

PACSystems Industrial PROFINET Managed Ethernet Switches MRP

APPLICATION GUIDE

GFK-3070A

Jan 2020

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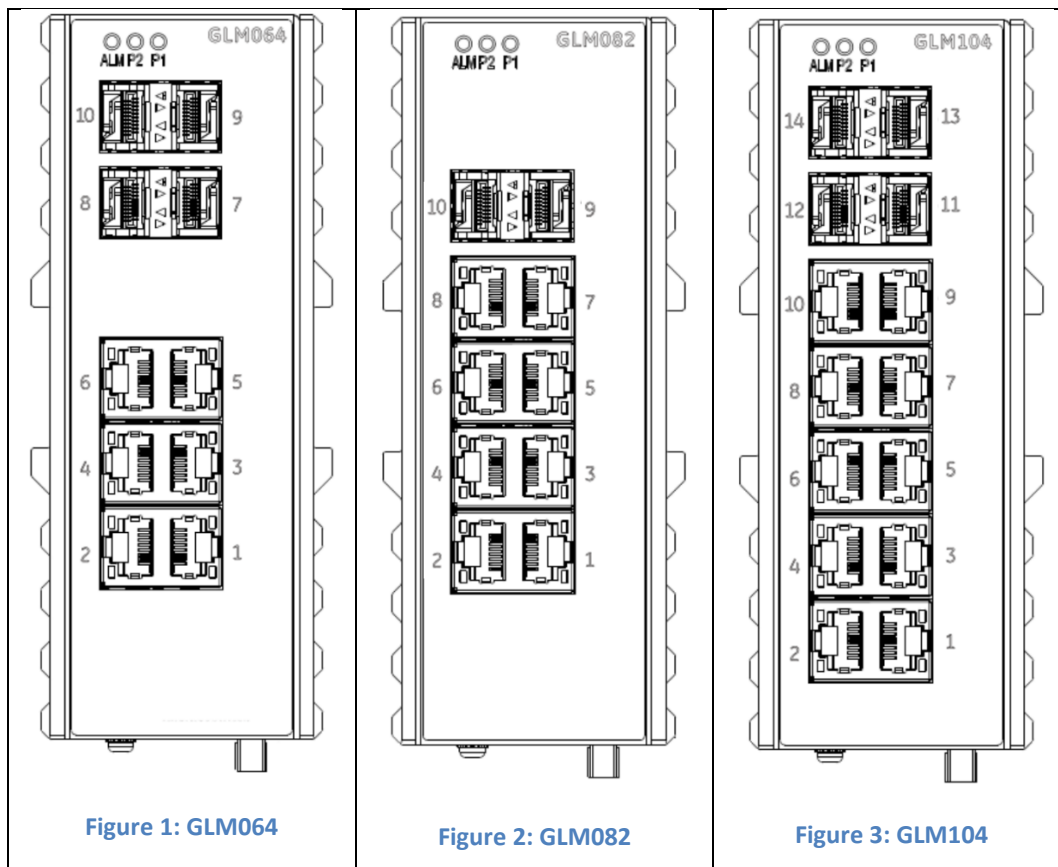
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Section 1 Introduction



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
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 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 following application scenarios.

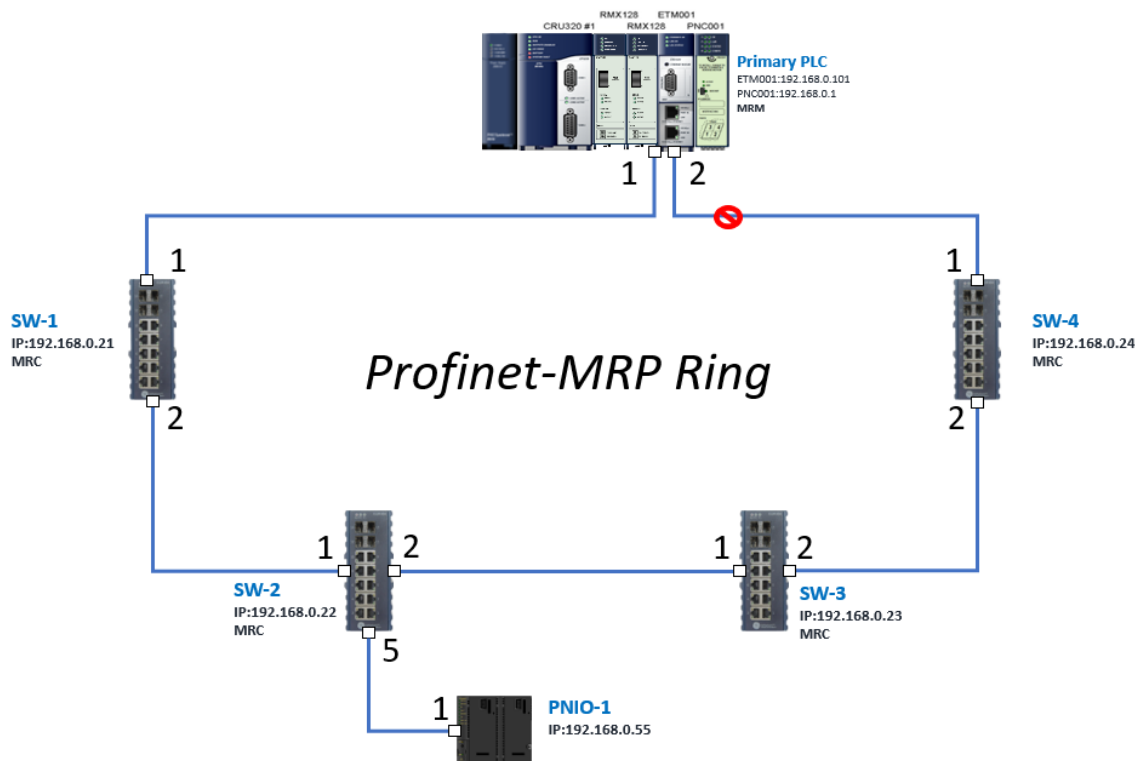
1. Single PROFINET_MRP Ring: In this application scenario, GLM switch act the role of MRC to cooperate with manager device, for providing the ring protection.
2. Multiple PROFINET-MRP Ring: In this application scenario, GLM switch act as role of MRC, to expend the ring protected network without the need of 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 communicating two rings connected with each other. The various topologies derived from Dual MRP fit for most of the PROFINET applications.
4. Multiple PROFINET MRP Ring and Subring: Via the capability of supporting of MRM & MRC roles, the network design can be flexible and cost effective according to variant application environment
5. PROFINET-MRP Main Ring couples with coupled two PROFINET-MRP Subring: In the application scenario, 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 setup the network topology which can support system redundancy and media redundancy.

Network topology, configuration and implementation of these application scenario are described in 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

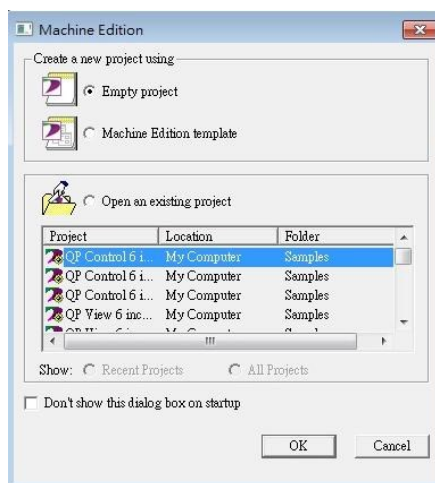
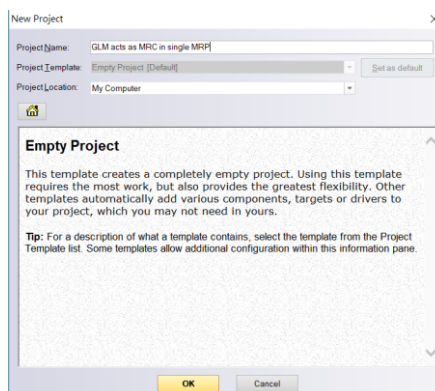


Figure 6: New Project Name

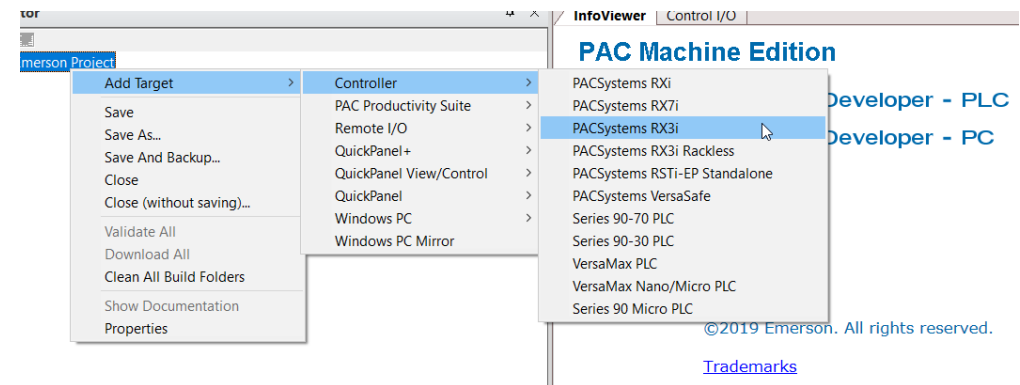


3.2.2 I/O Controller Setting

Next step is to add a target for this project. Click 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.

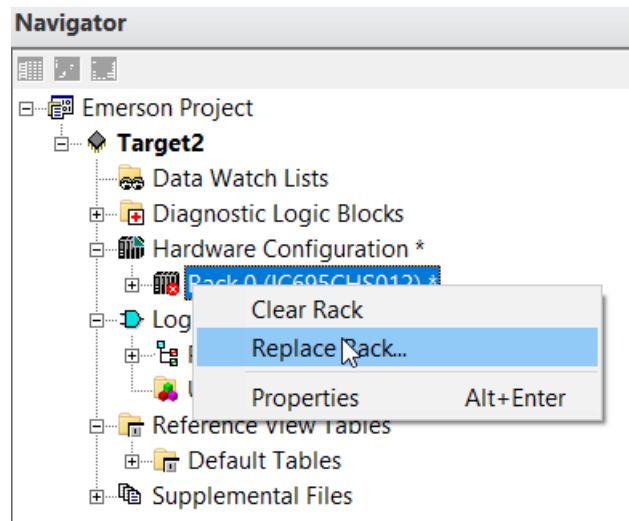
Figure 7: Adding a Target



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 power card, communication module, or bus controller. However, there are only 7 chassis can be used in the I/O Controller CRU320. Thus, replace the rack for 7 slots.

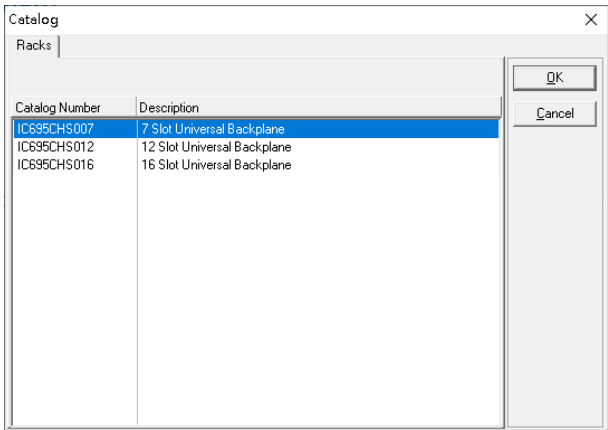
Click right button on “Rack 0 (IC695CHS012)” and select **Replace Rack**.

Figure 8: Replace Rack



Select “IC695CHS007” and click OK.

Figure 9: Selecting the Catalog Number



After the rack and the number of slots is 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.

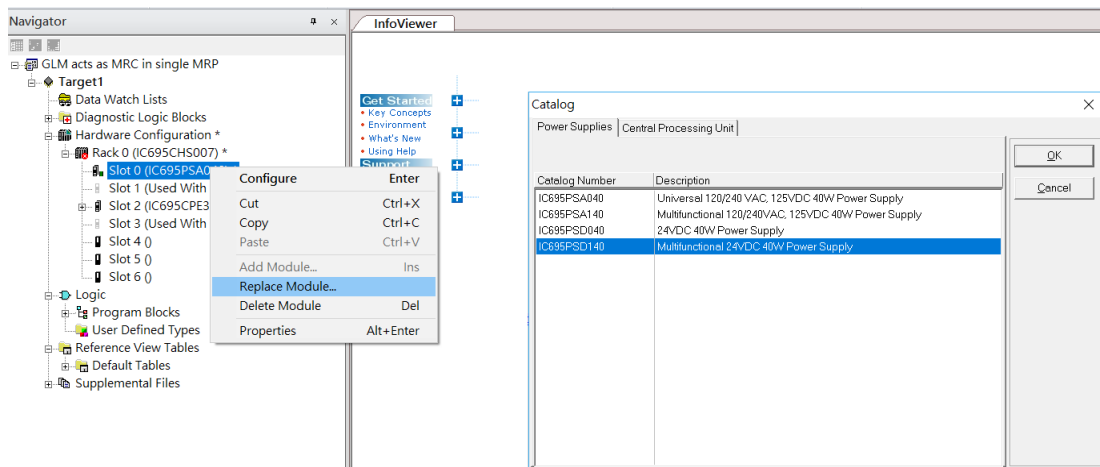
Devices on I/O Controller

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.

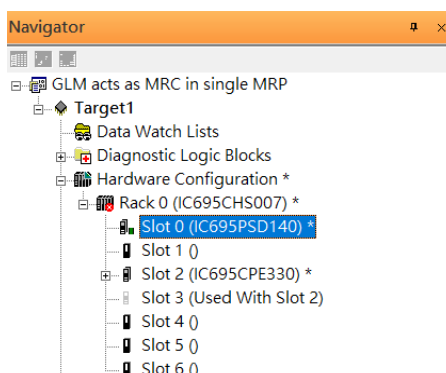
First, replace the power card. Click slot 0 and click the right button, select **Replace Module**, and specify the installed power card, PSD140, then click **OK**.

Figure 11: Replace Module



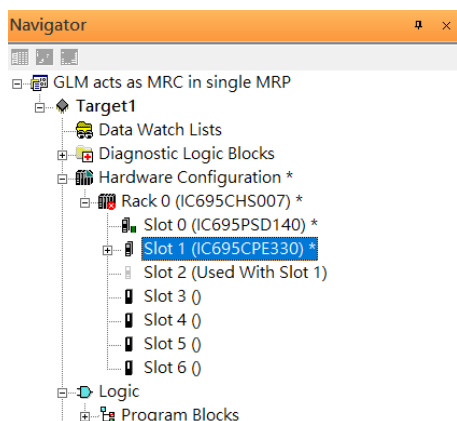
Slot 0 is replaced by current power card, PSD140.

Figure 12: Target Added



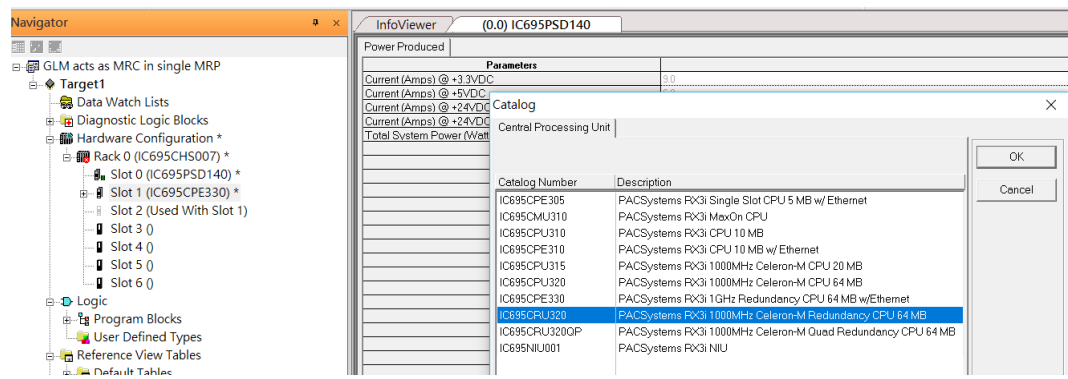
For slot 1 and 2, 2 chassis (1 and 2) is occupied by the Central Processing Unit, CRU320. To integrate slot 1 and 2, pull the slot 2 to slot 1. Now the slot 2 is cleaned.

Figure 13: Slot 1 and 2



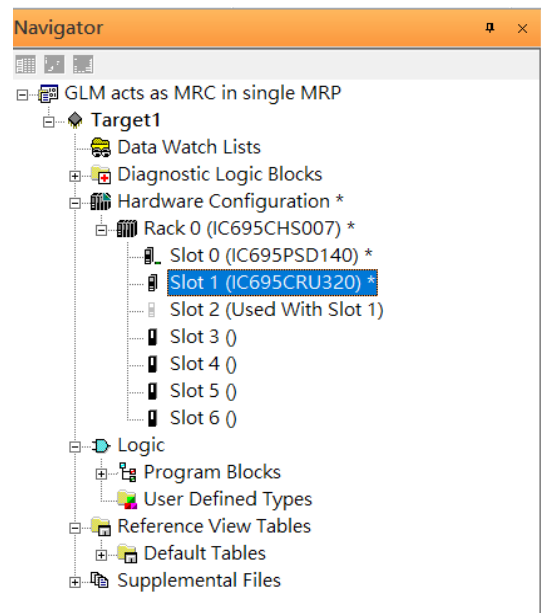
To select the Central Processing Unit, click slot 1 and click the right button, select **Replace Module** to choose CRU320. Then choose **No**.

Figure 14: Catalog Number



Now the CRU320 is specified.

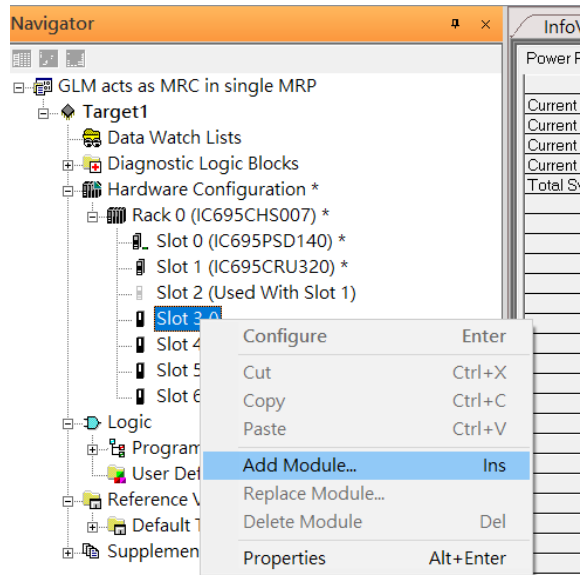
Figure 15: Select the specified target



3.2.2.1 Slot 3

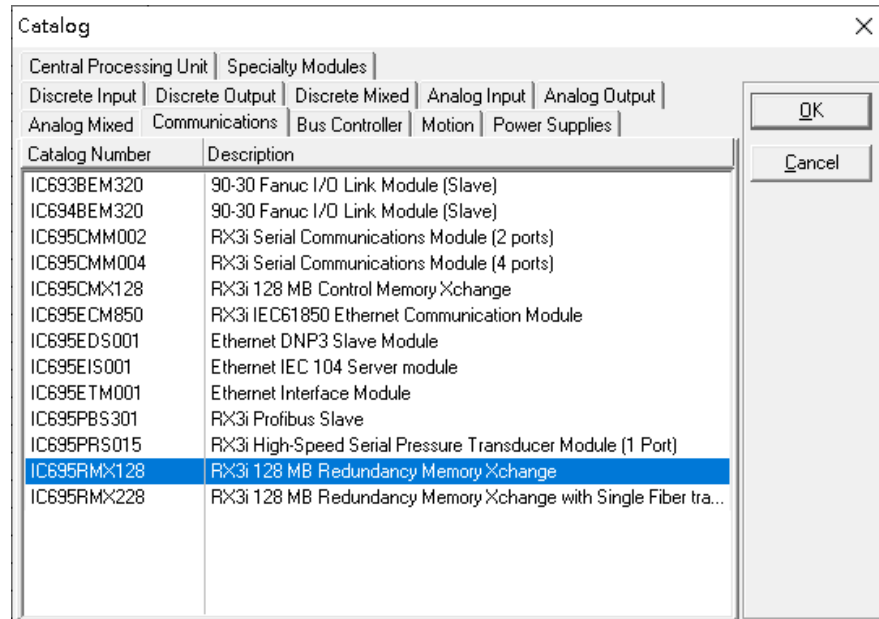
Next is to add RMX128 module for slot 3. Click the right button on slot 3, select **Add Module**.

Figure 16: Add Module



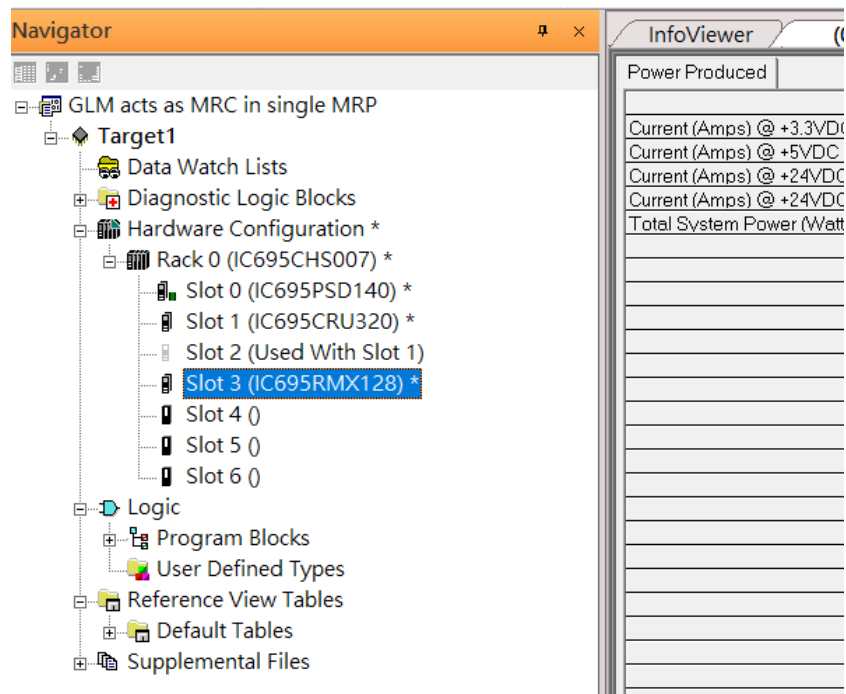
According to the current installation on the I/O Controller, the RMX128 shall be select. Select **Communications** -> **IC695RMX128** and click OK.

Figure 17: Select the module



Now the RMX128 is ready on slot 3.

