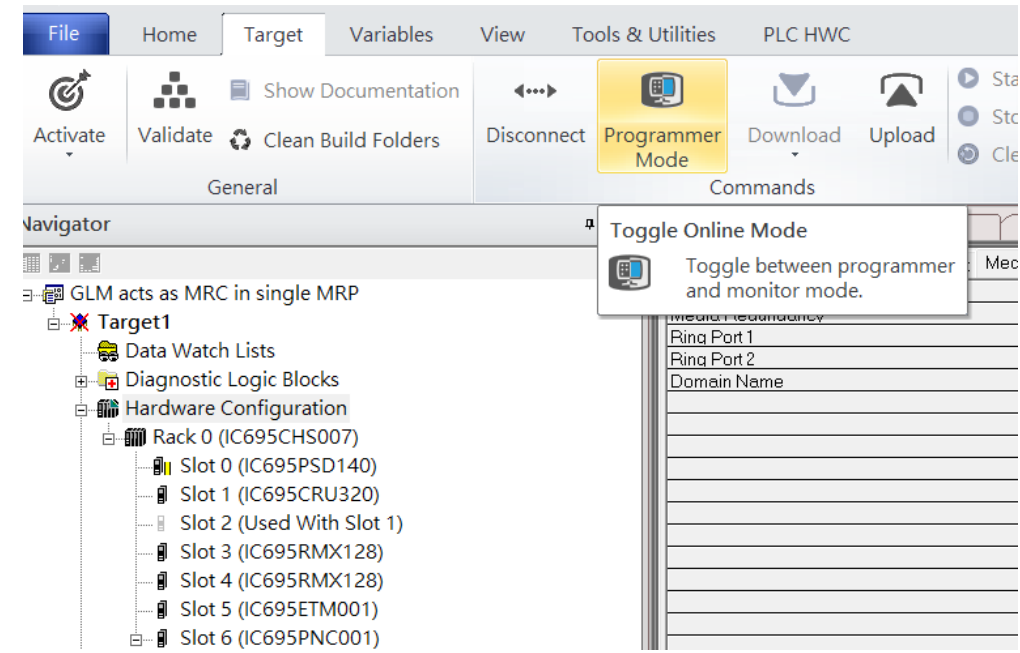
To download the configuration to hardware, the following steps shall be applied.
First, press the **Connect** icon.

Figure 187: Connecting to Target



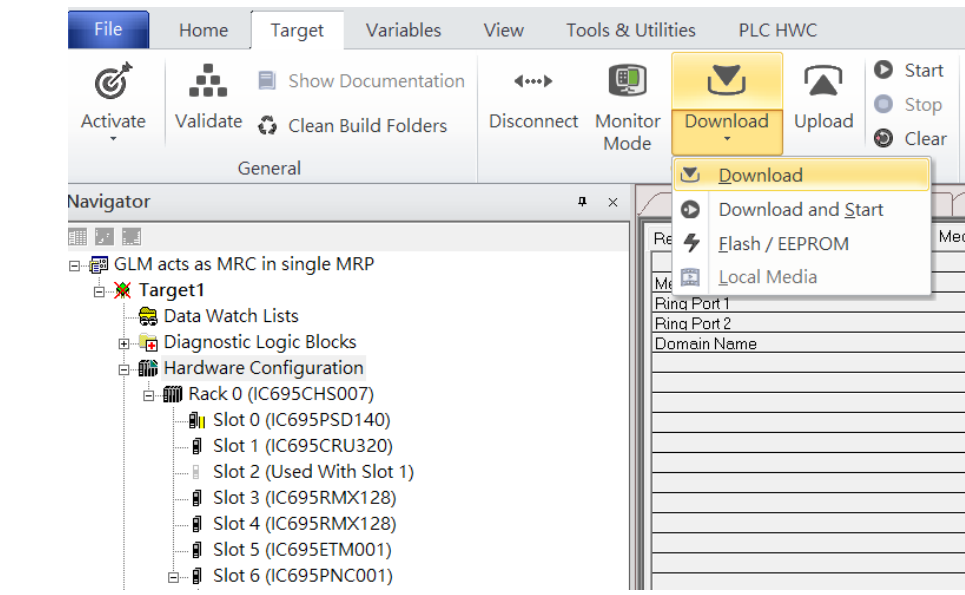
Then press the icon **Programmer Mode**.

Figure 188: Programmer Mode



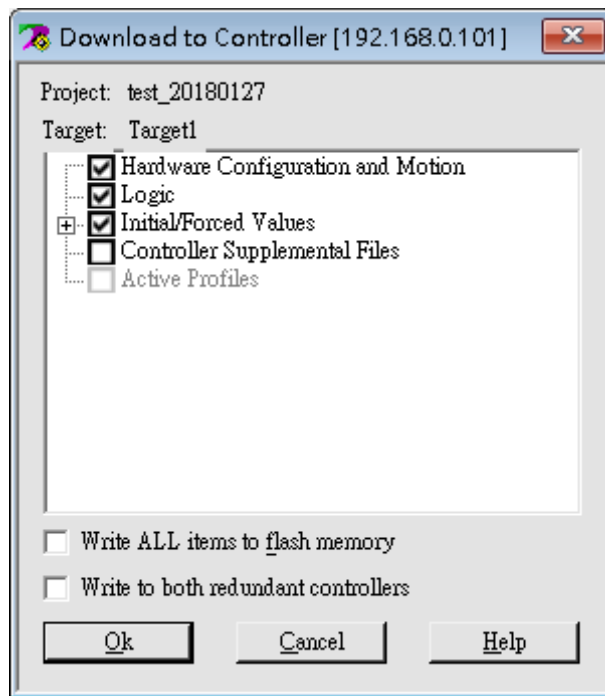
Then press the icon **Download** and select **Download**.

Figure 189: Download



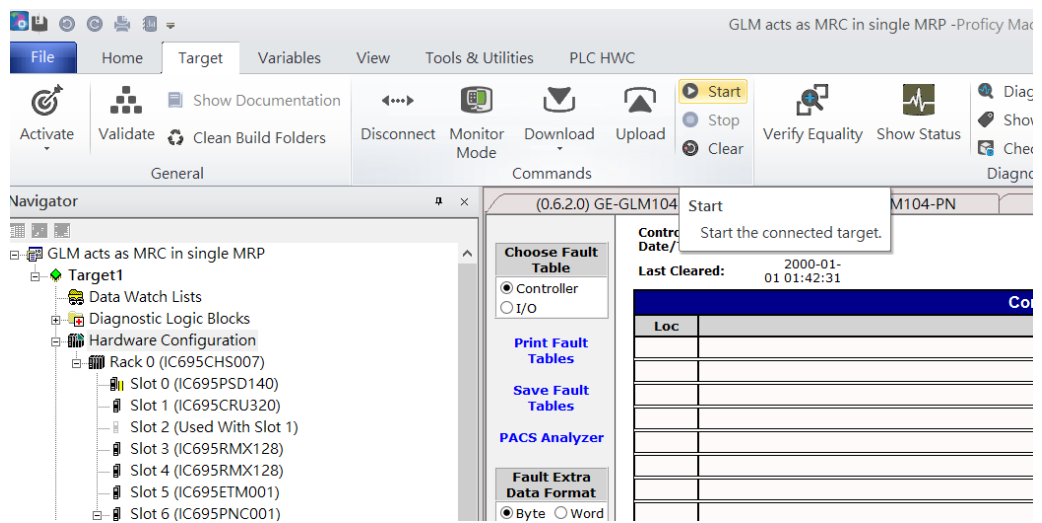
Then the dialogue is appeared to make sure the initialization procedure, select **OK**.

Figure 190: Download to Controller



After downloading completely, press the icon **Start** to active PLC. Note: After downloading completely, switch CRU320 to **Run I/O Enable** and select **OK**. If PLC has started successfully, a message “The Controller was successfully started”.

Figure 191: Start



Section 7 PROFINET-MRP Main Ring Coupled with Two PROFINET-MRP Subrings

7.1 Network Topology

Figure 192: PROFINET-MRP Main Ring couples with Coupled Two PROFINET-MRP Subrings

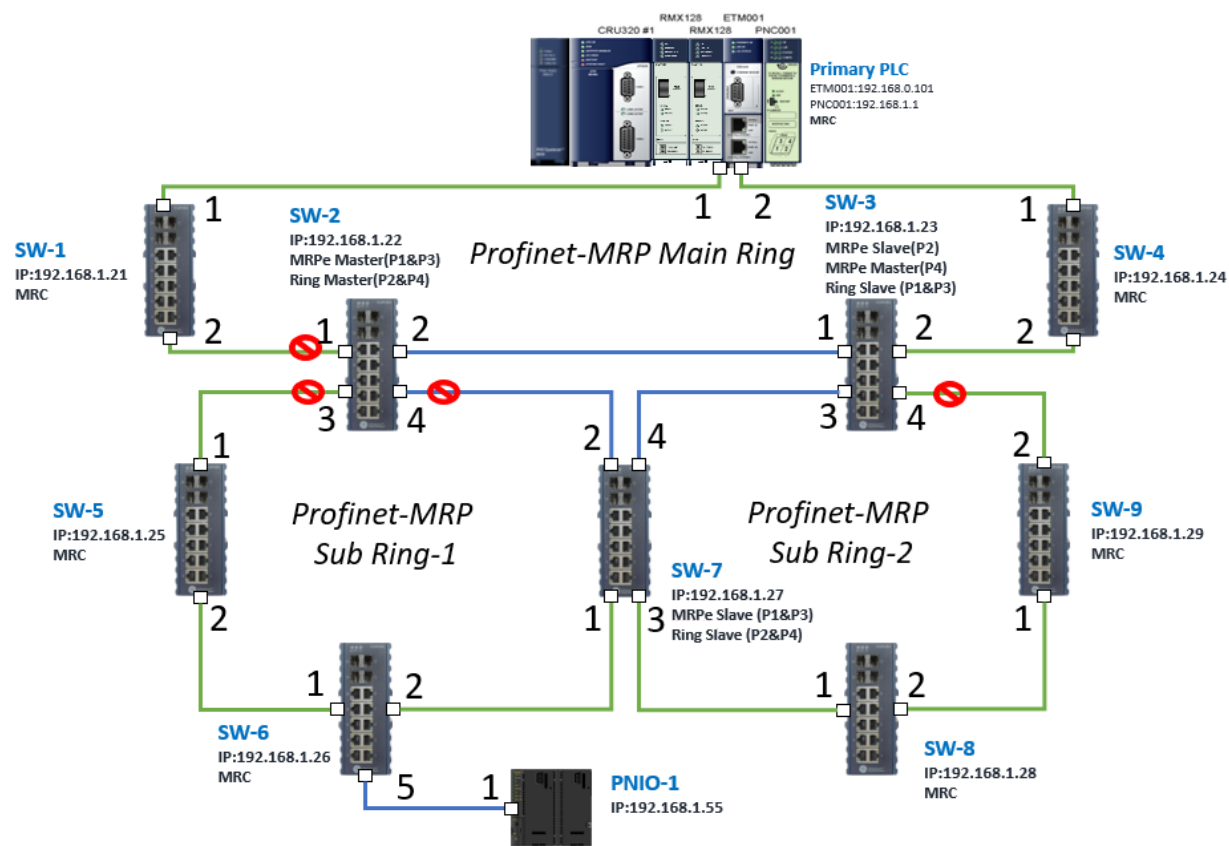


Figure 193

7.2 Hardware Configuration

On the CRU320, the I/O data can be set to “STOP”, “RUN OUTPUT DISABLE” or “RUN I/O Enable” states by a switch embedded on CRU320.

During the configuration, the switches on both 2 CRU320s must be set to “STOP”

7.2.1 Project Open

To start the software PAC Machine Edition, please follow the steps below:

4. Click **Start -> Emerson -> PAC Machine Edition -> PAC Machine Edition**
5. Select the empty project and click **OK**.
6. Set the project name and click **OK**.

Figure 194: Create a new project

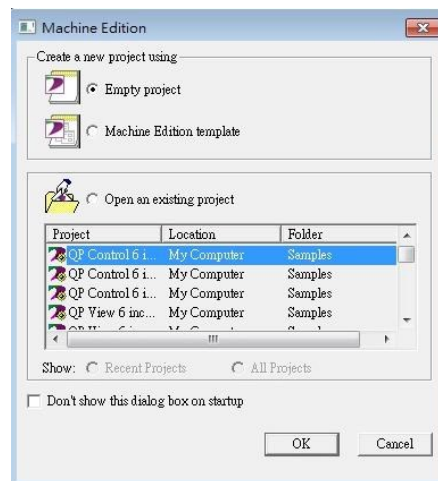
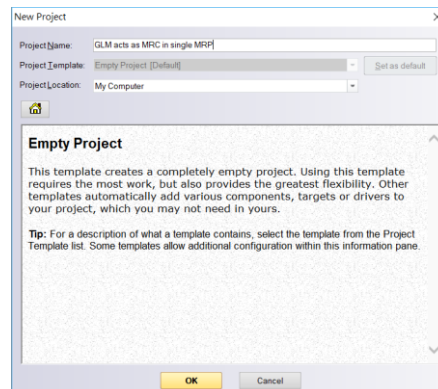


Figure 195: New Project Name



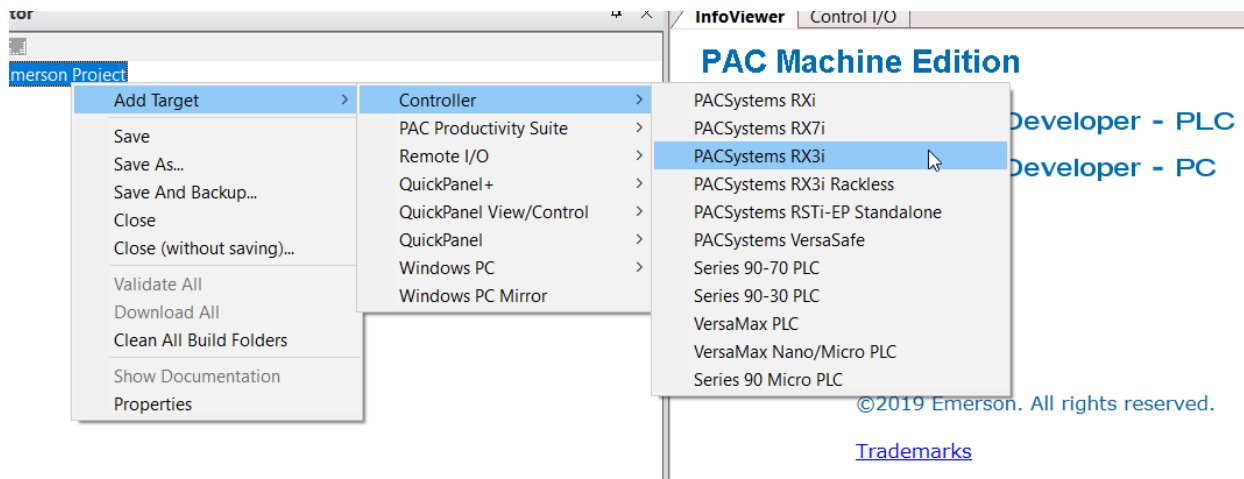
7.2.2 I/O Controller Setting

The next step is to add a target for this project.

Click the right button on project name “GLM act as MRC in single MRC group” and select **Add Target -> Controller -> PACSystems RX3i**.

The PACSystems RX3i is the I/O Controller to be tested. See the following picture.

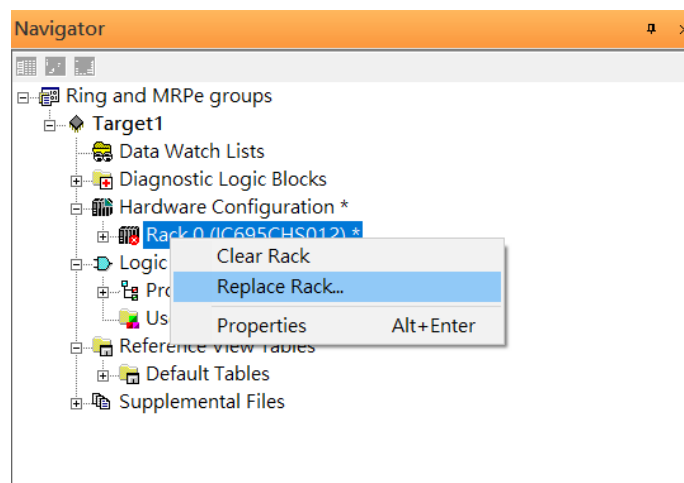
Figure 196: Adding I/O Controller



Originally the I/O Controller is described as the rack with 12 slots, each slot can be regarded as the chassis for device installation such as a power card, communication module, or bus controller. However, there are only 7 chassis that can be used in the I/O Controller CRU320. Thus, replace the rack with 7 slots.

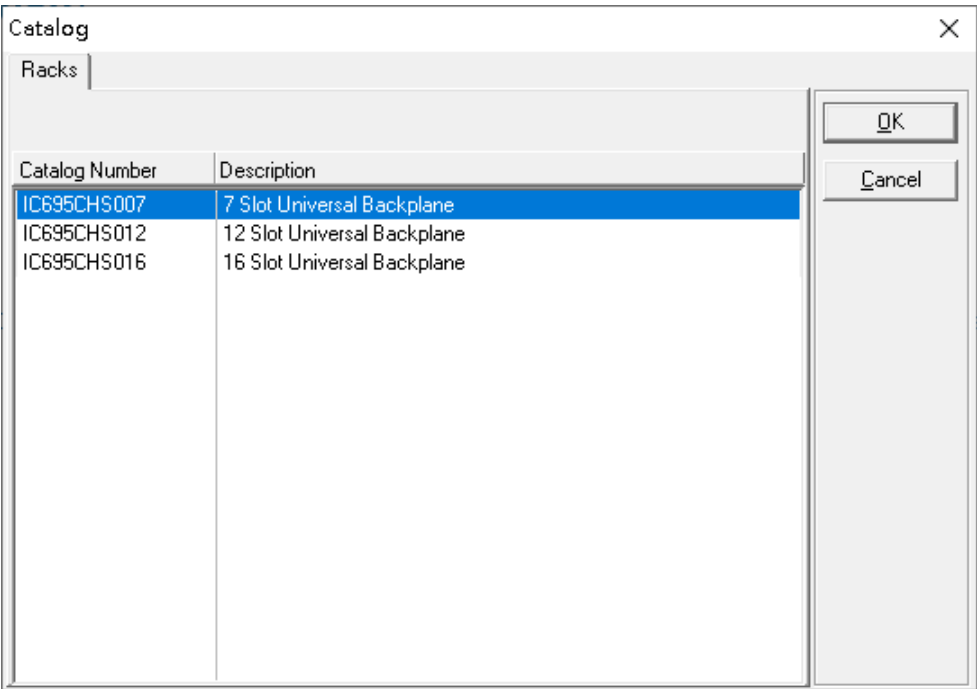
Click the right button on **Rack 0 (IC695CHS012)** and select **Replace Rack**.

Figure 197: Replace Rack



Select “IC695CHS007” and click OK.

Figure 198: Select the Catalog Number



After the rack and the number of slots are defined, select the corresponding devices into the slots according to the I/O Controller. The following picture is the current installation for each device on the I/O Controller

Figure 199: Rack Configuration



From left to right, the installed devices on the I/O Controller are:

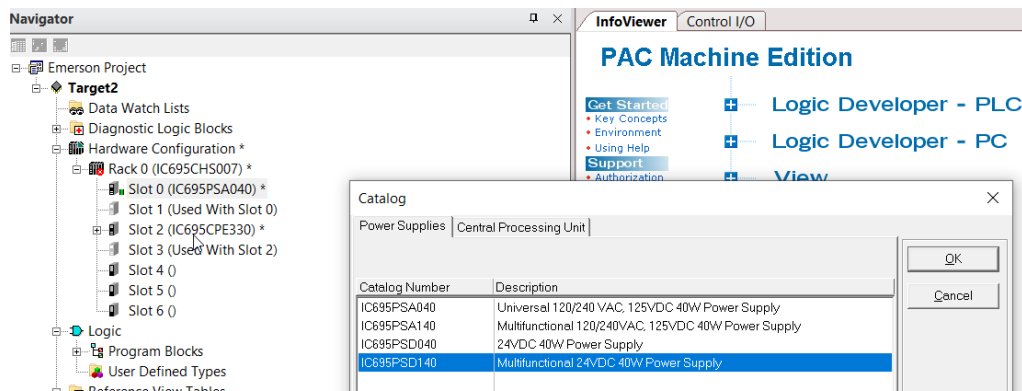
Devices on I/O Controller

Device Type	Device Name	Chassis index
Power Card	PSD140	0
Central Processing Unit	CRU320	1 ~ 2
Communication Module	RMX128	3
Communication Module	RMX128	4
Communication Module	ETM001	5
Bus Controller	PNC001	6

Now, add the module into the slots by the current devices on the I/O Controller, the chassis index is corresponding to the slot index.

First, replace the power card. Click slot 0 and click the right button, select **Replace Module**, and specify the installed power card, PD140, then click **OK**.

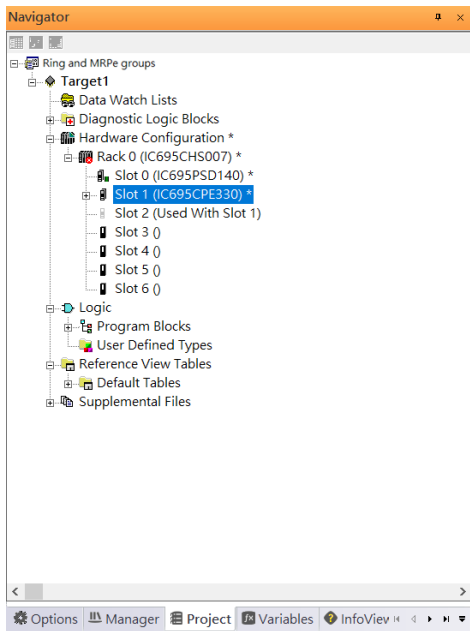
Figure 200: Replace Module



Slot 0 is replaced by the current power card, PSD140.

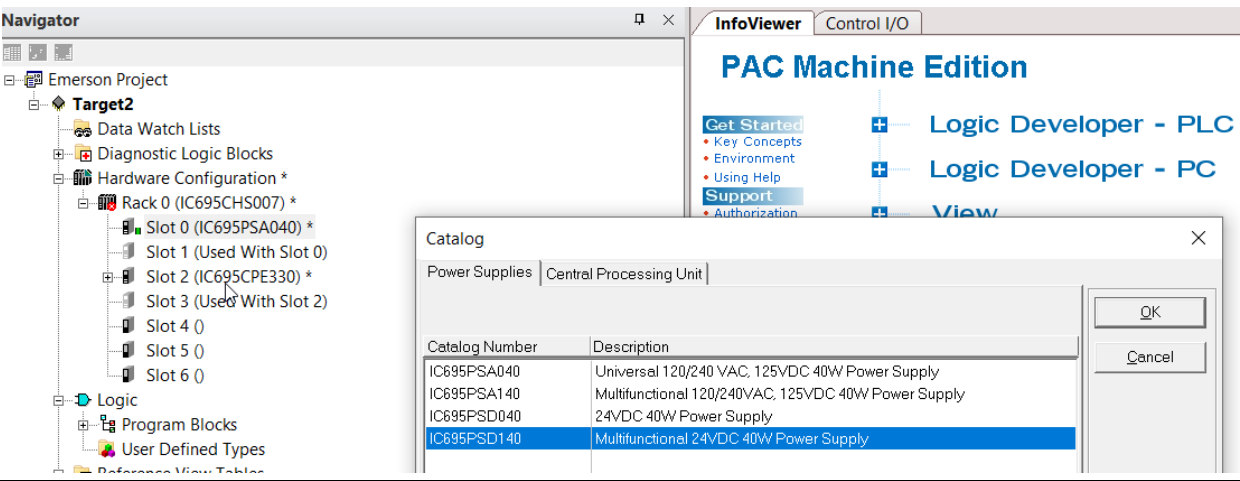
For slot 1 and 2, 2 chassis (1 and 2) is occupied by the Central Processing Unit, CRU320. To integrate slots 1 and 2, pull slot 2 to slot 1. The slot is not cleared.

Figure 201: Integrate Slot 1 and Slot 2



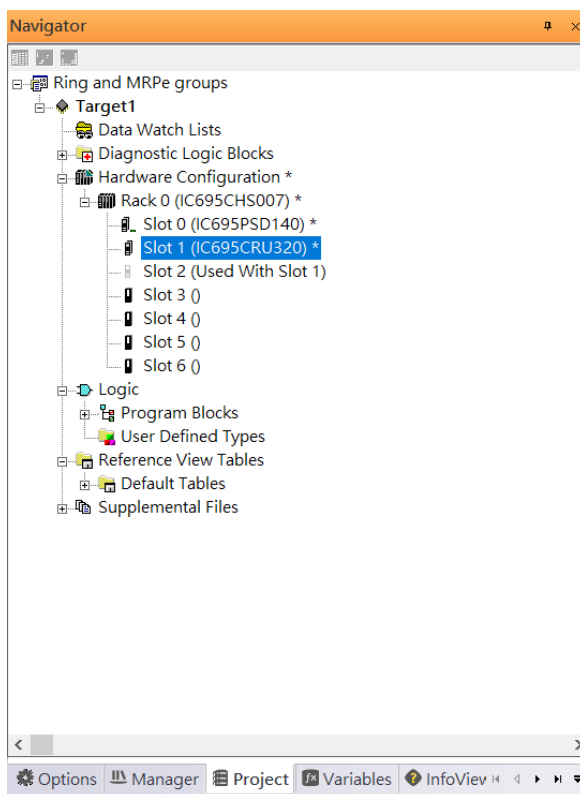
To select the Central Processing Unit, click slot 1 and click the right button, select **Replace Module** to choose CRU320, and select **No**.

Figure 202: Replace Module



Now the CRU320 is specified.

Figure 203: CRU320 is Specified

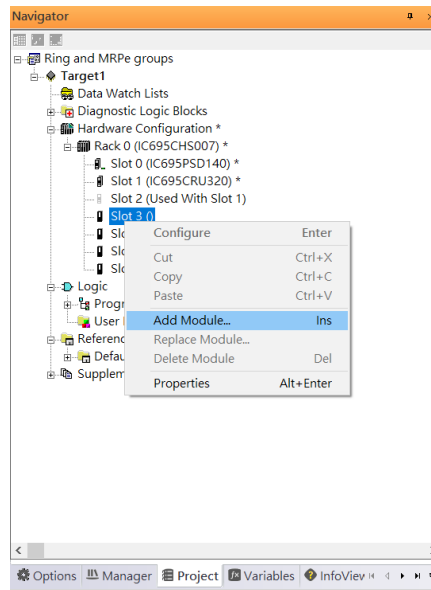


7.2.2.1 Slot 3

Next is to add the RMX128 module for slot 3.

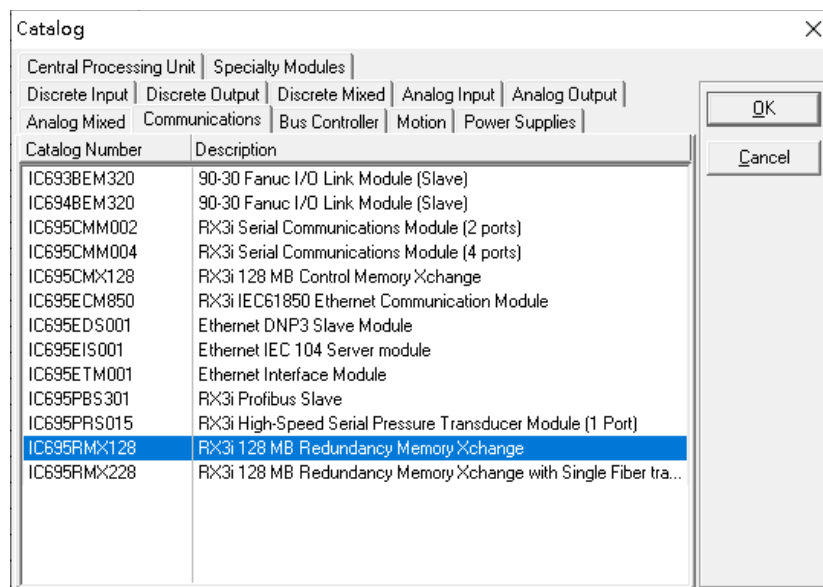
Click the right button on slot 3, and select **Add Module**.

Figure 204: Add Module



According to the current installation on the I/O Controller, the RMX128 shall be selected. Select **Communications** -> **IC695RMX128** and click OK.

Figure 205: RMX128



7.2.2.2 Slot 4

Next, select RMX128 for slot 4.

Click the right button on slot 4, select **Add Module**, select **Communications** - **IC695RMX128**, and click OK.