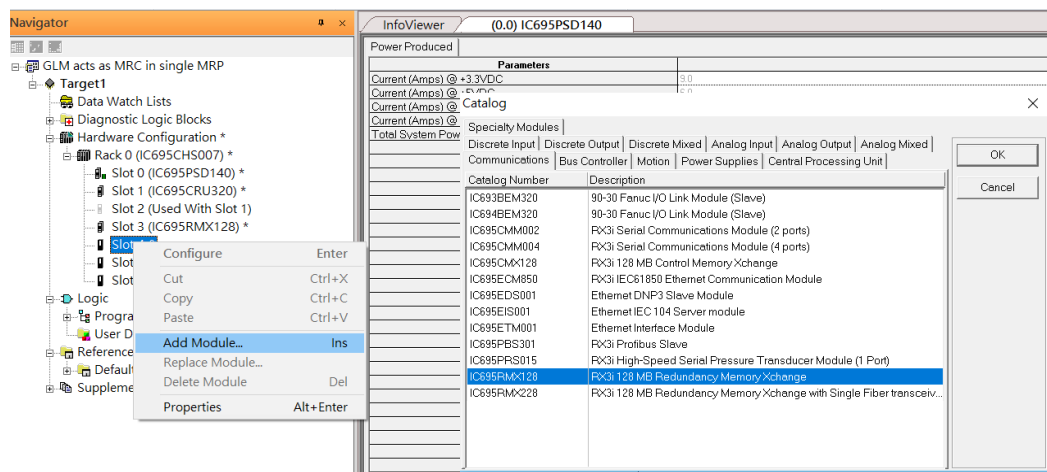
Figure 18: Review the configuration in Slot 3



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.

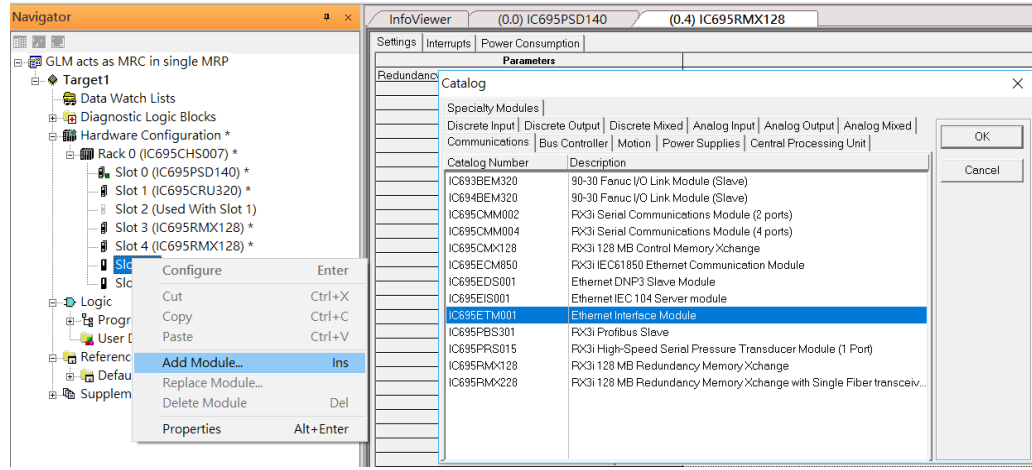
Figure 19: Add Module



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**.

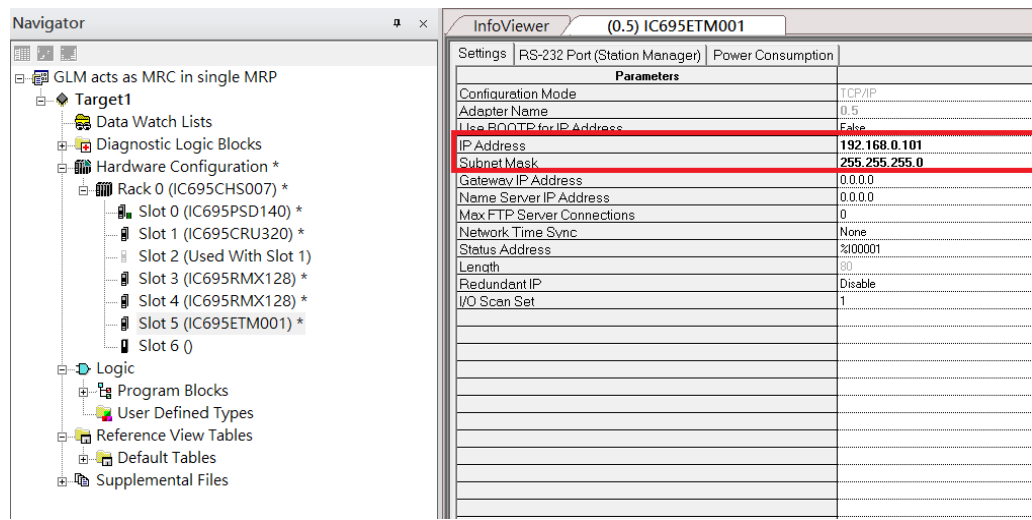
Figure 20: Add Module



It should be note that the ETM001 is the management device for PAC Machine Edition. The communication interface is 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.

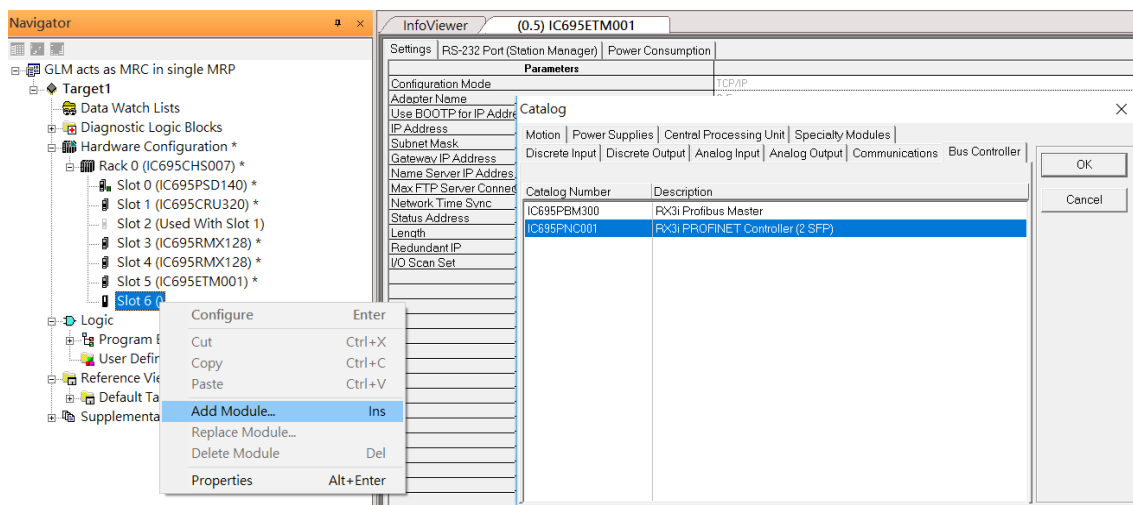
Figure 21: Specify the IP Address



3.2.2.4 Slot 6

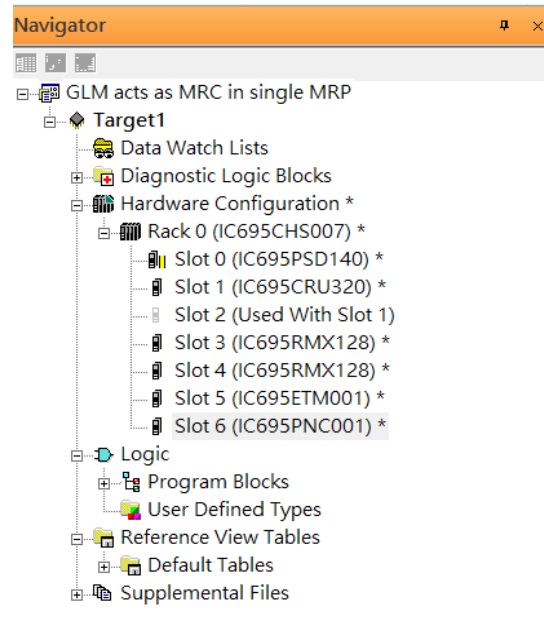
Next, select PNC001 for slot 6. Click slot 6 and click the right button, select **Add Module**, specify the installed Bus Controller, PNC001 and click **OK**

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.

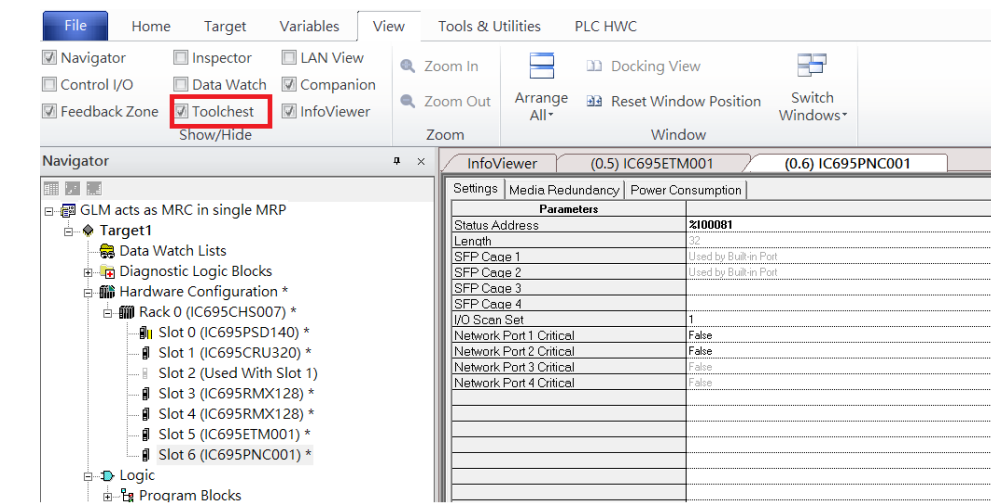
Figure 23: The rack is fully configured



3.2.3 I/O Device Setting

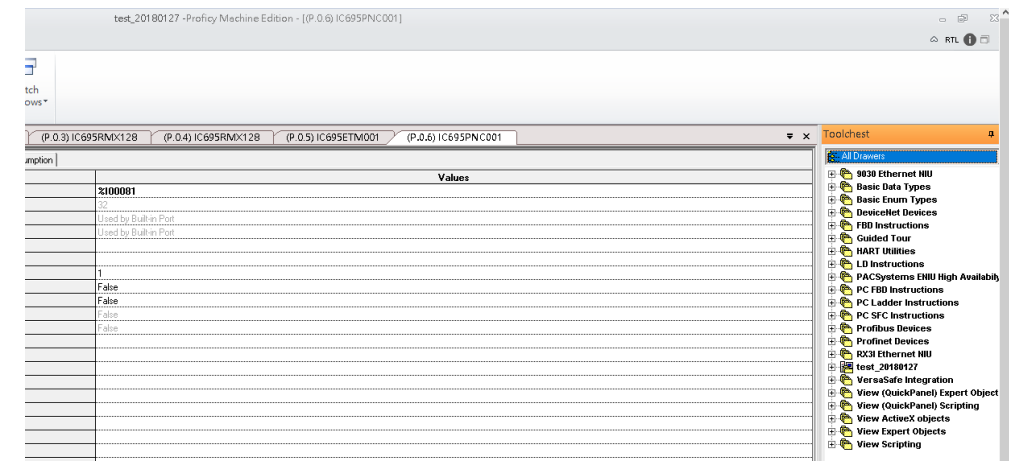
This section introduces the I/O Device integration. To configure the I/O Device, the GSDML file is necessary. Now we create another interface to load the GSDML file by using Toolchest.

Figure 24: Toolchest location



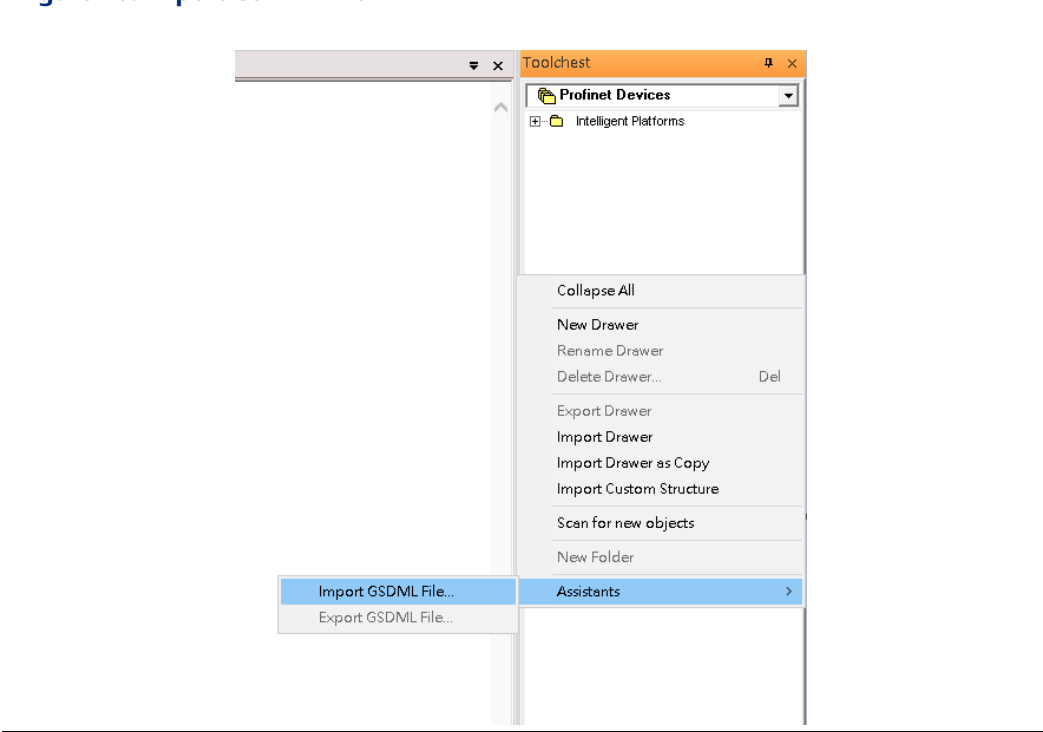
As shown in the following picture, a new interface is created on the right-hand side and select **Profinet Devices**.

Figure 25: Toolchest Interface



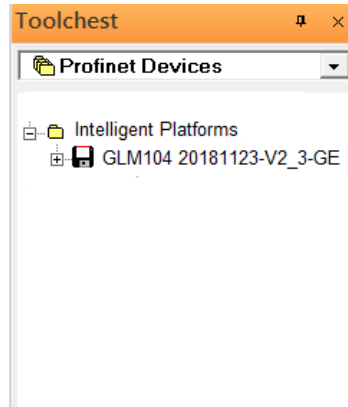
Click right button, select **Assistants-> Import GSDML File**. Select the GSDML File.

Figure 26: Import GSDML File



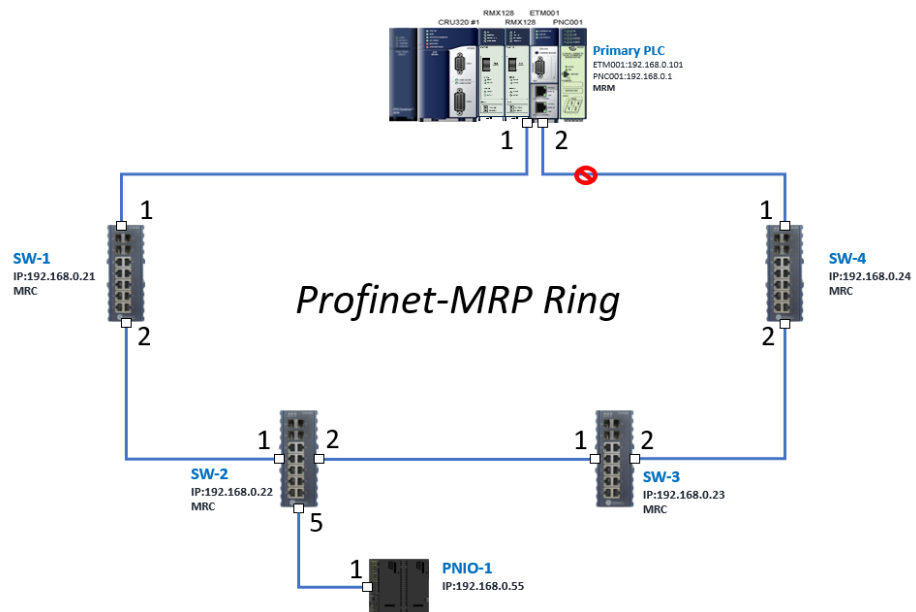
Then the corresponding I/O Device of GSDML File is added in the **Toolchest**.

Figure 27: Locate the GSDML file in the Toolchest



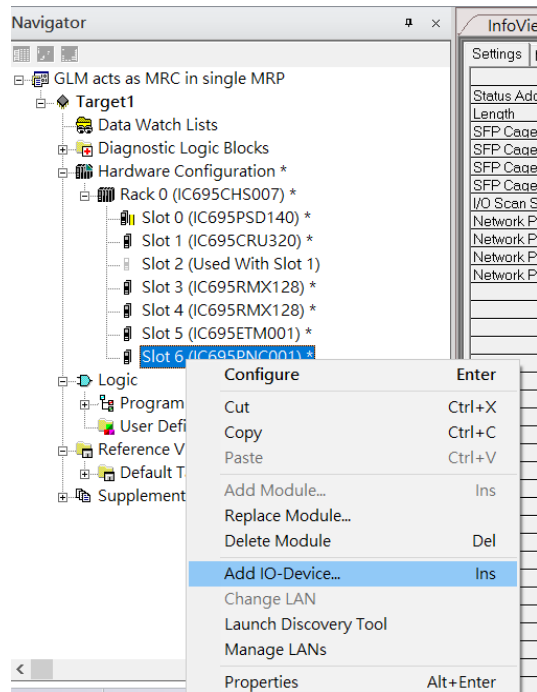
In this application setup, there are five I/O devices and one I/O controller. I/O devices are 4 switches and one Emerson VersaMax PROFINET I/O Scanner.

Figure 28: PROFINET-MRP Ring Application



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

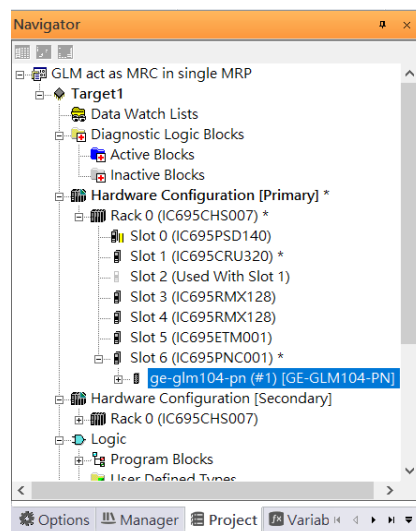
Figure 29: Add I/O Device



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.

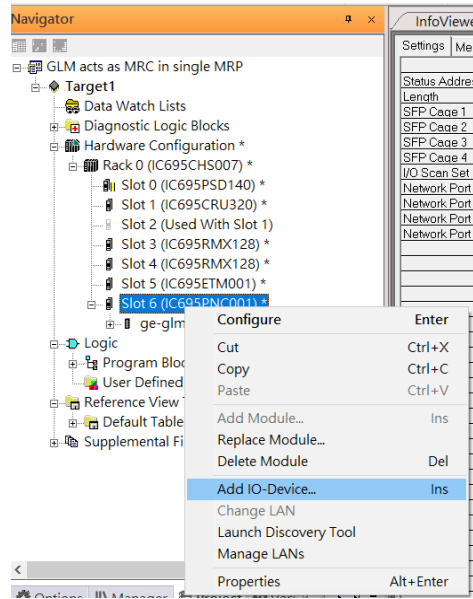
Figure 30



3.2.3.1 SW2

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

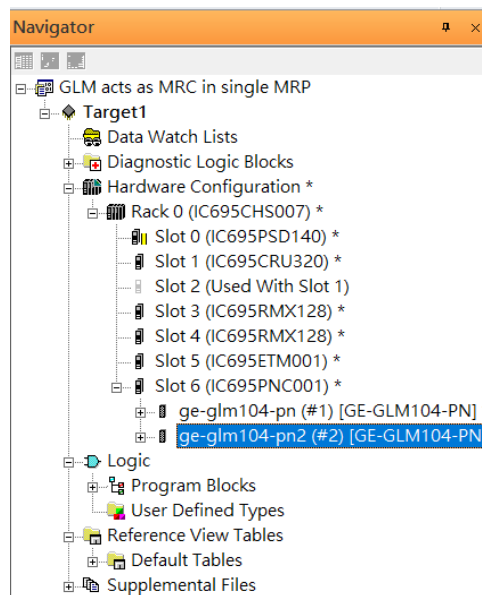
Figure 31



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.

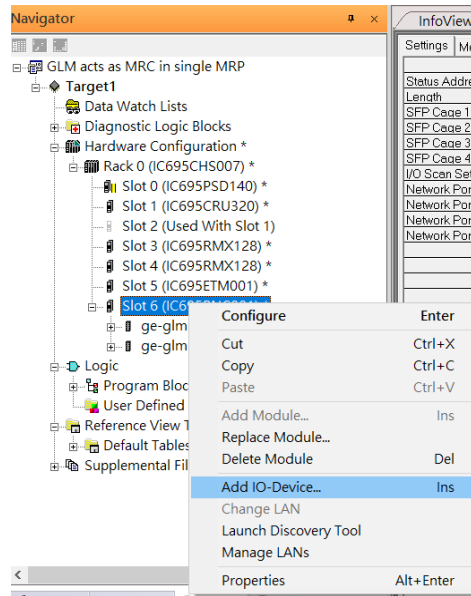
Figure 32: Sub-slot Configuration



3.2.3.2 SW3

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

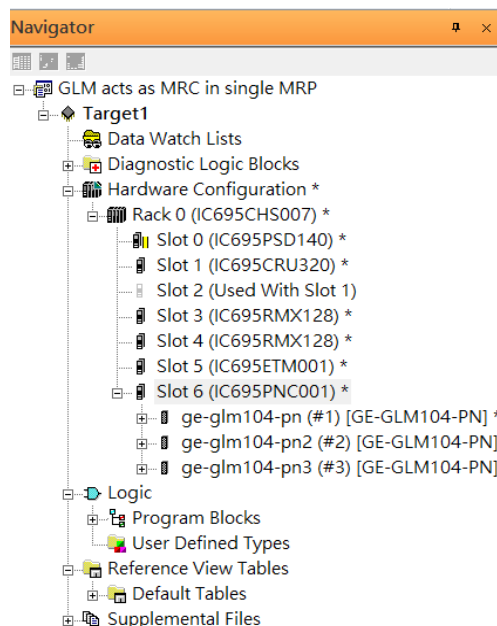
Figure 33: Adding third I/O Device



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.

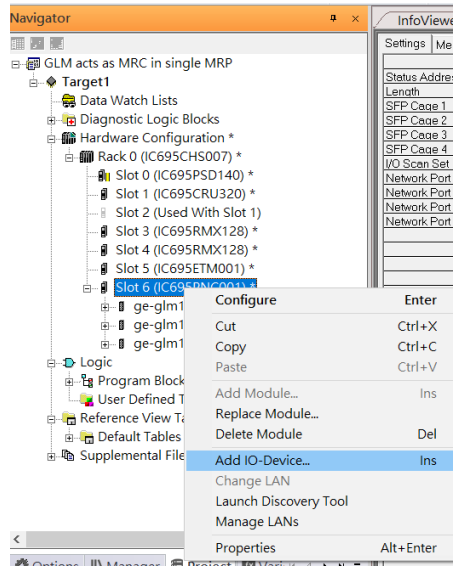
Figure 34: GLM104 (SW4)



3.2.3.3 SW4

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

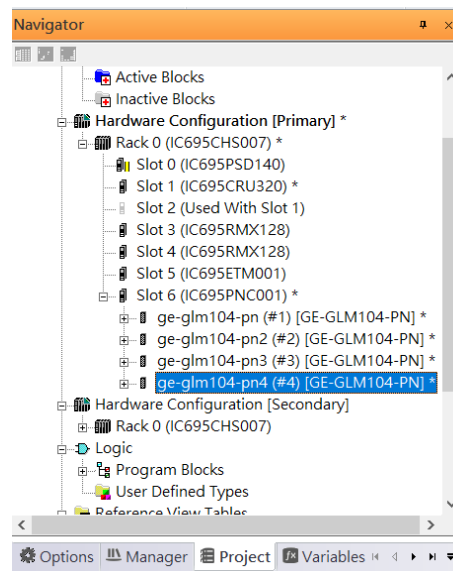
Figure 35: Add the fourth I/O device



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.

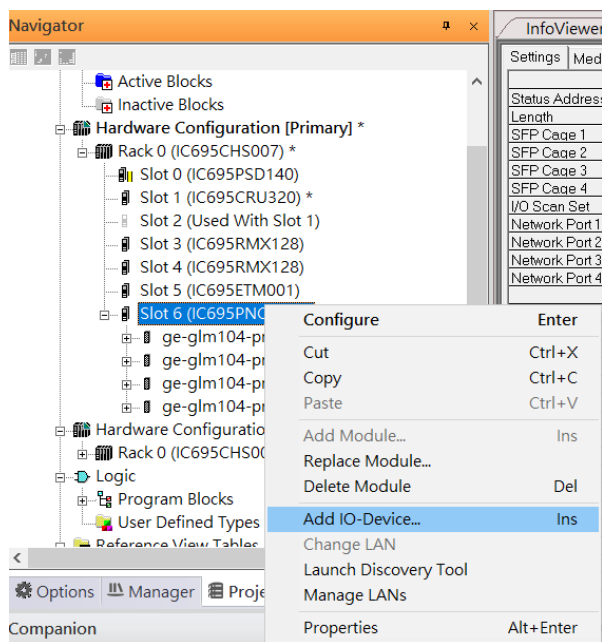
Figure 36: GLM104 (SW4)



3.2.3.4 SW5

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

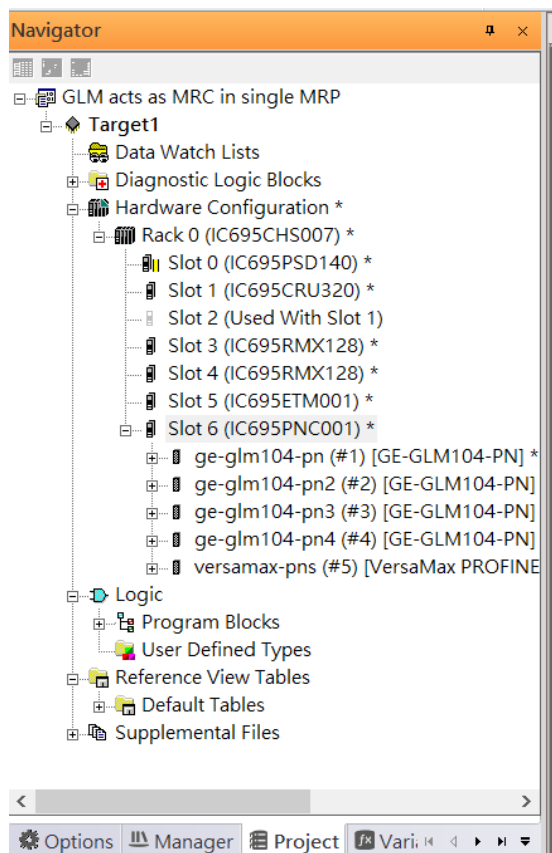
Figure 37: Add the Fifth I/O Device



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

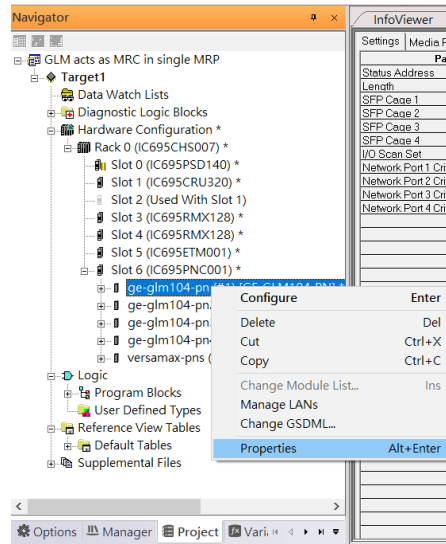


3.2.4 DCP Set Command

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

Under the 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 field **Device Name**, and the IP address can be set in field **IP address**. We modify 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 observed 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

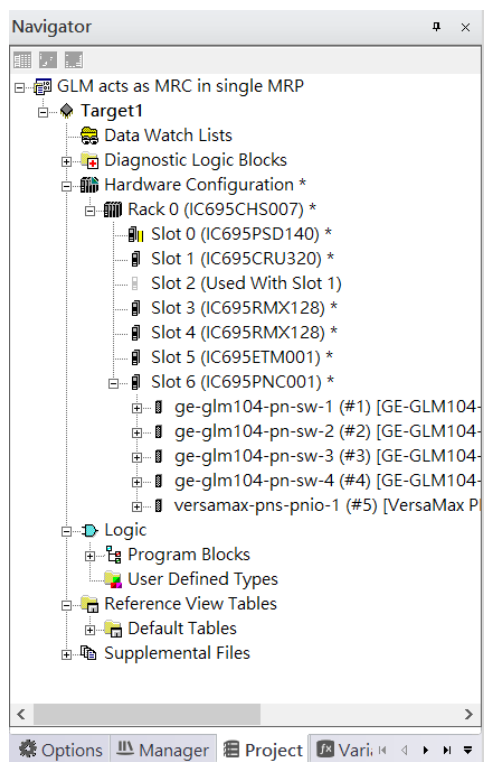
3.2.4.1 GLM104-PN2 through VERSAMAX-PNS-PNIO-1

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 been changed their device name and IP address like the following picture.

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

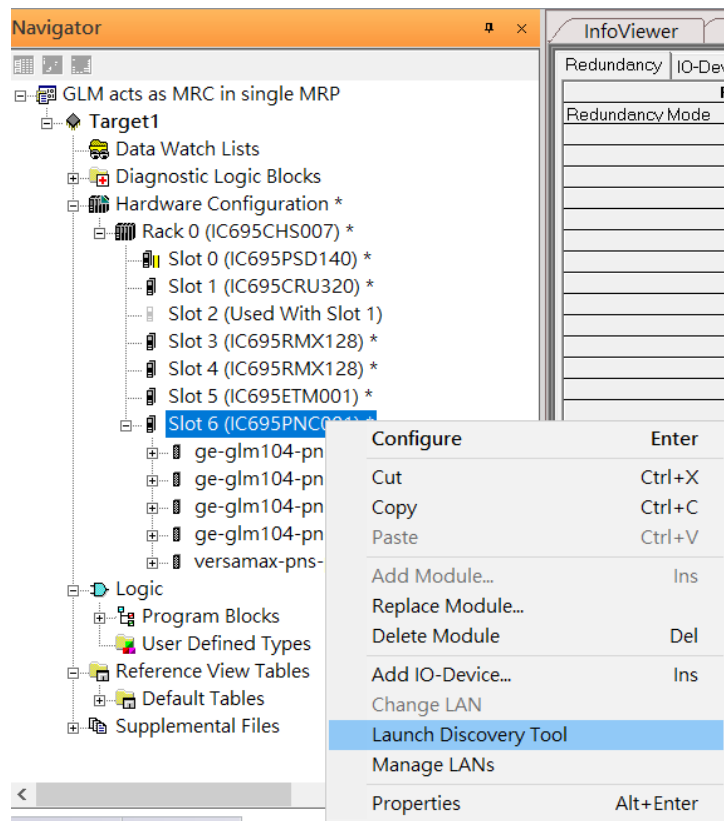


3.2.5 I/O Device Scan

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 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 are 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 **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

GLM104-PN Properties

Vendor Name: Intelligent Platforms Vendor ID: 015A
 MAC Address: 00-05-65-72-FB-D0 Device ID: 0104 Identify Device
 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 Set IP Information
 Gateway: 0.0.0.0

Reset device to factory settings
 Reset Device

Exit

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

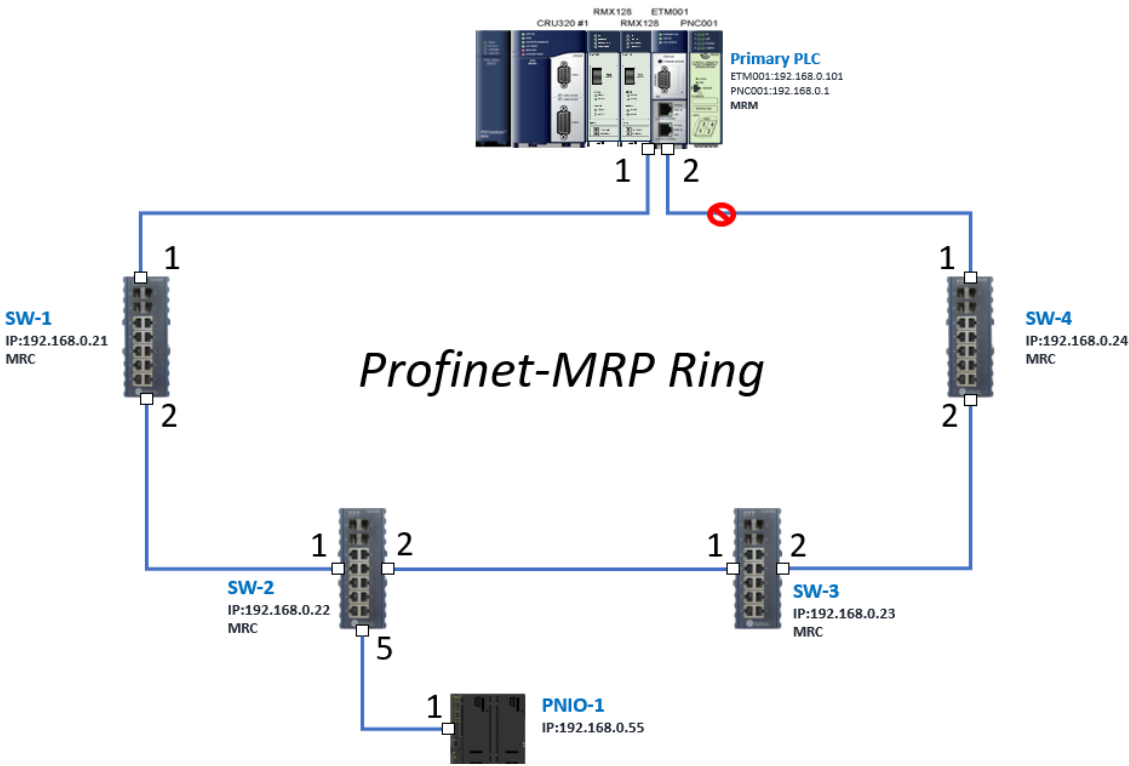
MAC Address: 00-09-91-56-C3-0E
 Device Role: Device
 Vendor ID: 015A
 Device ID: 0003
 IP Address: 192.168.0.55
 Subnet Mask: 255.255.255.0
 Gateway: 0.0.0.0

Identify Device Edit Device

3.2.6 MRP Setting

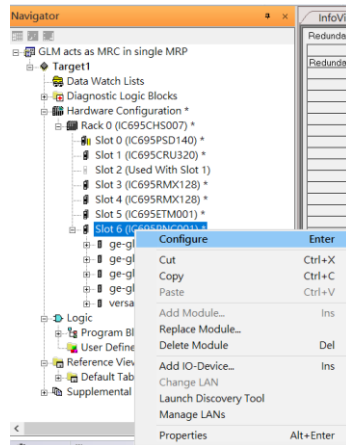
Setting MRP for I/O controller and I/O devices according to the following figure.

Figure 47: Profinet-MRP Ring Configuration



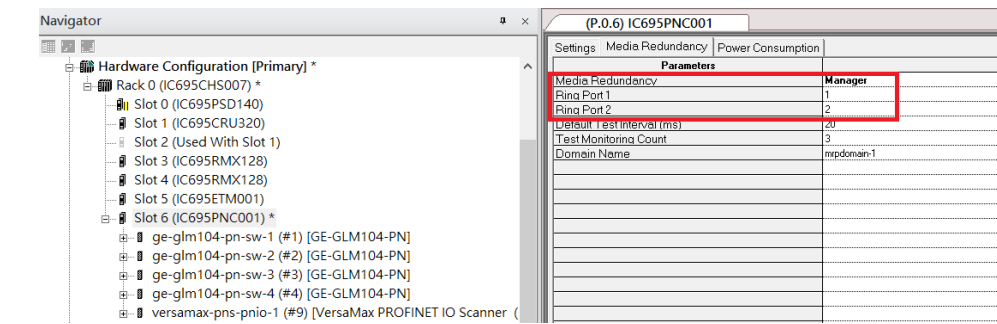
In order to enable MRP function in I/O controller, click the right button and choose **Configure**.

Figure 48: Configuring I/O Controller



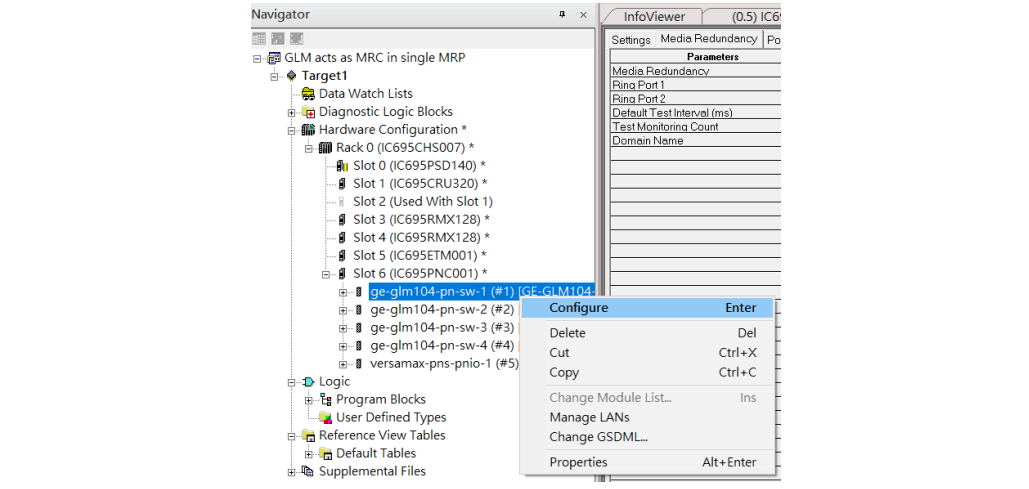
Enable MRP function by changing the value of **Media Redundancy** to Manager and select **Ring Port 1** to 1, **Ring Port 2** to 2.

Figure 49: Configuring Ring Port 1 and 2



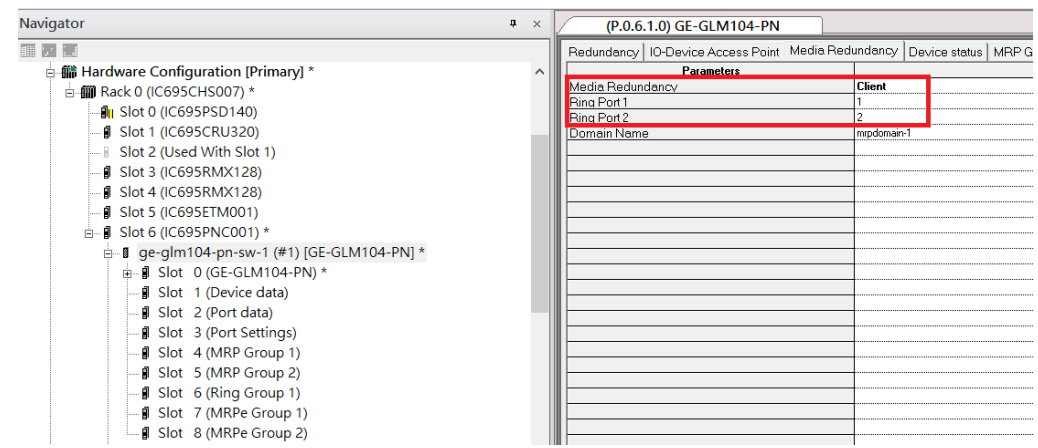
In order to enable MRP function in SW1, click the right button and choose **Configure**. It will show **Media Redundancy** on the right window.

Figure 50: Configuring Properties for SW1



Enable MRP function by changing the value of “Media Redundancy” to 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 I/O Controller shall be specified.

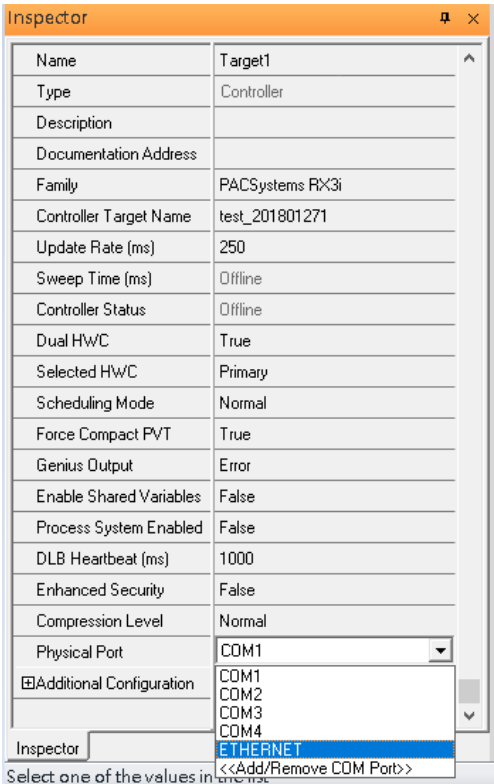
It should be noted that there is only 1 I/O Controller (Primary or Secondary) is able to communicate with PAC Machine Edition. Therefore, there are 3 rules of communication are defined.

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



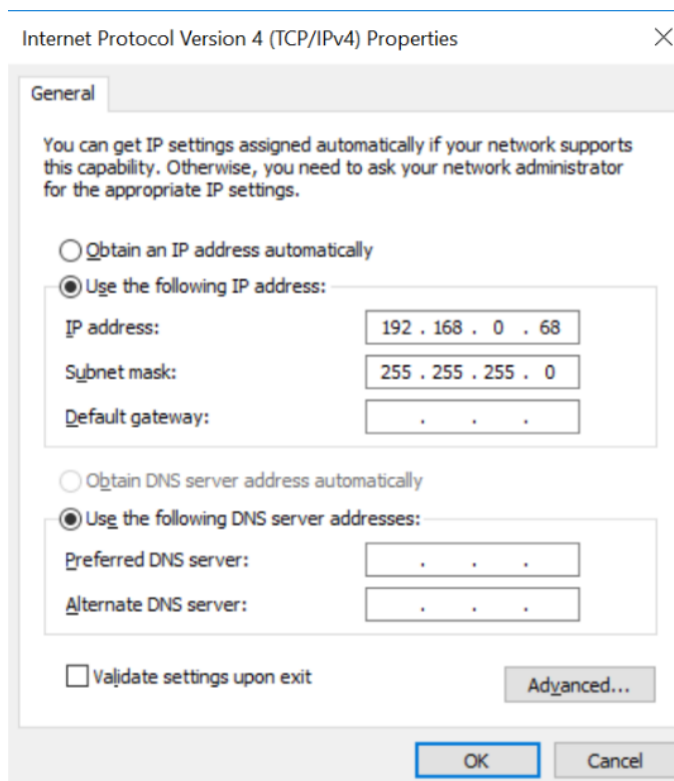
Also, the IP address of communicated I/O Controller shall be set. Here the **Primary** setting is shown.

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

3.2.8 PC Network

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

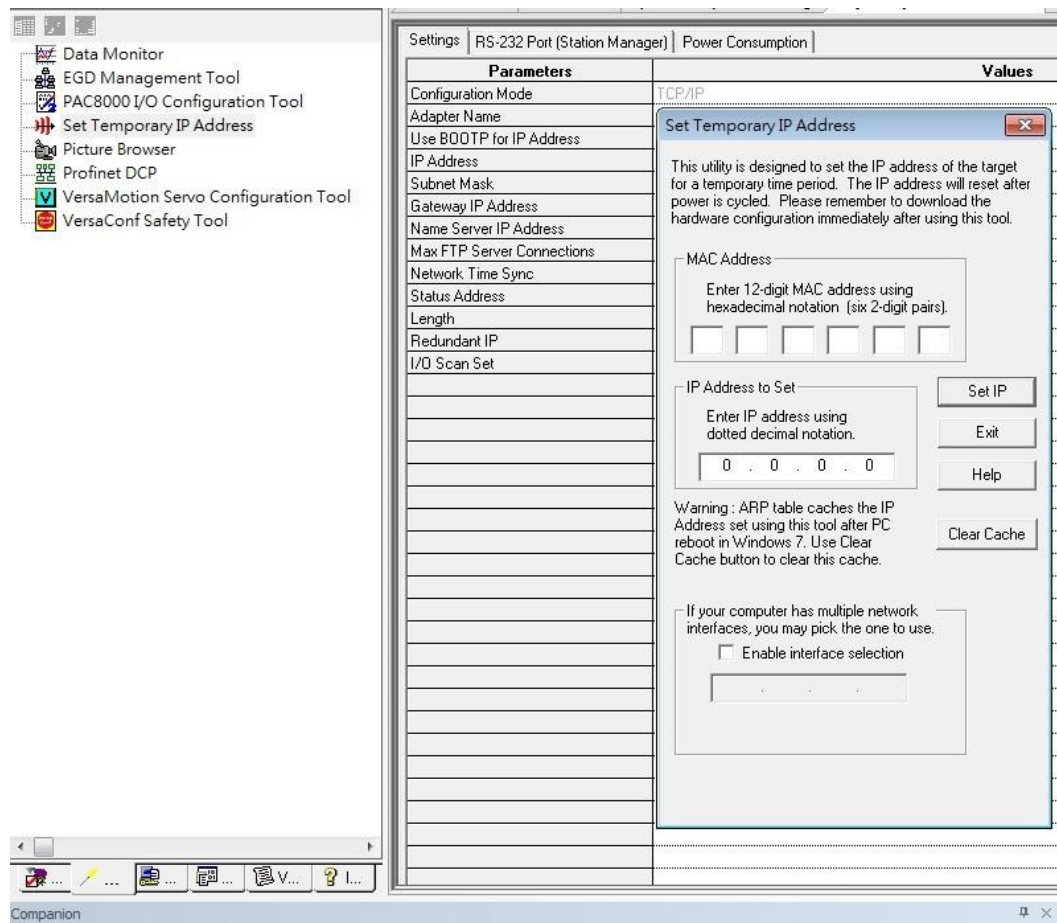
Figure 53: Configuring IP Address of PC with PME



3.2.9 Temporary IP

If the IP address of ETM001 is lost or forgotten, the IP address can be changed by the function **Set Temporary IP Address** according to the MAC address of ETM001. In the following figure, the MAC address is referenced to the ETM001, and the IP address can be defined by user.