7.2.2.3 Slot 5

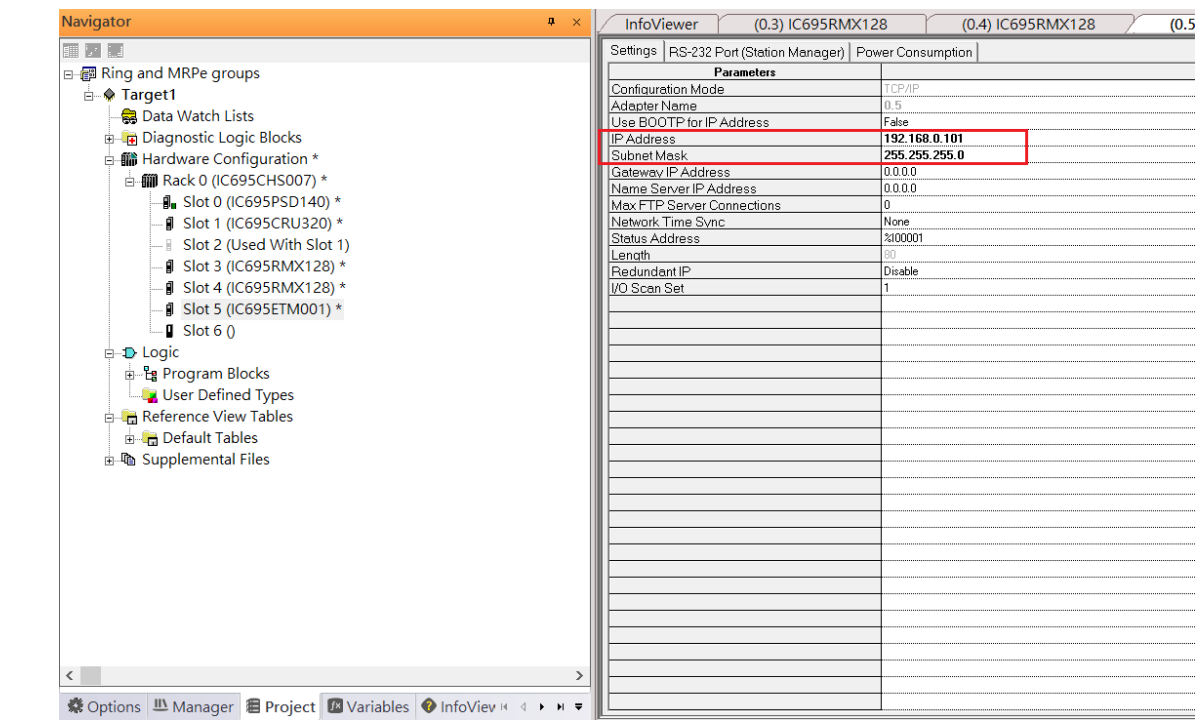
Next, select ETM001 for slot 5.

Click the right button on slot 5, select **Add Module**, select **Communications** -> **IC695ETM001**, and click **OK**.

It should be noted that the ETM001 is the management device for PAC Machine Edition. The communication interface is the Ethernet network. The IP address and Subnet Mask shall be specified.

In the following picture, the IP address 192.168.0.101 and mask 255.255.255.0 is specified on ETM001.

Figure 206: ETM001 Parameters



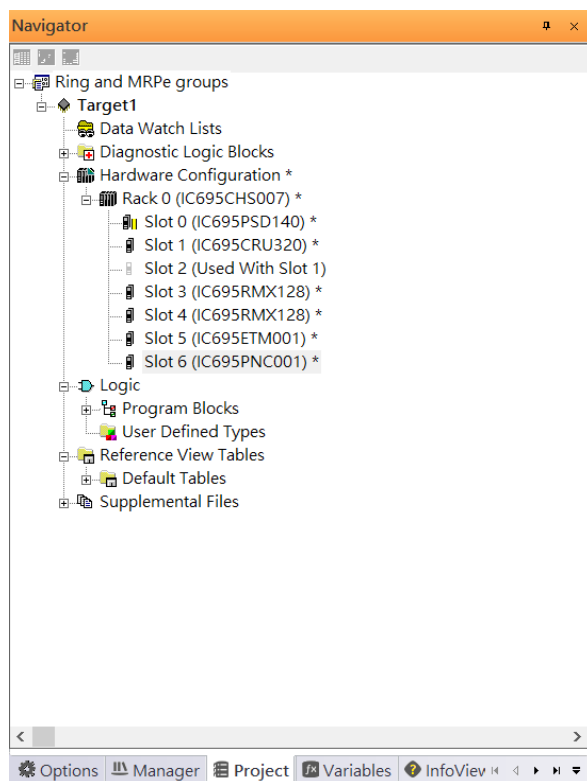
7.2.2.4 Slot 6

Next, select PNC001 for slot 6.

Click slot 6 and click the right button, select **Add Module**, specify the installed Bus Controller, PNC001, and click **OK**.

Now all the devices on the I/O Controller are ready on the slots on the rack, the following picture is the current status, and we shall save it.

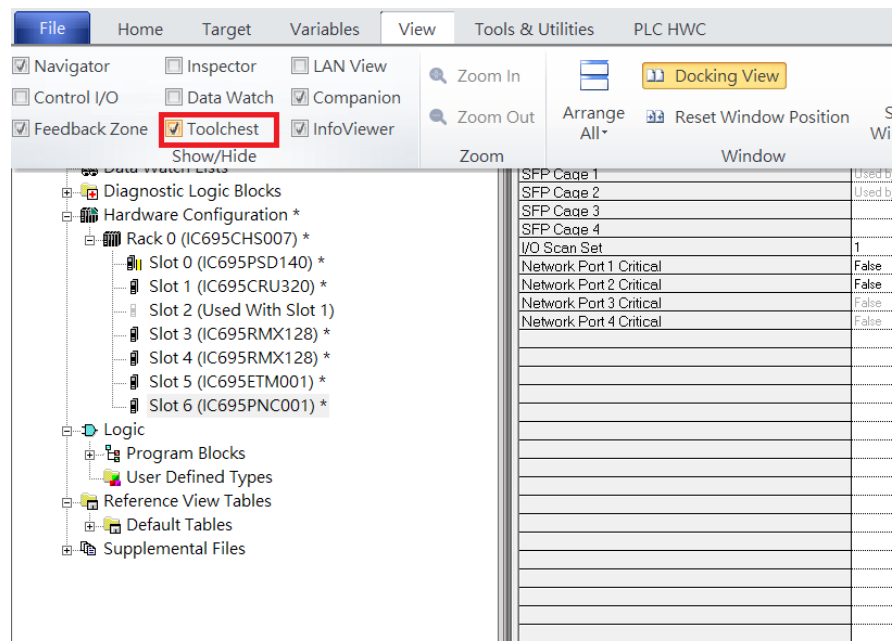
Figure 207: Final Configuration



7.2.3 I/O Device Setting

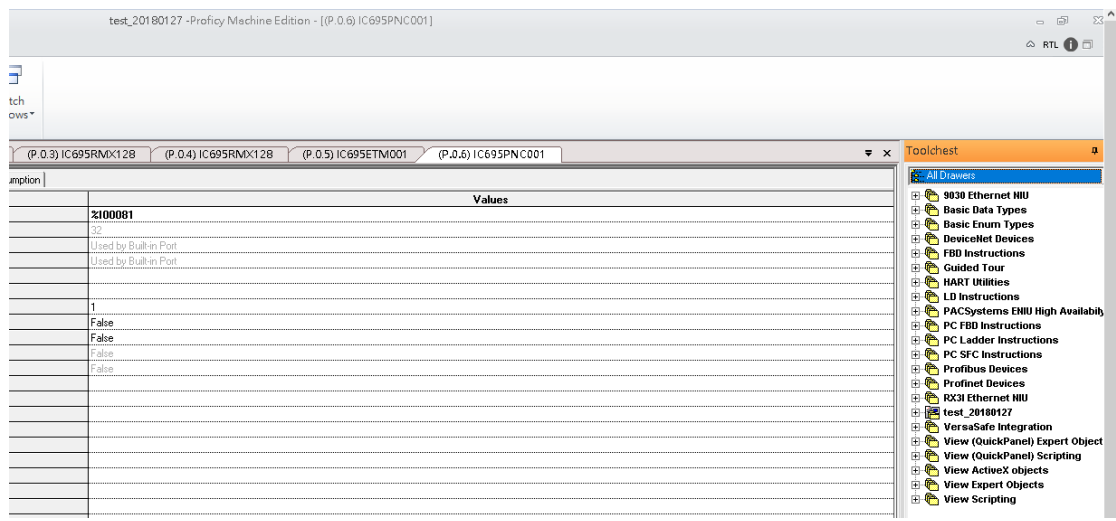
This section introduces the I/O Device integration. To configure the I/O Device, the GSDML file is necessary. Now we create another interface to load the GSDML file by using Toolchest.

Figure 208: Location of Toolchest button



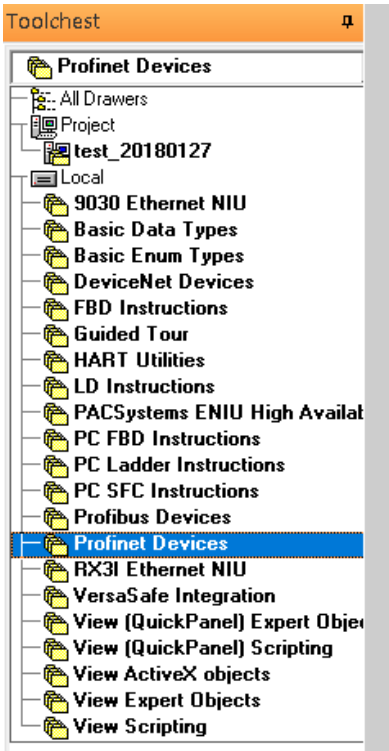
As shown in the following picture, a new interface is created on the right-hand side.

Figure 209: Toolchest Panel



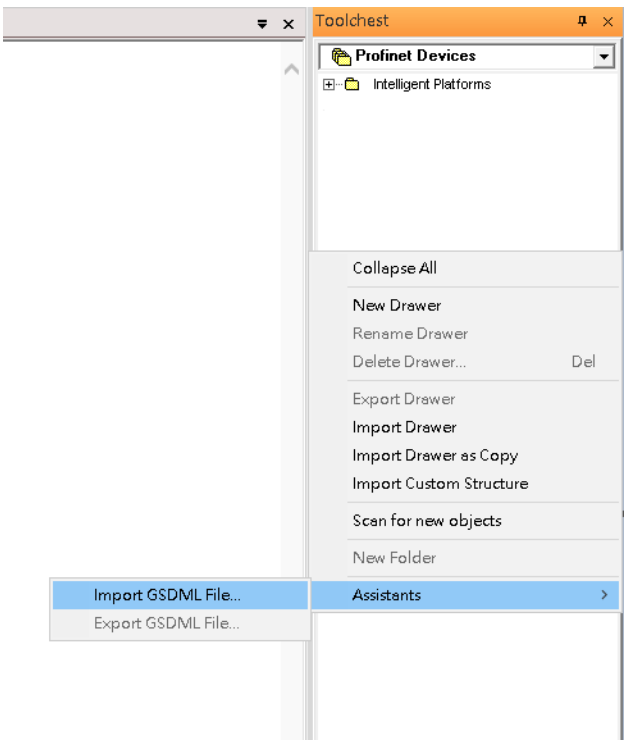
Select Profinet Devices.

Figure 210: Select Profinet Devices from the Toolchest



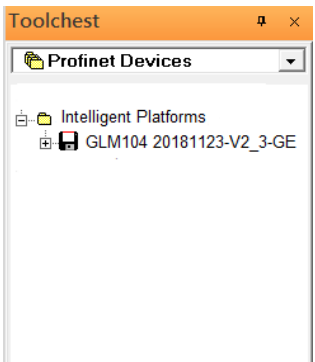
Right-click and select **Assistants** -> **Import GSDML File**, and select the target file.

Figure 211: Select the GSDML File



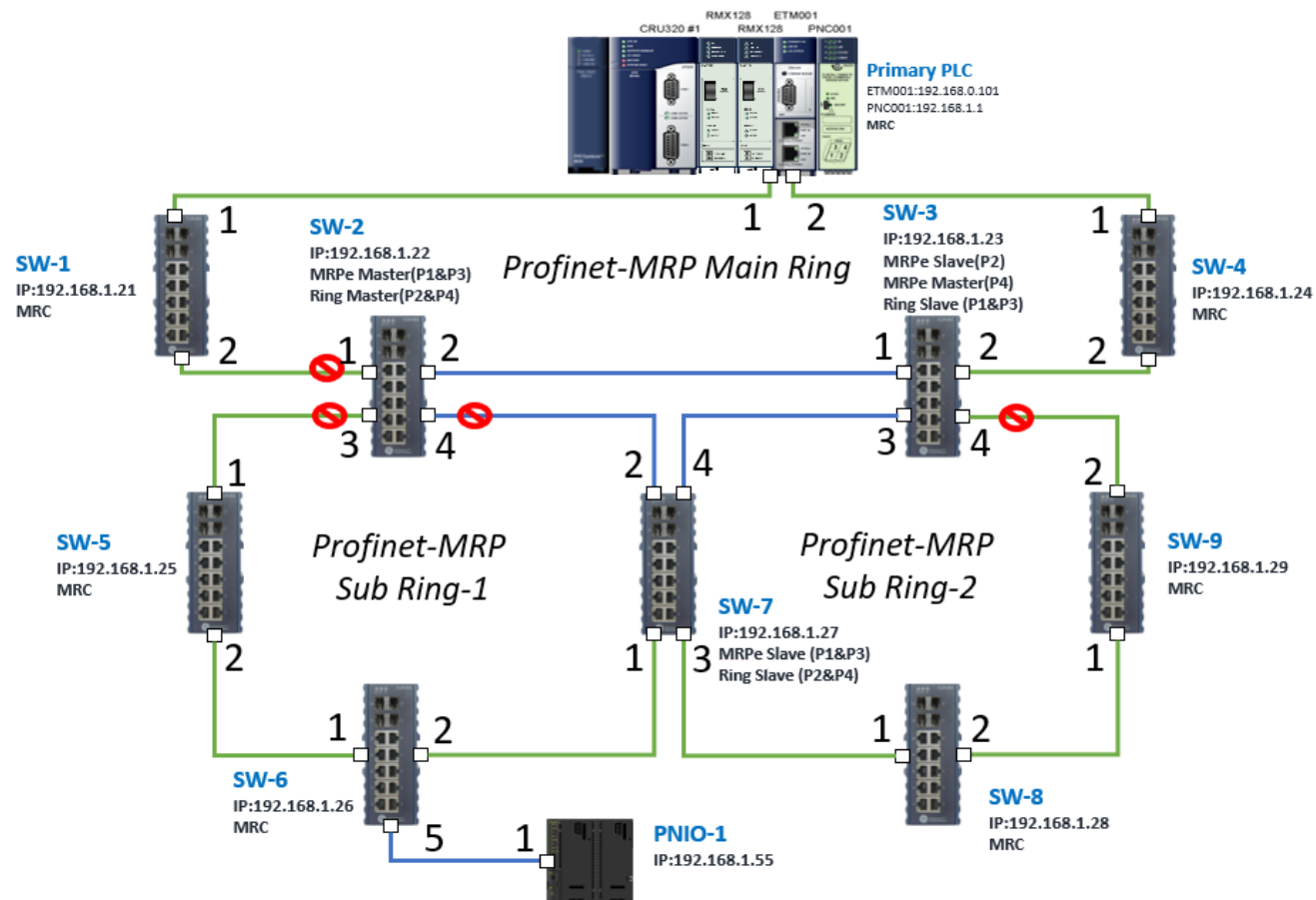
Then the corresponding I/O Device of the GSDML File is added to the **Toolchest**.

Figure 212: Imported GSDML File



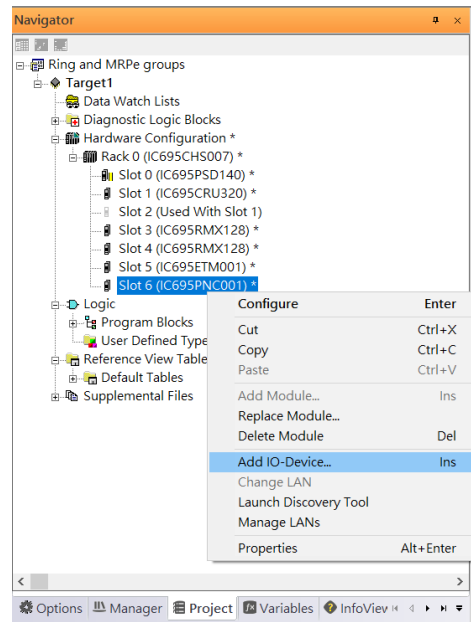
In this document, there are ten I/O devices and one I/O controller. I/O devices are nine switches and one Emerson VersaMax PROFINET I/O Scanner.

Figure 213: PROFINET-MRP Main Ring Coupled Two PROFINET-MRP Subrings



The I/O Device is connected to the Bus Controller on the I/O Controller. Click slot 6 and click the right button to add the I/O Device on the PNC001.

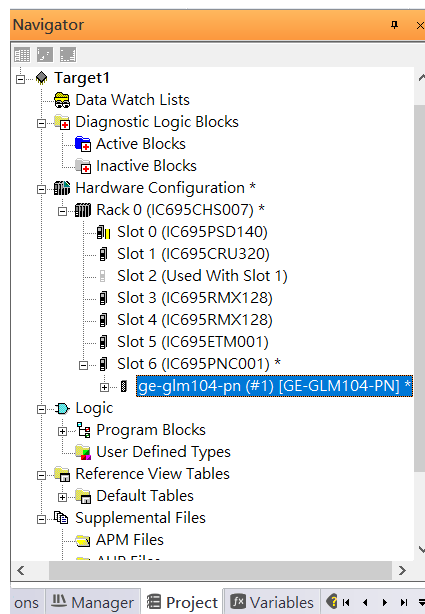
Figure 214: Add I/O Device on the PNC001



Select the specified I/O Service-> **GLM0104 20181123-V2_3-GE** -> **GE-GLM104-PN** and click **OK**.

Now the I/O device GLM104(SW1) is ready and is a sub-slot on PNC001.

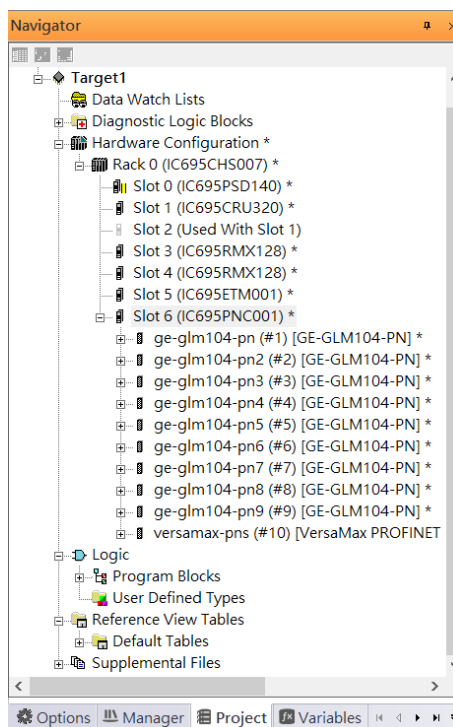
Figure 215: The device is now ready



7.2.3.1 SW2 – SW10

Repeat this process to add the second through the tenth I/O devices to the PNC001. The final results will look like the figure below:

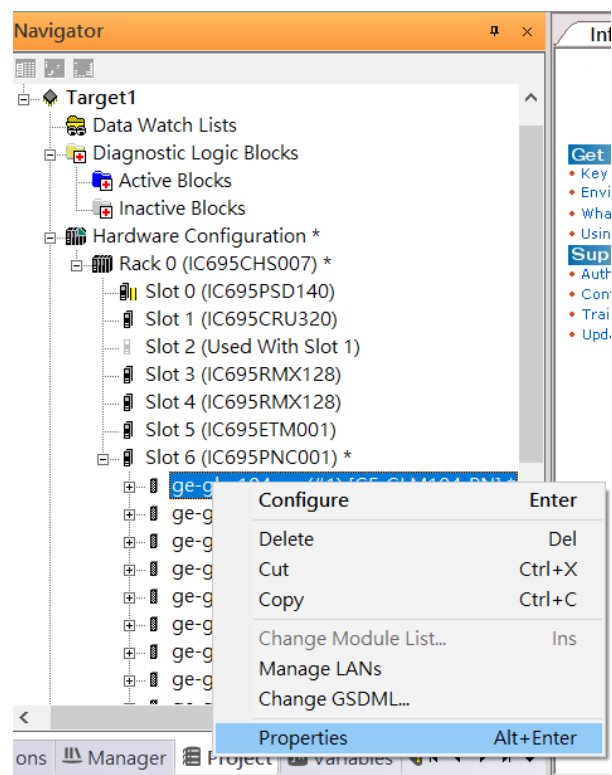
Figure 216: Finished Configuration



7.2.4 DCP Set Command

To configure the setting or monitor the status of the I/O Device, the communication interface is also based on an Ethernet network. We can specify the IP address and the device name from I/O Controller via the DCP (Discovery and Configuration Protocol).
Under slot 6, PNC001, select the I/O Device, ge-glm104-pn, and click the right button.
Select **Properties**.

Figure 217: Properties



In this table, the I/O Device name can be specified in the field **Device Name**, and the IP address can be set in the field **IP address**. We modify the device name to “ge-glm104-pn-sw-1” and the IP address to “192.168.0.21”.

Device Discovery Tool to observe an I/O Device and set I/O Device's name to "ge-glm104-pn-sw-1".

Figure 218: Discovery Tool

The screenshot shows a window titled "Inspector" with a close button (x) in the top right corner. The window is divided into two main sections. The top section, labeled "IO-Device", contains the following fields:

- Device Number: 1
- Update Rate (ms): 128
- Reference Variable: <None>
- Network Identification: (collapsed)
- IO LAN: LAN01
- Device Name: ge-glm104-pn-sw-1
- Device Description: (empty)
- IP Address: 192.168.0.21

The bottom section, labeled "General", contains the following fields:

- GSDML: GSDML-V2.3-GE-GLM104-20181123.xml
- Device Type: GE-GLM104-PN
- Device Access Point ID: GE-GLM104-PN
- Group IO References: True

At the bottom of the window, there is a tab labeled "Inspector".

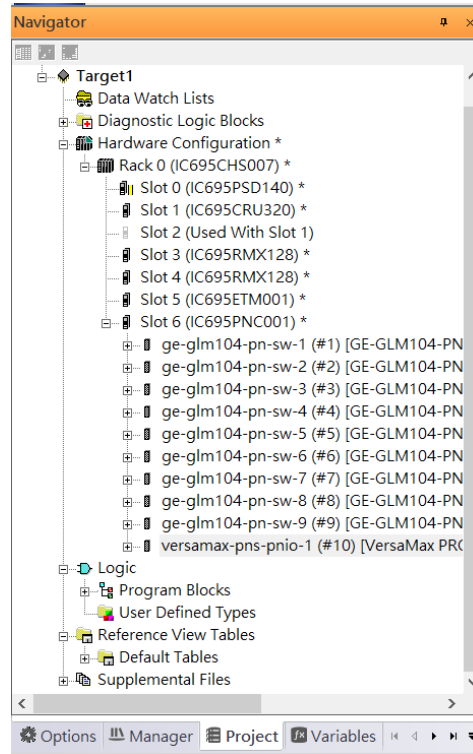
7.2.4.1 GLM104-PN2 through VERSAMAX-PNS-PNIO-1

Repeat this process and for the remaining I/O Devices. Use the table below to define the device name and IP address for each I/O device:

I/O Device	IP Address	Device Name
GLM10-PN	192.168.0.21	ge-glm104-pn-sw-1
GLM10-PN2	192.168.0.22	ge-glm104-pn-sw-2
GLM10-PN3	192.168.0.23	ge-glm104-pn-sw-3
GLM10-PN4	192.168.0.24	ge-glm104-pn-sw-4
GLM10-PN5	192.168.0.25	ge-glm104-pn-sw-5
GLM10-PN6	192.168.0.26	ge-glm104-pn-sw-6
GLM10-PN7	192.168.0.27	ge-glm104-pn-sw-7
GLM10-PN8	192.168.0.28	ge-glm104-pn-sw-8
GLM10-PN9	192.168.0.29	ge-glm104-pn-sw-9
GLM10-PN10	192.168.0.30	ge-glm104-pn-sw-10
VERSAMAX-PNIO	192.168.0.55	versamax-pns-pnio-1

Now all the devices have been changed their device name and IP address like the following picture.

Figure 219: Finished Configuration

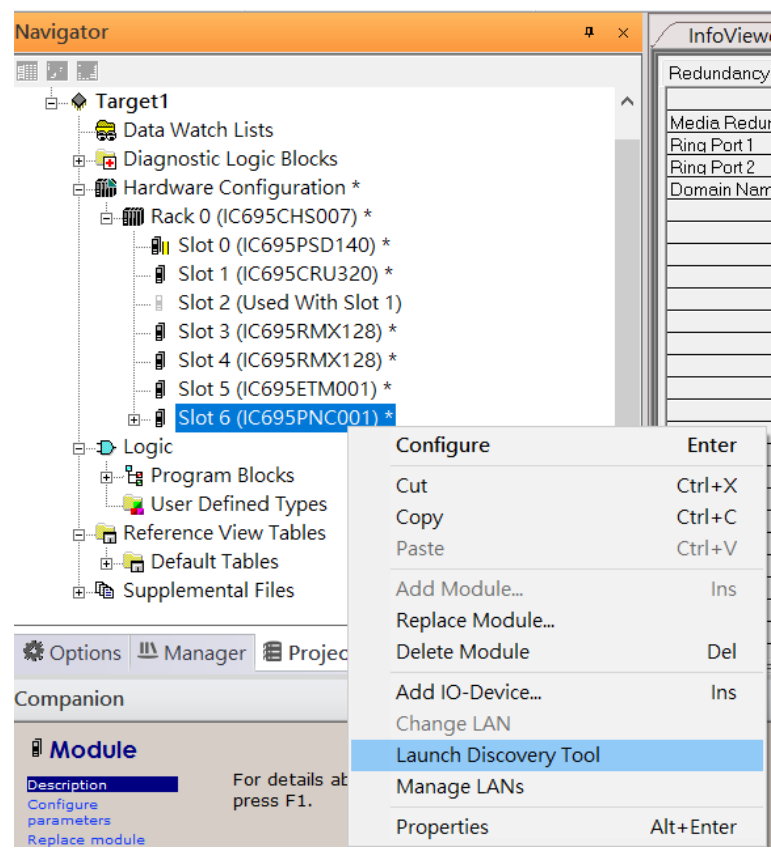


7.2.5 I/O Device Scan

The PAC Machine Edition also supports the function to scan the connected I/O Devices. First, the observed I/O Device shall be connected to the ETM001 on the **Primary** hardware configuration, then using the function **Launch Discovery Tool**.

Note: Before we finish downloading the configuration to CRU320, need to unplug the block port according to the hardware topology to avoid a loop.

Figure 220: Launch Discovery Tool



The tool is shown in the following picture, then press **Refresh Device List**.

Figure 221: Refresh Device List

Connection Settings

Connection: Ethernet 8

LAN: LAN01

Status: No Errors

Refresh Device List

Status	Device Name	IP Address	Vendor	Device Type
--------	-------------	------------	--------	-------------

PROFINET DCP Discovery

Device Discovery State

Filters (0/0)

- ☒ Assigned
- ☒ Assigned with errors
- ☒ Not assigned

Selection Properties

MAC Address:

Device Role:

Vendor ID:

Device ID:

IP Address:

Subnet Mask:

Gateway:

Identify Device

Edit Device

Then the connected I/O Device is listed in the following table.

Figure 222: Identify Device

PROFINET DCP - Direct Connection

Connection Settings

Connection: Ethernet 8

LAN: LAN01

Status: No Errors

Refresh Device List

Status	Device Name	IP Address	Vendor	Device Type
?	ge-glm104-pn	192. 0. 2. 1	Intelligent Platforms	GE-GLM104-PN
?	ge-glm104-pn	192. 0. 2. 1	Intelligent Platforms	GE-GLM104-PN
?	ge-glm104-pn	192. 0. 2. 1	Intelligent Platforms	GE-GLM104-PN
?	ge-glm104-pn	192. 0. 2. 1	Intelligent Platforms	GE-GLM104-PN
?	ge-glm104-pn	192. 0. 2. 1	Intelligent Platforms	GE-GLM104-PN
?	ge-glm104-pn	192. 0. 2. 1	Intelligent Platforms	GE-GLM104-PN
?	ge-glm104-pn	192. 0. 2. 1	Intelligent Platforms	GE-GLM104-PN
?	ge-glm104-pn	192. 0. 2. 1	Intelligent Platforms	GE-GLM104-PN
?	ge-glm104-pn	192. 0. 2. 1	Intelligent Platforms	GE-GLM104-PN
?	ge-glm104-pn	192. 0. 2. 1	Intelligent Platforms	GE-GLM104-PN

Filters (12/12)

- ☒ Assigned
- ☒ Assigned with errors
- ☒ Not assigned

Selection Properties

MAC Address: 00-05-65-73-3C-8E

Device Role: Device

Vendor ID: 015A

Device ID: 0104

IP Address: 192.0.2.1

Subnet Mask: 255.255.255.0

Gateway: 0.0.0.0

Identify Device

Edit Device

There are I/O Devices and their status is in “Not assigned”. We need to change their device name to and IP address. Use **Identify Device** to make sure which device we set according to the hardware topology. Then start to set SW-1 device name and IP address.

Click **Edit Device**, set Device Name to “ge-glm104-pn-sw-1” and click the **Set Device Name** button, then set IP Address to “192.168.0.21”, Subnet Mask to “255.255.255.0” and click **Set IP Information** button.

Figure 223: Device Properties

GLM104-PN Properties

Vendor Name:	Intelligent Platforms	Vendor ID:	015A	Identify Device
MAC Address:	00-05-65-72-FB-D0	Device ID:	0104	
Device Type:	GE-GLM104-PN	Device Role:	Device	

Device Name

ge-glm104-pn-sw-1 Set Device Name

IP Address

IP Address: 192.168.0.21
Subnet Mask: 255.255.255.0
Gateway: 0.0.0.0 Set IP Information

Reset device to factory settings

Reset Device

Exit

Then set SW-2 device name and IP address

Click **Edit Device**, set Device Name to “ge-glm104-pn-sw-2” and click the **Set Device Name** button, then set IP Address to “192.168.0.22”, Subnet Mask to “255.255.255.0” and click **Set IP Information** button.