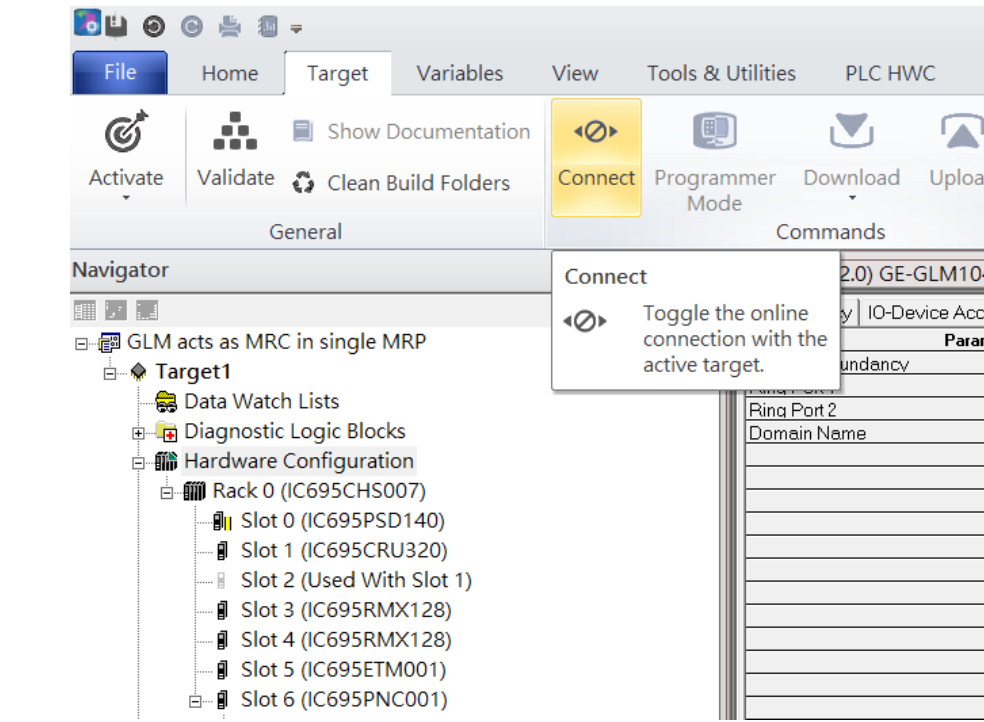
Figure 54: Set Temporary IP Address



3.3 Implementation

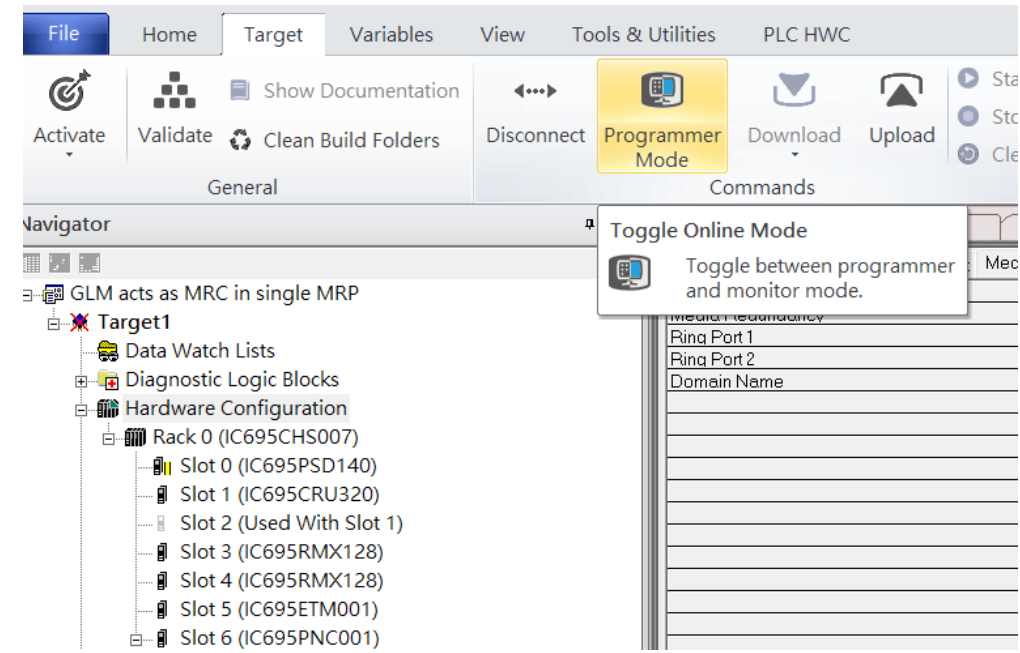
To download the configuration to hardware, the following steps shall be applied.
First, press the **Connect** icon.

Figure 55: Connecting to Target



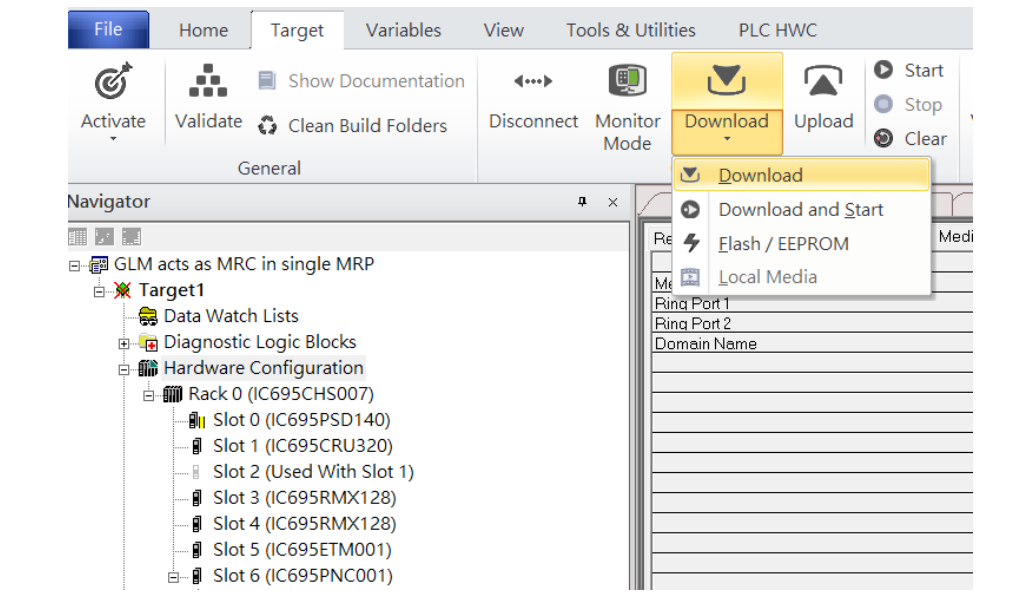
Then press the icon **Programmer Mode**.

Figure 56: Programmer Mode



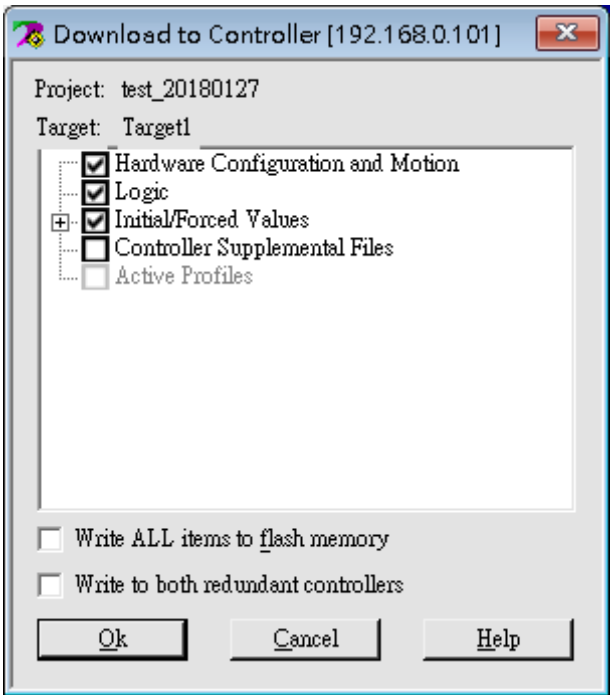
Then press icon **Download** and select **Download**.

Figure 57: Download



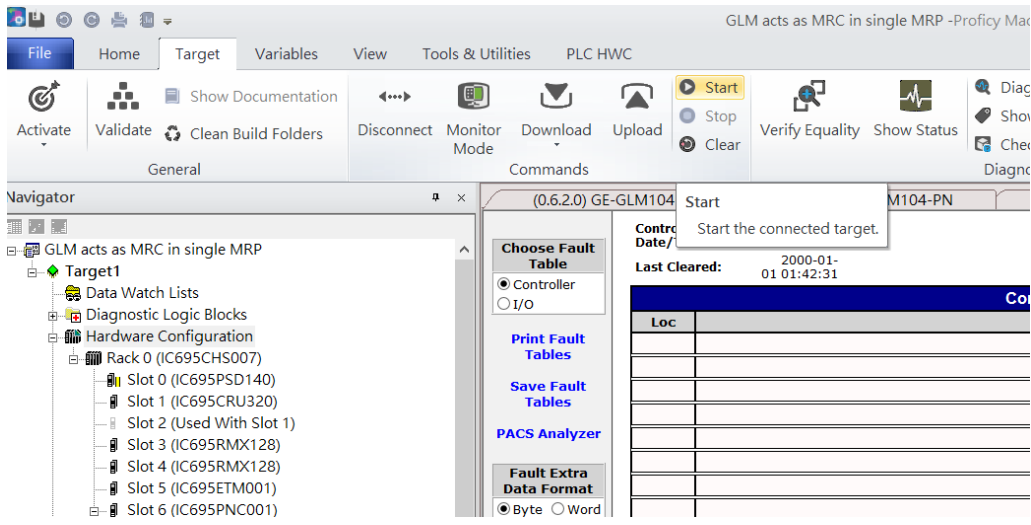
Then the dialogue is appeared to make sure the initialization procedure, select **OK**.

Figure 58: 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 59: Start



Section 4 Multiple PROFINET-MRP Ring

4.1 Network Topology

Figure 60: Multiple PROFINET-MRP Ring

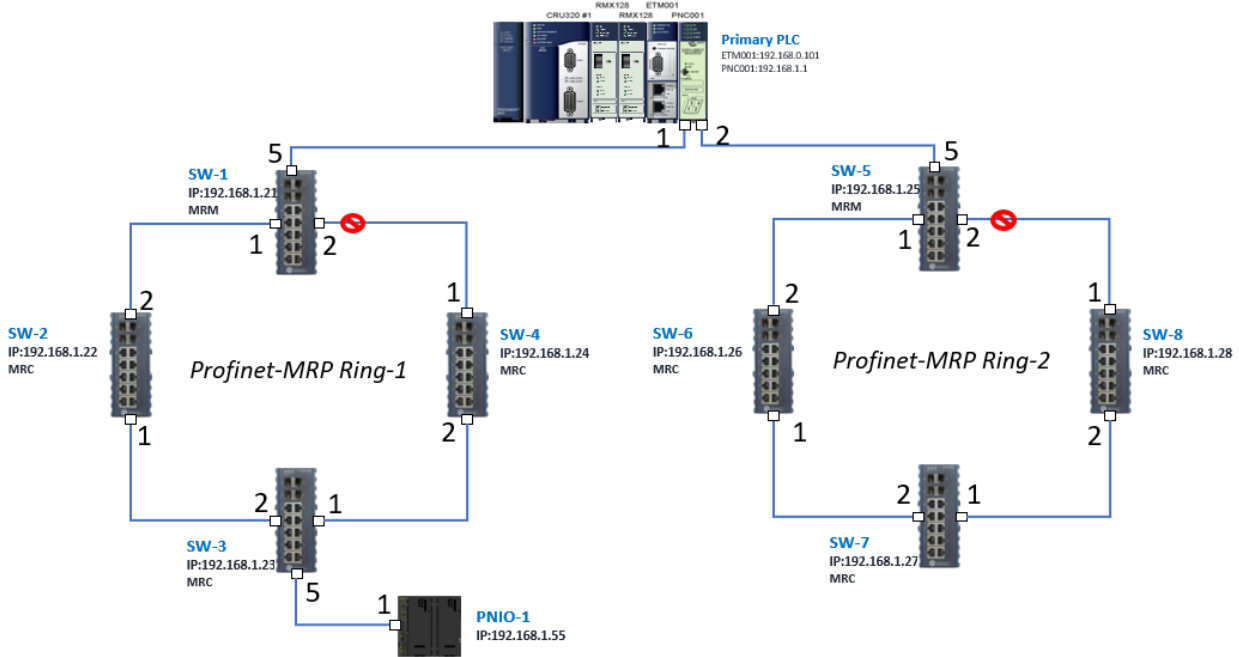


Figure 61

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 imbedded 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 62: Create a new project

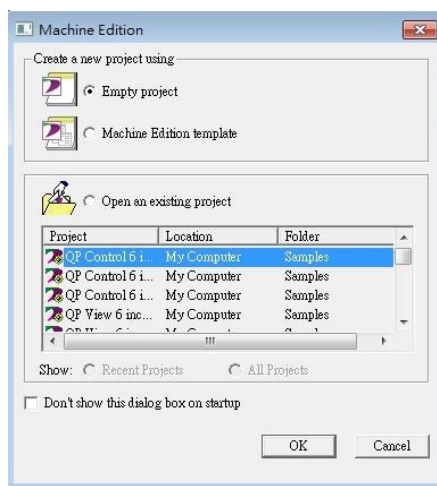
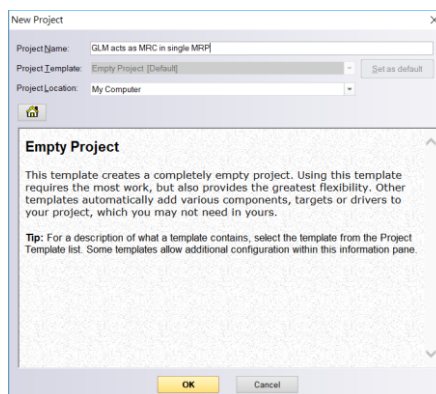


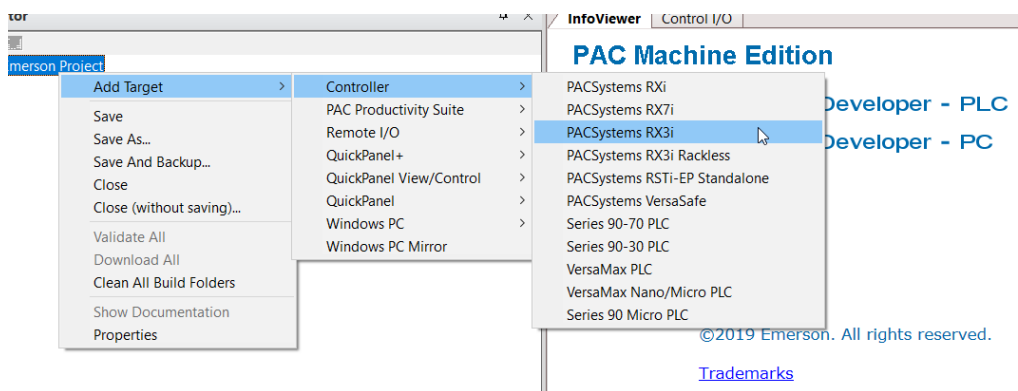
Figure 63: New Project Name



4.2.2 I/O Controller Setting

Next step is to add a target for this project. Click 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.

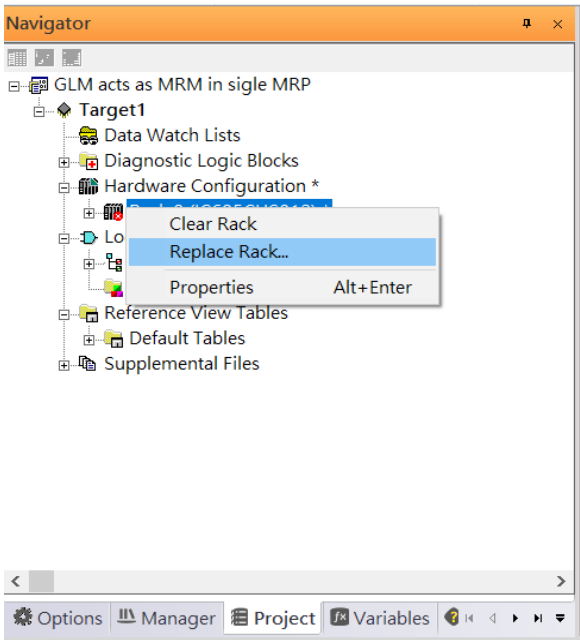
Figure 64: Adding a Target to Project



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 power card, communication module, or bus controller. However, there are only 7 chassis can be used in the I/O Controller CRU320. Thus, replace the rack for 7 slots.

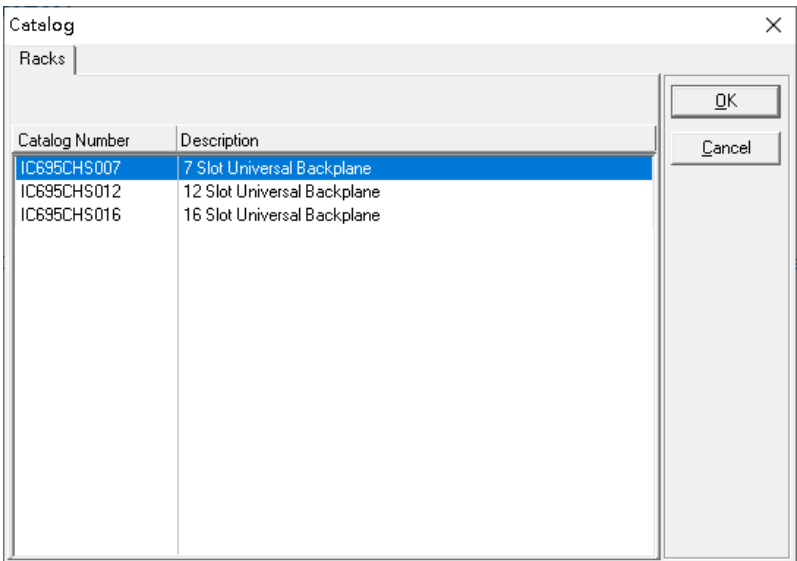
Click right button on “Rack 0 (IC695CHS012)” and select **Replace Rack**.

Figure 65: Replace Rack



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

Figure 66: Select CHS007



After the rack and the number of slots is 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 67: Rack Configuration for this Use Case



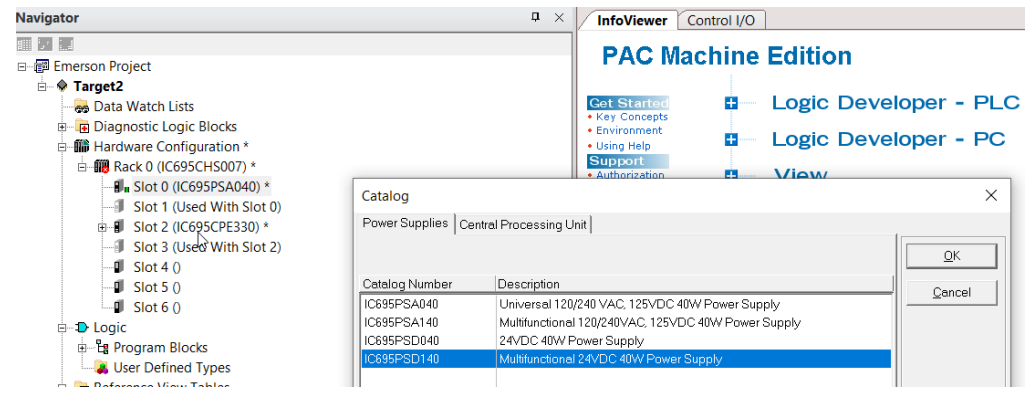
From left to right, the installed devices on the I/O Controller are
Devices on I/O Controller

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.

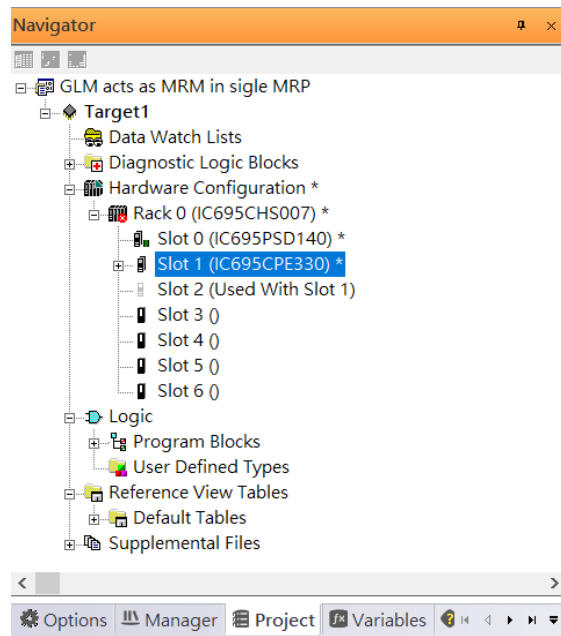
First, replace the power card. Click slot 0 and click the right button, select **Replace Module**, and specify the installed power card, PSD140, then click **OK**.

Figure 68: Specifying the power card for Slot 0



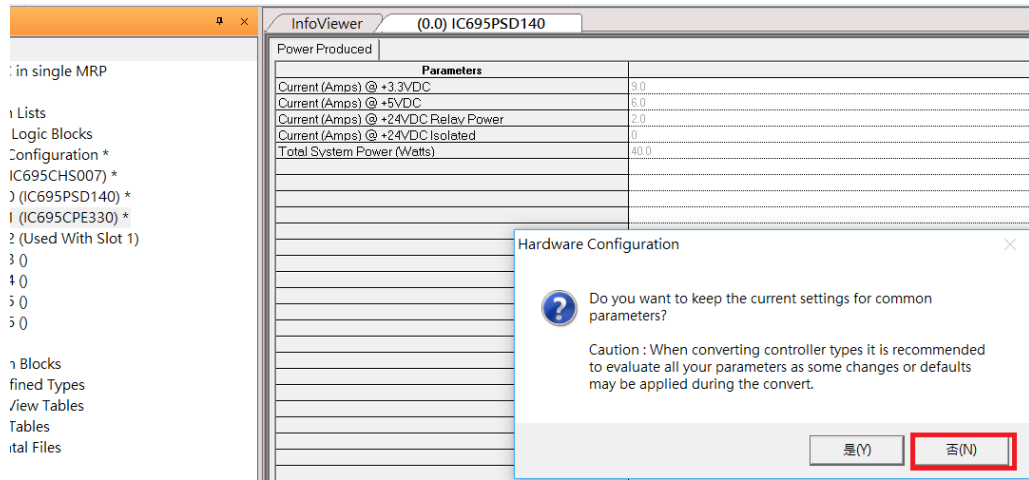
For slot 1 and 2, 2 chassis (1 and 2) is occupied by the Central Processing Unit, CRU320. To integrate slot 1 and 2, pull the slot 2 to slot 1. Slot 2 is now clear.