Device Name	IP Address	Subnet Mask
ge-glm104-pn-sw-1	192.168.0.21	255.255.255.0
ge-glm104-pn-sw-2	192.168.0.22	255.255.255.0
ge-glm104-pn-sw-3	192.168.0.23	255.255.255.0
ge-glm104-pn-sw-4	192.168.0.24	255.255.255.0
ge-glm104-pn-sw-5	192.168.0.25	255.255.255.0
ge-glm104-pn-sw-6	192.168.0.26	255.255.255.0
ge-glm104-pn-sw-7	192.168.0.27	255.255.255.0
ge-glm104-pn-sw-8	192.168.0.28	255.255.255.0
ge-glm104-pn-sw-9	192.168.0.29	255.255.255.0
ge-glm104-pn-sw-10	192.168.0.30	255.255.255.0
Versamax-PNS-PNIO-1	192.168.0.55	255.255.255.0

After assigning Device Name and IP Address correctly, the Status will be in “Assigned” status.

Figure 224: Device Name and IP Address Set

Connection Settings

Connection: Ethernet 8

Refresh Device List

LAN: LAN01

Status: No Errors

Status	Device Name	IP Address	Vendor	Device Type
✓	ge-glm104-pn-sw-1	192.168. 0. 21	Intelligent Platforms	GE-GLM104-PN
✓	ge-glm104-pn-sw-2	192.168. 0. 22	Intelligent Platforms	GE-GLM104-PN
✓	ge-glm104-pn-sw-3	192.168. 0. 23	Intelligent Platforms	GE-GLM104-PN
✓	ge-glm104-pn-sw-4	192.168. 0. 24	Intelligent Platforms	GE-GLM104-PN
✓	ge-glm104-pn-sw-5	192.168. 0. 25	Intelligent Platforms	GE-GLM104-PN
✓	ge-glm104-pn-sw-6	192.168. 0. 6	Intelligent Platforms	GE-GLM104-PN
✓	ge-glm104-pn-sw-7	192.168. 0. 27	Intelligent Platforms	GE-GLM104-PN
✓	ge-glm104-pn-sw-8	192.168. 0. 28	Intelligent Platforms	GE-GLM104-PN
✓	ge-glm104-pn-sw-9	192.168. 0. 29	Intelligent Platforms	GE-GLM104-PN
✓	iolan-controller01	192.168. 0. 1	Intelligent Platforms	IC695PNC001
✓	versamax-pns-pnio-1	192.168. 0. 55	Intelligent Platforms	IC200PNS001

Filters (11/11)

☒ ✓ Assigned
 ☒ ✗ Assigned with errors
 ☒ ? Not assigned

Selection Properties

MAC Address: 00-05-65-72-FB-D0

Device Role: Device

Vendor ID: 015A

Device ID: 0104

IP Address: 192.168.0.21

Subnet Mask: 255.255.255.0

Gateway: 0.0.0.0

Identify Device

Edit Device

7.2.6 MRP Setting

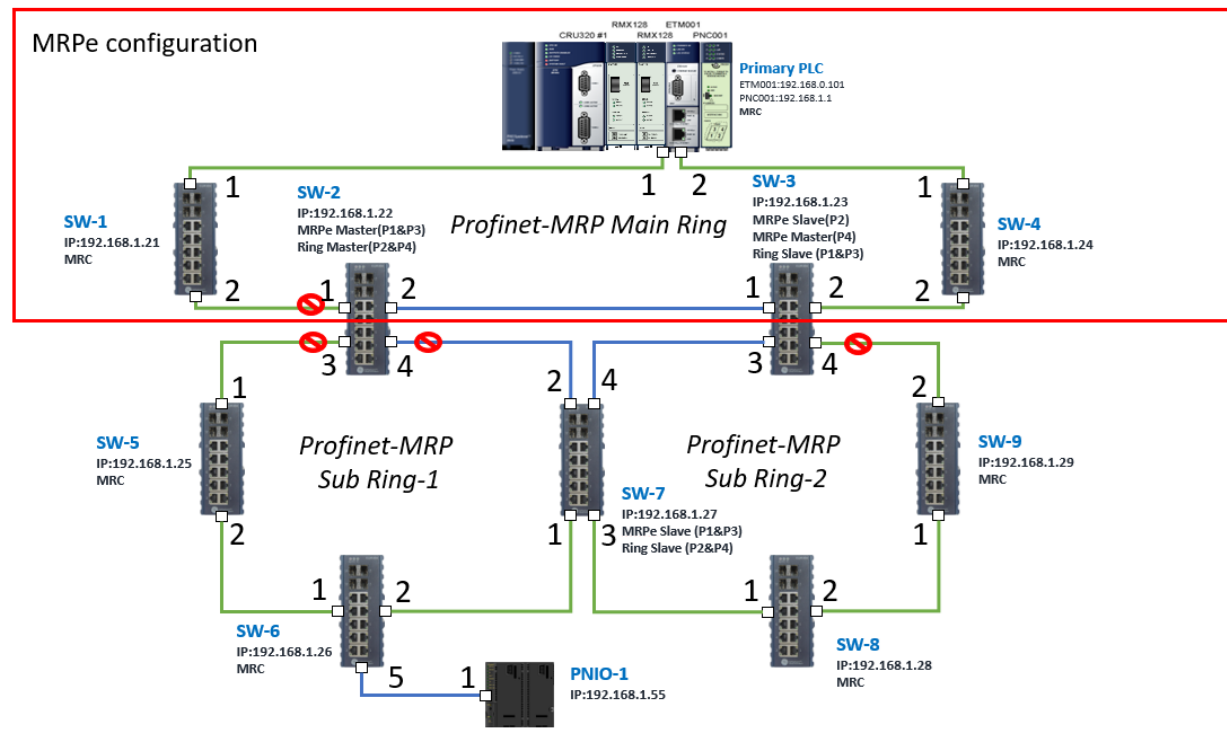
The steps to enable MRP functionality on the I/O controller and I/O devices will be the same for all components in the figure below. Refer to this section to configure SW1-SW10.

7.2.6.1 Profinet MRP Main Ring

We will be setting MRP for the I/O controller and I/O devices highlighted in the red box below.

First, configure the MRP in Profinet MRP Main Ring.

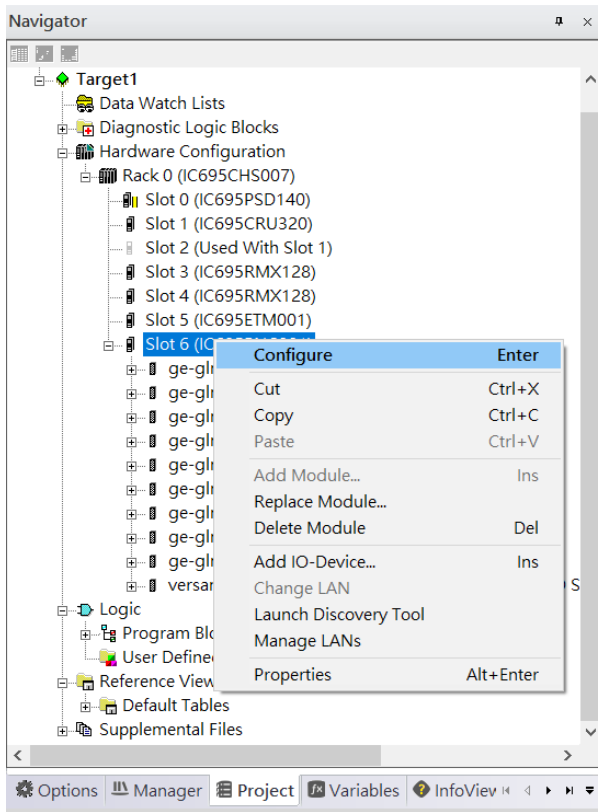
Figure 225: Pofinet MRP Main Ring



In order to enable the MRP function in the I/O controller, right-click the target and choose **Configure**.

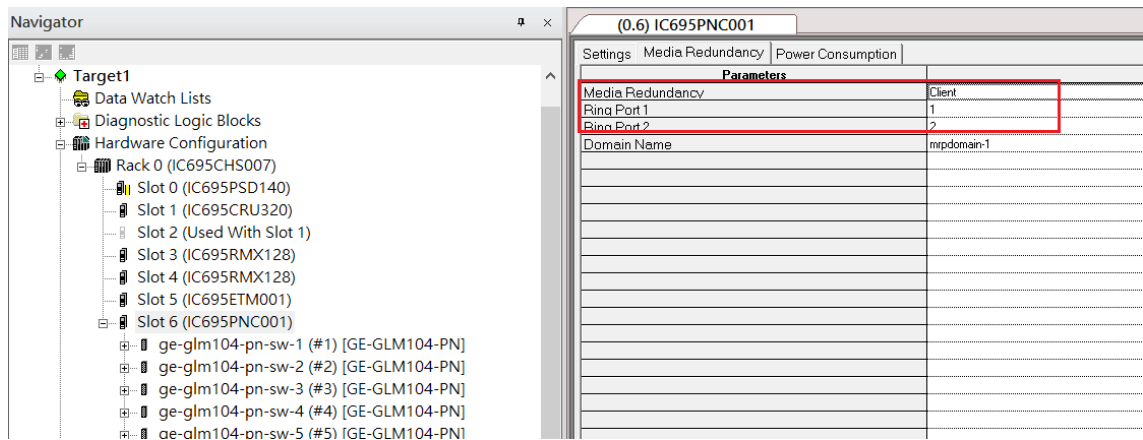
It will show “Media Redundancy” on the right window.

Figure 226: Configure



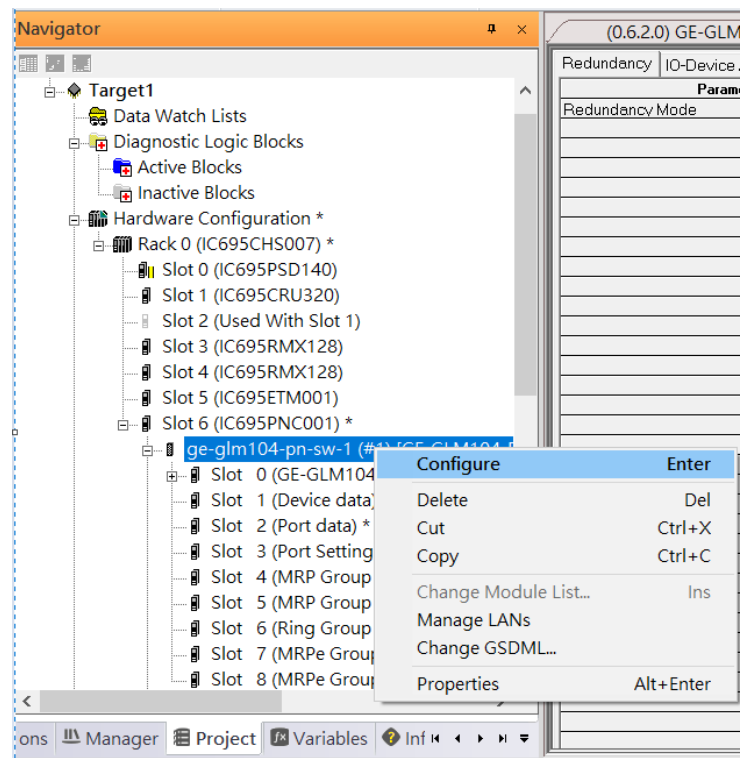
Enable the MRP function by changing the value of “Media Redundancy” to the client and select Ring Port 1 to 1, Ring Port to 2.

Figure 227: Media Redundancy Parameters



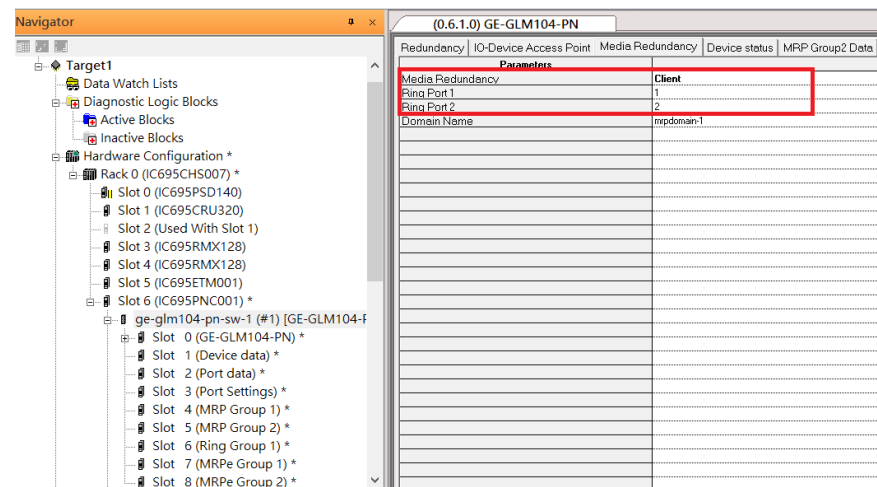
In order to enable the MRP function in SW1, click the right button and choose **Configure**. It will show “Media Redundancy” on the right window.

Figure 228: Media Redundancy Parameters



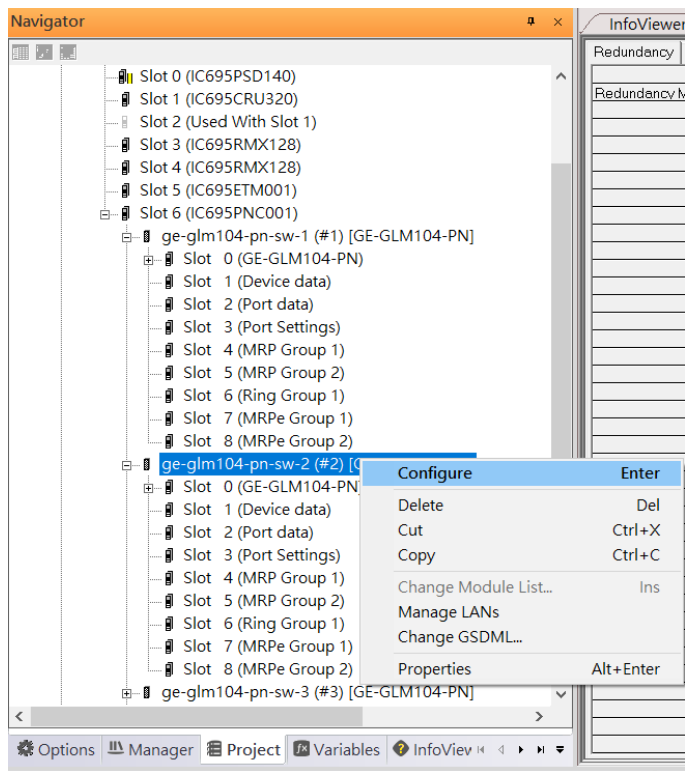
Enable the MRP function by changing the value of “Media Redundancy” to the manager and select Ring Port 1 to 1, Ring Port 2 to 2.

Figure 229: Media Redundancy Parameters



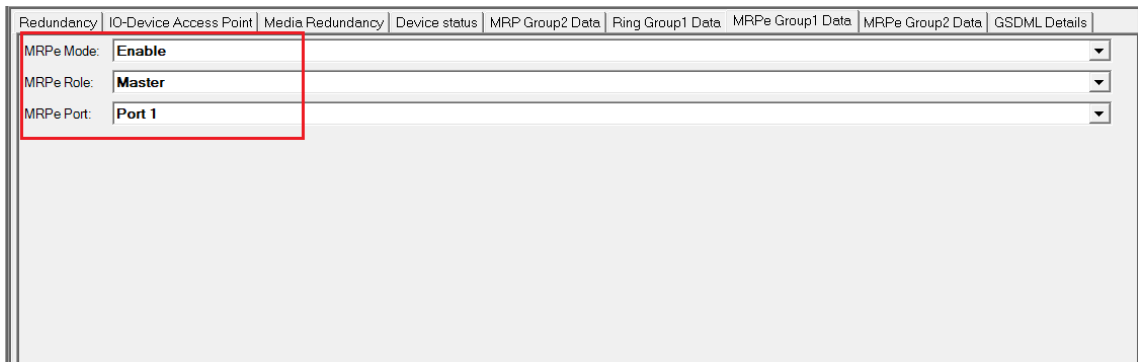
To enable MRPe functions in SW2, click the right button and choose **Configure**.

Figure 230: MRPe Functionality



Enable MRPe functionality by changing the value of “MRPe Group1 Data” to Master and select **MRPe Port** to **Port 1**.

Figure 231: MRPe Functionality



7.2.6.2 SW3

To enable MRPe functions in SW3, click the right button and choose **Configure**.

Enable MRPe function by changing the value of “MRPe Group1 Data” to Slave and select **MRPe Port** to **Port 2**.

Figure 232: MRPe Group1 Data

Redundancy	IO-Device Access Point	Media Redundancy	Device status	MRP Group2 Data	Ring Group1 Data	MRPe Group1 Data	MRPe Group2 Data	GSDML Details
MRPe Mode:		Enable						▼
MRPe Role:		Slave						▼
MRPe Port:		Port 2						▼

7.2.6.3 SW4

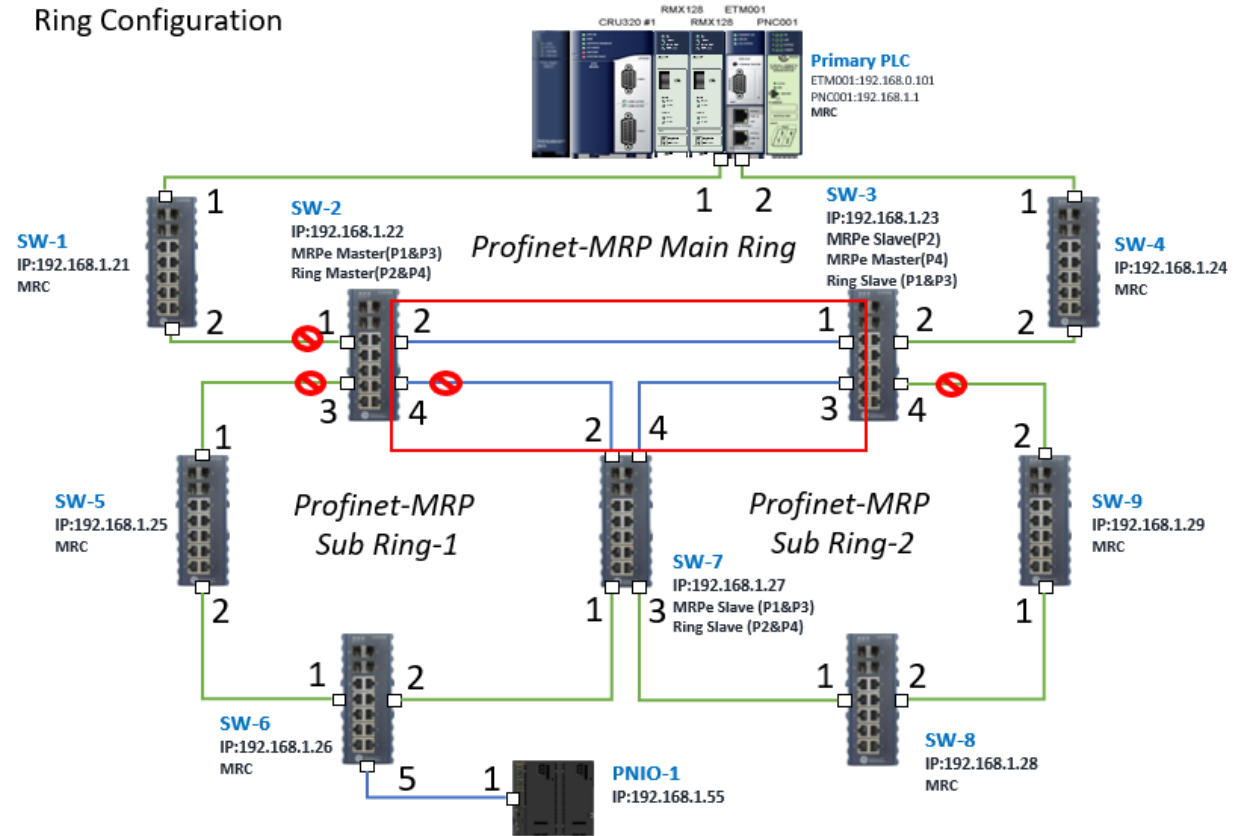
To enable MRP function in SW4, click the right button and choose **Configure**. It will show “Media Redundancy” on the right window.

Enable MRP function by changing the value of “Media Redundancy” to the client and select **Ring Port 1** to 1, **Ring Port 2** to 2.

7.2.6.4 Ring in Profinet Main Ring

Next, we configure the Ring in Profinet Main Ring (blue line in the box).

Figure 233: Ring in Profinet Main Ring



7.2.6.4.1 Configuring SW2, SW3, and SW7

To enable Ring functionality for SW2, SW3, and SW7, right-click and choose **Configure**. Enable the Ring function by changing the values to match the table below.

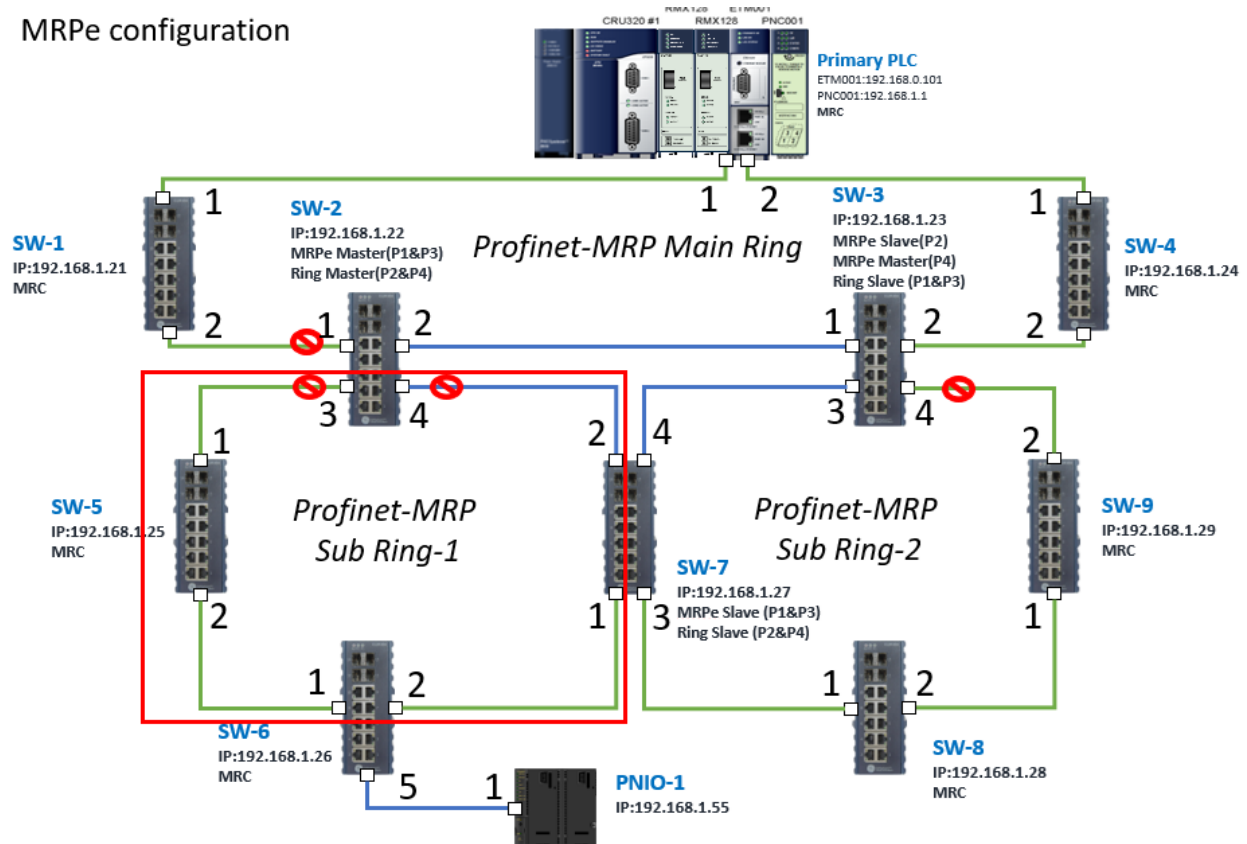
SW Name	Ring Group1 Data	Ring Group Port1	Ring Group Port 2
SW2	Master	Port 2	Port 4
SW3	Slave	Port 1	Port 3
SW7	Slave	Port 2	Port 4

7.2.6.5 MRPe in Profinet MRP Sub Ring-1

Then configure the MRPe in Profinet MRP Sub Ring-1 (green line in the box).

Figure 234: MRPe in Profinet MRP Sub Ring-1

MRPe configuration



7.2.6.5.1 Configuring SW2, SW5, SW6, and SW7

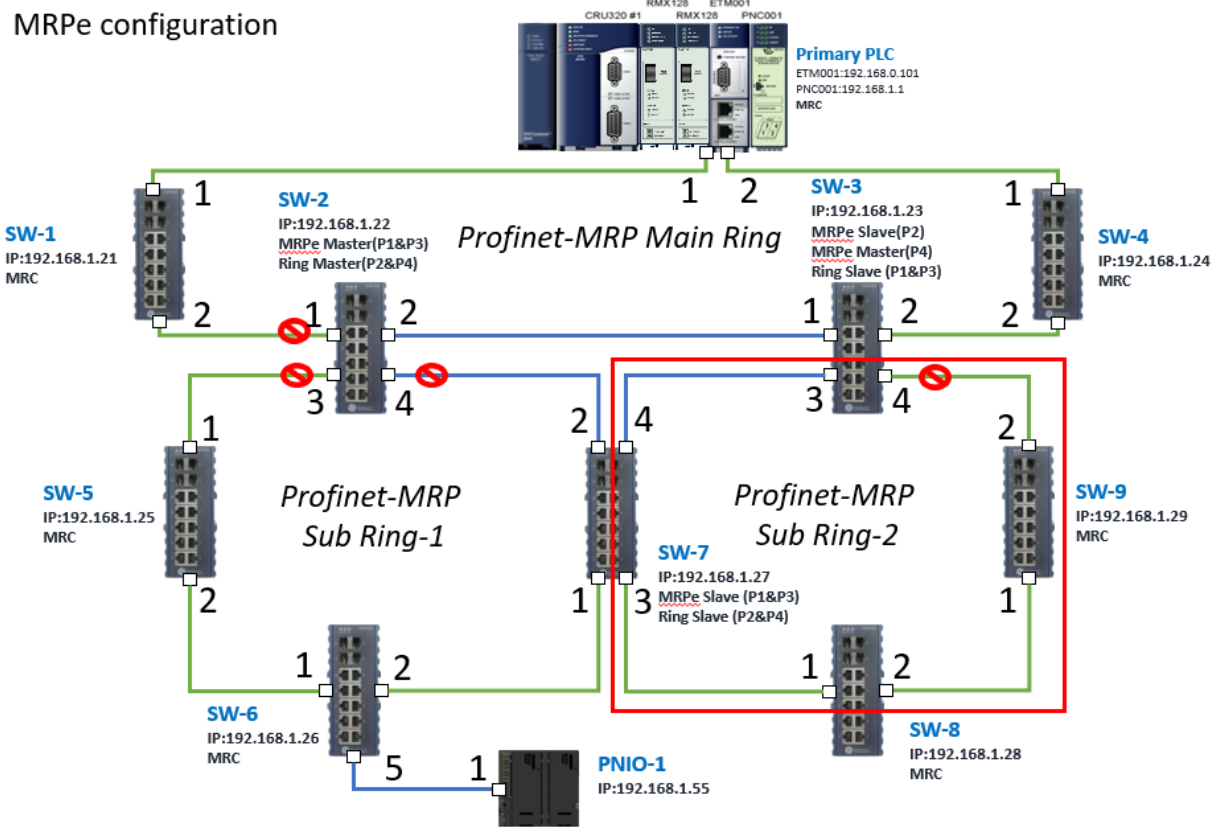
To enable Ring functionality for SW2, SW3, and SW7, right-click and choose **Configure**. Enable Ring function by changing the values to match the table below.

SW Name	MRPe Group1 Data	MRPe Group2 Data	Ring Group Port1	Ring Group Port 2
SW2	Master	-	Port 3	-
SW5	-	Manager	Port 1	Port 2
SW6	-	Client	Port 1	Port 2
SW7	Slave	-	-	-

7.2.6.6 MRPe in Profinet MRP Sub Ring-2

Next, we configure the MRPe in Profinet MRP Sub Ring-2 (green line in the box).

Figure 235: MRPe in Profinet MRP Sub Ring-2



7.2.6.6.1 Configuring SW7, SW8, and SW9

To enable Ring functionality for SW7, SW8, and SW9, right-click and choose **Configure**. Enable Ring function by changing the values to match the table below.

SW Name	Media Redundancy	MPRe Group1 Data	MRPe Group2 Data	MRPe Port	Ring Group Port1	Ring Group Port 2
SW3	-	Master	-	Port 4	-	-
SW7	Client	-	-	-	Port 1	Port 2
SW8	Client	-	-	-	Port 1	Port 2
SW9	Client	-	-	-	Port 1	Port 2

7.2.7 Network Setting

To establish the communication to the I/O Controller from PAC Machine Edition, the interface of the I/O Controller shall be specified.

It should be noted that there is only 1 I/O Controller (Primary or Secondary) can communicate with PAC Machine Edition. Therefore, there are 3 rules of communication that are defined.

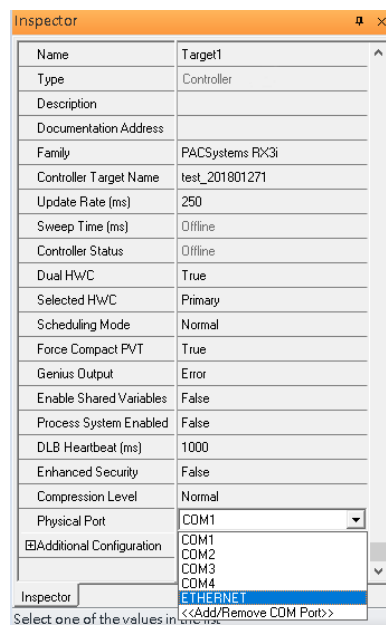
I/O Controller Communication Rule

Rule	Description
1	The communicated I/O Controller shall be specified. Click primary or secondary hardware configuration, click the right button, and select Set as Selected HWC .
2	During the communication, the cable shall be connected to the ETM001 in specified hardware (Primary or Secondary)
3	Specify the interface and IP address for communicated I/O Controller

For rule 3, click **Target 1** and Select **Property**.

In the **Inspector** pane, change the value of **Physical Port** to **Ethernet**.

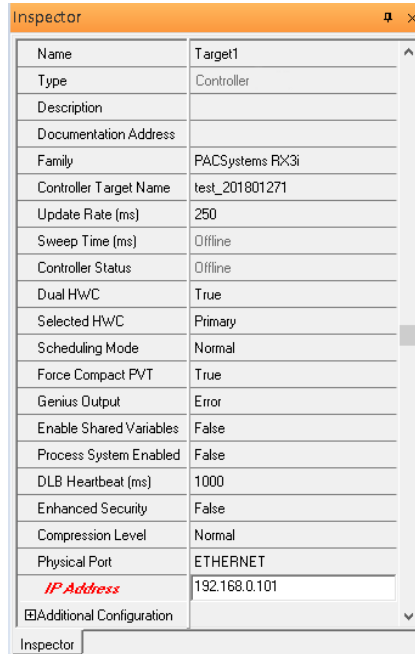
Figure 236: Changing the Physical Port Parameter



Also, the IP address of communicated I/O Controller shall be set. Here the **Primary** setting is shown.

Note that the specified IP address is set as the IP address on ETM001.

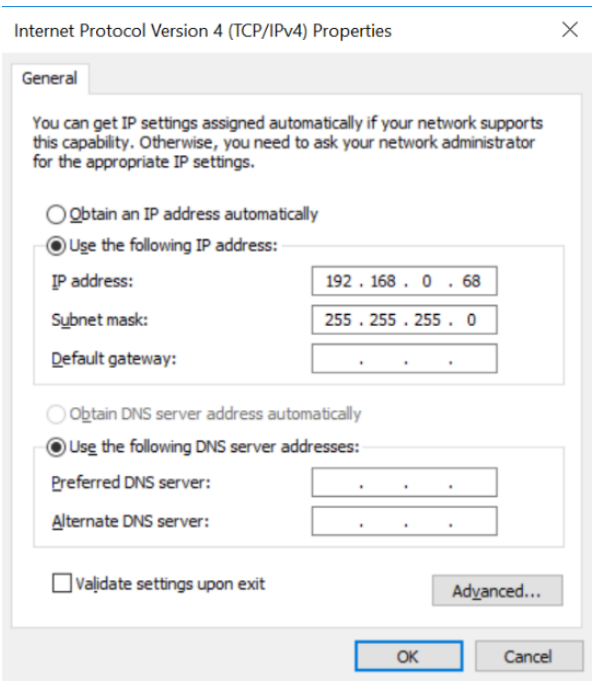
Figure 237: Specified IP Address Appears



7.2.8 PC Network

The IP address of the PC with PAC Machine Edition shall be set in the same network area.

Figure 238: Setting the IP Address of the PC with PME

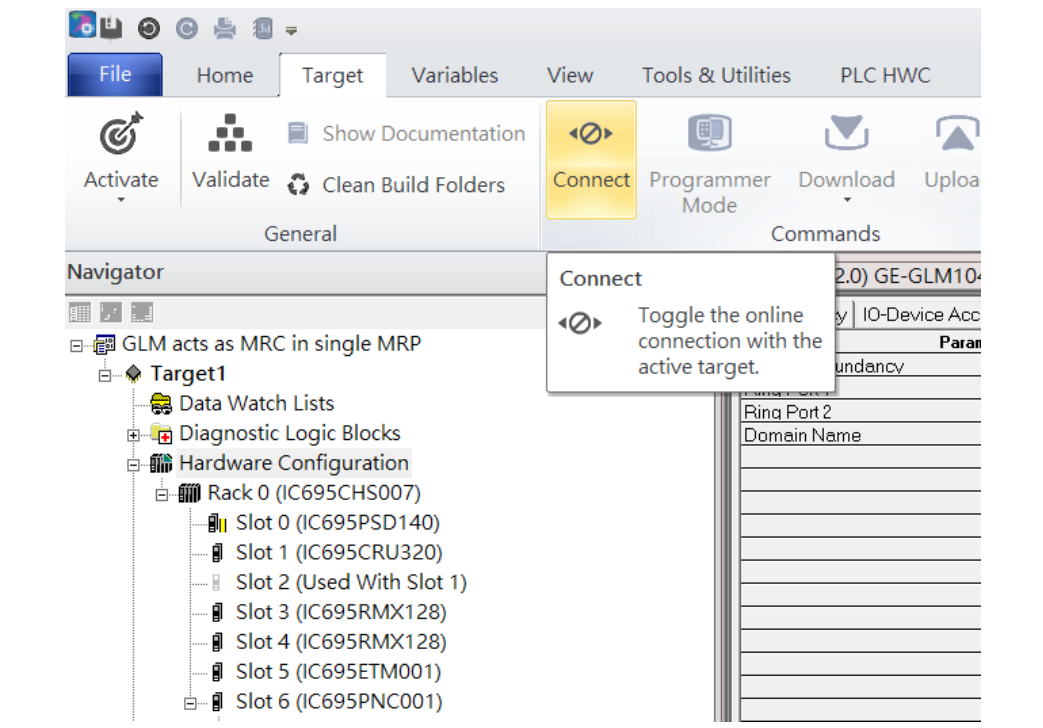


Note: For ETM configuration, please consult GFK-2224 PACSystems Rx3i TCP/IP Ethernet Communications User Manual

7.3 Implementation

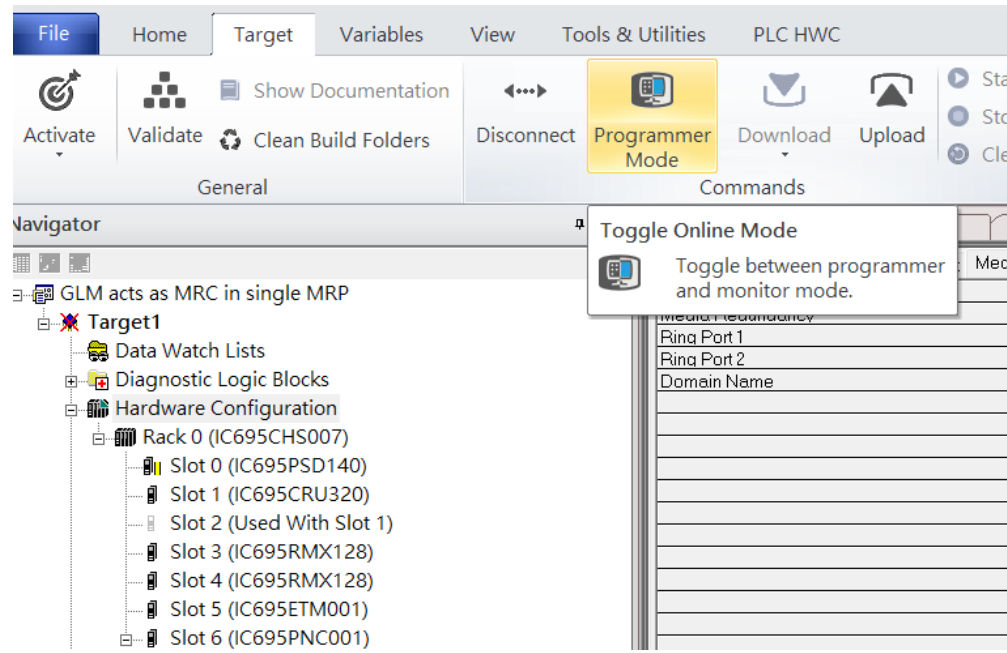
To download the configuration to hardware, the following steps shall be applied.
First, press the **Connect** icon.

Figure 239: Connecting to Target



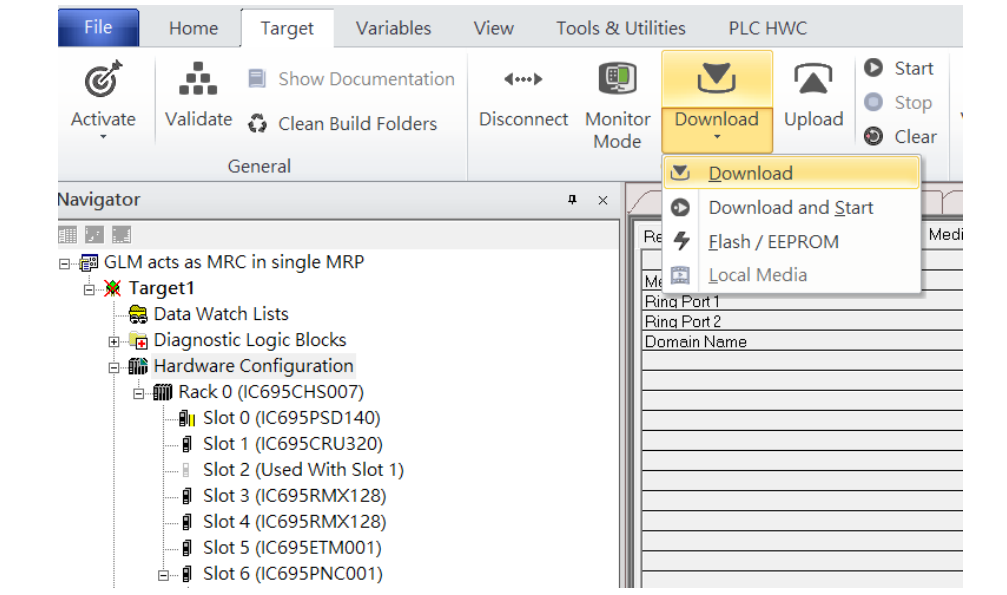
Then press the icon **Programmer Mode**.

Figure 240: Programmer Mode



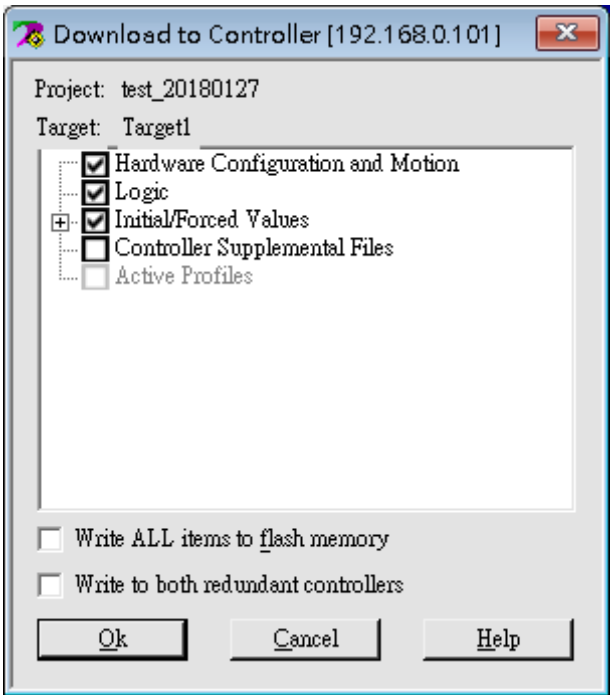
Then press the icon **Download** and select **Download**.

Figure 241: Download



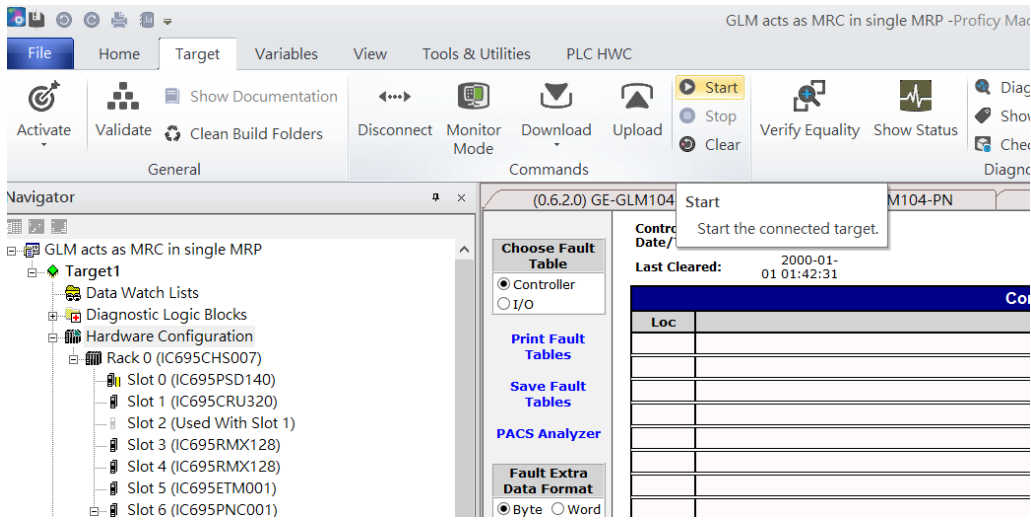
Then the dialogue is appeared to make sure the initialization procedure, select **OK**.

Figure 242: Download to Controller



After downloading completely, press the icon **Start** to active PLC. Note: After downloading completely, switch CRU320 to **Run I/O Enable** and select **OK**. If PLC has started successfully, a message “The Controller was successfully started”.

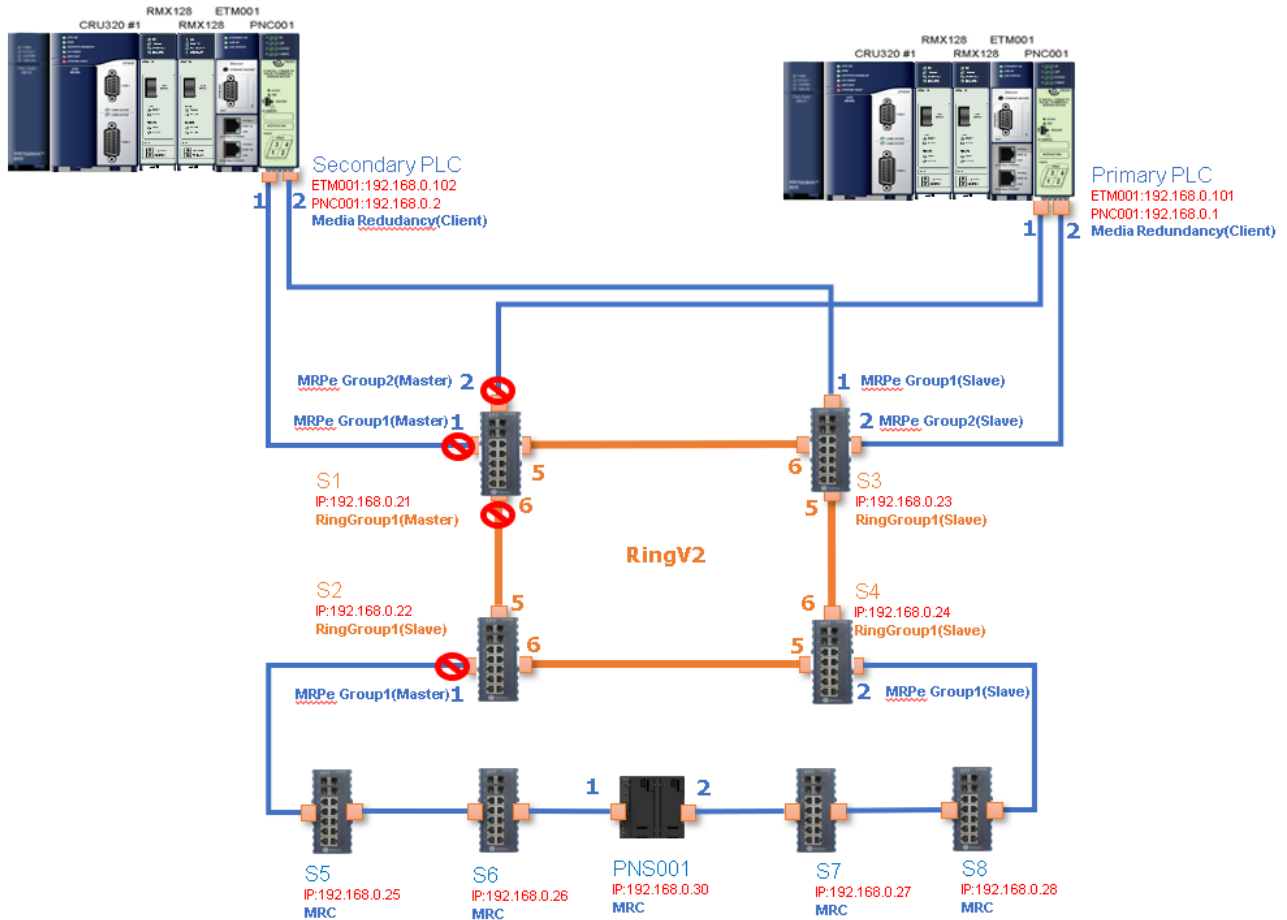
Figure 243: Start



Section 8 PROFINET System Redundancy

8.1 Network Topology

Figure 244: PROFINET System Redundancy



8.2 Hardware Configuration

On the 2 CRU320s, the I/O data can be set to “STOP”, “RUN OUTPUT DISABLE” or “RUN I/O Enable” states by a switch embedded on CRU320. During the configuration, the switches on both 2 CRU320s must be set to “STOP”

8.2.1 Project Open

To start the software PAC Machine Edition, please follow the steps below:

1. Click **Start -> Emerson -> PAC Machine Edition -> PAC Machine Edition**
2. Select the empty project and click **OK**.
3. Set the project name and click **OK**.

Figure 245: Create a new project

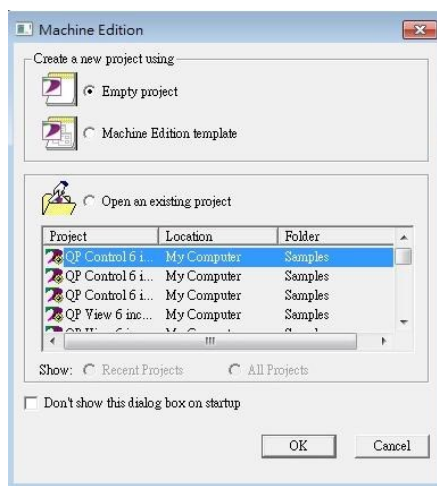
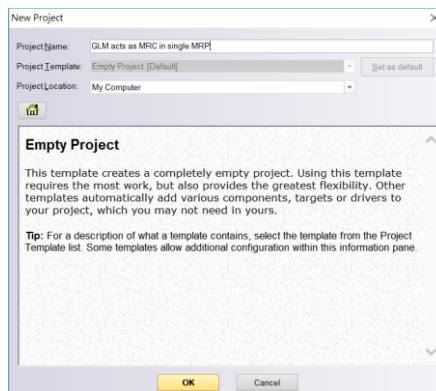


Figure 246: New Project Name



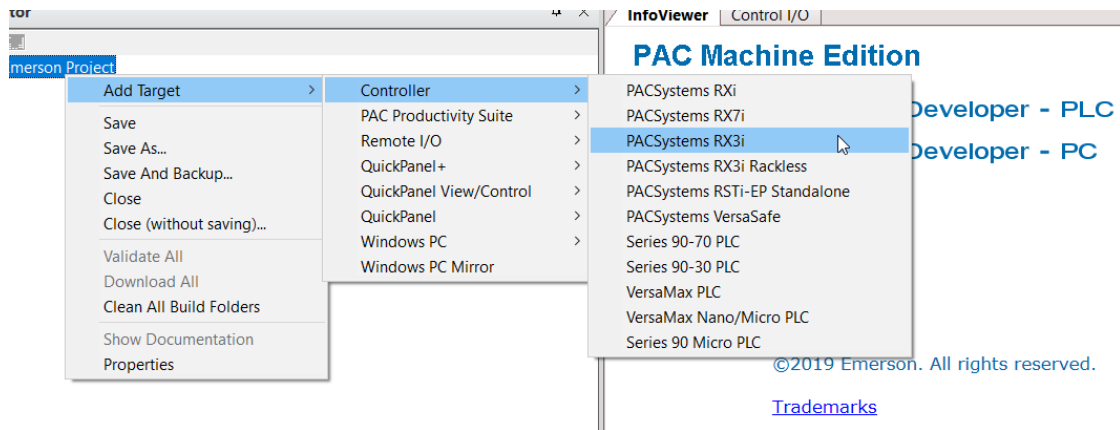
8.2.2 I/O Controller Setting

The next step is to add a target for this project.

Click right button on project name “test_20150127” and select **Add Target -> Controller -> PACSystems RX3i**.

The PACSystems RX3i is the I/O Controller to be tested. See the following picture.

Figure 247: Adding I/O Controller



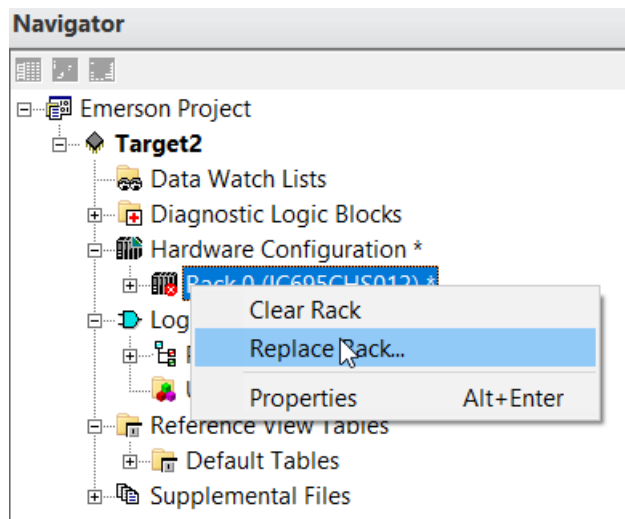
Originally the I/O Controller is described as the rack with 12 slots, each slot can be regarded as the chassis for device installation such as a power card, communication module, or bus controller.

However, there are only 7 chassis that can be used in the I/O Controller CRU320. Thus, replace the rack with 7 slots.

Right-click on “Rack 0 (IC695CHS012)” and select **Replace Rack**.

Select “IC695CHS007” and click **OK**.

Figure 248: Replace Rack



After the rack and the number of slots are defined, select the corresponding devices into the slots according to the I/O Controller. The following picture is the current installation for each device on the I/O Controller

Figure 249: Rack Configuration



From left to right, the installed devices on the I/O Controller are

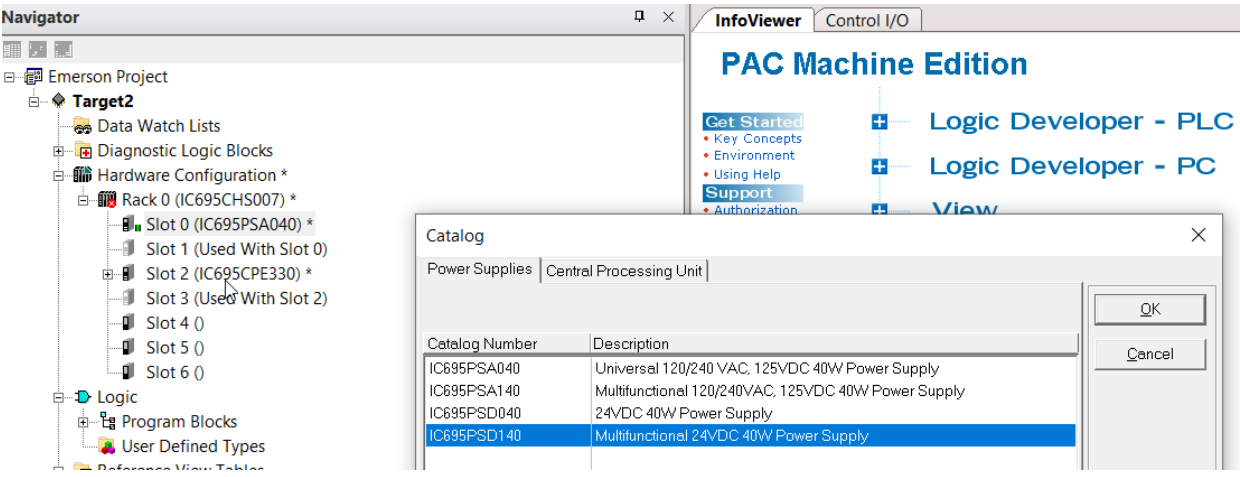
Devices on I/O Controller

Device Type	Device Name	Chassis index
Power Card	PSD140	0
Central Processing Unit	CRU320	1 ~ 2
Communication Module	RMX128	3
Communication Module	RMX128	4
Communication Module	ETM001	5
Bus Controller	PNC001	6

Now, add the module into the slots by the current devices on the I/O Controller, the chassis index is corresponding to the slot index.

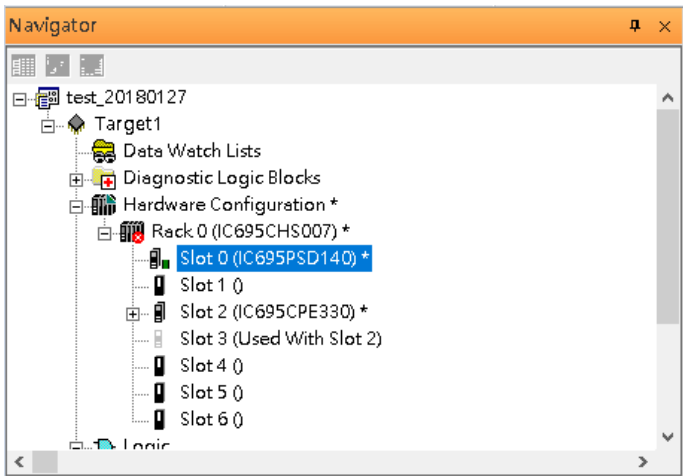
First, replace the power card. Click slot 0 and click the right button, select **Replace Module**, and specify the installed power card, PSD140, then click **OK**.

Figure 250: Replace Module



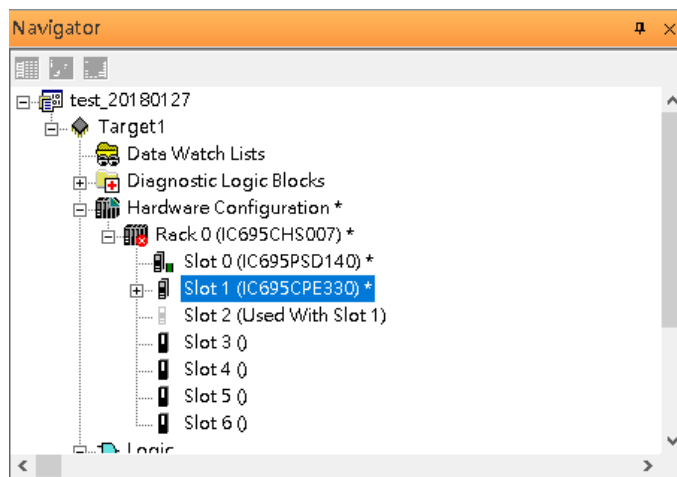
Slot 0 is replaced by the current power card, PSD140.

Figure 251: PSD140



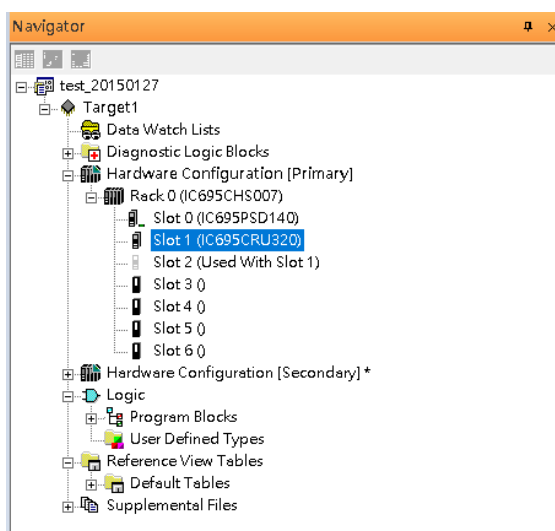
For slot 1 and 2, 2 chassis (1 and 2) is occupied by the Central Processing Unit, CRU320. To integrate slots 1 and 2, pull slot 2 to slot 1. Slot 2 is now clear.

Figure 252: Integrate Slot 1 and 2



To select the Central Processing Unit, click slot 1 and click the right button, select **Replace Module** to choose CRU320. Now the CRU320 is specified.

Figure 253: CRU320 is Now Specified



Note, for redundancy, the current hardware configuration is defined as **Primary**: Hardware Configuration **Primary**. Therefore, the secondary hardware is created as well.