Figure 69: 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**.

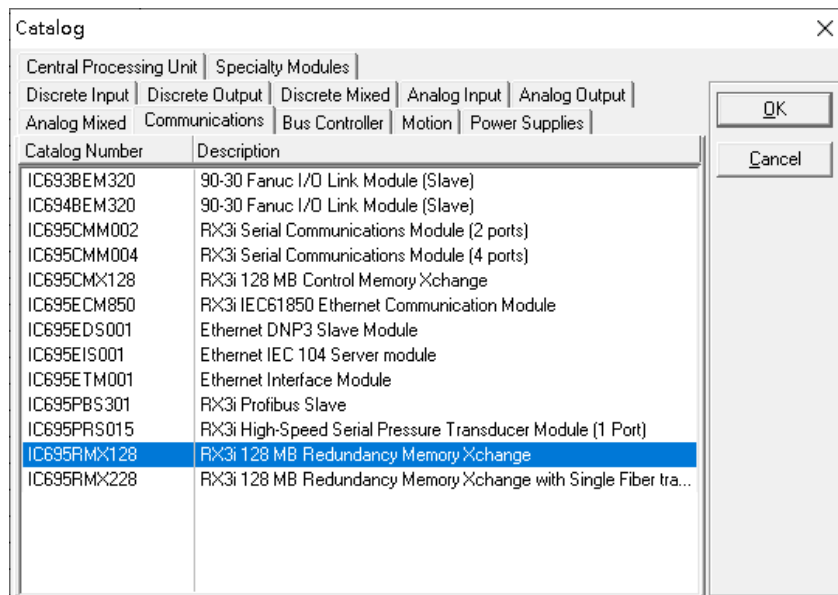
Figure 70: Dismissing Common Parameters



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

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

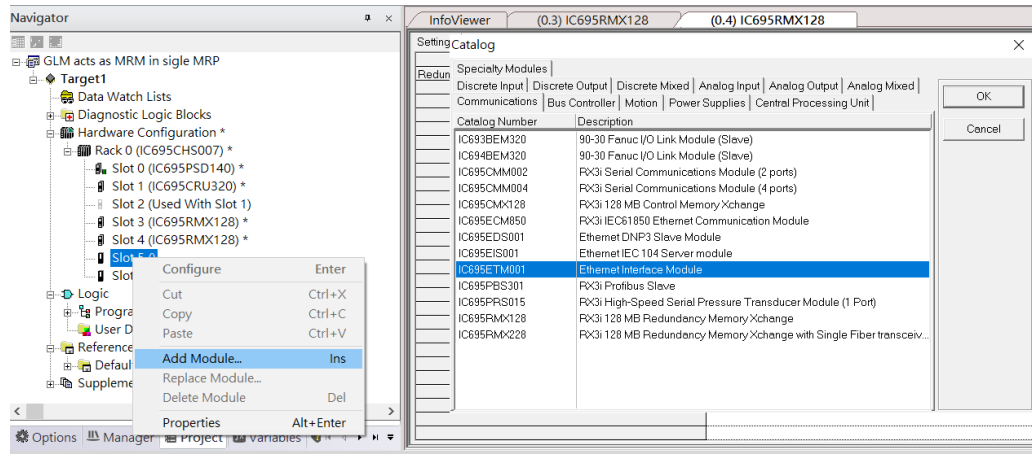
Figure 71: Selecting RMX128



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

Next, configure slot 5 with the ETM001.

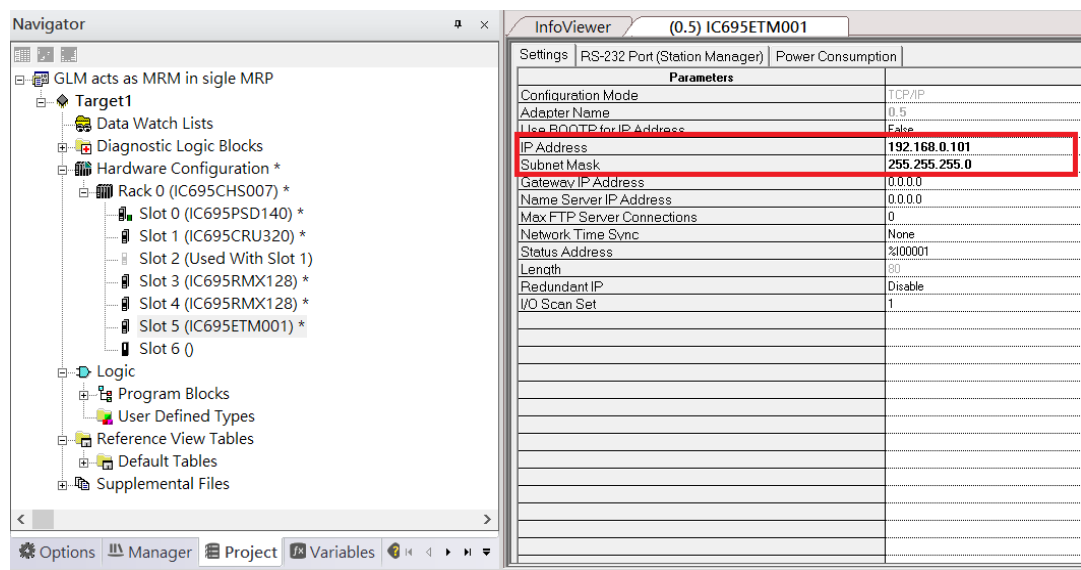
Figure 72: Configuring Slot 5 with an ETM001 module.



It should be noted that the ETM001 is the management device for PAC Machine Edition. The communication interface is 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.

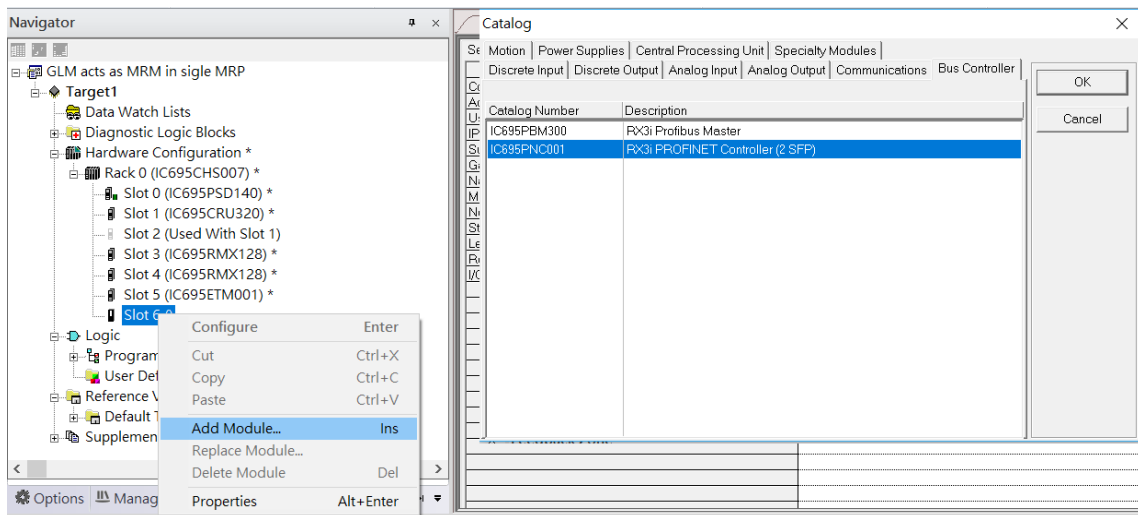
Figure 73: Configuring the IP Address and Subnet Mask on the ETMETM001



Next, select PNC001 for slot 6.

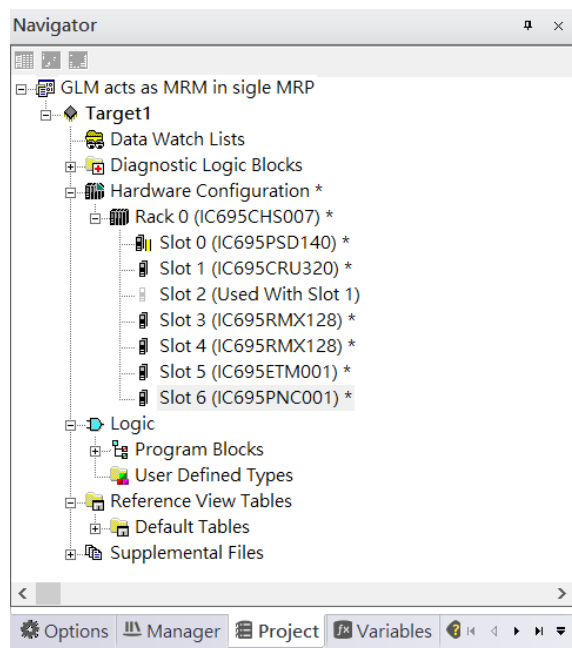
Click slot 6 and click the right button, select **Add Module**, specify the installed Bus Controller, PNC001 and click OK.

Figure 74: 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.

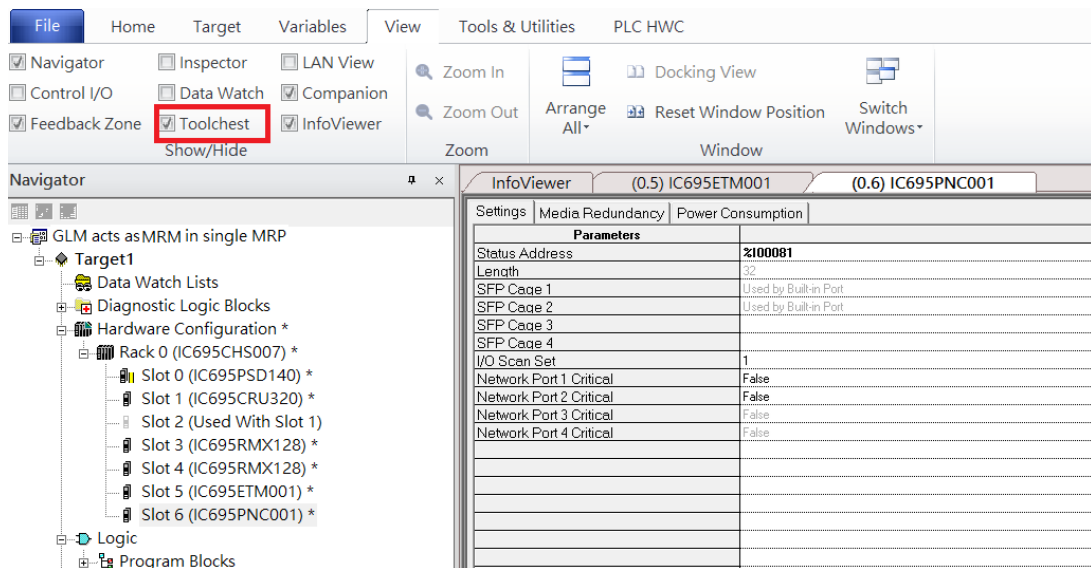
Figure 75: Final Rack Configuration



4.2.3 I/O Device Setting

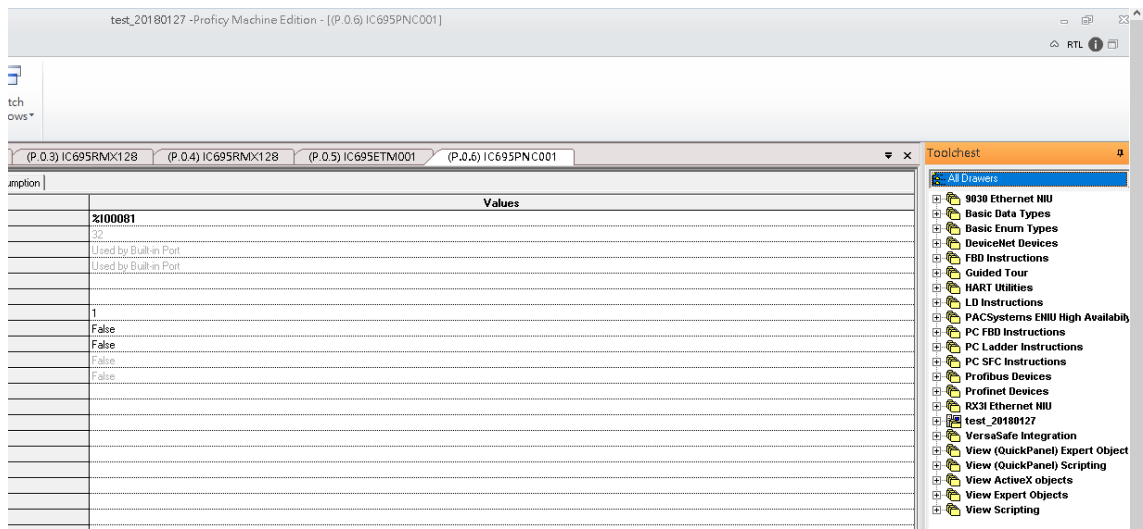
This section introduces the I/O Device integration. To configure the I/O Device, the GSDML file is necessary. Now we create another interface to load the GSDML file by using Toolchest.

Figure 76: Toolchest feature



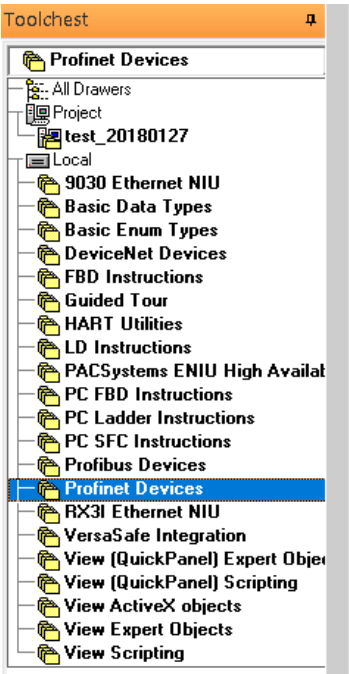
As shown in the following picture, the interface is created on the right-hand side.

Figure 77: Default Toolchest Interface Location



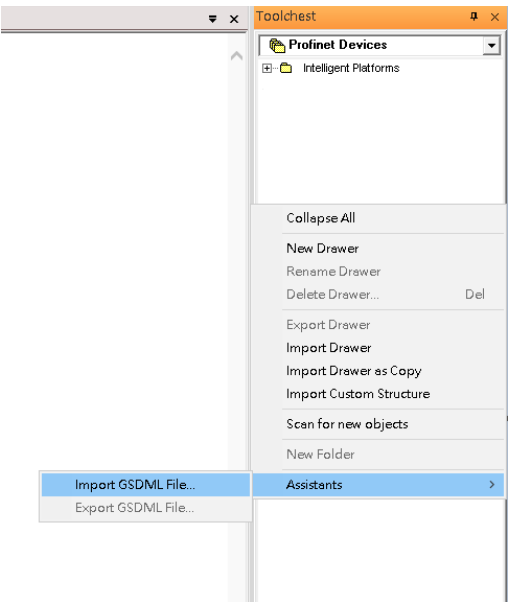
Select Profinet Devices from the Toolchest.

Figure 78: Profinet Devices



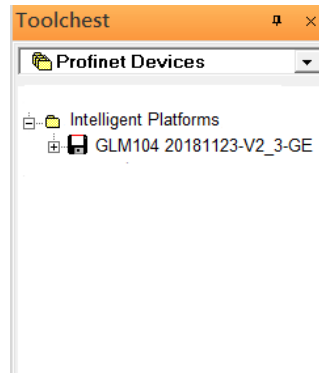
Click right button, select Assistants -> Import GSDML File ...

Figure 79: Importing the GSDML File



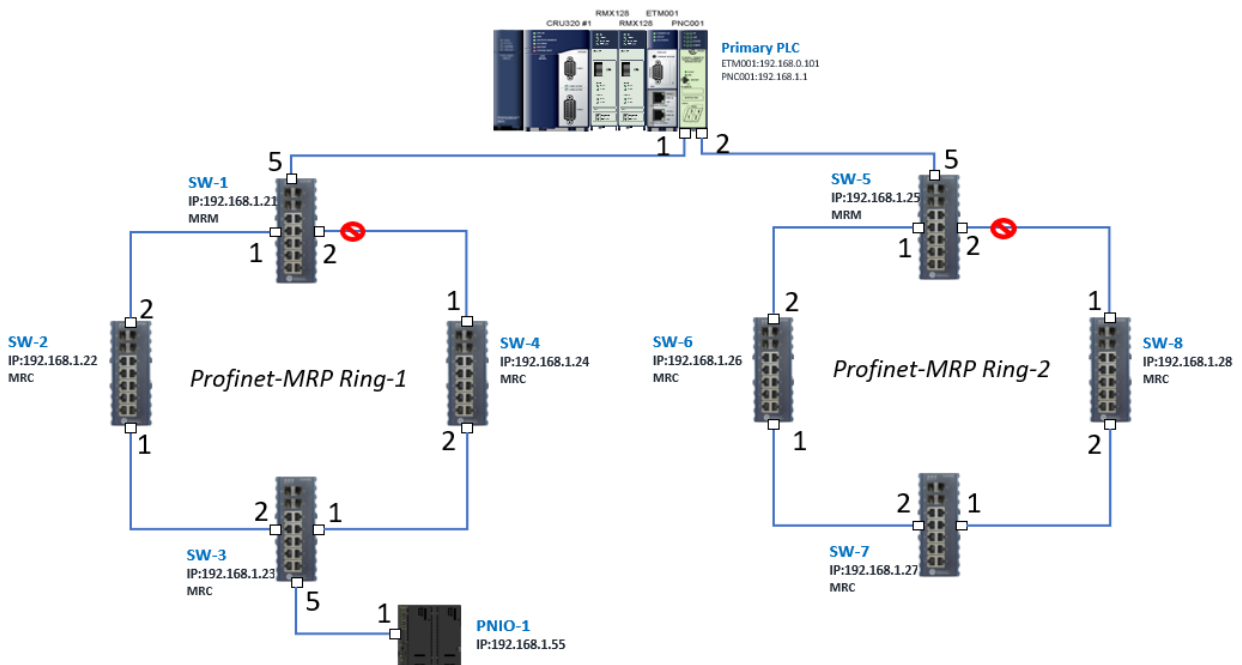
Select the GSDML File to open. The corresponding I/O Device of GSDML File is added in the Toolchest.

Figure 80: GSDML File Added to the Toolchest



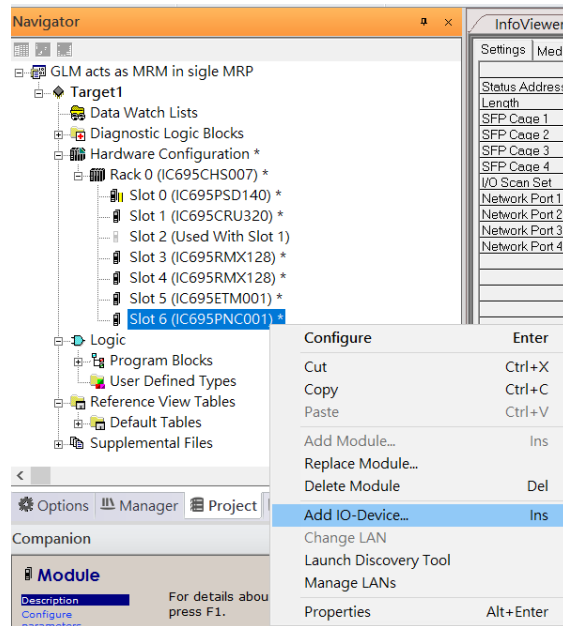
In this document, there are nine I/O devices and one I/O controller. I/O devices are eight switches and one Emerson VersaMax PROFINET I/O Scanner.

Figure 81: Multiple PROFINET-MRP Rings



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.

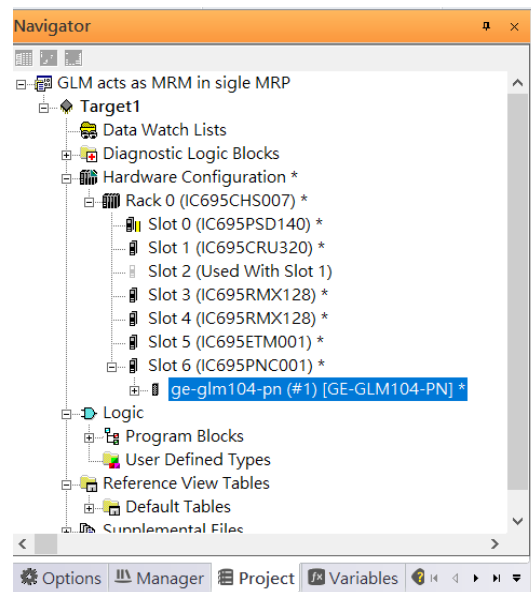
Figure 82: Add the I/O Device on PNC001



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

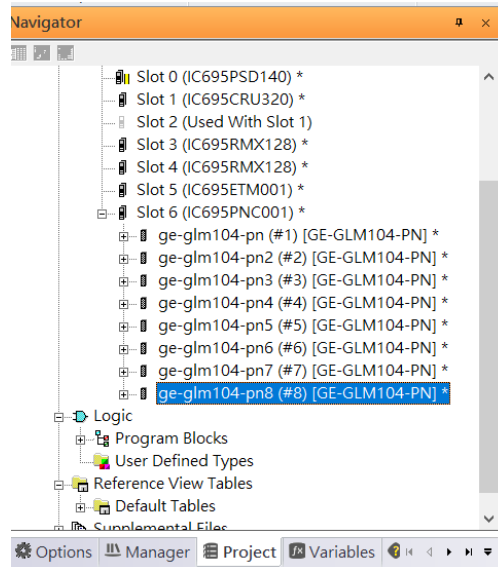
Now the I/O device GLM104(SW1) is ready and is a sub slot on PNC001.

Figure 83: 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:

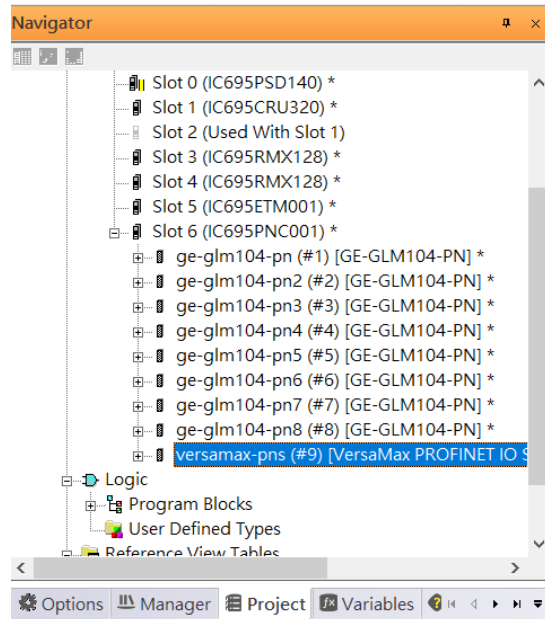
Figure 84: Eight I/O Devices Added to the PNC001



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 85: All Nine I/O Devices Added to the PNC001



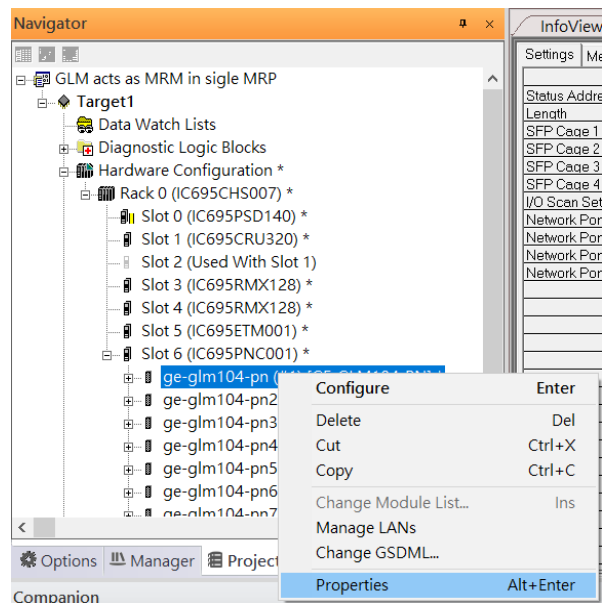
4.2.4 DCP Set Command

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

Under the slot 6, PNC001, select the I/O Device, ge-glm104-pn, and click the right button.

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

Figure 86: Opening the first I/O Device's Properties



In this table, the I/O Device name can be specified in field **Device Name**, and the IP address can be set in field **IP address**. We modify 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 87: Device Name in "Network Identification"

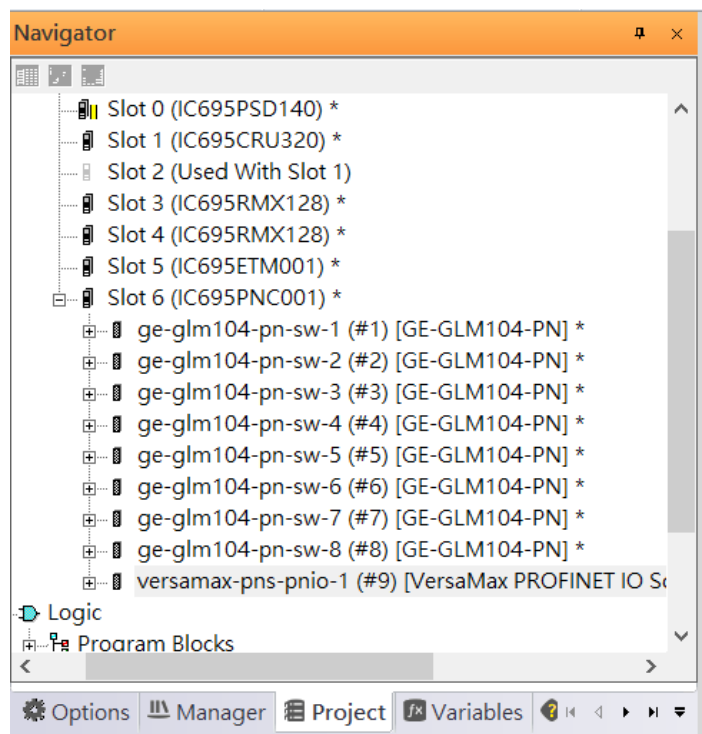
The screenshot shows the 'Inspector' window with the 'Network Identification' tab selected. The 'Device Name' field is set to 'ge-glm104-pn-sw-2'. Other fields include 'Device Number' (2), 'Update Rate (ms)' (128), 'Reference Variable' (<None>), 'IO LAN' (LAN01), 'Device Description', 'IP Address' (192.168.0.22), 'General' (expanded), 'GSDML' (GSDML-V2.3-GE-GLM104-20181123.xml), 'Device Type' (GE-GLM104-PN), 'Device Access Point ID' (GE-GLM104-PN), and 'Group IO References' (True).

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 88: Fully Configured Rack

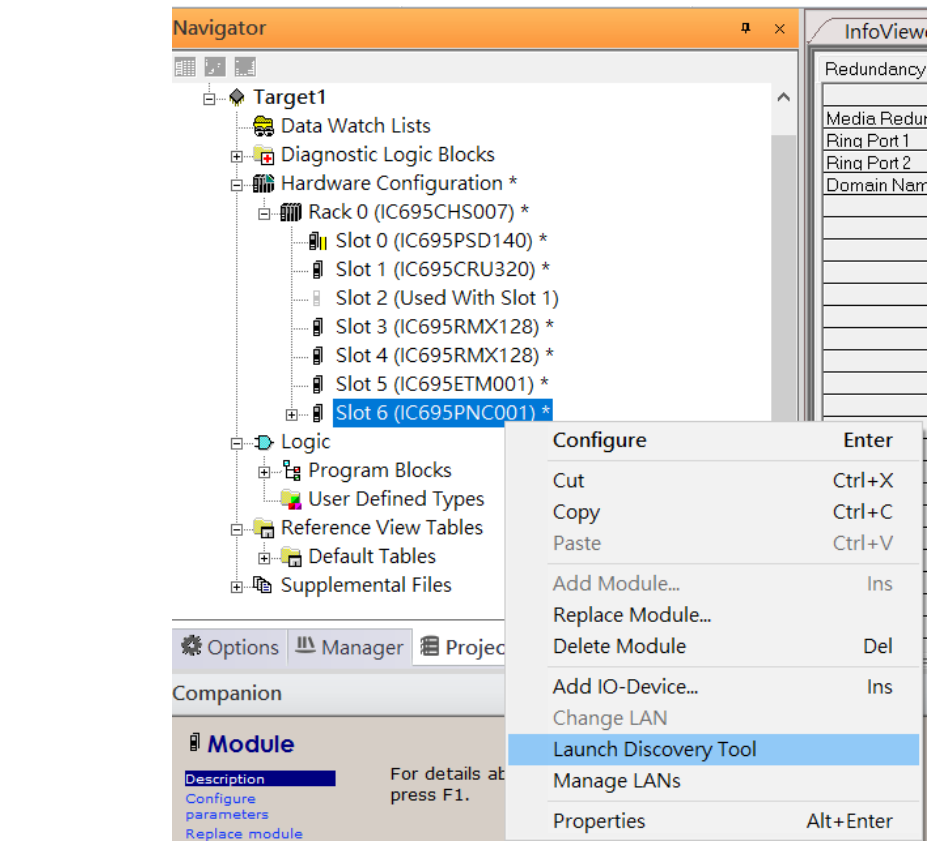


4.2.5 I/O Device Scan

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 loop.

Figure 89: Launch Dsicovery 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 90: Refreshing Device List

There are I/O Devices and their status are 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 **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 91: 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 92: Assigned Devices

The screenshot shows the InfoViewer application window. The title bar indicates the connection is 'PROFINET DCP - Direct Connection'. The main window displays a table of assigned devices. The table has columns for Status, Device Name, IP Address, Vendor, and Device Type. All devices listed have a green checkmark in the Status column, indicating they are assigned. The devices include eight GE Intelligent Platforms switches (ge-glm104-pn-sw-1 to sw-8) and one Versamax PNS PNIO (versamax-pns-pnio-1). The bottom of the window shows filter settings (Assigned, Assigned with errors, Not assigned) and selection properties for the selected device (IP Address: 192.168.0.55, Subnet Mask: 255.255.255.0, Gateway: 0.0.0.0).

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

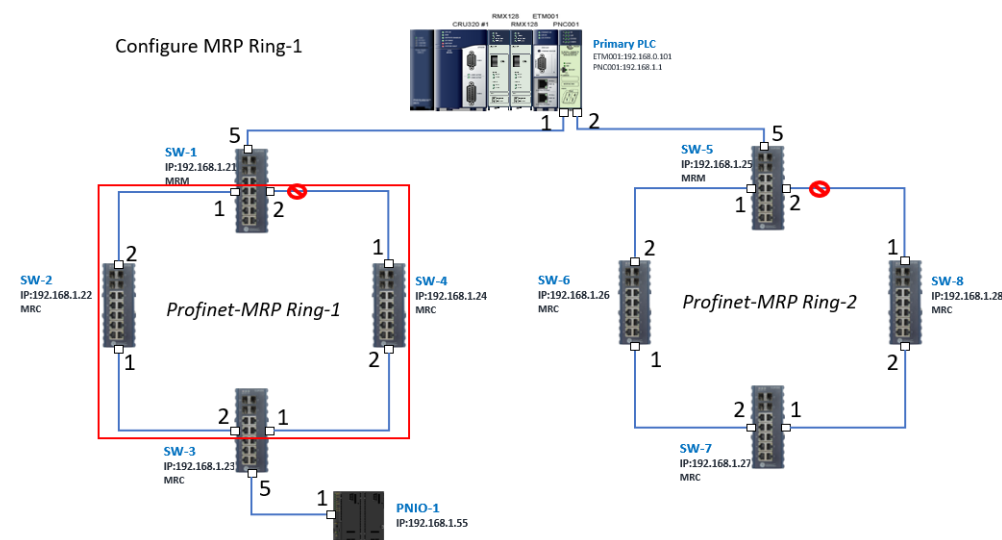
Selection Properties:
 MAC Address: 00-09-91-56-C3-0E
 Device Role: Device
 Vendor ID: 015A
 Device ID: 0003
 IP Address: 192.168.0.55
 Subnet Mask: 255.255.255.0
 Gateway: 0.0.0.0

Buttons: Identify Device, Edit Device

4.2.6 MRP Setting

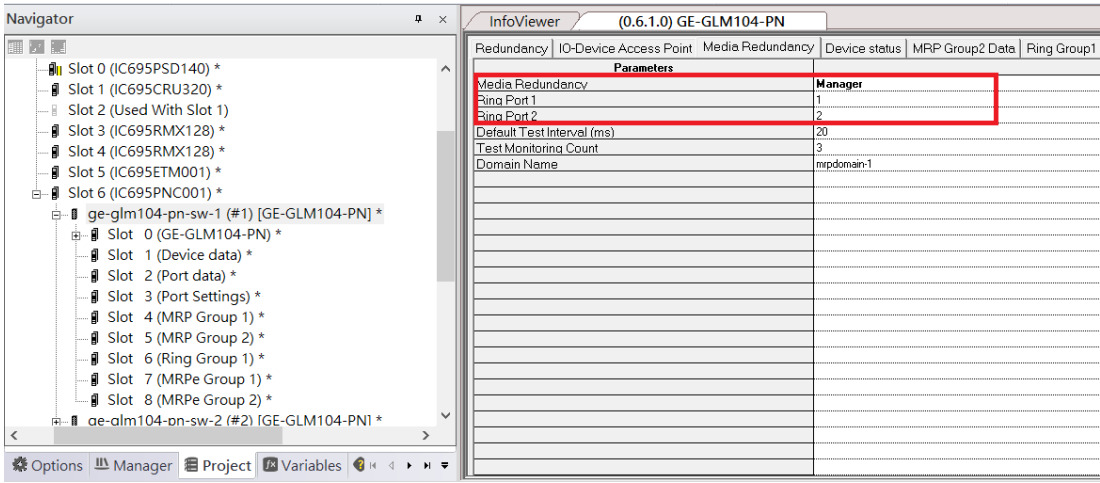
To being, we will configure the MRP outlined in the red box of the Profinet MRP Ring-1 configuration

Figure 93: Configuring MRP Ring-1



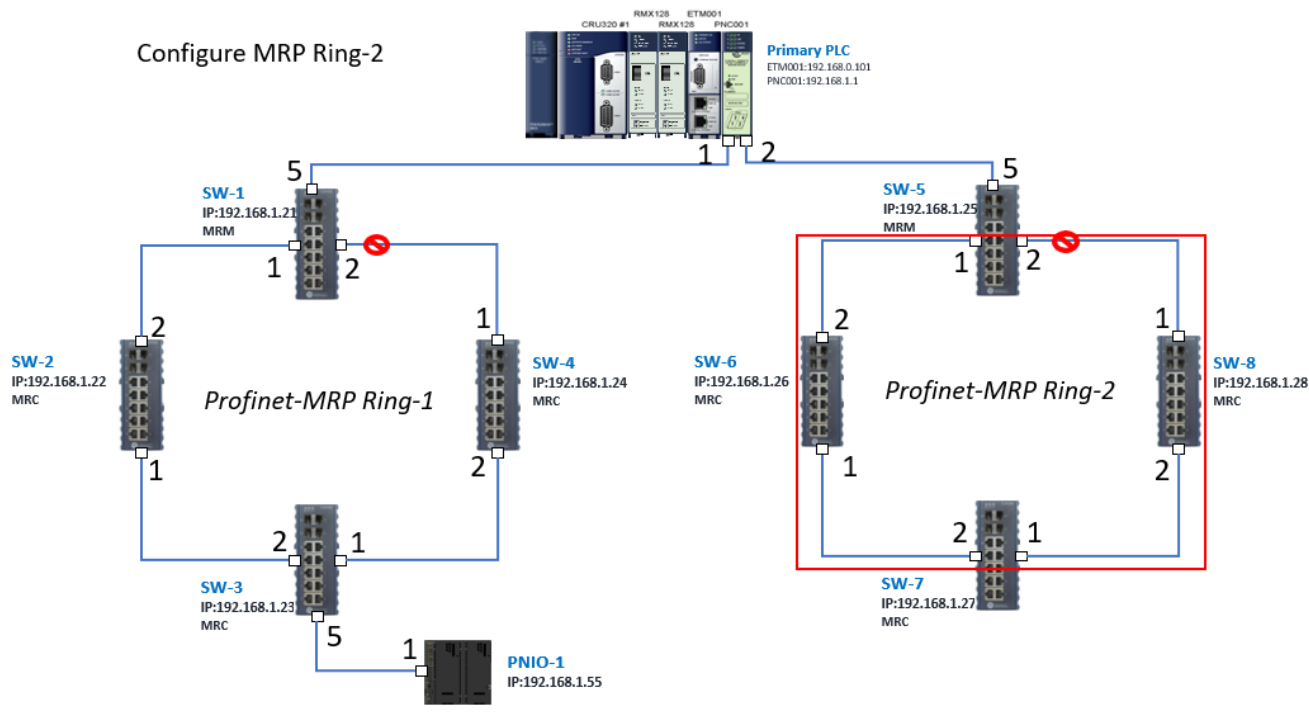
In order to enable MRP function in SW1, right-click the target and choose **Configure**.
Enable MRP function by changing the value of **Media Redundancy** to **manager** and set **Ring Port 1** to **1**, **Ring Port 2** to **2**.
Repeat these sets to enable MRP function for SW2-SW4.

Figure 94: Configuring Medi Redundancy Parameters



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

Figure 95: 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 I/O Controller shall be specified.

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

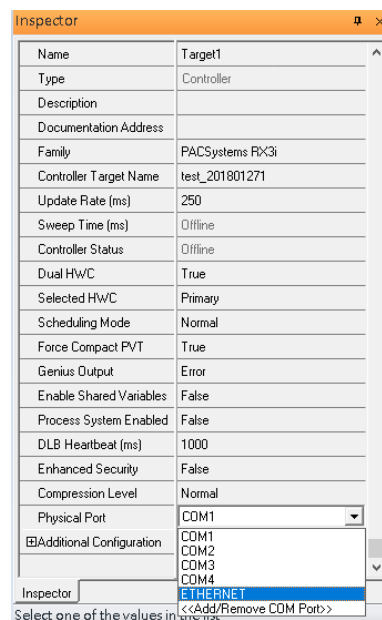
I/O Controller Communication Rule

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 96: 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.

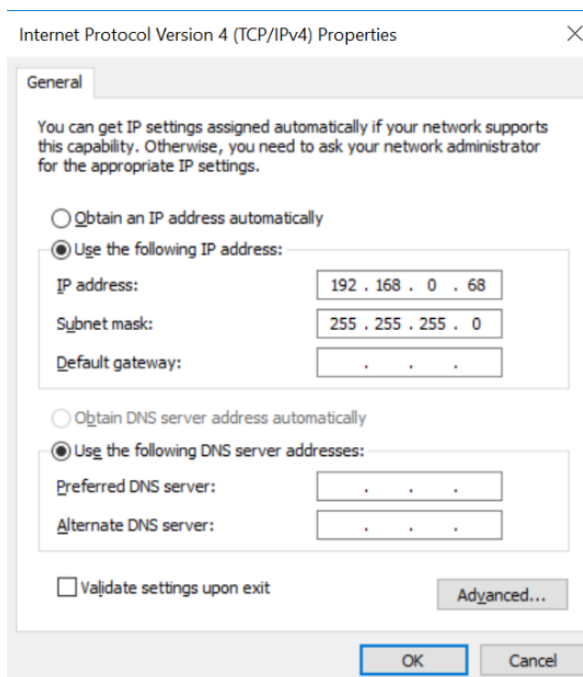
Figure 97: Specified IP Address Appears



4.2.8 PC Network

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

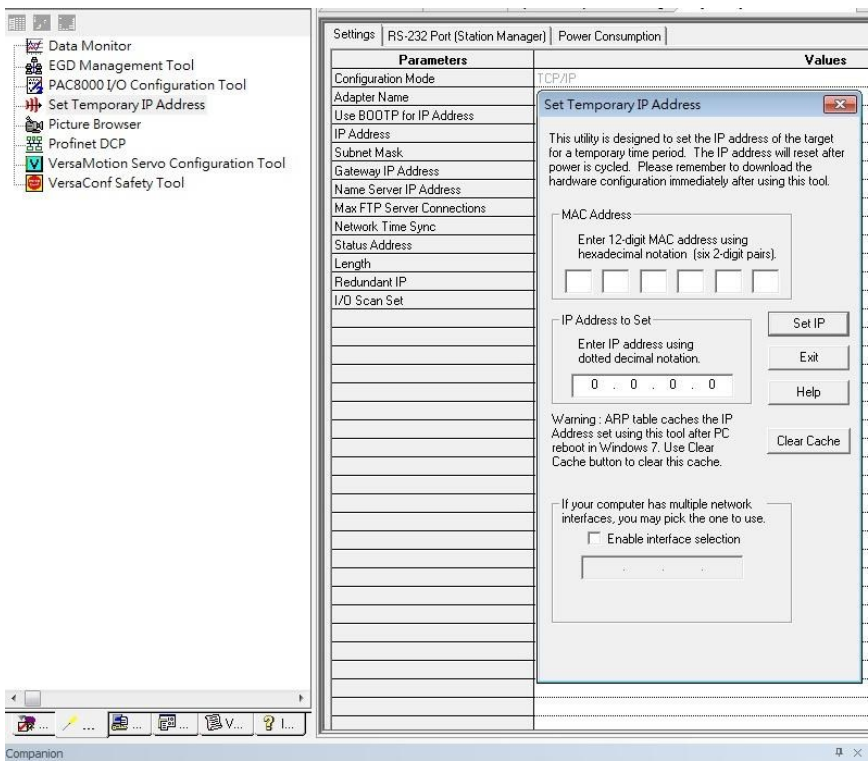
Figure 98: Setting the IP Address of the PC with PME



4.2.9 Temporary IP

However, if the IP address of ETM001 is lost or forgotten, the IP address can be changed by the function **Set Temporary IP Address** according to the MAC address of ETM001. In the following figure, the MAC address is referenced to the ETM001, and the IP address can be defined by user.

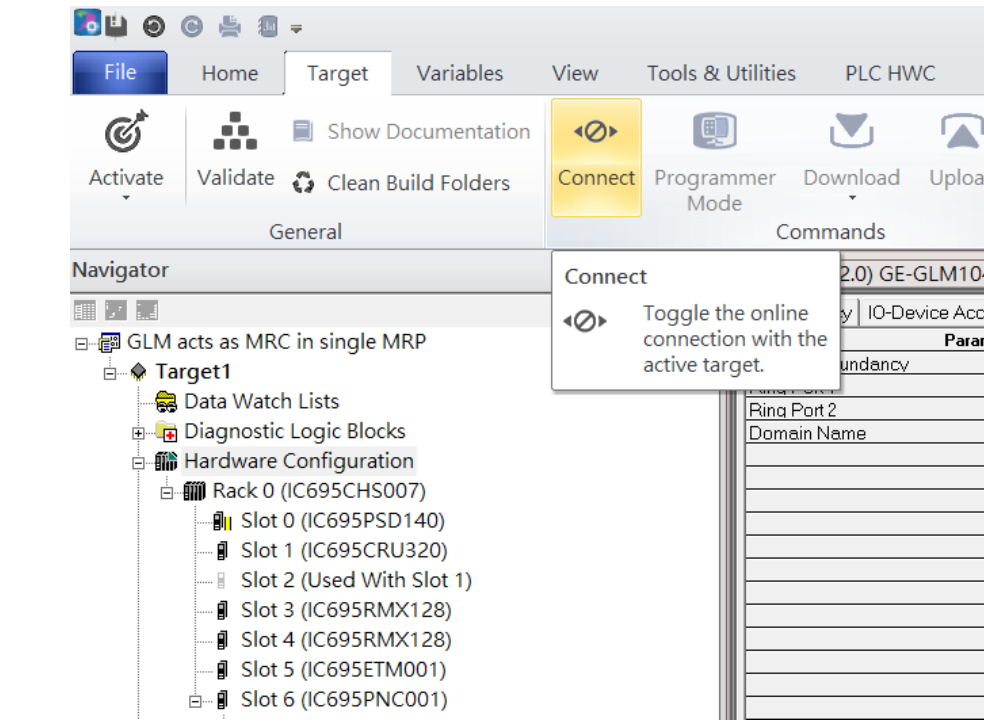
Figure 99: Set Temporary IP Address



4.3 Implementation

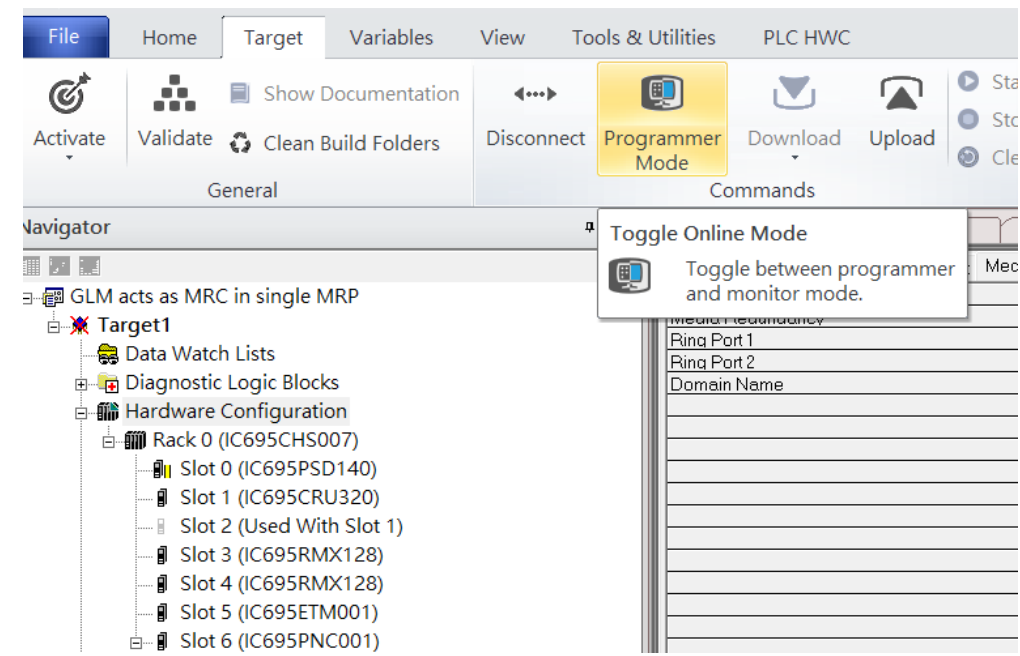
To download the configuration to hardware, the following steps shall be applied.
First, press the **Connect** icon.