Figure 254: CRU320 Parameters

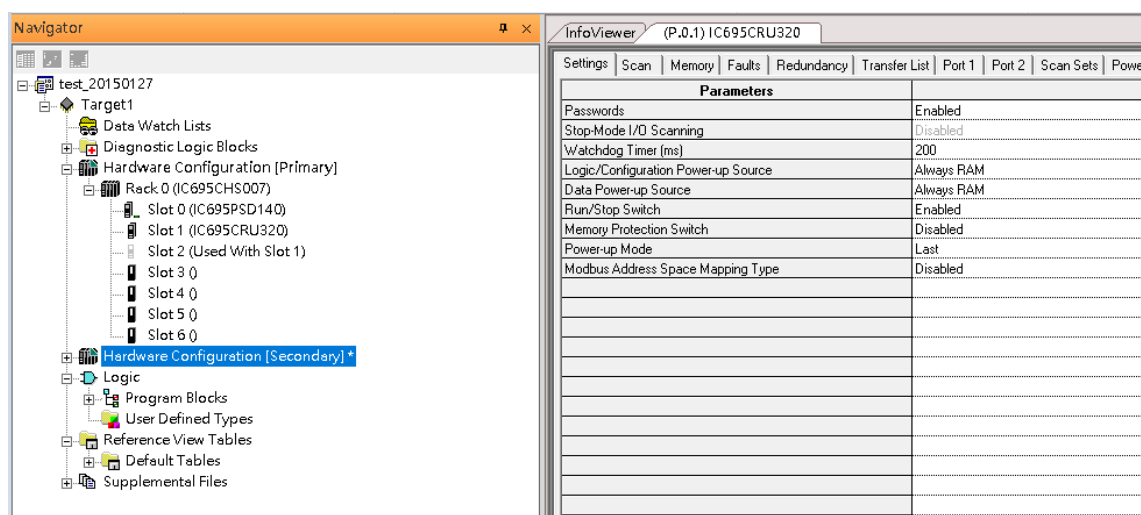


Figure 255

8.2.2.1 Sot 3

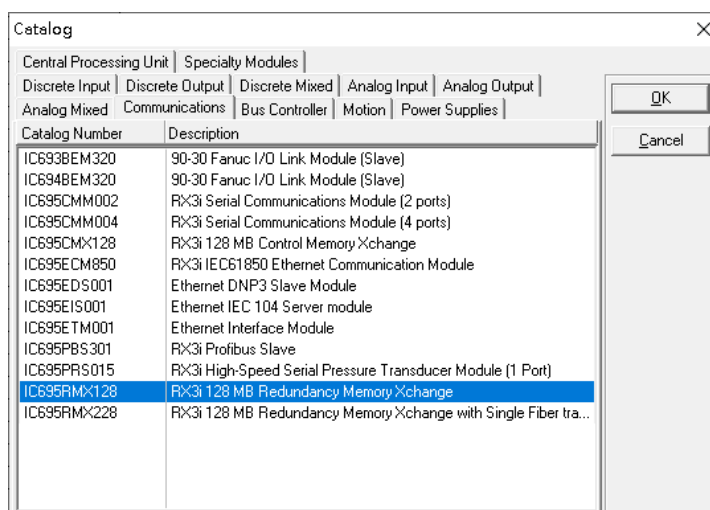
Next is to add the RMX128 module for slot 3.

Click the right button on slot 3, and select **Add Module**.

According to the current installation on the I/O Controller, the RMX128 shall be selected.

Select **Communications-> IC695RMX128** and click **OK**.

Figure 256: Select RMX128



Now the RMX128 is ready on slot 3.

8.2.2.2 Slot 4

Next, select RMX128 for slot 4.

Click the right button on slot 4, select **Add Module**, select **Communications** -> **IC695RMX128**, and click **OK**.

8.2.2.3 Slot 5

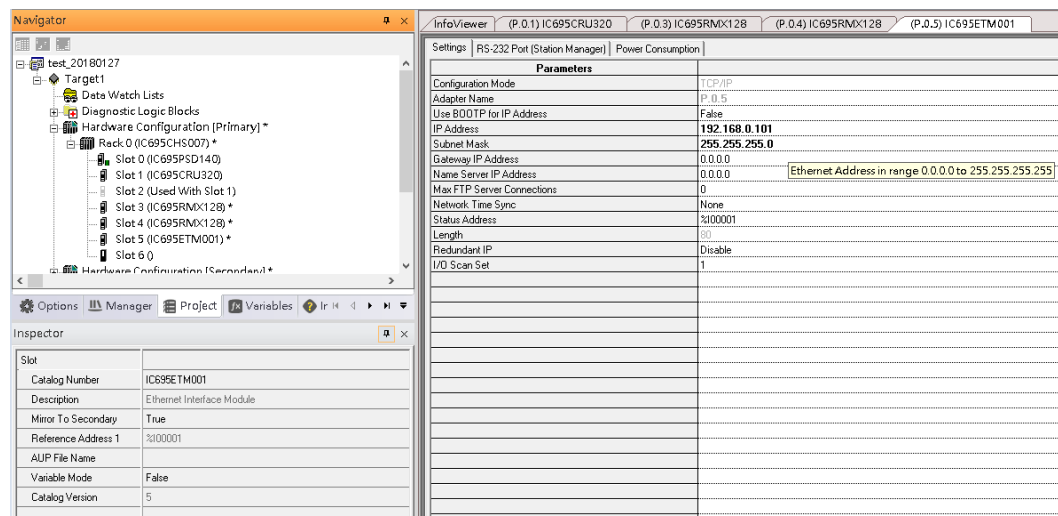
Next, select ETM001 for slot 5.

Click the right button on slot 5, select **Add Module**, select **Communications**-> **IC695ETM001**, and click **OK**.

It should be noted that the ETM001 is the management device for PAC Machine Edition. The communication interface is the Ethernet network. The IP address and Subnet Mask shall be specified.

In the following picture, the IP address 192.168.0.101 and mask 255.255.255.0 is specified on ETM001.

Figure 257: ETM001 Parameters



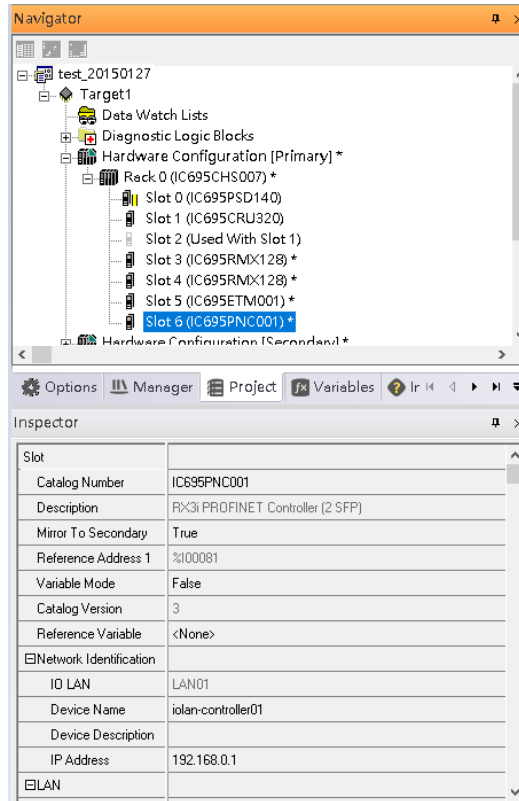
8.2.2.4 Slot 6

Next, select PNC001 for slot 6.

Click slot 6 and click the right button, select **Add Module**, specify the installed Bus Controller, PNC001, and click **OK**.

Now all the devices on the I/O Controller are ready on the slots on the rack, the following picture is the current status, and we shall save it.

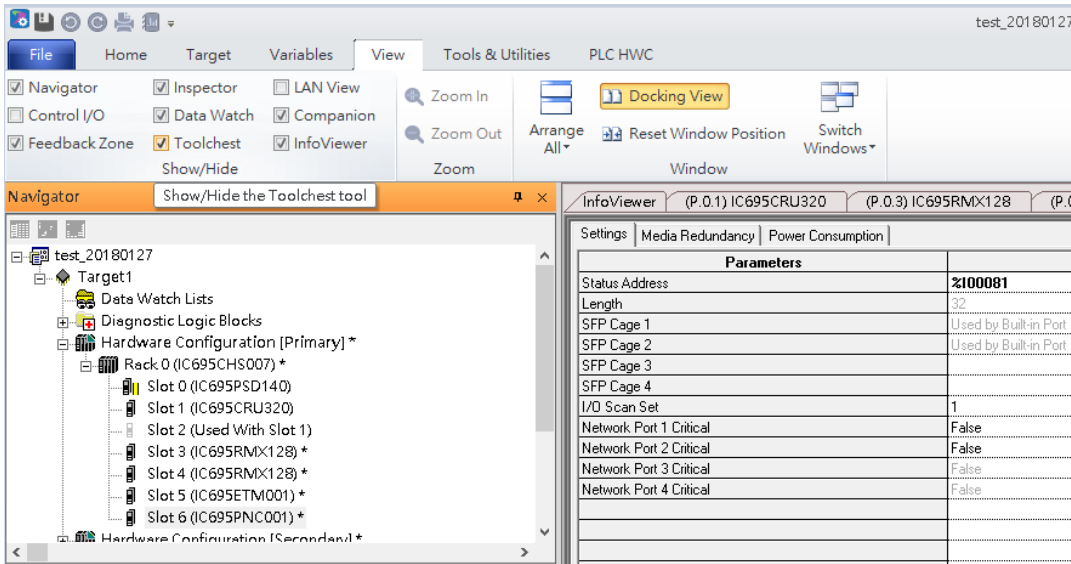
Figure 258: Final Configuration



8.2.3 I/O Device Setting

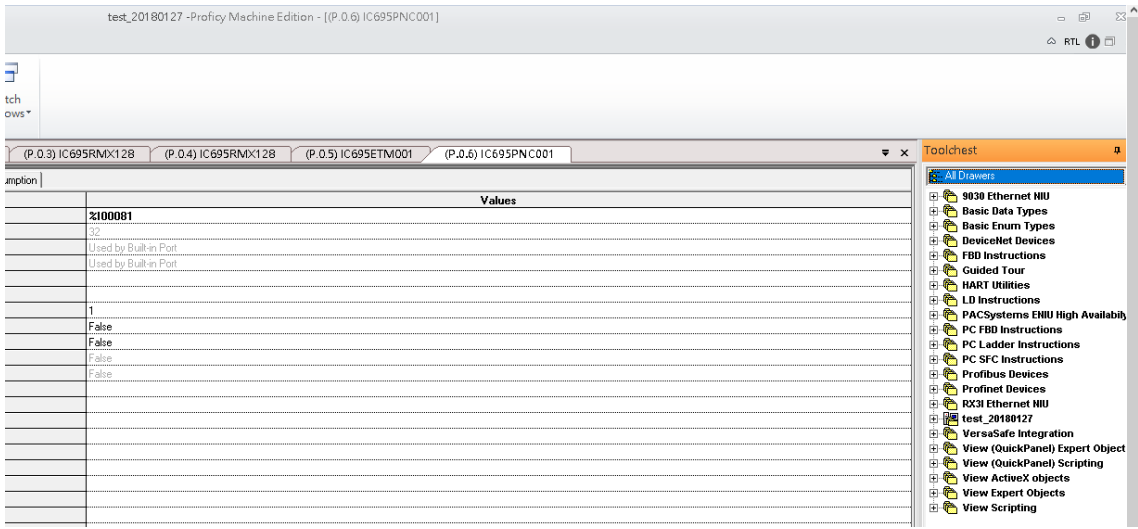
This section introduces the I/O Device integration. To configure the I/O Device, the GSDML file is necessary. Now we create another interface to load the GSDML file by using Toolchest.

Figure 259: Toolchest Button Location



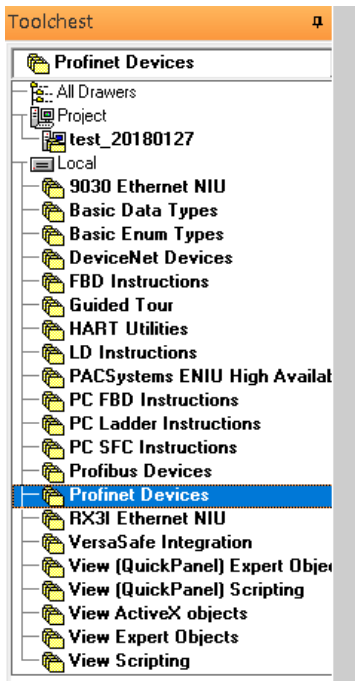
As shown in the following picture, a new interface is created on the right-hand side.

Figure 260: Toolchest Panel



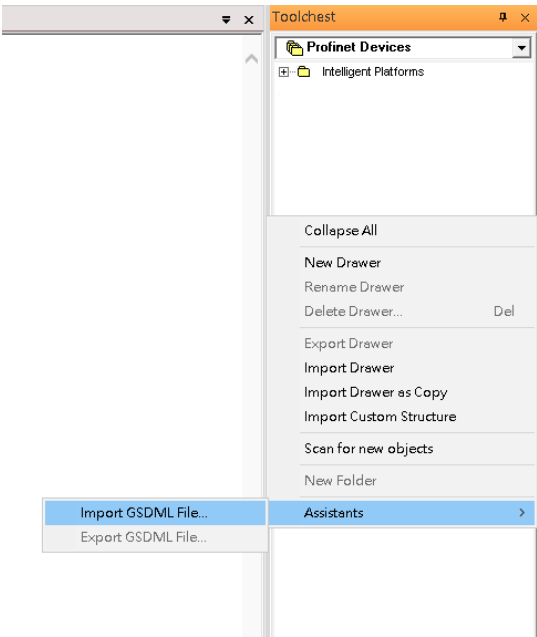
Select Profinet Devices.

Figure 261: Select PROFINET Devices

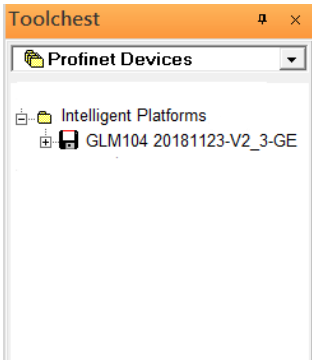


Click right button, select **Assistants** -> **Import GSDML File**.

Figure 262: Import GSDML File

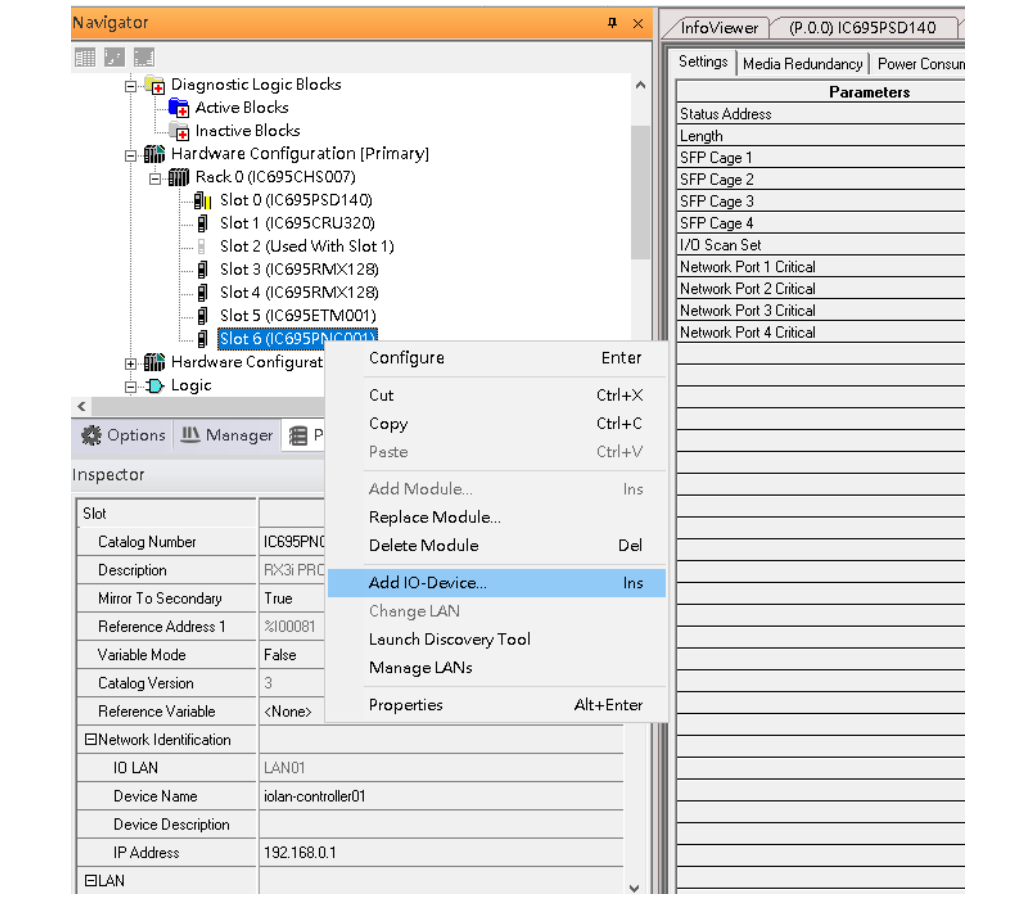


Select the GSDML File.
Then the corresponding I/O Device of the GSDML File is added to the **Toolchest**.



The I/O Device is connected to the Bus Controller on the I/O Controller. Click the slot 6 and click the right button to add the I/O Device on the PNC001

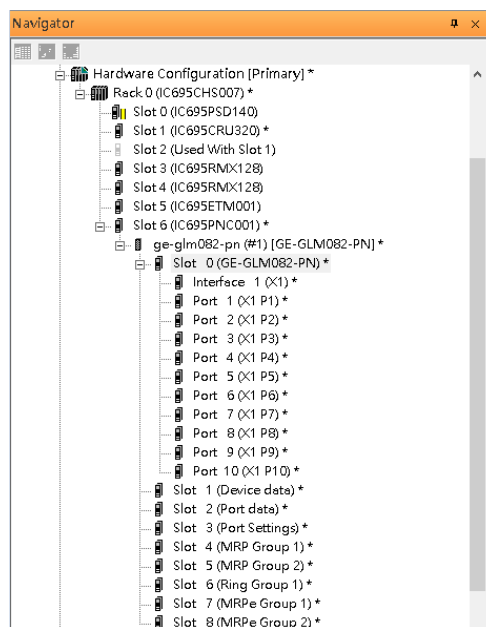
Figure 263: Add I/O Device



Select the specified I/O Service **GLM082 20181123-V2_3-GE -> GE-GLM082-PN** and click **OK**.

Now the I/O device GLM082 is ready and is a sub-slot on PNC001.

Figure 264: GLM082 is Now Configured

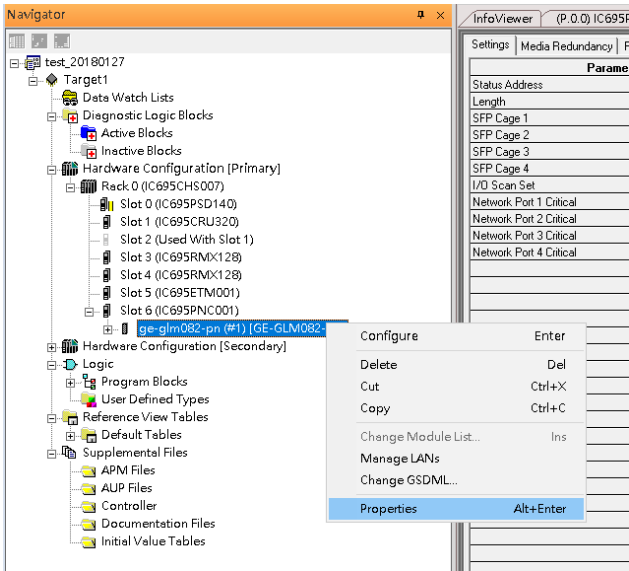


8.2.4 DCP Set Command

To configure the setting or monitor the status of the I/O Device, the communication interface is also based on an Ethernet network. We can specify the IP address and the device name from I/O Controller via the DCP (Discovery and Configuration Protocol).

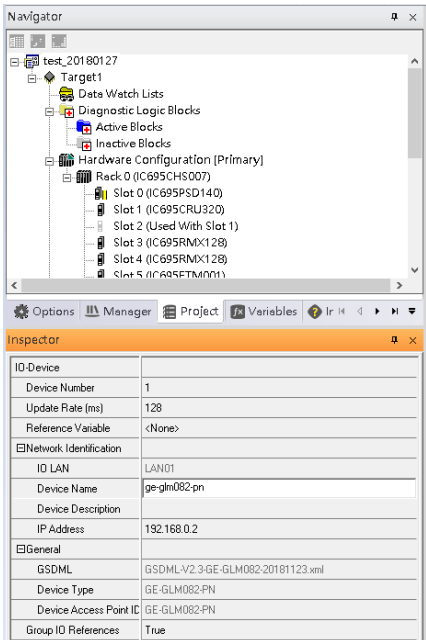
Under slot 6, PNC001, select the I/O Device, GLM082, and click the right button.

Figure 265: Properties



Select **Properties**, see the following picture.

Figure 266: Inspector Panel



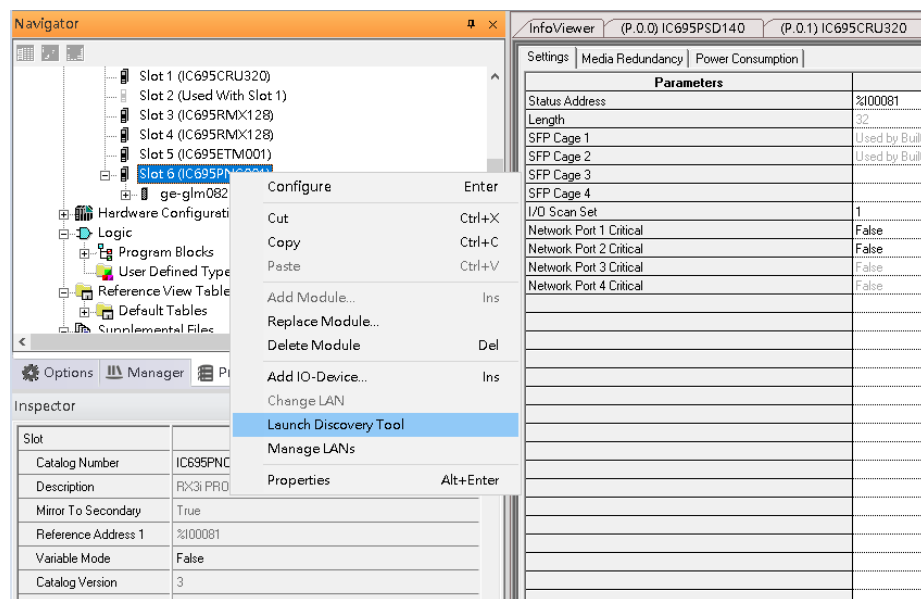
In this table, the I/O Device name can be specified in the field **Device Name**, and the IP address can be set in the field **IP address**. We modify the device name to “ge-glm082-pn-02” then we use I/O Device Discovery Tool to observe an I/O Device and set I/O Device’s name to “ge-glm082-pn-02” later.

It should be noted that both the **Properties** of the I/O Device shall be synchronized between **Primary** and **Secondary** hardware configurations. The DCP setting will be effective when all the configurations are downloaded to the hardware from the **Primary** hardware configuration.

8.2.5 I/O Device Scan

The PAC Machine Edition also supports the function to scan the connected I/O Devices. First, the observed I/O Device shall be connected to the ETM001 on the **Primary** hardware configuration, then using the function **Launch Discovery Tool**.

Figure 267: Launch Discovery Tool



The tool is shown in the following picture, then press **Refresh Device List**.

Then the connected I/O Device is listed in the following table.

Figure 268: Unassigned Device

Connection Settings

Connection: 以太网2

LAN: LAN01

Status: No Errors

Status	Device Name	IP Address	Vendor	Device Type
?	ge-glm082-pn	192.0.2.1	Intelligent Platforms	GE-GLM082-PN

Filters (1/1)

- ☒ Assigned
- ☒ Assigned with errors
- ☒ Not assigned

Selection Properties

MAC Address: 00-05-65-73-F9-1A

Device Role: Device

Vendor ID: 015A

Device ID: 0082

IP Address: 192.0.2.1

Subnet Mask: 255.255.255.0

Gateway: 0.0.0.0

Identify Device

Edit Device

There is an I/O Device named “ge-glm082-pn” whose status is in “Not assigned”. We need to change its device name to **ge-glm082-pn-02** and IP address to **192.168.0.2** as the previous configuration in Figure 37.

Click **Edit Device**, set Device Name to “ge-glm082-pn-02” and click the **Set Device Name** button, then set IP Address to “192.168.0.2”, Subnet Mask to “255.255.255.0” and click **Set IP Information** button.

Figure 269: GLM082-PN Properties

GLM104-PN Properties

Vendor Name: Intelligent Platforms

MAC Address: 00-05-65-72-FB-D0

Device Type: GE-GLM104-PN

Vendor ID: 015A

Device ID: 0104

Device Role: Device

Identify Device

Device Name

ge-glm104-pn-sw-1

Set Device Name

IP Address

IP Address: 192.168.0.21

Subnet Mask: 255.255.255.0

Gateway: 0.0.0.0

Set IP Information

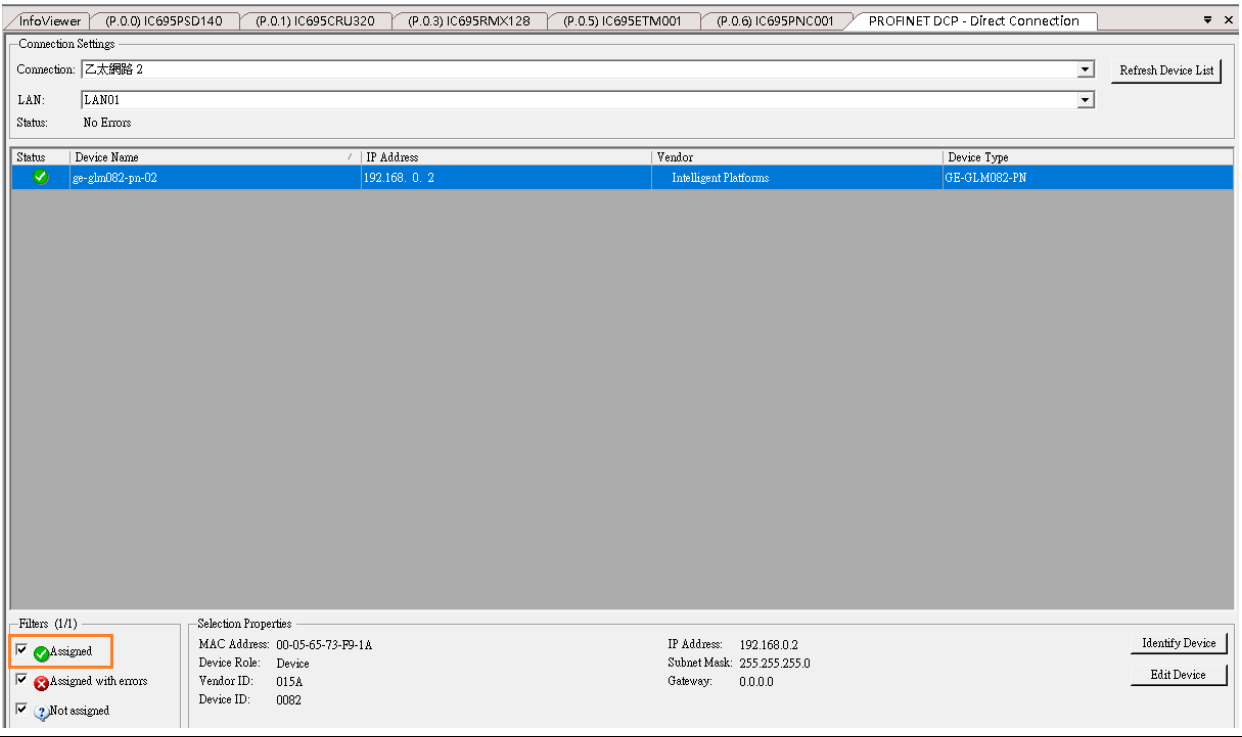
Reset device to factory settings

Reset Device

Exit

After assigning Device Name and IP Address correctly, the Status will be in “Assigned” status.

Figure 270: Status "Assigned"



8.2.6 MRP Setting

This example will show how to use RingV2 and MRPe to set up the network topology which can support system redundancy and media redundancy.

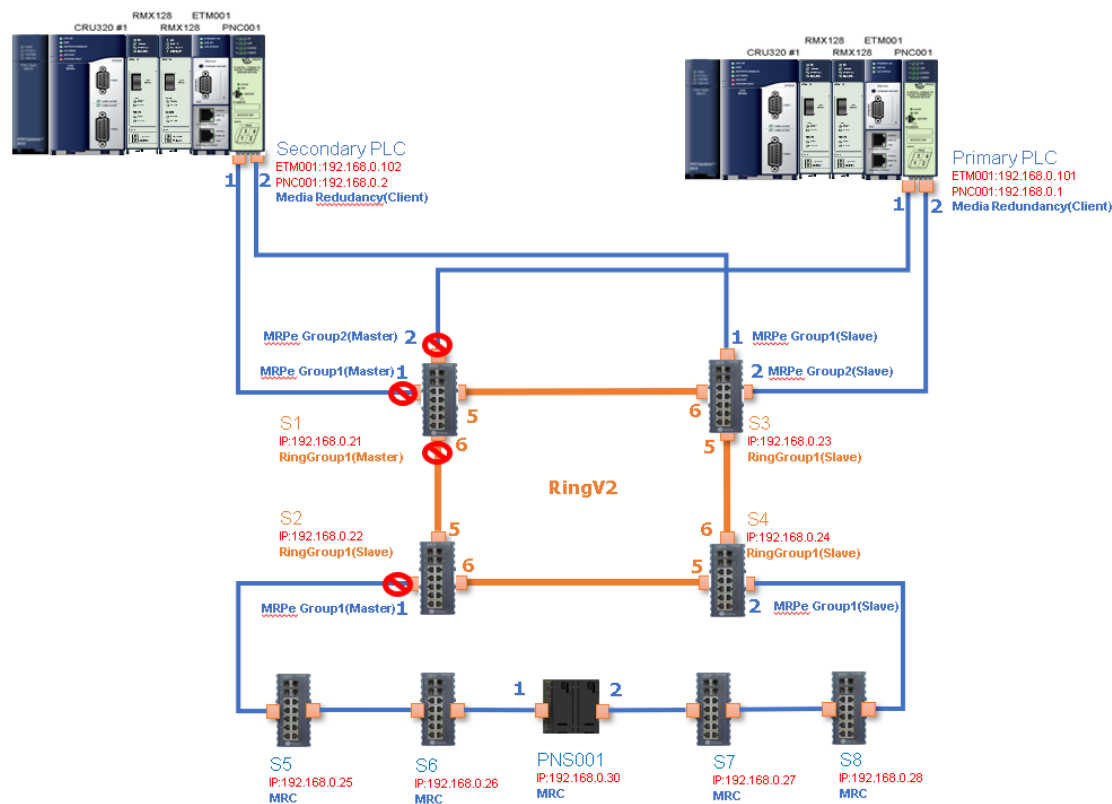
In this network topology shown in the figure below, switch ports 5,6 of Switch S1, S2, S3, and S4 will use RingV2 to protect the link in the ring. Switch S1 runs as RingV2 Master role, Switch S2, S3 and S4 runs as RingV2 Slave role. In the normal state, Master will block one of its ring ports for preventing a broadcast storm in the ring. If any link between these 4 switches fails, the Master will set this blocked port to a forward state, so the traffic will resume soon.