Figure 100: Connecting to Target



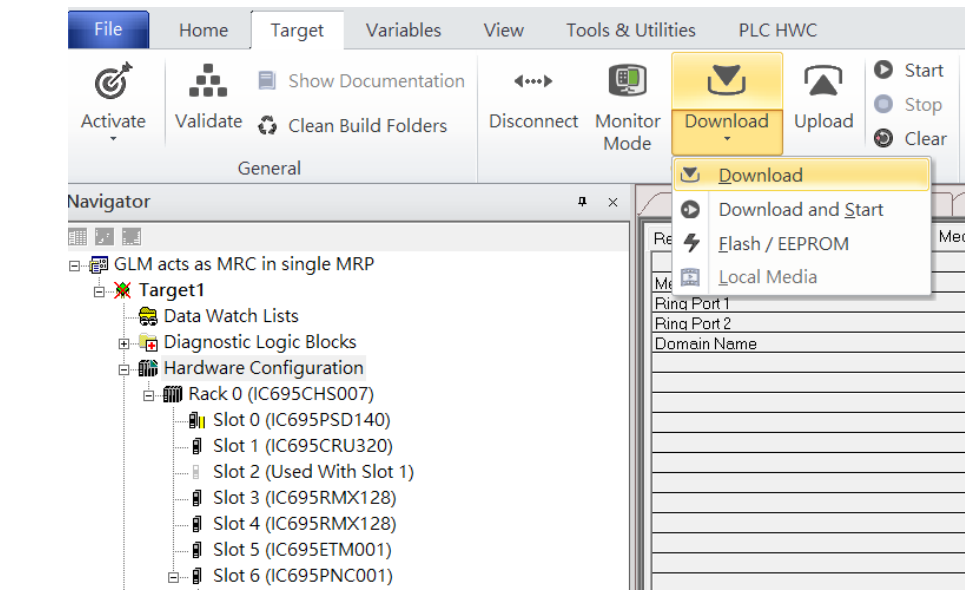
Then press the icon **Programmer Mode**.

Figure 101: Programmer Mode



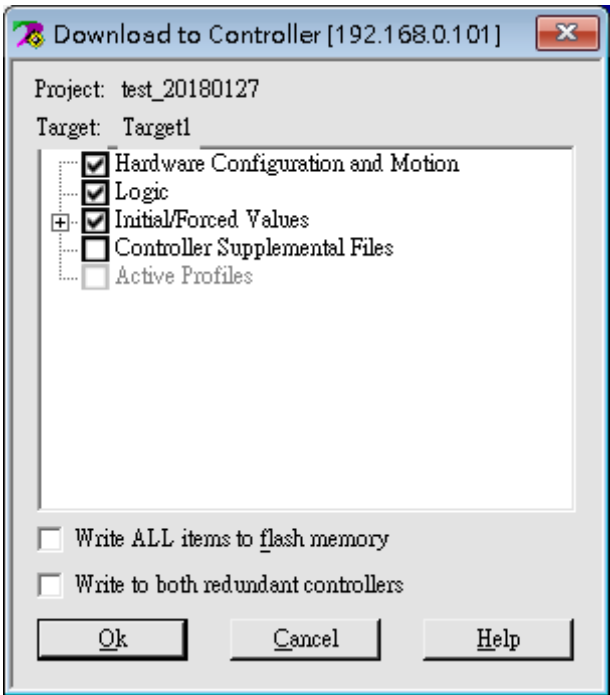
Then press icon **Download** and select **Download**.

Figure 102: Download



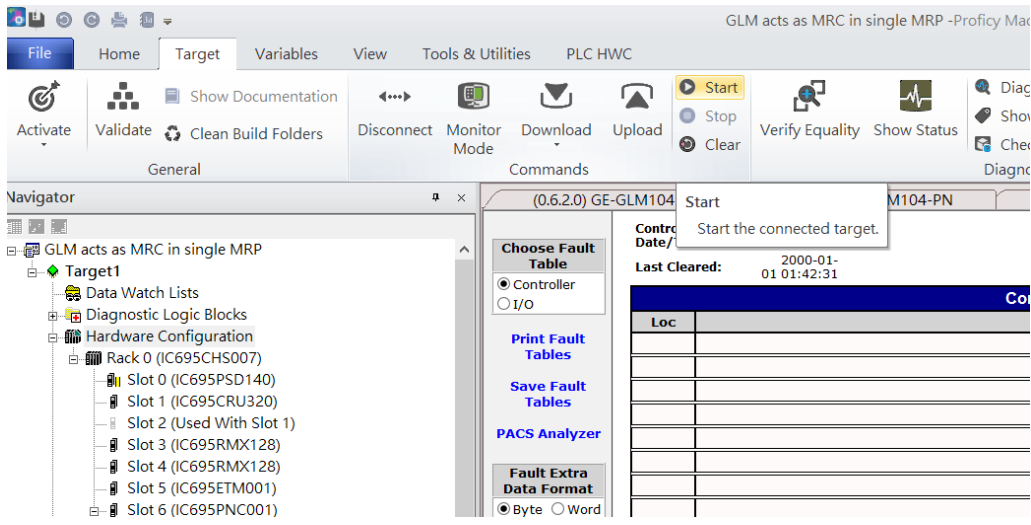
Then the dialogue is appeared to make sure the initialization procedure, select **OK**.

Figure 103: 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”.

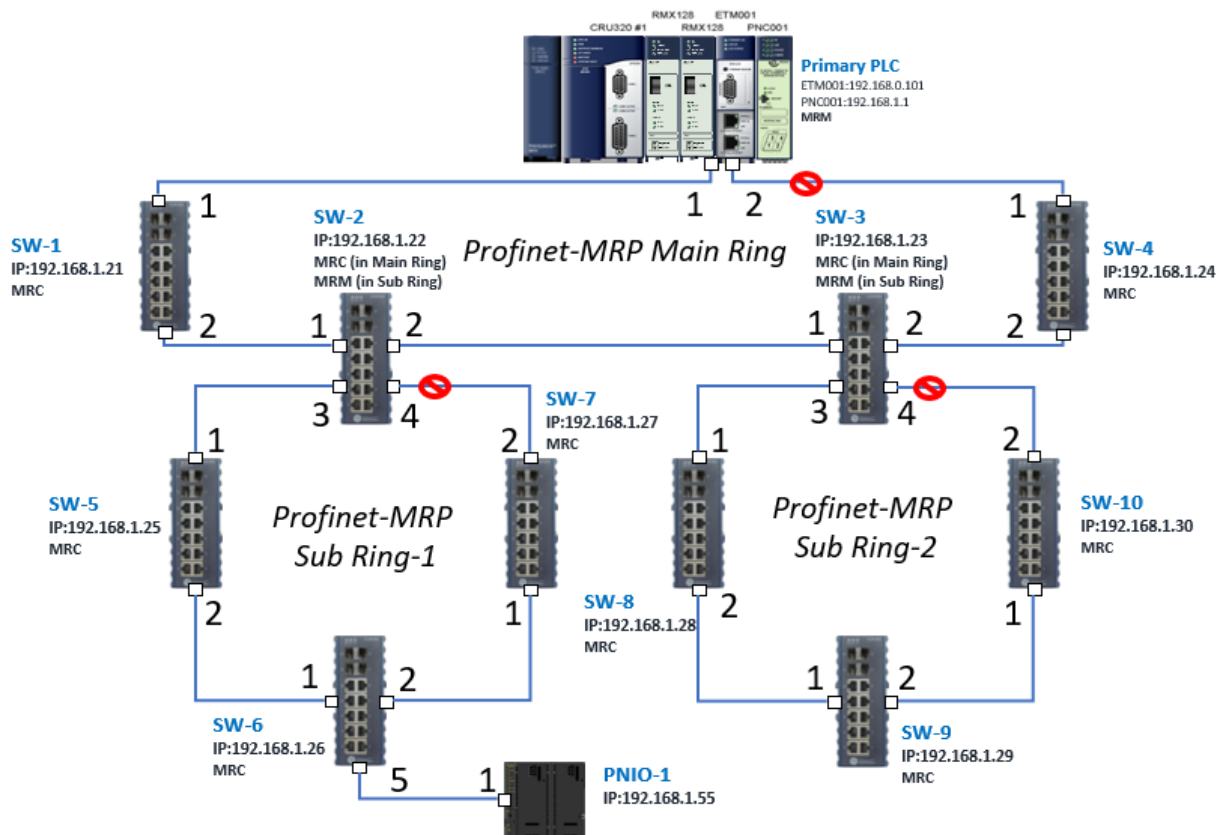
Figure 104: Start



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

5.1 Network Topology

Figure 105: 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 106: Create a new project

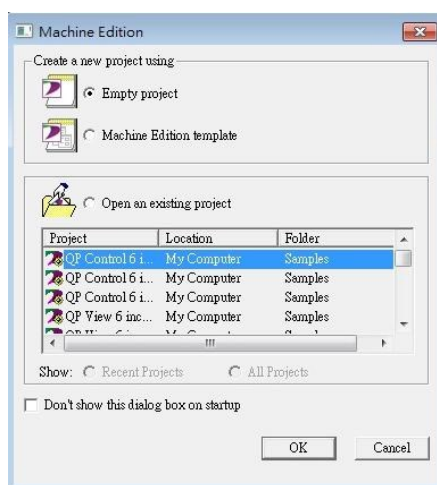
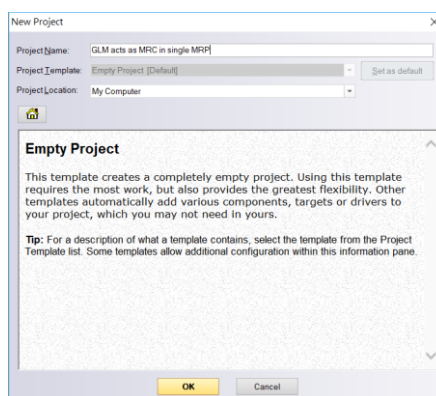


Figure 107: New Project Name



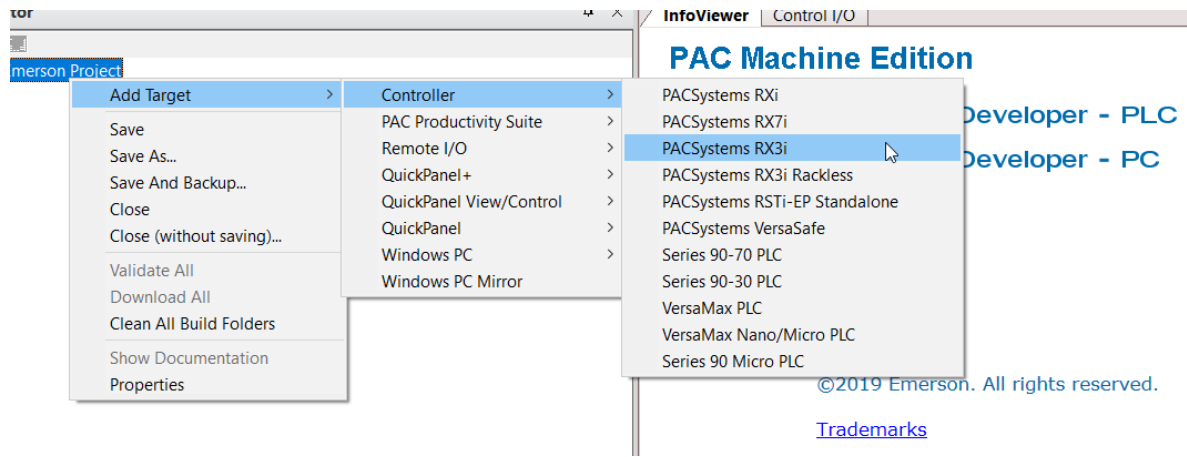
5.2.2 I/O Controller Setting

Next step is to add a target for this project.

Click 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 108: Add Controller

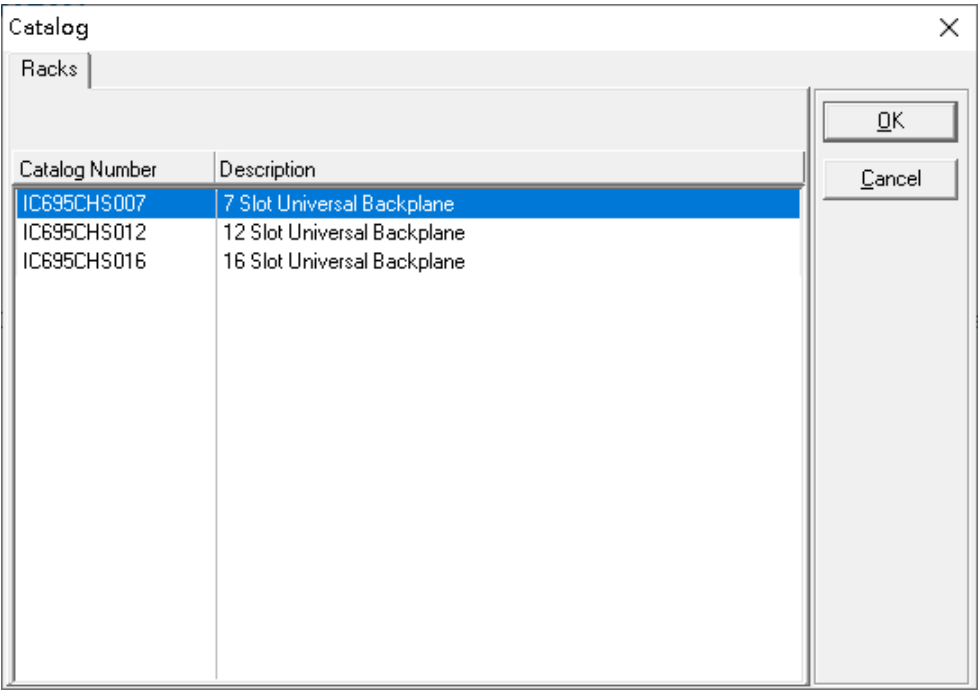


Originally the I/O Controller is described as the rack with 12 slots, each slot can be regarded as the chassis for device installation such as power card, communication module, or bus controller. However, there are only 7 chassis can be used in the I/O Controller CRU320. Thus, replace the rack for 7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

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

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

Figure 109: Selecting IC695CHS007



After the rack and the number of slots is 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 110: Rack Configuration



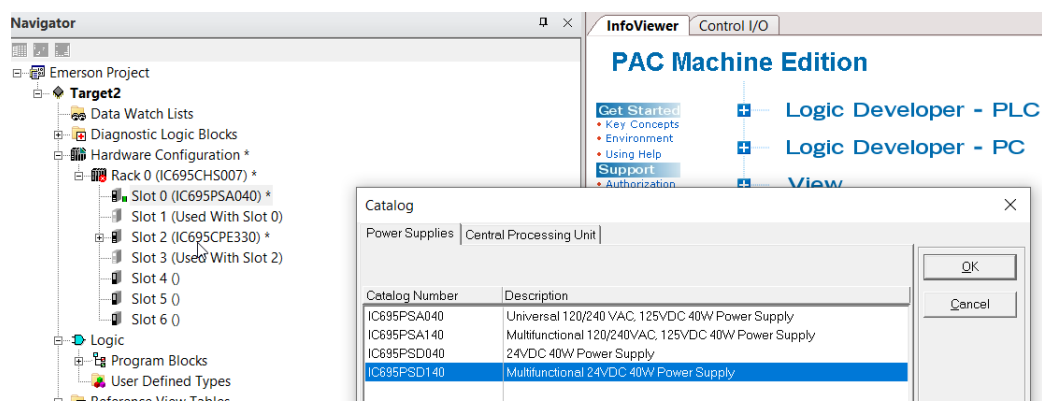
From left to right, the installed devices on the I/O Controller are

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 111: Replace Module



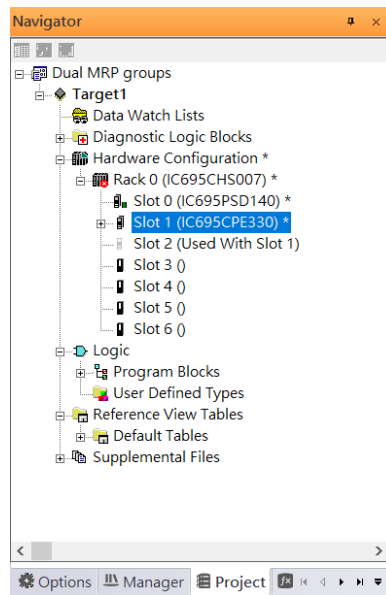
Slot 0

Slot 0 is replaced by current power card, PSD140.

Slot 1 and 2

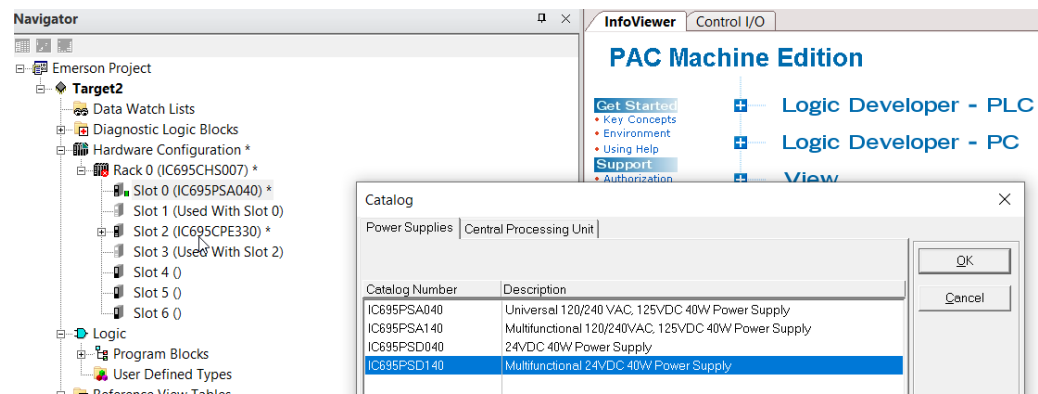
For slot 1 and 2, 2 chassis (1 and 2) is occupied by the Central Processing Unit, CRU320. To integrate slot 1 and 2, pull the slot 2 to slot 1. Now the slot 2 is cleaned.

Figure 112: 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 113: Replace Module

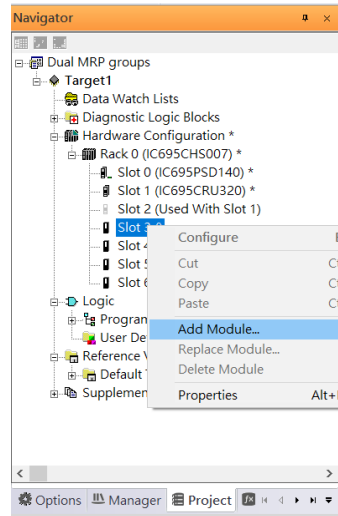


5.2.2.1 Slot 3

Next is to add RMX128 module for slot 3

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

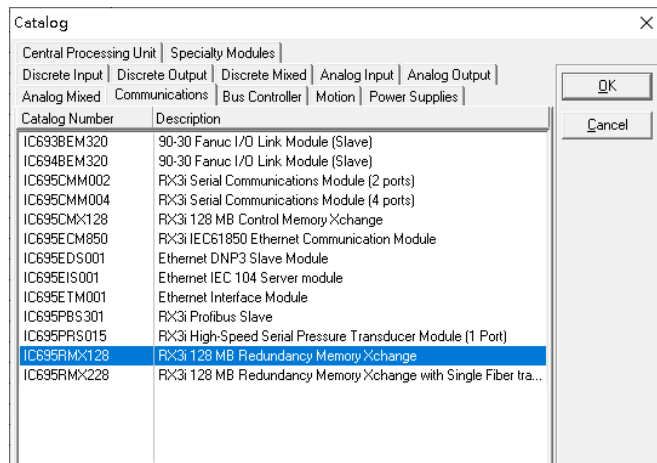
Figure 114: Add Module



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 115: 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 note that the ETM001 is the management device for PAC Machine Edition. The communication interface is 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 116: 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 and highlighted in blue. On the right, the **InfoViewer** pane shows the parameters for the selected module, **(0.5) IC695ETM001**. The **Parameters** tab is active, displaying a list of configuration parameters. 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 rectangle. 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

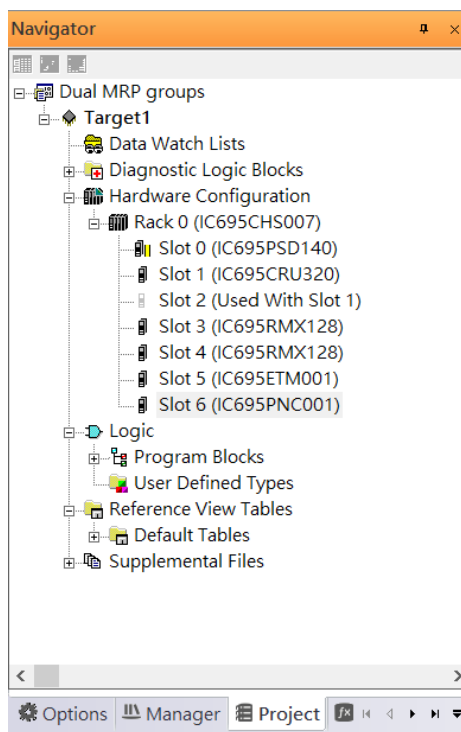
5.2.2.4 Slot 6

Next, select PNC001 for slot 6.

Click slot 6 and click the right button, select **Add Module** 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.