Switch port 2 of Switch S1 and S3 connect to Primary PLC by using MRPe to protect the links. In this link, Primary PLC runs as MRC, MRPe Group2(Master) will manage port 2 of Switch S1. MRPe Group2(Master) will set port2 of Switch S1 to be blocked in the Normal state. If MRPe Group2(Master) detects a link failure, it will set port2 of Switch S1 to forwarded.

Switch port 1 of Switch S1 and S3 connect to Secondary PLC by using MRPe to protect the links. MRPe Group1(Master) will manage port 1 of Switch S1. MRPe Group1(Master) will set port1 of Switch S1 to be blocked in the Normal state. If MRPe Group1(Master) detects a link failure, it will set port1 of Switch S1 to forwarded.

Switch port 1 of Switch S2 and Switch port 2 of Switch S4 connect to 5 MRC Devices by using MRPe to protect the links. MRPe Group1(Master) will manage port 1 of Switch S2. MRPe Group1(Master) will set port1 of Switch S2 to be blocked in Normal state. If MRPe Group1(Master) detects link-failure, it will set port1 of Switch S2 to forwarded.

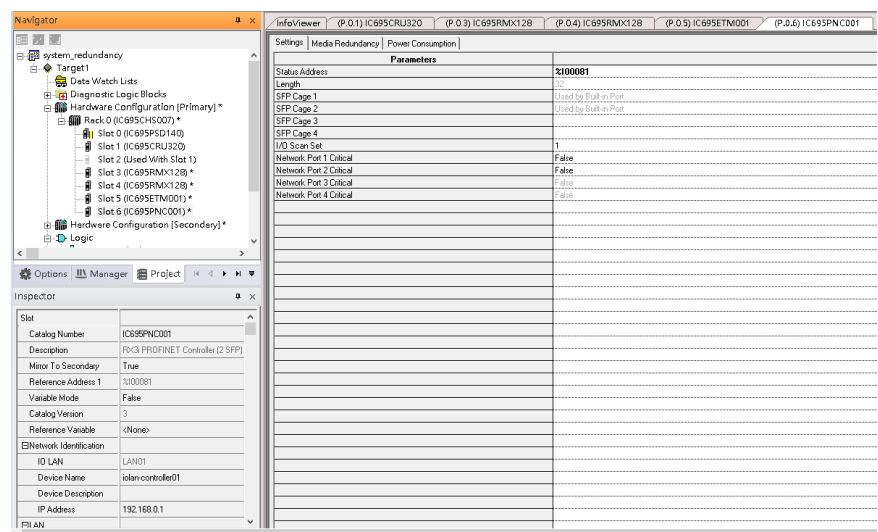
Figure 271: Network Topology



Follow the procedures to complete the configuration of the network:

1. Create PME project and add needed modules.

Figure 272: Create PME Project

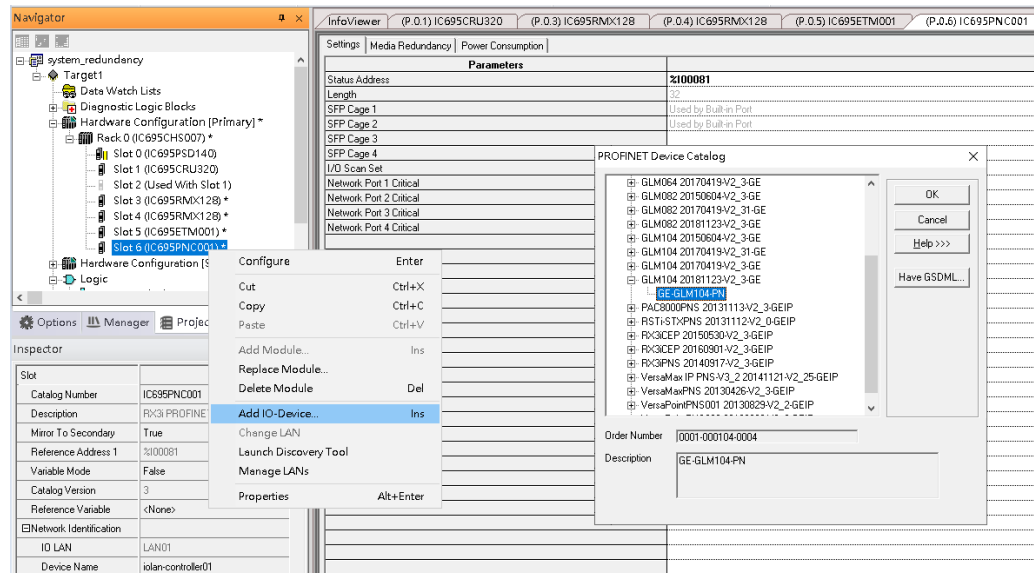


The screenshot displays the NetScout Systems GUI with three main panels:

- Navigator:** Shows a hierarchical tree of system components. Under "Hardware Configuration [Primary] *", "Rack 0 (IC695CHS007) *", and "Slot 6 (IC695PNC001) *" are highlighted with red boxes.
- InfoViewer:** Shows the configuration for "Slot 6 (IC695PNC001)". The "Media Redundancy" tab is selected, showing a table with "Parameters" and "Client" columns. The "Client" column contains the value "mxpdomain-1".
- Inspector:** Shows the configuration for "Slot 6 (IC695PNC001)". The "Network Identification" section is expanded, showing the "ID LAN" configuration with the "Device Name" set to "iolan-controller01" and the "IP Address" set to "192.168.0.1".

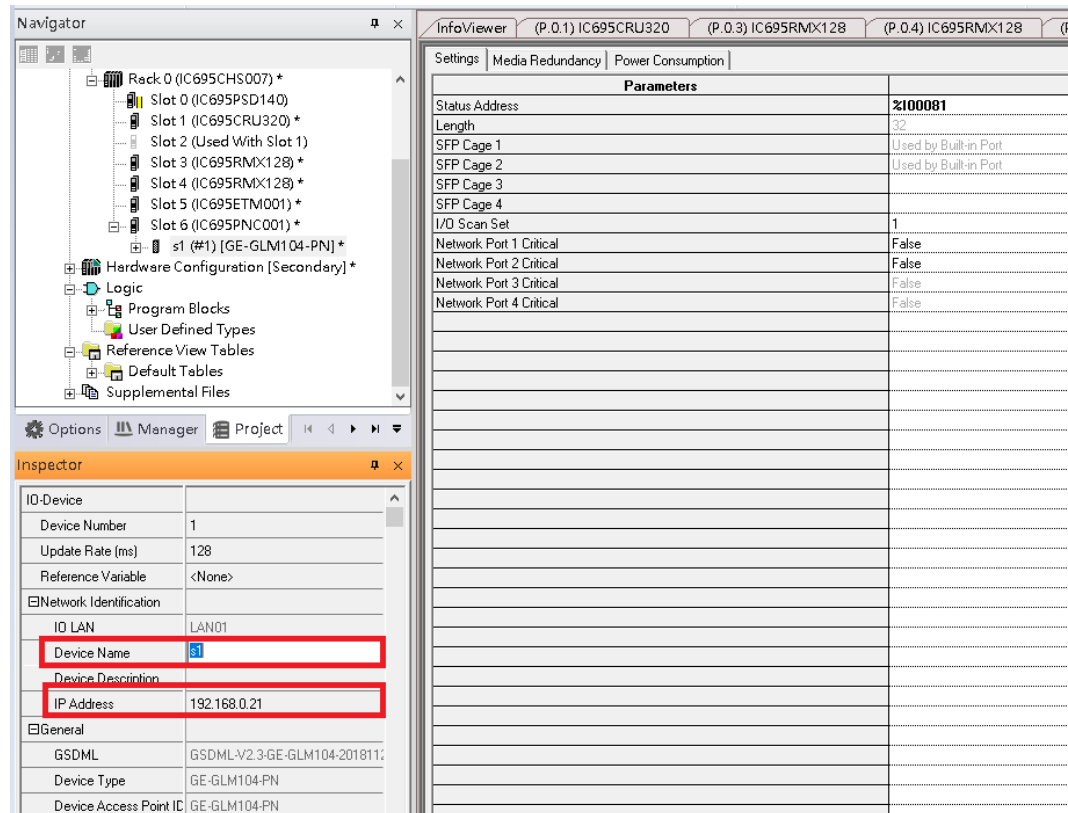
3. Add Switch S1

Figure 273: Add Switch S1



4. Set Switch S1 device name and IP address.

Figure 274: Set Switch S1 Device Name and IP Address



5. Config Switch S1 to run RingV2 and MRPe.

Set Switch S1 to run RingV2 Master Role:

In **Ring Group1 Date**, set:

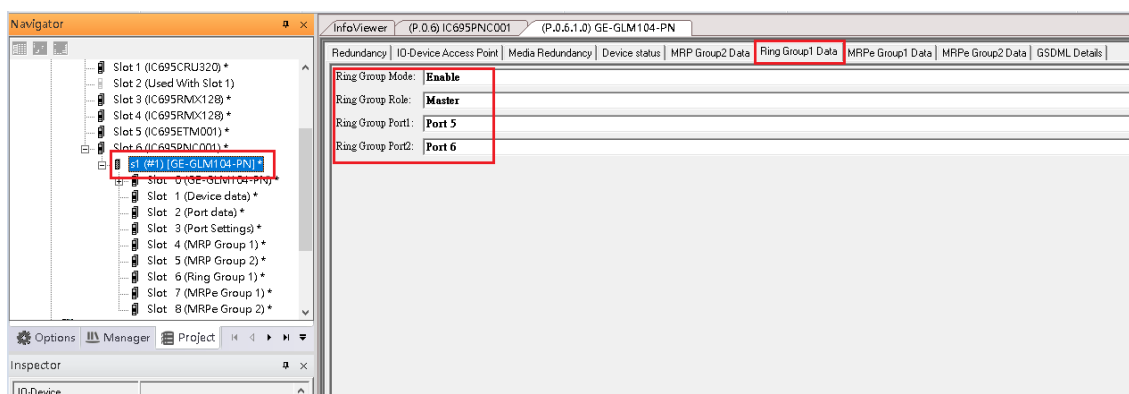
Ring Group Mode: Enable

Ring Group Role: Master

Ring Group Port1: Port5

Ring Group Port2: Port6

Figure 275: Ring Group1 Data



6. Set Switch S1 port1 and port2 to run MRPe Master

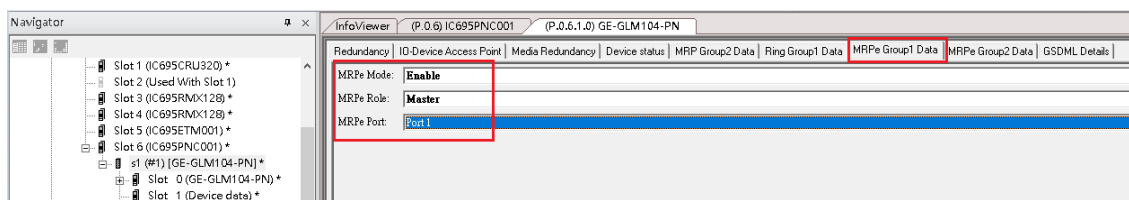
In **MRPe Group1 Date**, set:

MRPe Mode: Enable

MRPe Role: Master

MRPe port: Port1

Figure 276: MRPe Group1 Data



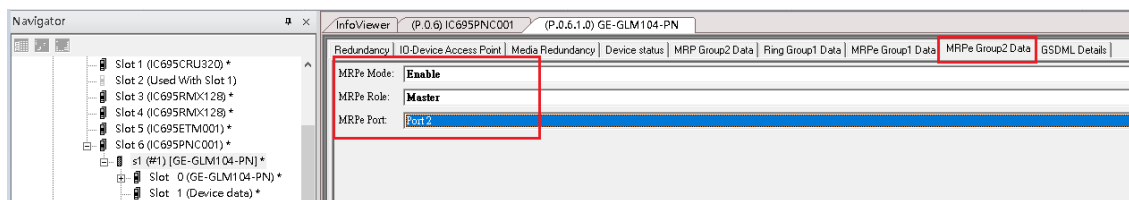
7. In **MRPe Group2 Date**, set:

MRPe Mode: Enable

MRPe Role: Master

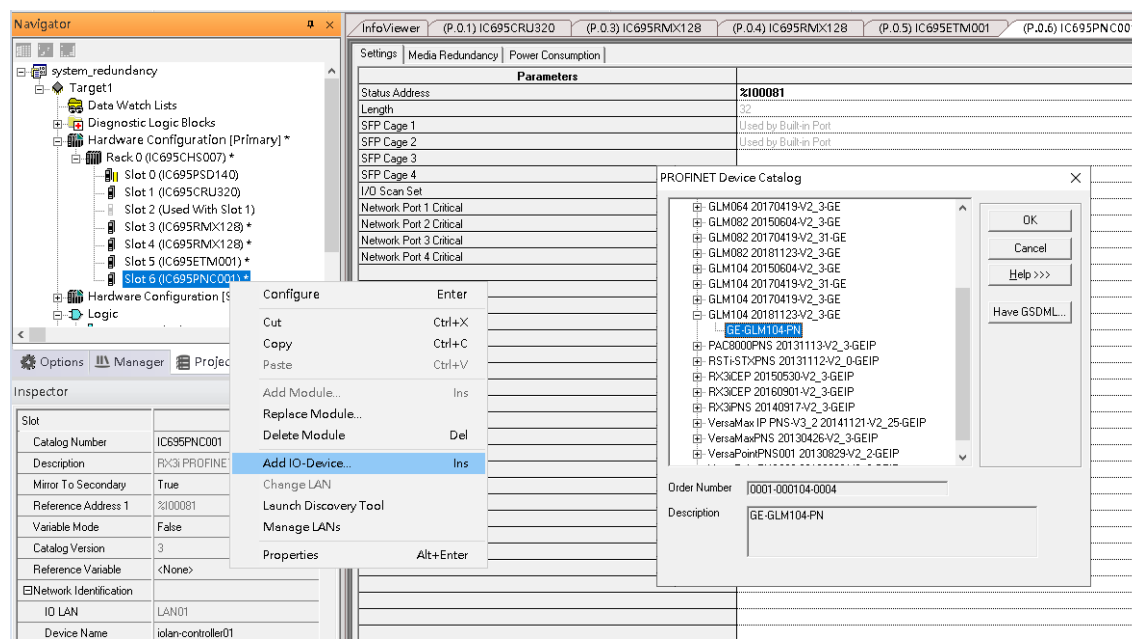
MRPe port: Port2

Figure 277: MRPe Group2 Date



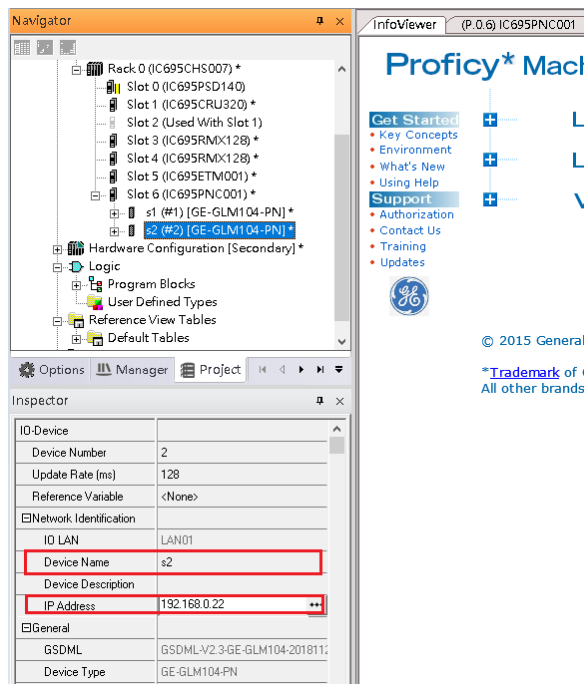
8. Add Switch S2

Figure 278: Add I/O Device



9. Set Switch S2 device name and IP address

Figure 279: Switch S2 Device Name and IP Address



10. Config Switch S2 to run RingV2 and MRPe.

Set Switch S2 to run RingV2 Slave Role

In **Ring Group1 Data**, set:

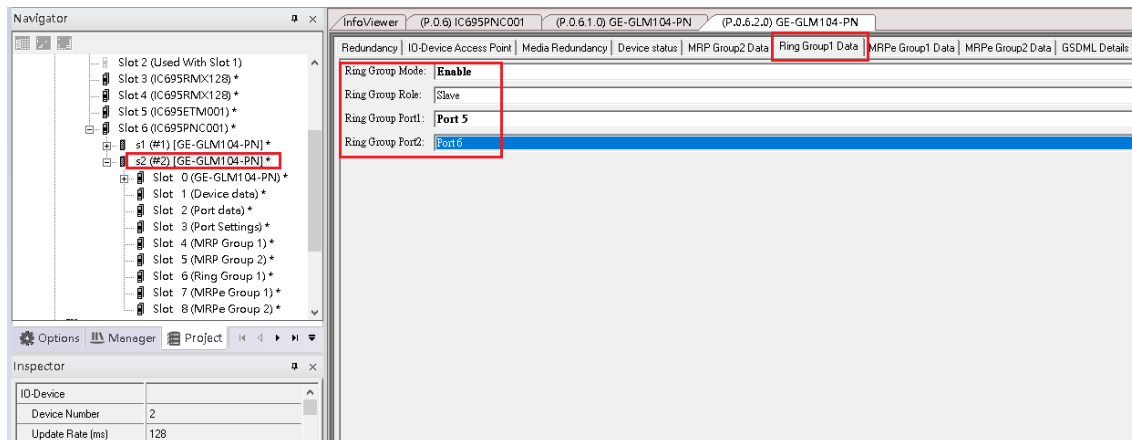
Ring Group Mode: Enable

Ring Group Role: Slave

Ring Group Port1: Port5

Ring Group Port2: Port6

Figure 280: Ring Group1 Data



11. Set Switch S2 Port1 to run MRPe Master

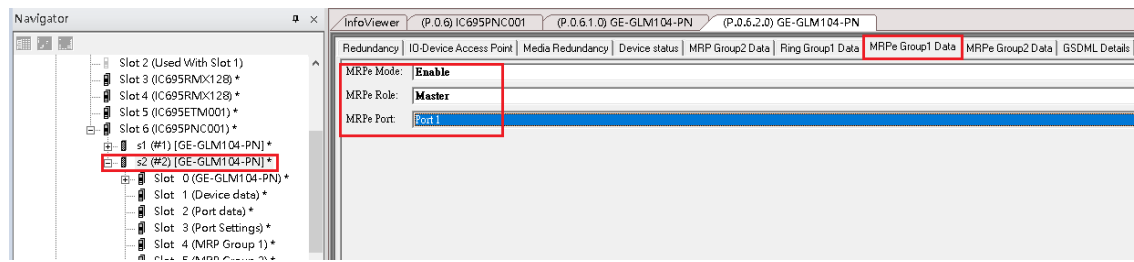
In MRPe Group1 Date, set:

MRPe Mode: Enable

MRPe Role: Master

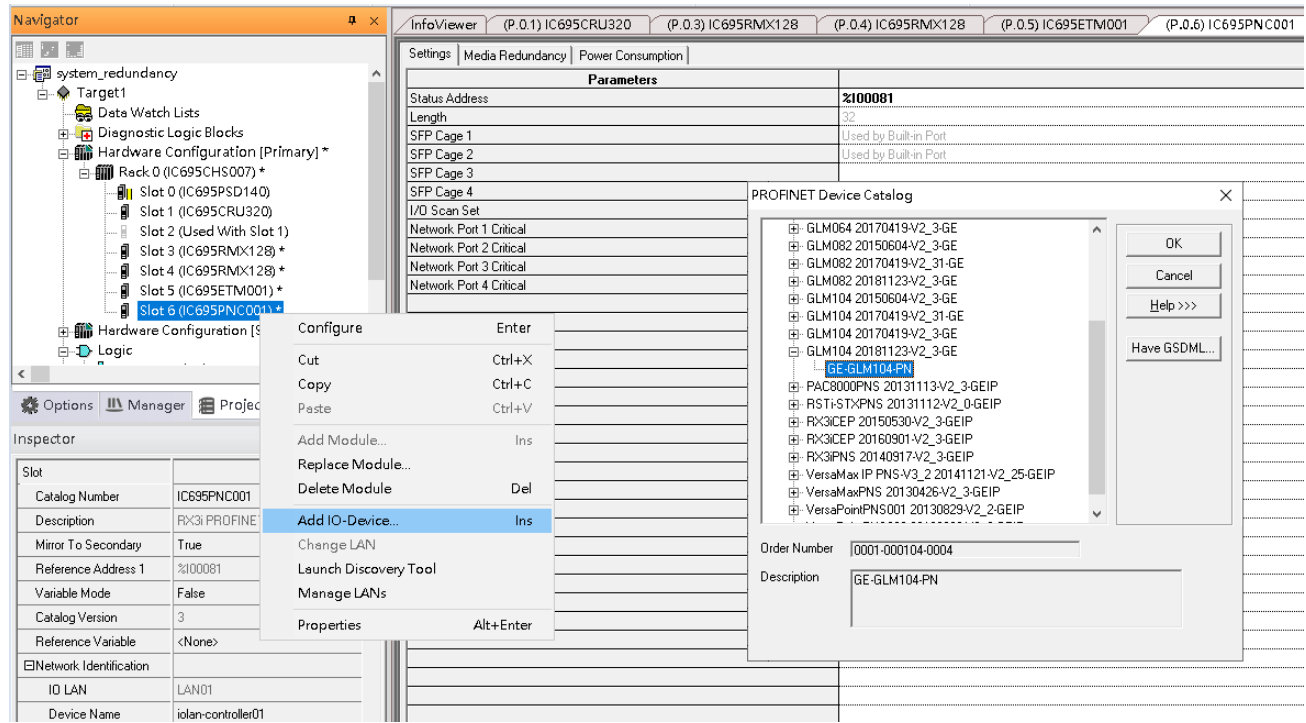
MRPe port: Port1

Figure 281: Switch SW Port1 to MRPe Master



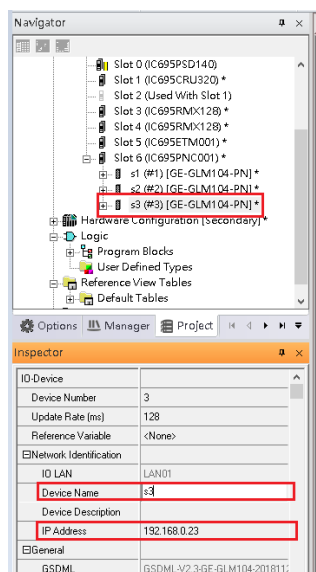
12. Add Switch S3

Figure 282: Add Switch S3



13. Set Switch S3 Device Name and IP Address

Figure 283: Set Switch S3 Device Name and IP Address



14. Config Switch S3 to run RingV2 and MRPe.

Set Switch S3 to run RingV2 Slave Role:

In **Ring Group1 Data**, set:

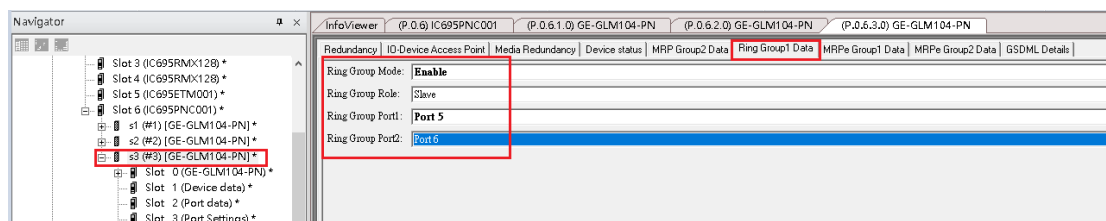
Ring Group Mode: Enable

Ring Group Role: Slave

Ring Group Port1: Port5

Ring Group Port2: Port6

Figure 284: Switch S3 to RingV2 and MRPe



15. Set Switch S3 port1 and port2 to run MRPe Slave

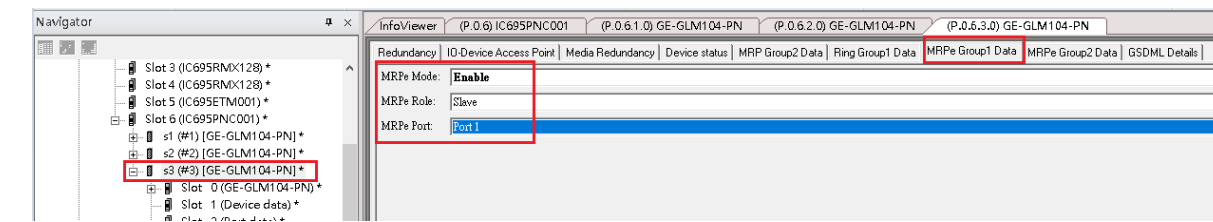
In **MRPe Group1 Date**, set:

MRPe Mode: Enable

MRPe Role: Slave

MRPe port: Port1

Figure 285: Switch S3 Port1 and Port2



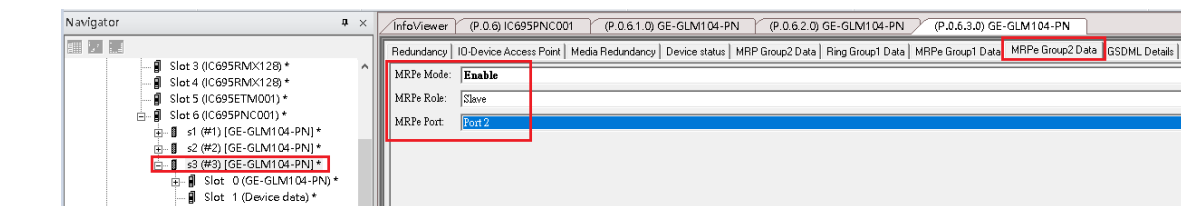
16. In **MRPe Group2 Date**, set:

MRPe Mode: Enable

MRPe Role: Master

MRPe port: Port2

Figure 286: MRPe Group2 Date



19. Config Switch S4 to run RingV2 and MRPe.

Set Switch S4 to run RingV2 Slave Role

In **Ring Group1 Date**, set:

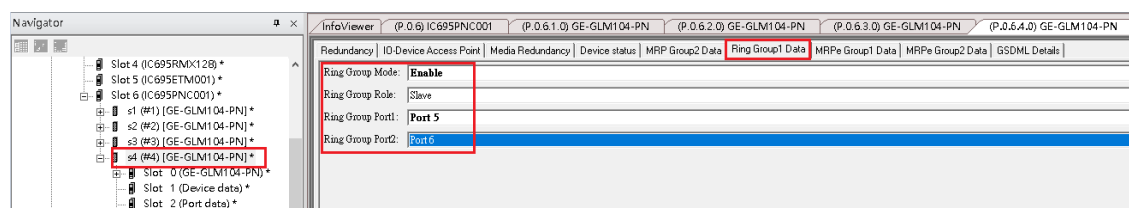
Ring Group Mode: Enable

Ring Group Role: Slave

Ring Group Port1: Port5

Ring Group Port2: Port6

Figure 289: Switch S4 to RingV2 and MRPe



20. Step17: Set Switch S4 port2 to run MRPe Slave

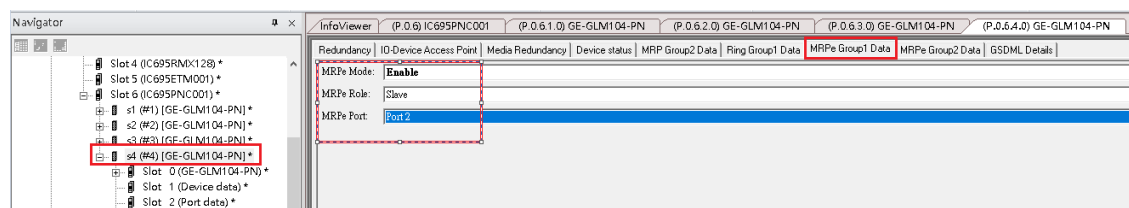
In **MRPe Group1 Date**, set:

MRPe Mode: Enable

MRPe Role: Slave

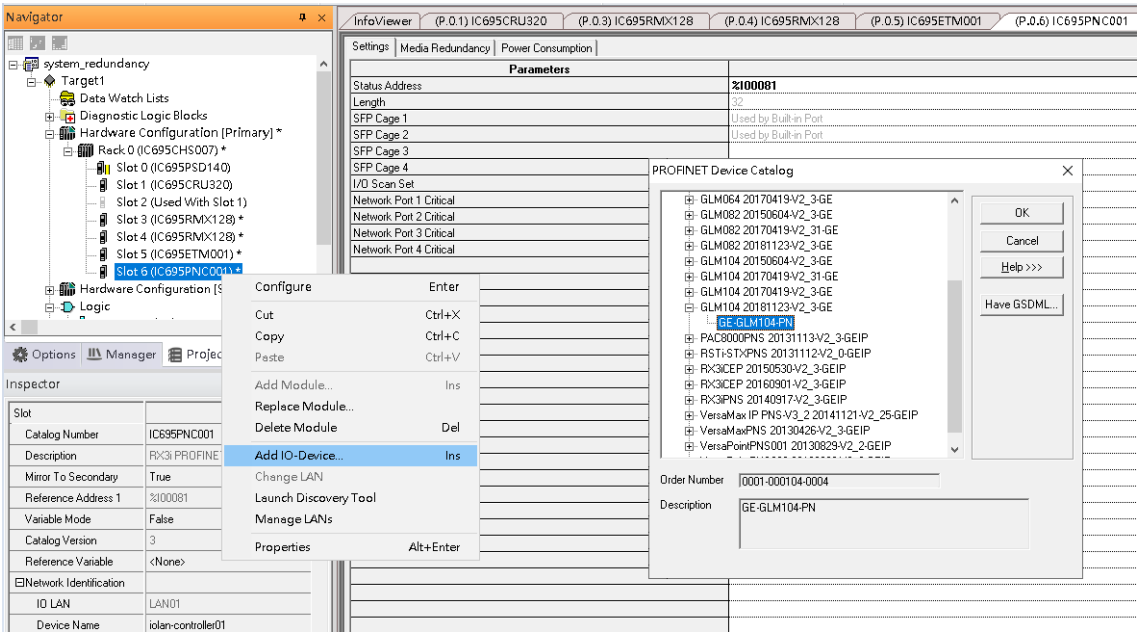
MRPe port: Port2

Figure 290: Switch S4 Port2 to Run MRPe Slave



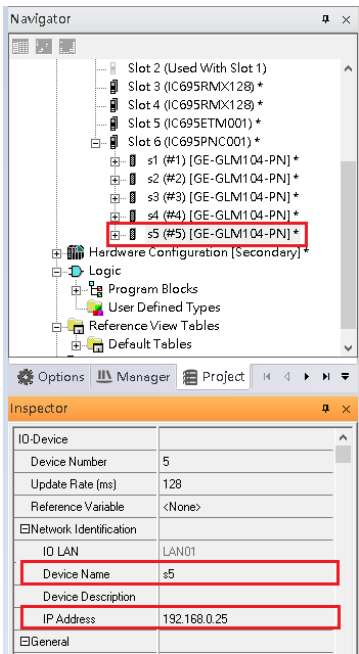
21. Add Switch S5

Figure 291: Switch S5



22. Set Switch S5 device name and IP address.

Figure 292: Switch S5 Device Name and IP Address



23. Config Switch S5 to run MRC.

Set Switch S5 to run MRC

In **Media Redundancy**, set:

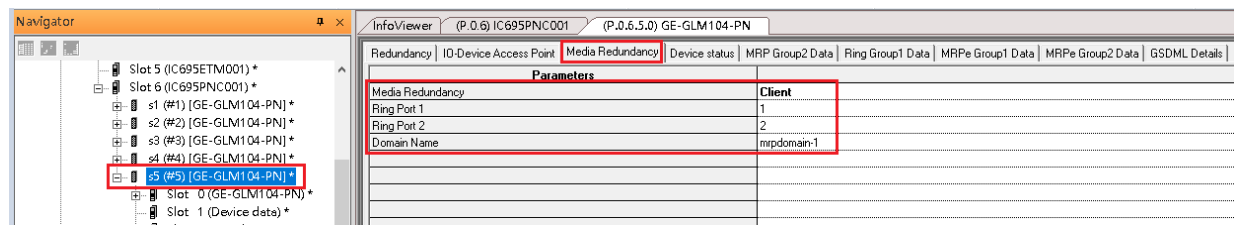
Media Redundancy: Client

Ring Port 1: 1

Ring Port 2: 2

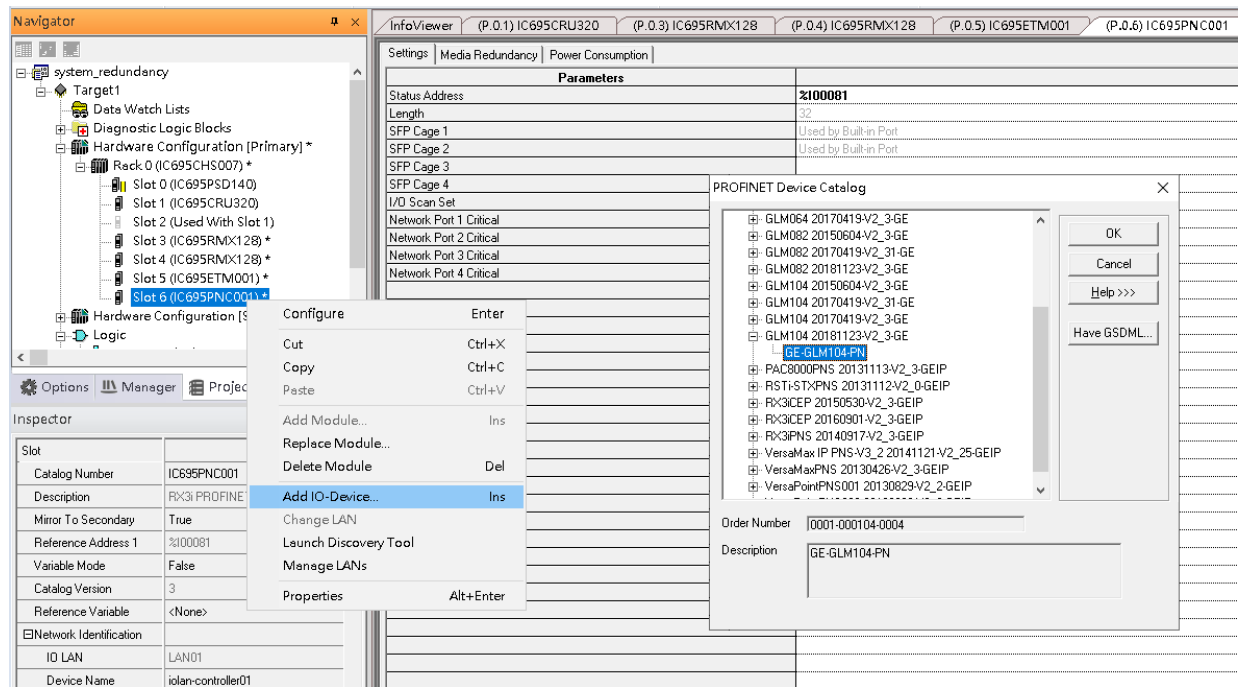
Domain Name: mrpdomain-1

Figure 293: Switch S5 to Run MRC



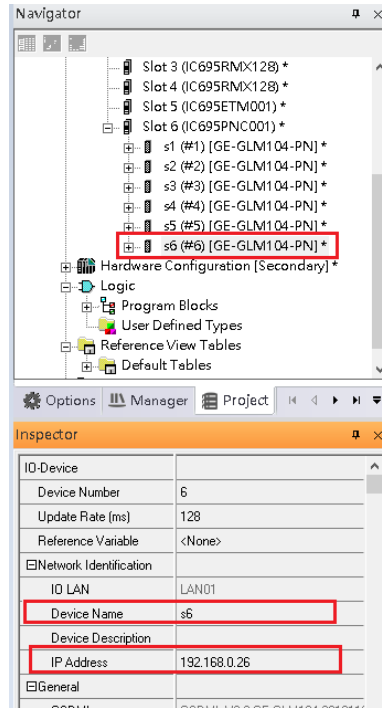
24. Add Switch S6

Figure 294: Switch S6



25. Set Switch S6 device name and IP Address.

Figure 295: Switch S6 Device Name and IP Address



26. Config Switch S6 to run MRC.

Set Switch S6 to run MRC

In **Media Redundancy**, set:

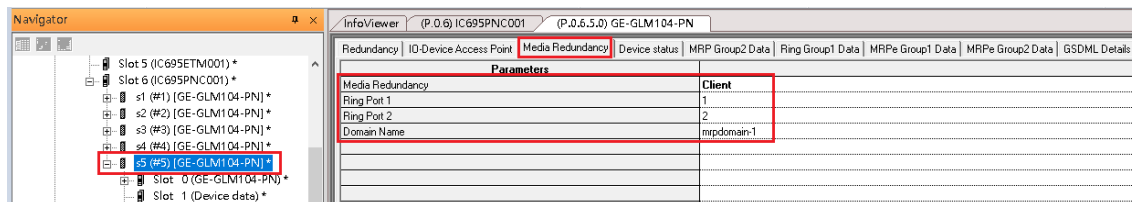
Media Redundancy: Client

Ring Port 1: 1

Ring Port 2: 2

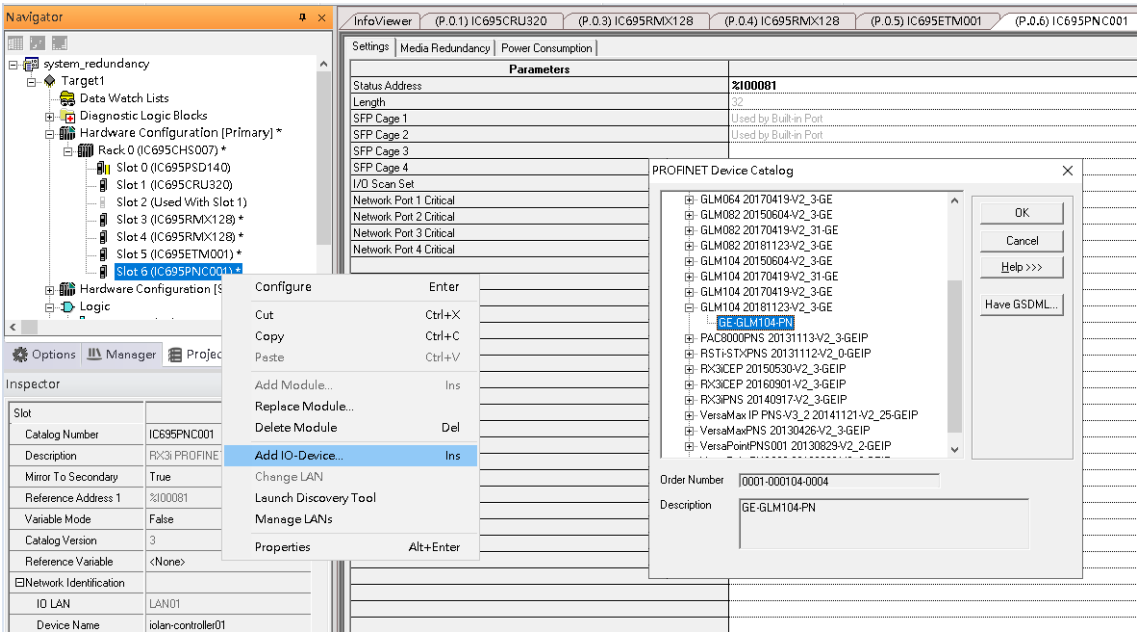
Domain Name: mrpdomain-1

Figure 296: Config Switch S6 to Run MRC



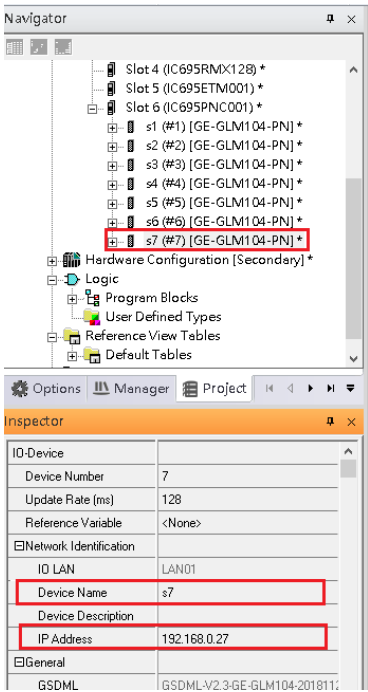
26. Add Switch S7

Figure 297: Add Switch S7



27. Set Switch S7 device name and IP address

Figure 298: Switch S7 Device Name and IP Address



28. Config Switch S7 to run MRC.

Set Switch S7 to run MRC

In **Media Redundancy**, set:

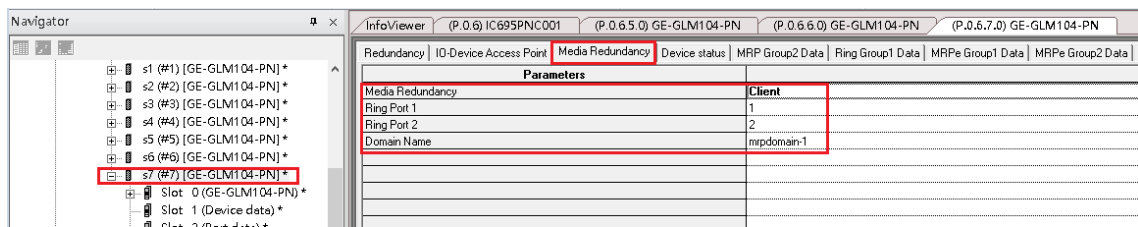
Media Redundancy: Client

Ring Port 1: 1

Ring Port 2: 2

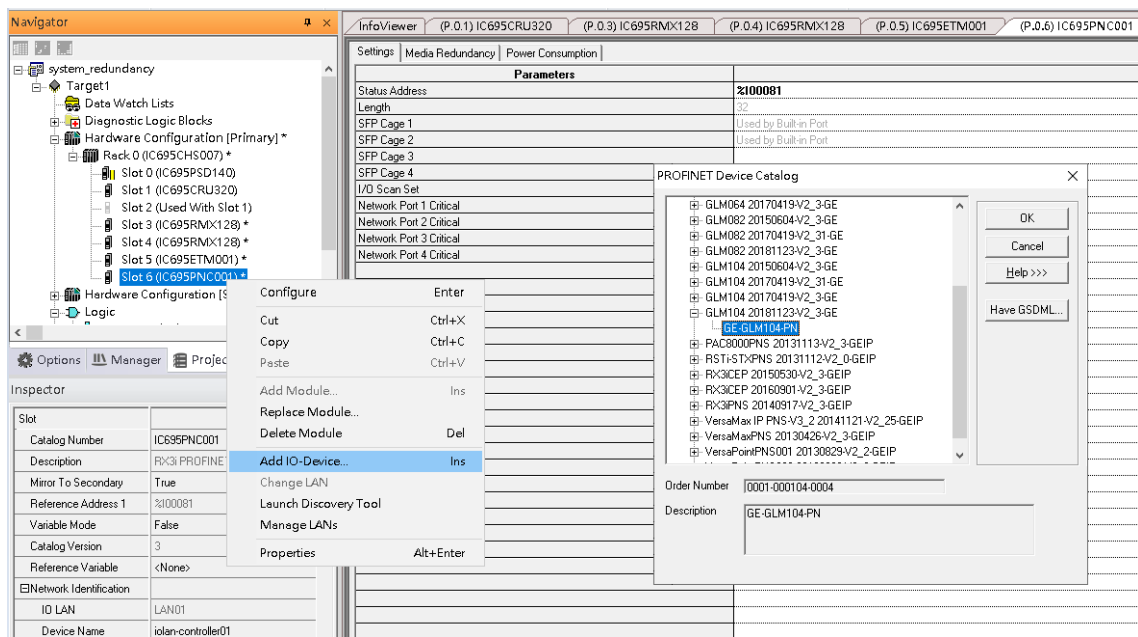
Domain Name: mrpdomain-1

Figure 299: Switch S7 to run MRC



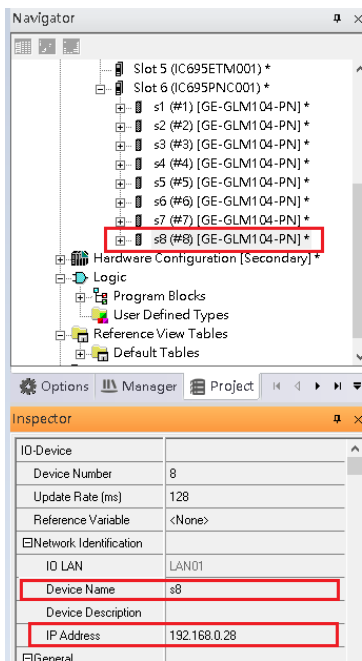
29. Add Switch S8

Figure 300: Add Switch S8



30. Set Switch S8 device name and IP address.

Figure 301: Switch S8 Device Name and IP Address



31. Config Switch S8 to run MRC.

Set Switch S8 to run MRC

In **Media Redundancy**, set

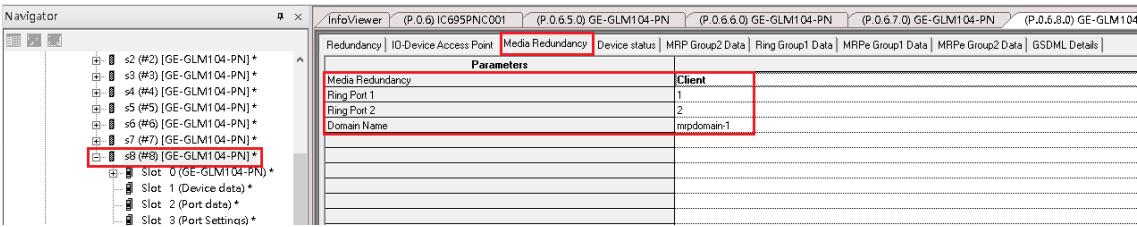
Media Redundancy: Client

Ring Port 1: 1

Ring Port 2: 2

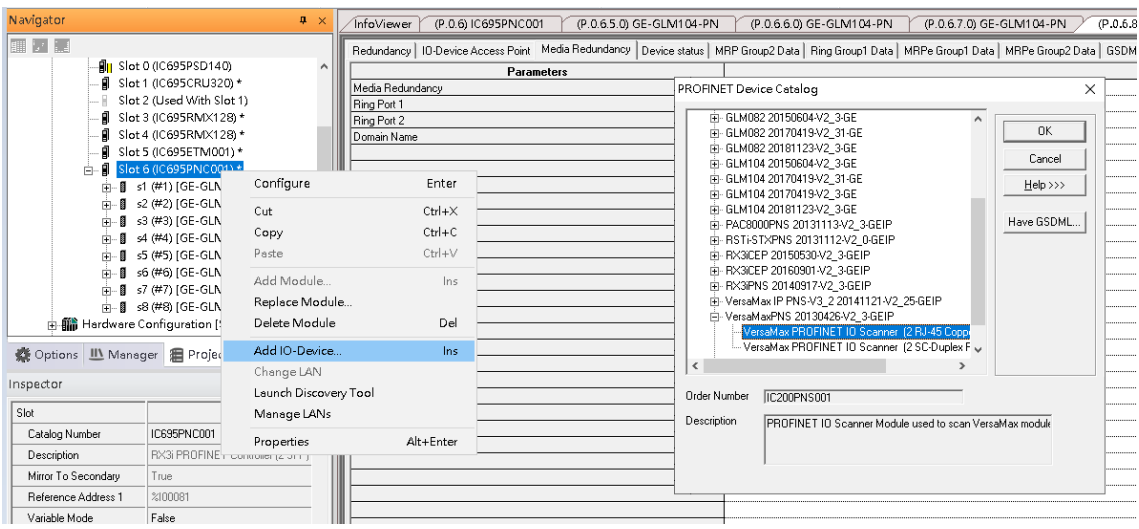
Domain Name: mrpdomain-1

Figure 302: Switch S8 to run MRC

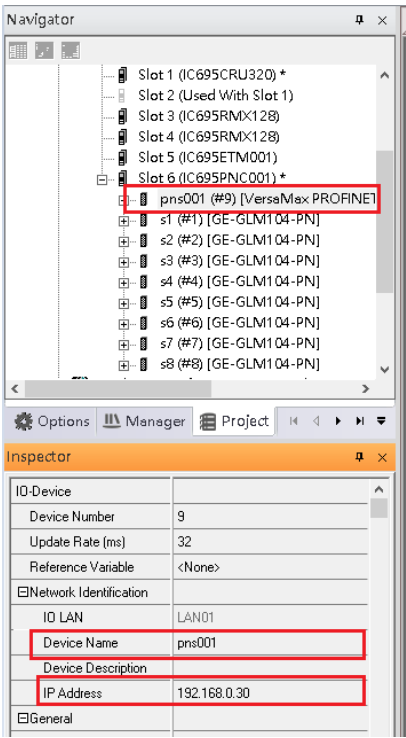


32. Add IO-Device PNS001

Figure 303: Add I/O Device PNS001



33. Set Switch PNS001 device name and IP address:



34. Config Switch PNS001 to run MRC.

Set Switch PNS001 to run MRC

In **Media Redundancy**, set:

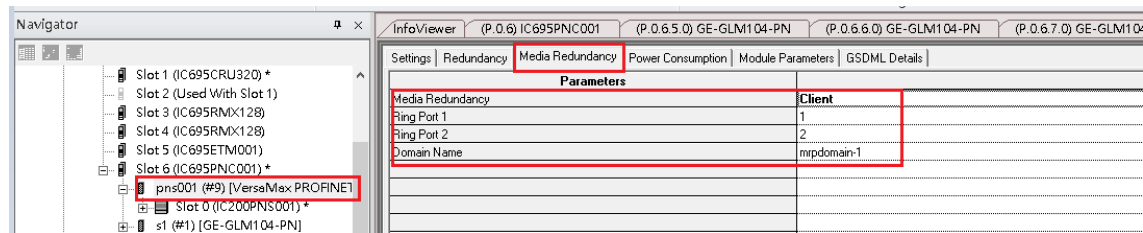
Media Redundancy: Client

Ring Port 1: 1

Ring Port 2: 2

Domain Name: mrpdomain-1

Figure 304: Switch PNS001 to run MRC



35. Mirror configuration to Secondary PLC

Figure 305: Secondary PLC

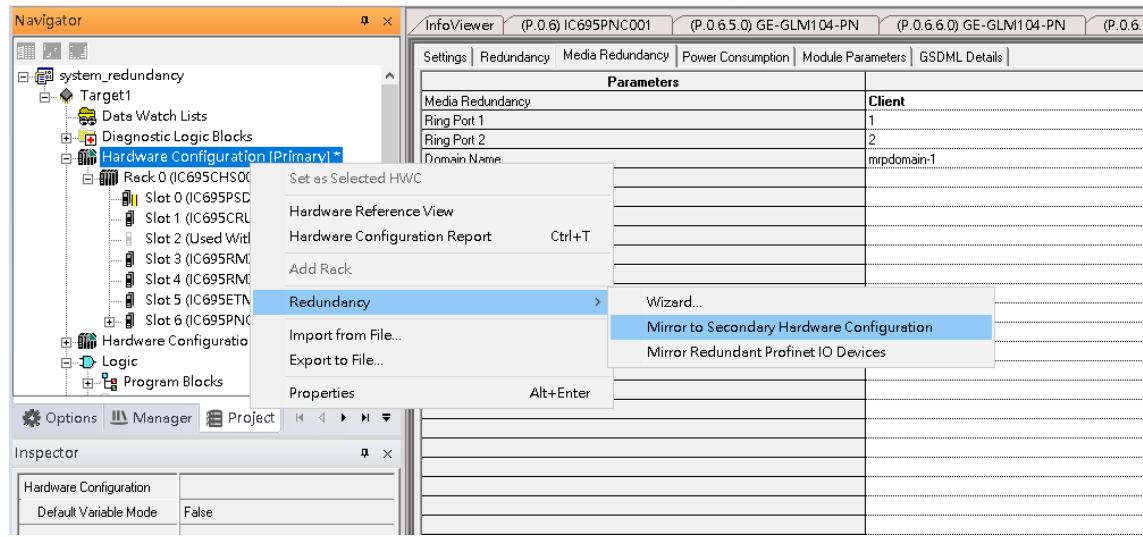
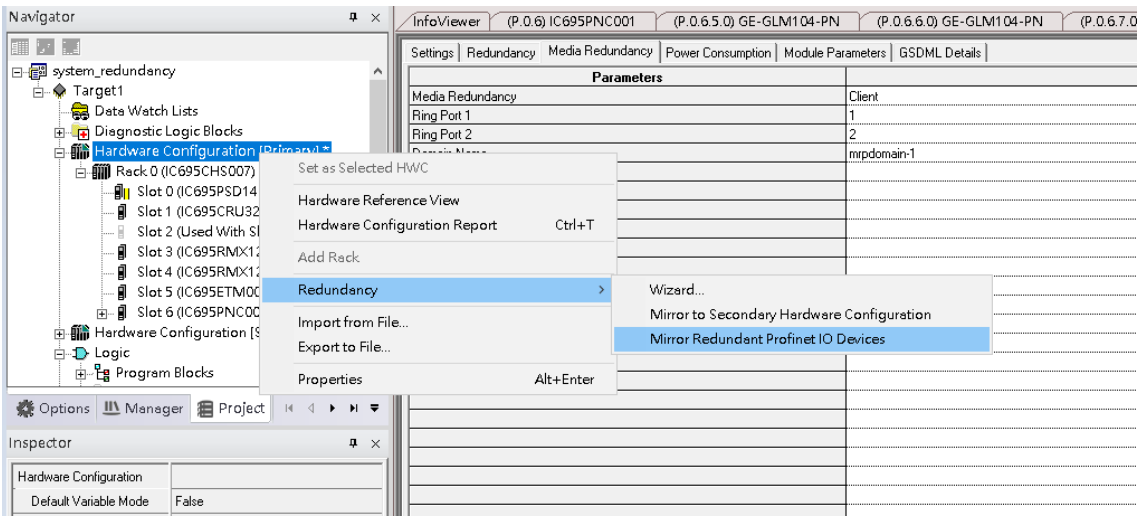
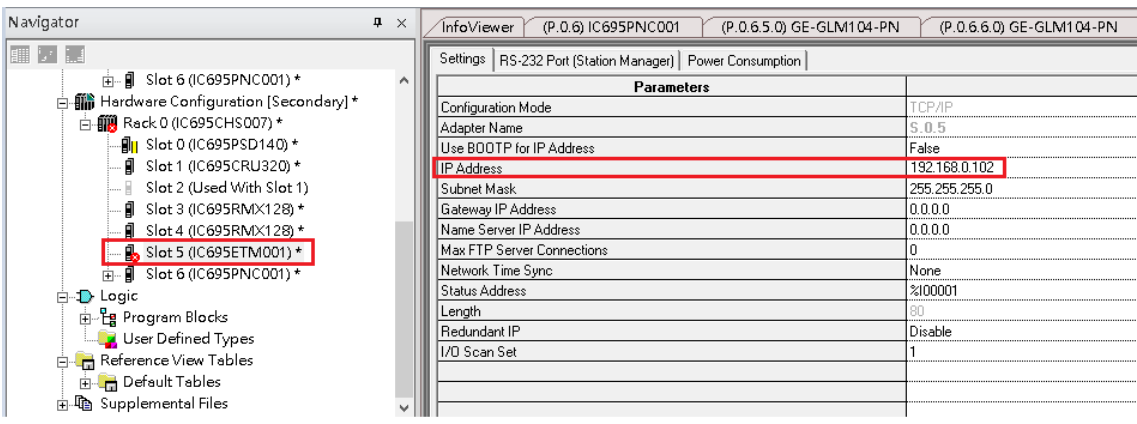


Figure 306: Mirror Redundant Profinet IO Devices



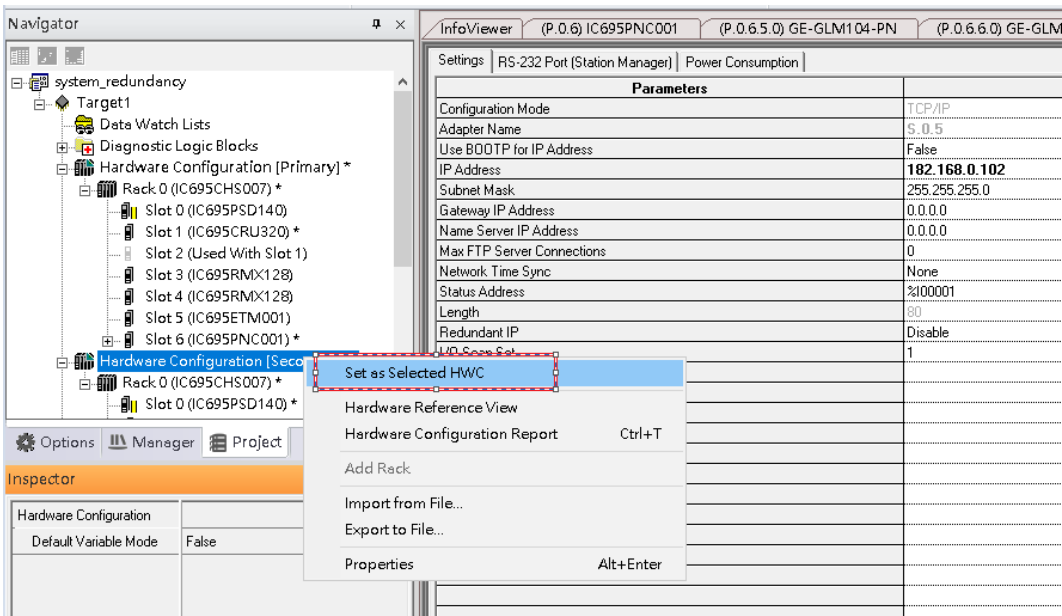
36. Set ETM001 IP Address of Secondary PLC to 192.168.0.102

Figure 307: Setting IP Address of Secondary PLC



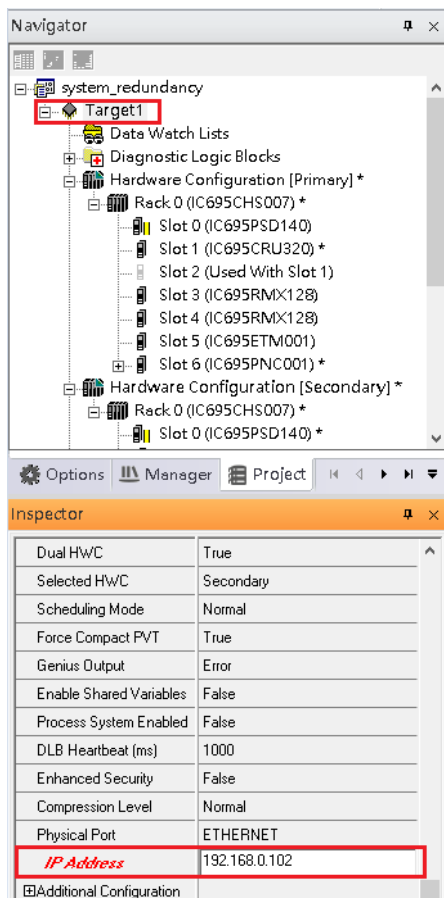
37. Set Secondary PLC as HWC

Figure 308: Set Secondary PLC as Hardware Configuration



38. Double click **Target1**, and set IP Address to 192.168.0.102.

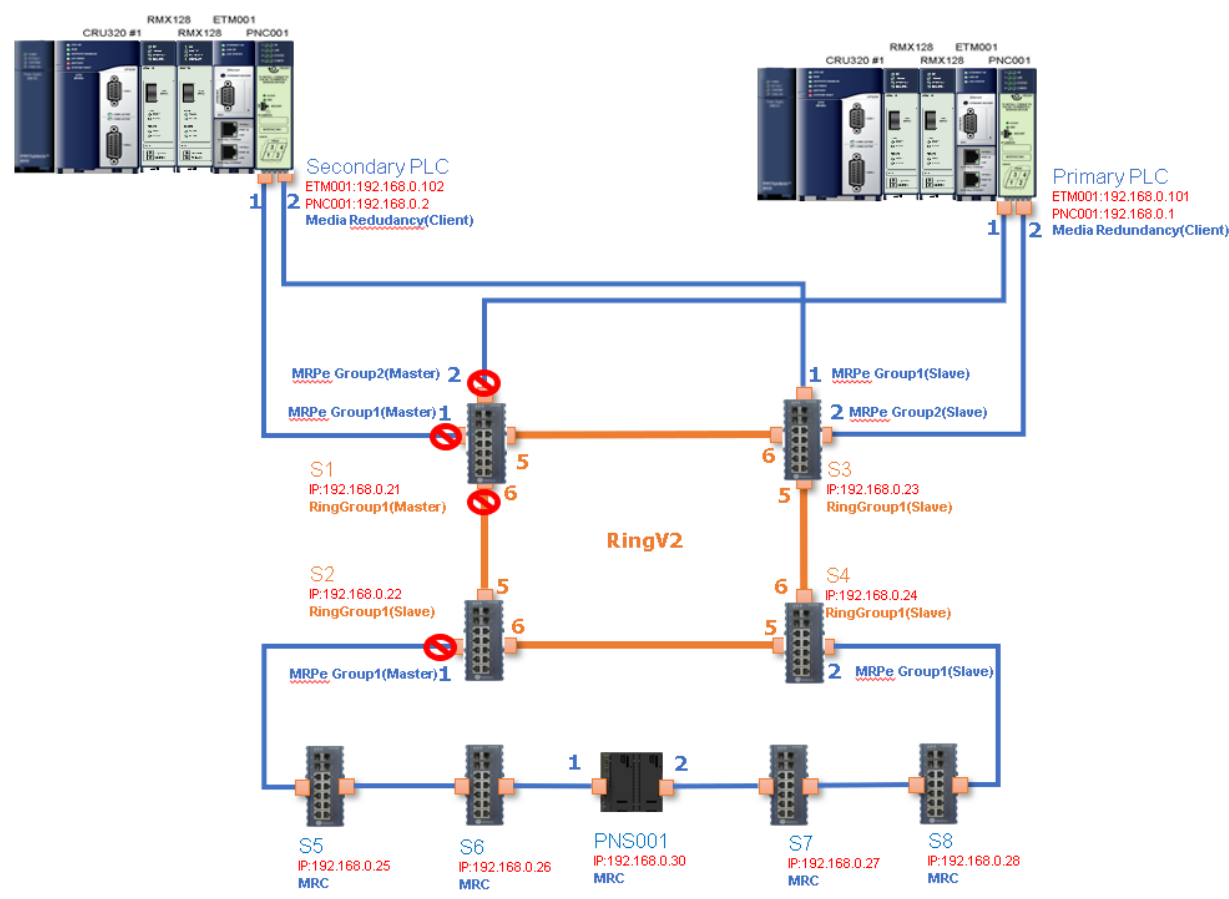
Figure 309: Set IP Address of Target1



Before use Profinet DCP or Download configuration to PLC, make sure to remove following ethernet cable for preventing **broadcast storm** in the network.

- Port1 of Switch S3
- Port2 of Switch S3
- Port6 of Switch S3
- Port2 of Switch S4

Figure 310: Configuring RingV2



Use Profinet DCP to find out all the devices which connecting to the network. If the Device Name or IP Address is not the same as configuration, please set them to correct Device Name and IP Address.

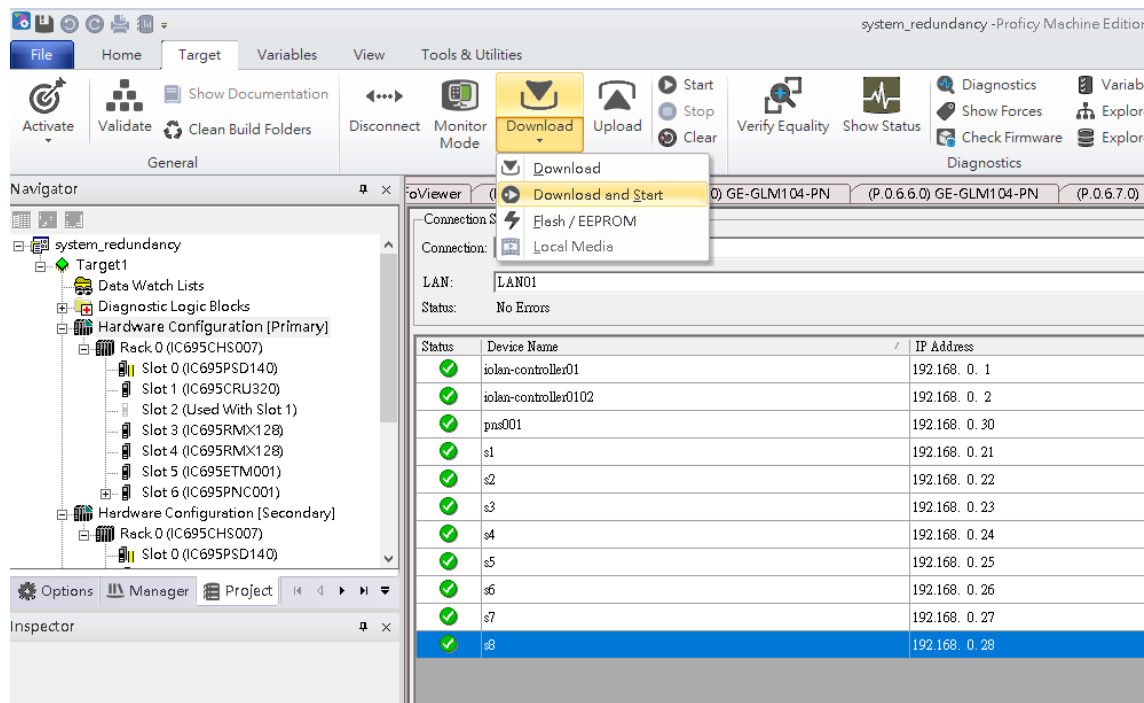
After correct setting, all the devices when into “Assigned” state.

Figure 311: Assigned Devices

oViewer (P.0.6) IC695PNC001 (P.0.6.5.0) GE-GLM104-PN (P.0.6.6.0) GE-GLM104-PN (P.0.6.7.0) GE-GLM104-PN (P.0.6.8.0) GE-GLM104-PN (P.0.6.9.0) IC200PNS001 (S.0.5) IC695ETM001 PROFINET DCP - Direct Connection						
Connection Settings						
Connection: 以太网 16 Refresh Device List						
LAN: LAN01						
Status: No Errors						
Status	Device Name	IP Address	Vendor	Device Type		
✓	iclan-control01	192.168.0.1	Intelligent Platforms	IC695PNC001		
✓	iclan-control0102	192.168.0.2	Intelligent Platforms	IC695PNC001		
✓	pns001	192.168.0.30	Intelligent Platforms	IC200PNS001		
✓	s1	192.168.0.21	Intelligent Platforms	GE-GLM104-PN		
✓	s2	192.168.0.22	Intelligent Platforms	GE-GLM104-PN		
✓	s3	192.168.0.23	Intelligent Platforms	GE-GLM104-PN		
✓	s4	192.168.0.24	Intelligent Platforms	GE-GLM104-PN		
✓	s5	192.168.0.25	Intelligent Platforms	GE-GLM104-PN		
✓	s6	192.168.0.26	Intelligent Platforms	GE-GLM104-PN		
✓	s7	192.168.0.27	Intelligent Platforms	GE-GLM104-PN		
✓	s8	192.168.0.28	Intelligent Platforms	GE-GLM104-PN		

39. Download and Start for Primary PLC

Figure 312: Download and Start Primary PLC

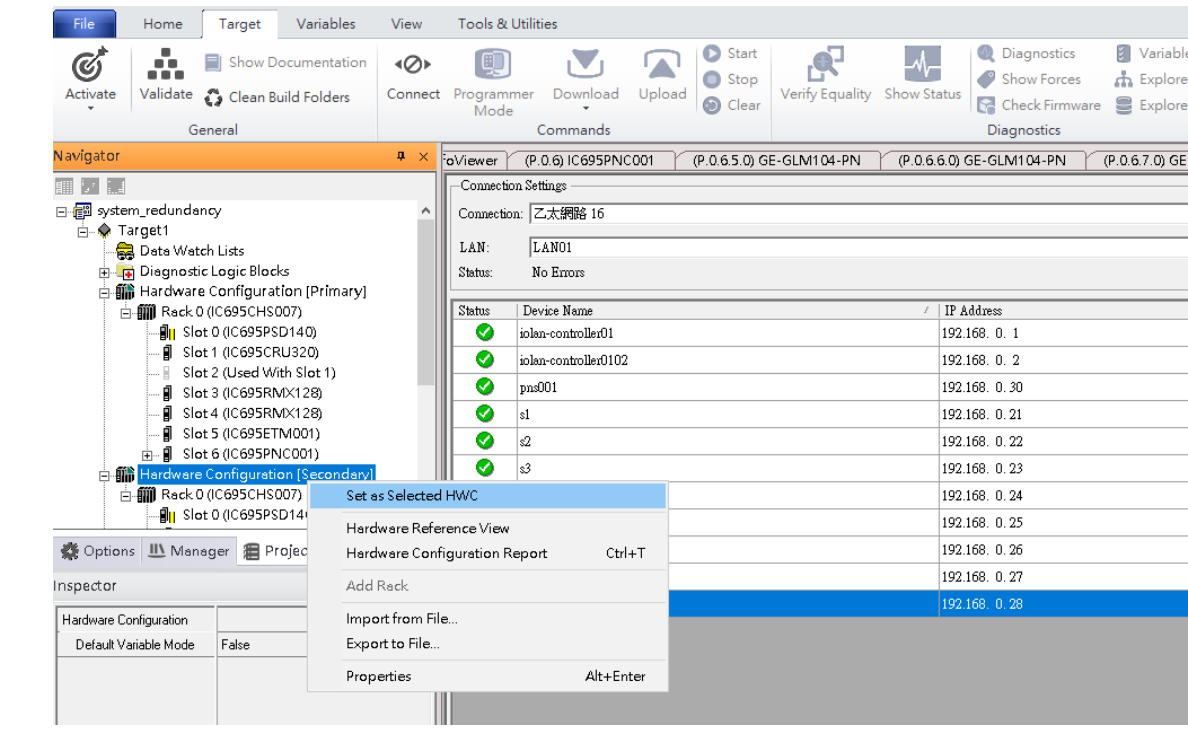


Note: There are two databases in the switch, one is for the web (runtime) configuration and the other is for the PROFINET configuration. The Ring(group 1) and M-Chain (group 4,5) of the RingV2 configuration are defined by the PME and will be saved to the PROFINET database. The Ring/Coupling (group 2), and Chain(group 3) are configured by the Web server interface and will be saved to the Web database.

When the ring parameters have to be set through the web configuration only Ring/Coupling(group 2), and Chain(group 3) can be used and when the parameters have to be set via the PME application only Ring(group 1), M-Chain(group 4, 5) can be used.

40. Set Secondary PLC to HWC

Figure 313: Secondary PLC to Hardware Configuration



41. Download and Start for Secondary PLC

Figure 314: Download and Start Secondary PLC

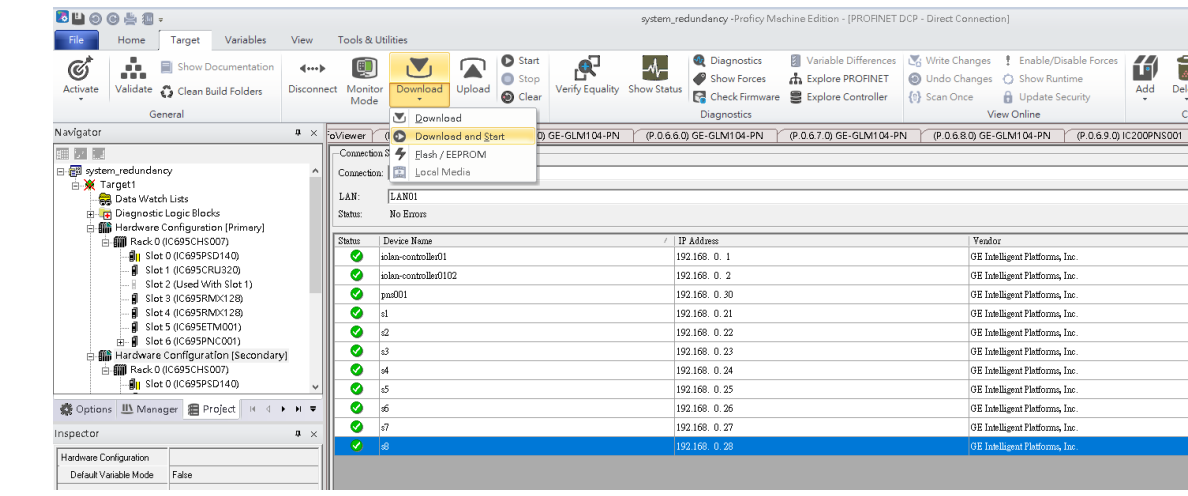


Figure 315

8.2.7 Network Setting

To establish the communication to the I/O Controller from PAC Machine Edition, the interface of the I/O Controller shall be specified.

It should be noted that there is only 1 I/O Controller (Primary or Secondary) able to communicate with PAC Machine Edition. Therefore, there are 3 rules of communication that are defined.

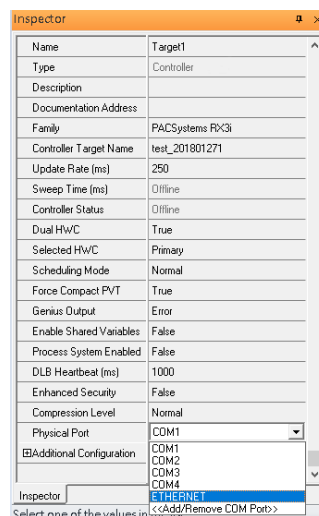
I/O Controller Communication Rule

Rule	Description
1	The communicated I/O Controller shall be specified. Click primary or secondary hardware configuration, click the right button, and select Set as Selected HWC .
2	During the communication, the cable shall be connected to the ETM001 in specified hardware (Primary or Secondary)
3	Specify the interface and IP address for communicated I/O Controller

For rule 3, click **Target 1** and Select **Property**.

In the **Inspector** pane, change the value of **Physical Port** to **Ethernet**.

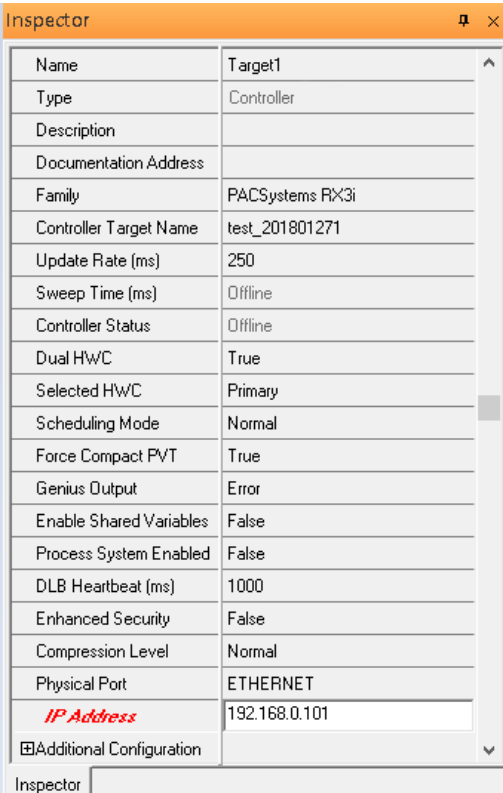
Figure 316: Changing the Physical Port Parameter



Also, the IP address of communicated I/O Controller shall be set. Here the **Primary** setting is shown.

Note, the specified IP address is set as the IP address on ETM001.

Figure 317: Specified IP Address Appears

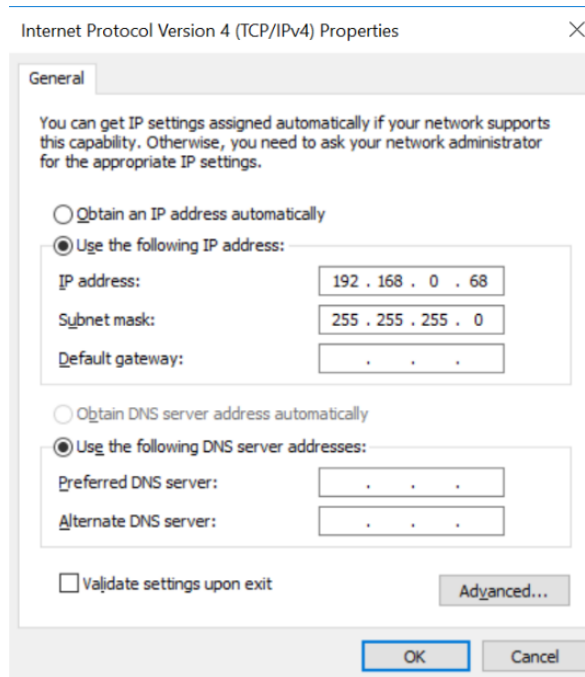


Inspector	
Name	Target1
Type	Controller
Description	
Documentation Address	
Family	PACSystems RX3i
Controller Target Name	test_201801271
Update Rate (ms)	250
Sweep Time (ms)	Offline
Controller Status	Offline
Dual HwC	True
Selected HwC	Primary
Scheduling Mode	Normal
Force Compact PVT	True
Genius Output	Error
Enable Shared Variables	False
Process System Enabled	False
DLB Heartbeat (ms)	1000
Enhanced Security	False
Compression Level	Normal
Physical Port	ETHERNET
IP Address	192.168.0.101
Additional Configuration	

8.2.8 PC Network

The IP address of PC with PAC Machine Edition shall be set in the same network area.

Figure 318: Setting the IP Address of the PC with PME

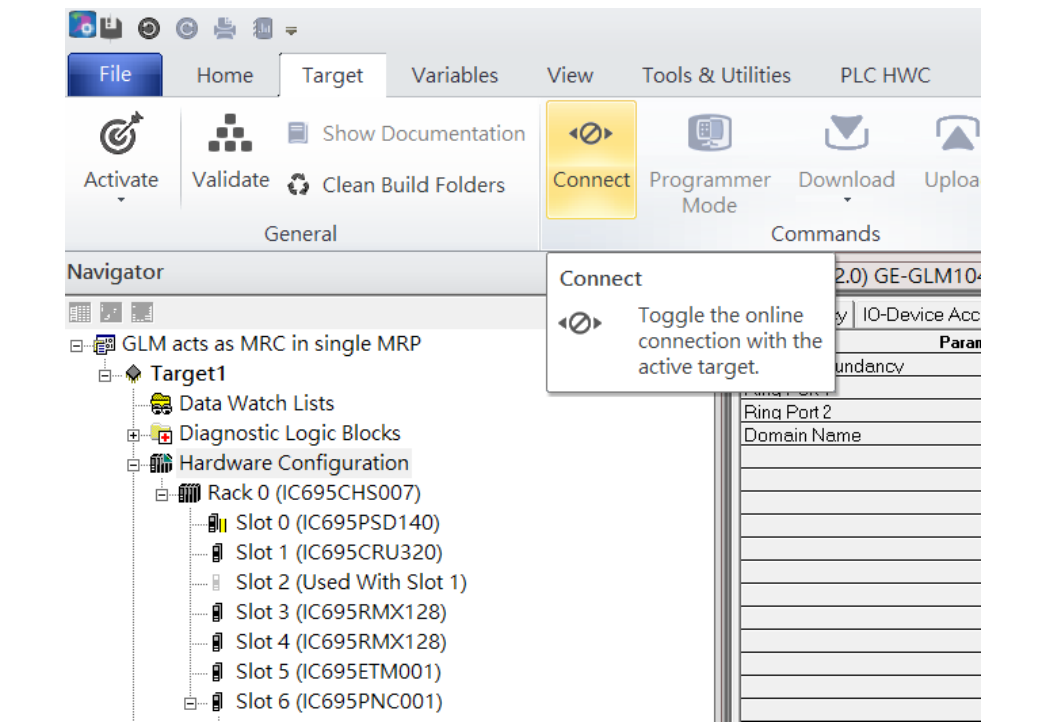


Note: For ETM configuration, please consult GFK-2224 PACSystems Rx3i TCP/IP Ethernet Communications User Manual

8.3 Implementation

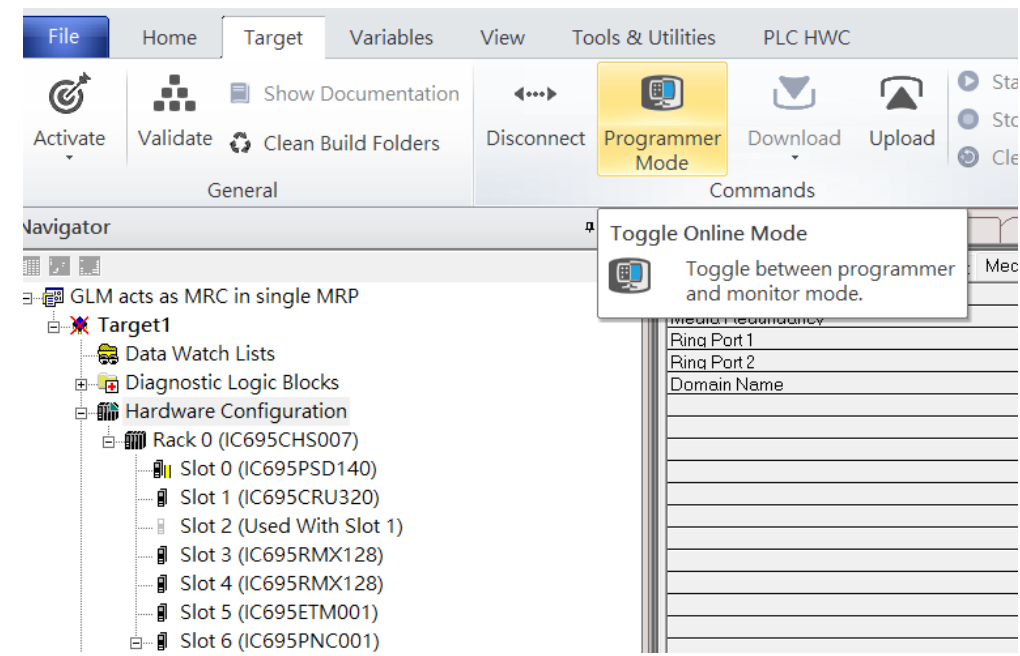
To download the configuration to hardware, the following steps shall be applied.
First, press the **Connect** icon.

Figure 319: Connecting to Target



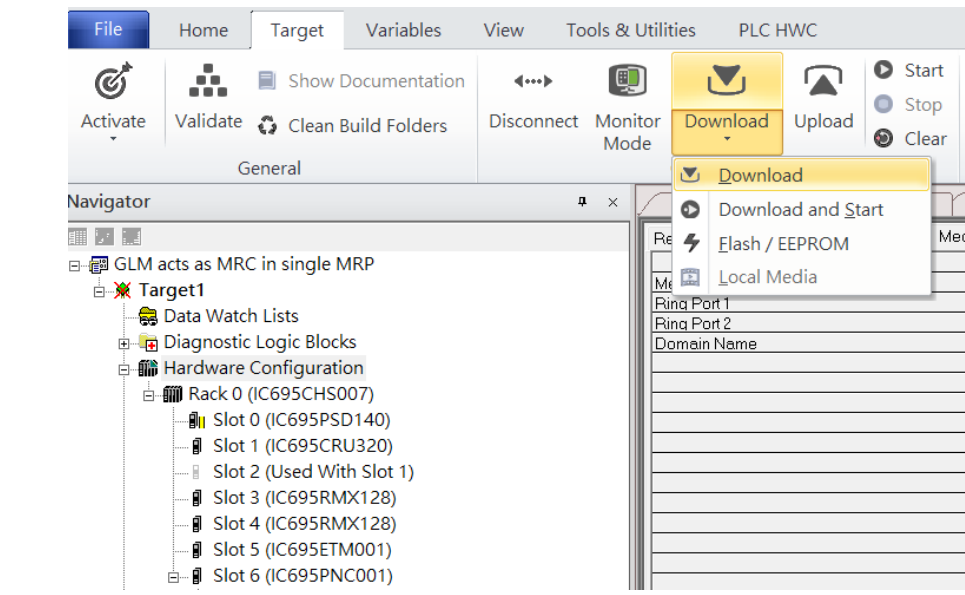
Then press the icon **Programmer Mode**.

Figure 320: Programmer Mode



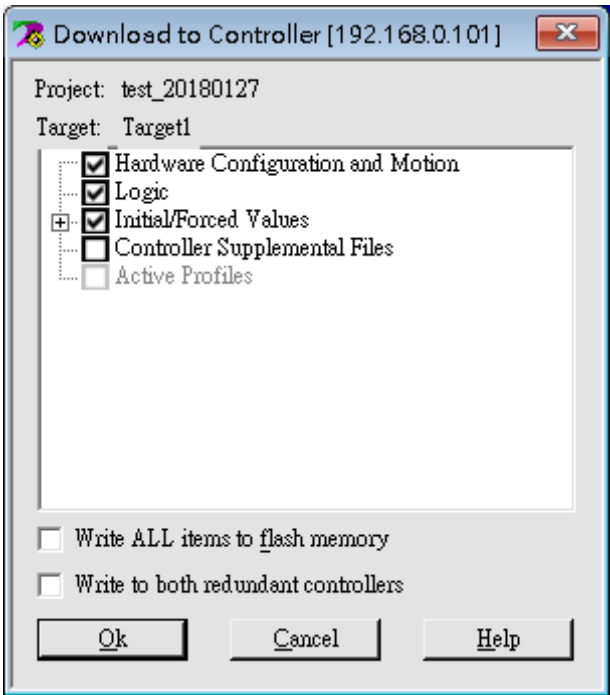
Then press icon **Download** and select **Download**.

Figure 321: Download



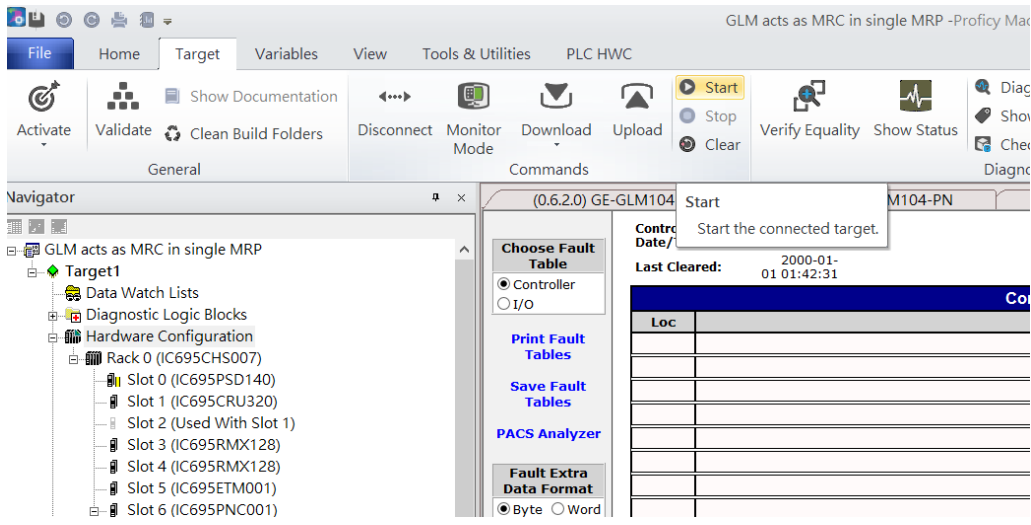
Then the dialogue is appeared to make sure the initialization procedure, select **OK**.

Figure 322: Download to Controller



After download completely, press icon **Start** to active PLC. Note: After downloading completely, switch CRU320 to **Run I/O Enable** and select **OK**. If PLC has started successfully, a message “The Controller was successfully started”.

Figure 323: Start



General Contact Information

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

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