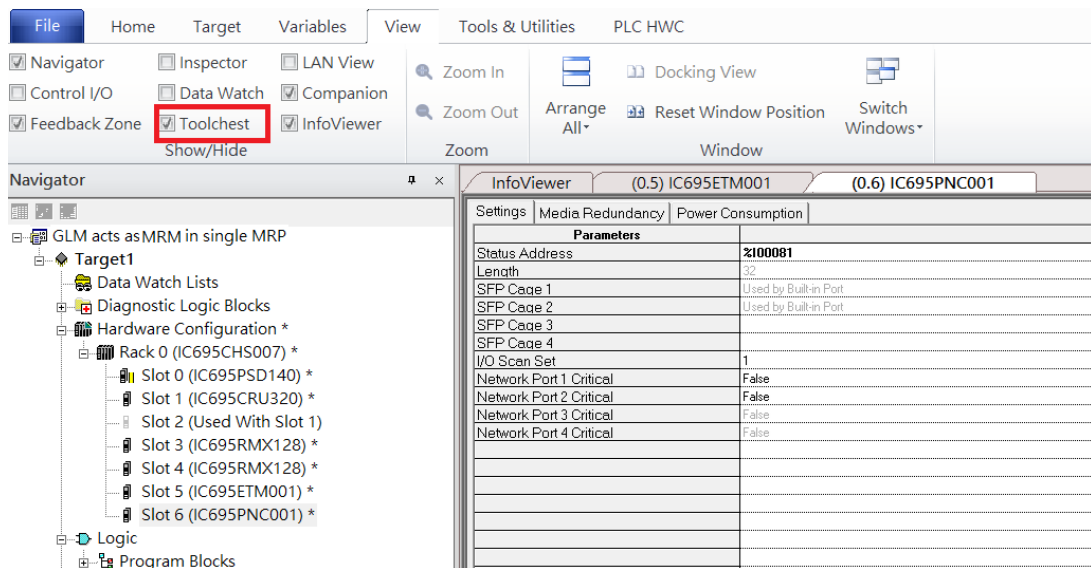
Figure 117: Configured Rack



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 118: Toolchest feature



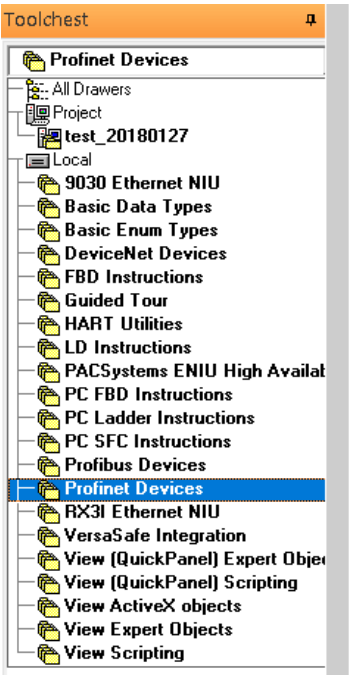
As shown in the following picture, the interface is created on the right-hand side.

Figure 119: Default Toolchest Interface Location



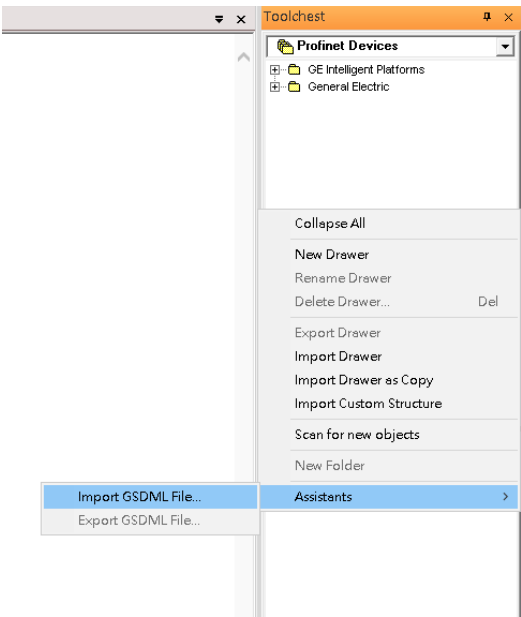
Select Profinet Devices from the Toolchest.

Figure 120: Profinet Devices



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

Figure 121: Importing the GSDML File



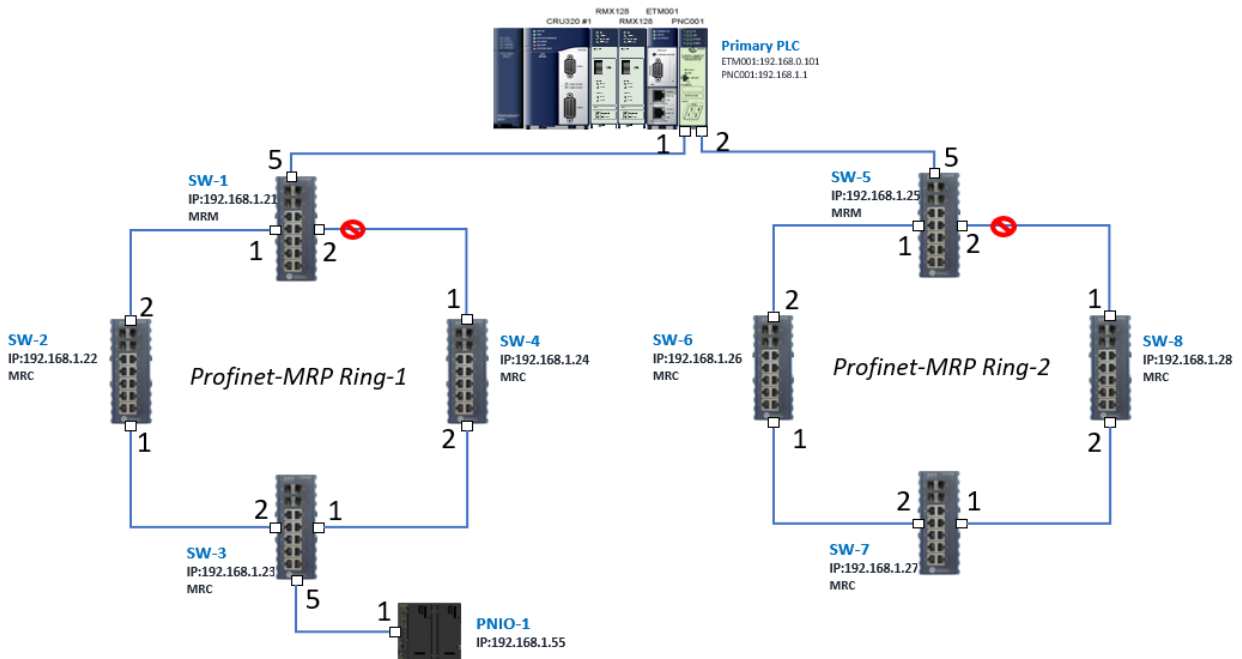
Select the GSDML File to open. The corresponding I/O Device of GSDML File is added in the Toolchest.

Figure 122: GSDML File Added to the Toolchest



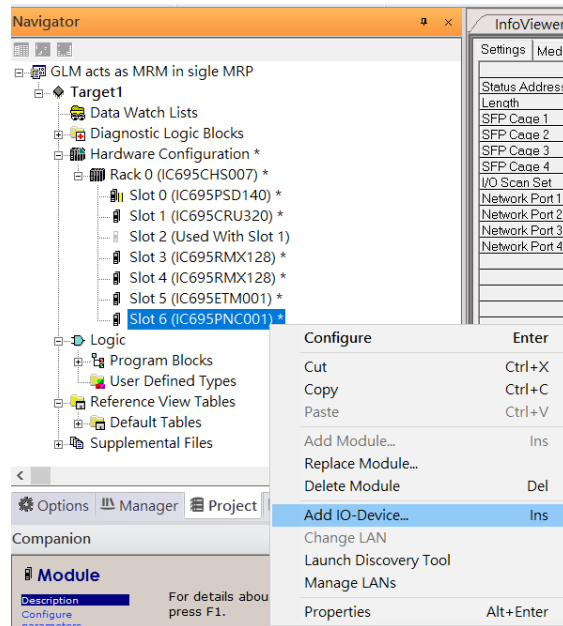
In this document, there are nine I/O devices and one I/O controller. I/O devices are eight switches and one Emerson VersaMax PROFINET I/O Scanner.

Figure 123: Multiple PROFINET-MRP Rings



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.

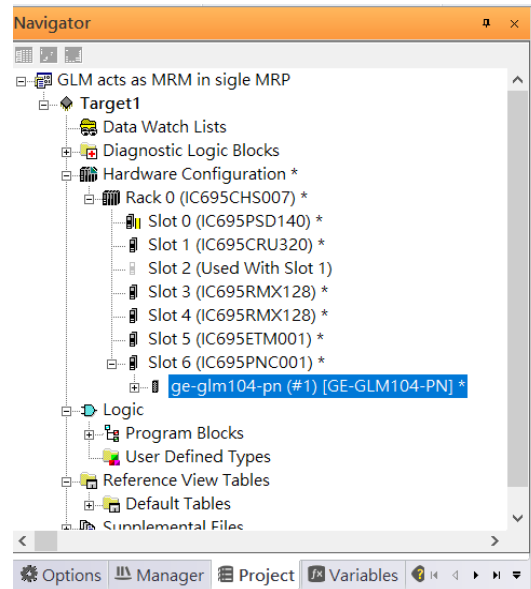
Figure 124: Add the I/O Device on PNC001



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.

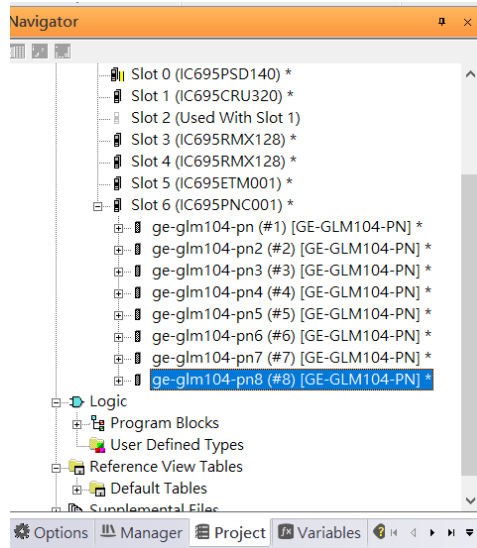
Figure 125: SW1 is Configured with GLM104-PN



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:

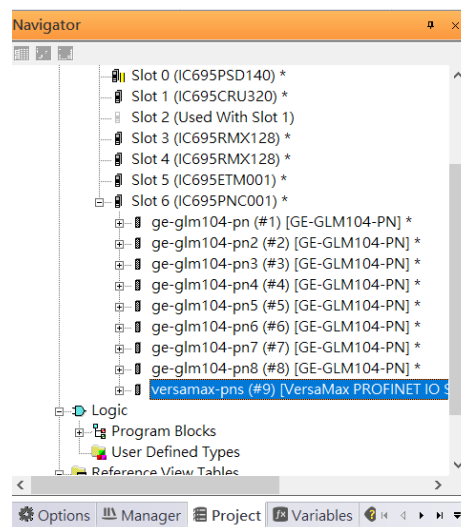
Figure 126: Eight I/O Devices Added to the PNC001



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 127: All Nine I/O Devices Added to the PNC001



5.2.4 DCP Set Command

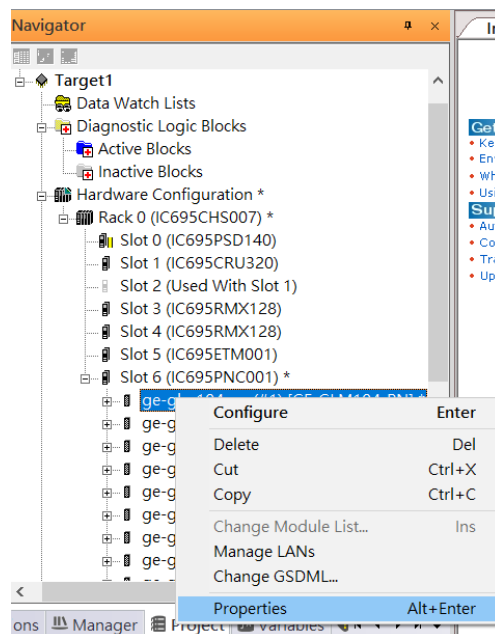
To configure the setting or monitor the status on the I/O Device, the communication interface is also based on Ethernet network. We can specify the IP address and the device name from I/O Controller via the DCP (Discovery and Configuration Protocol).

5.2.4.1 GLM104-PN

Under the slot 6, PNC001, select the I/O Device, ge-glm104-pn, and click the right button.

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

Figure 128: Properties



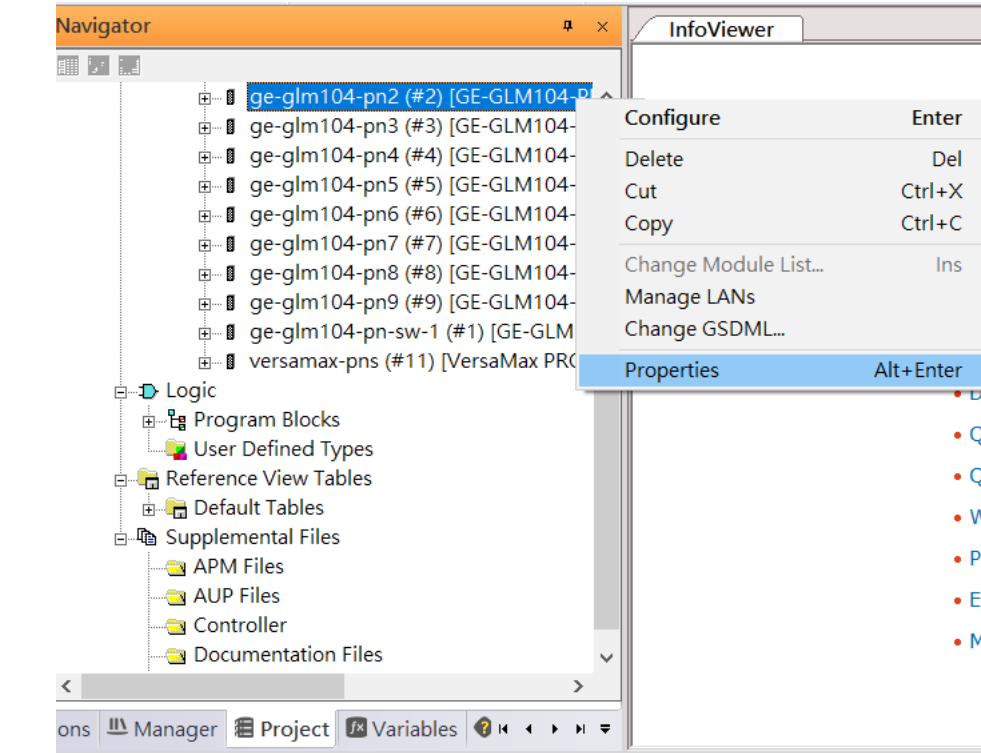
In this table, the I/O Device name can be specified in field **Device Name**, and the IP address can be set in field **IP address**. We modify device name to “ge-glm104-pn-sw-1” and IP address to “192.168.0.21” then we use I/O Device Discovery Tool to observed an I/O Device and set I/O Device’s name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

5.2.4.2 GLM104-PN2

Under the slot 6, PNC001, select the I/O Device, ge-glm104-pn2, and click the right button.

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

Figure 129: Properties



We modify 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 observed an I/O Device and set I/O Device’s name to “ge-glm104-pn-sw-2” later.

Figure 130: 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

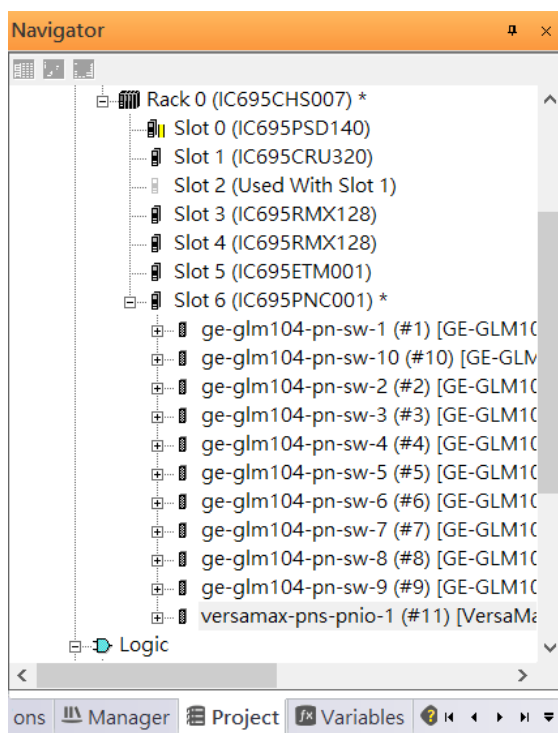
5.2.4.3 GLM10-PN3 through GLM-PN10

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 131:Finished Configuration

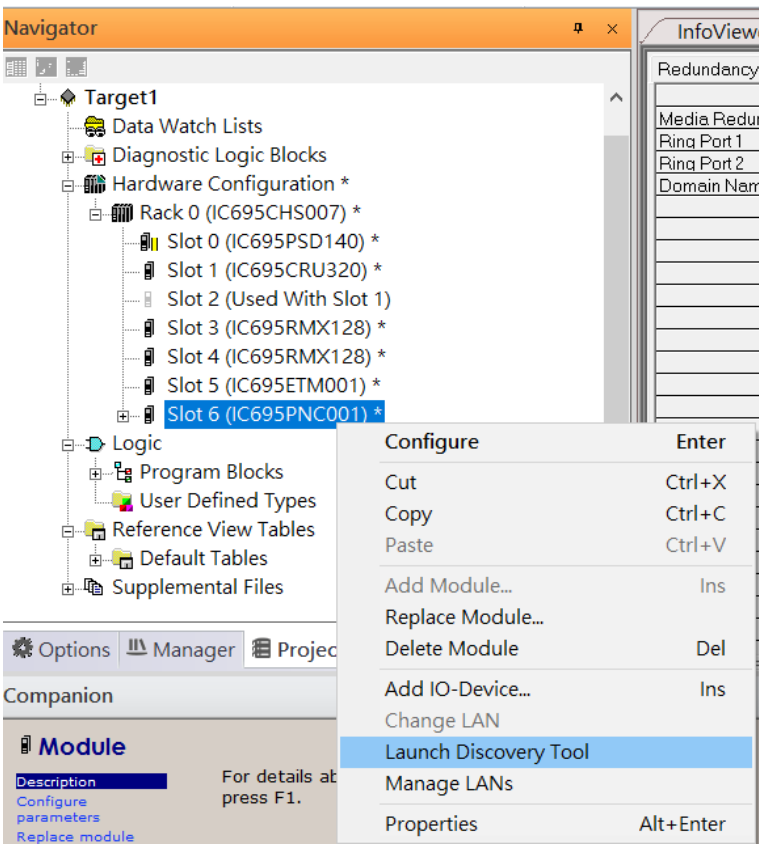


5.2.5 I/O Device Scan

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**.

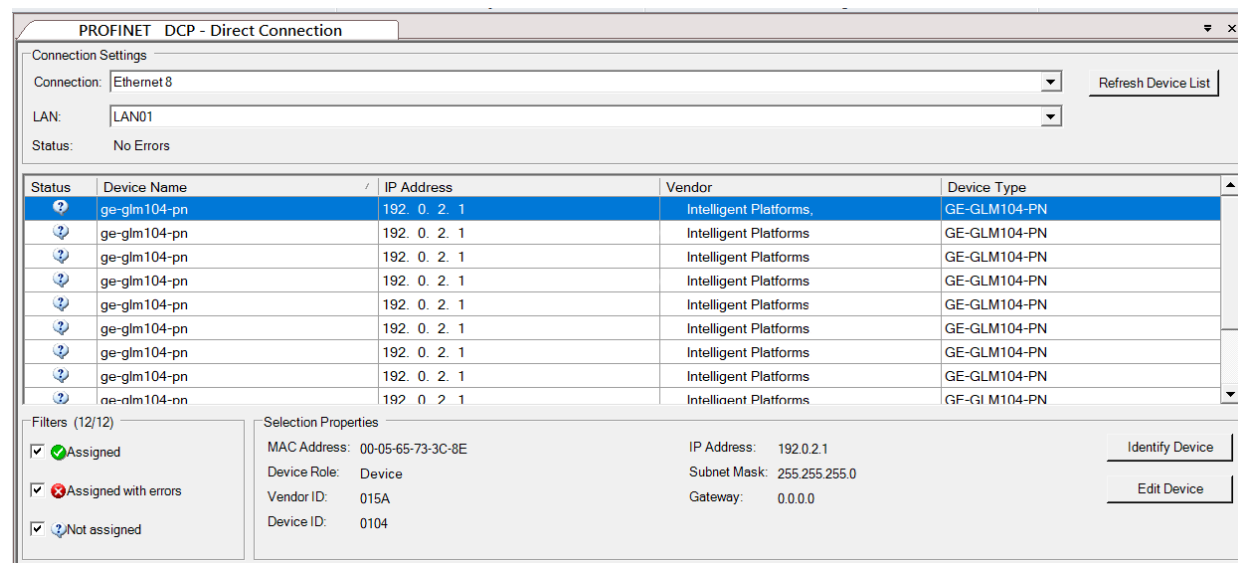
Note: Before we finish downloading the configuration to CRU320, need to unplug the block port according to the hardware topology to avoid loop.

Figure 132: Launch Discovery Tool



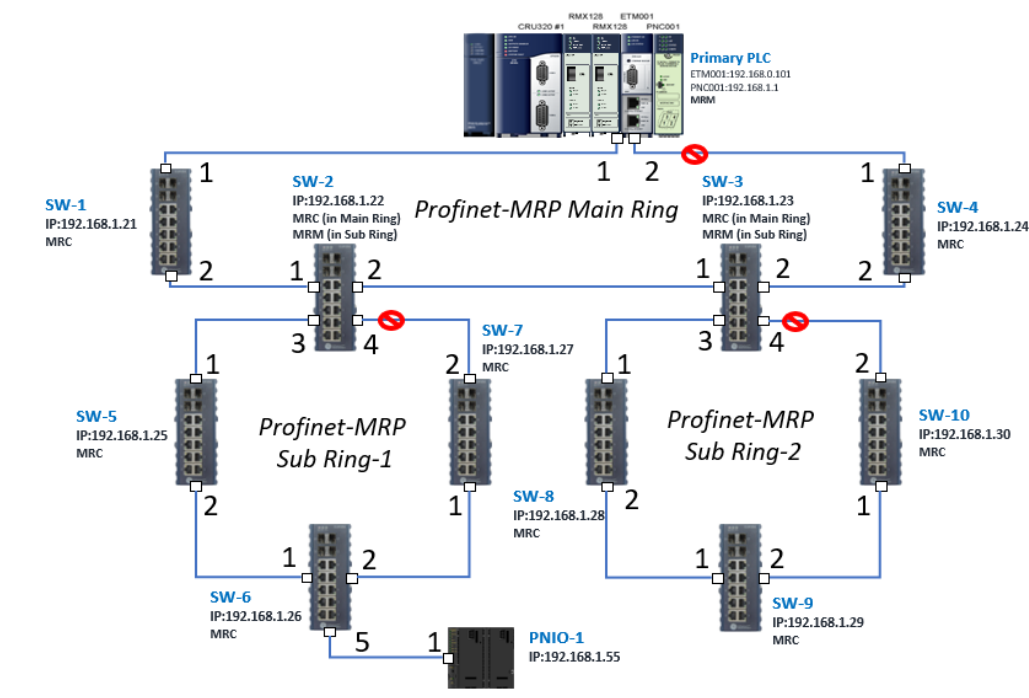
The tool is shown in the following picture, then press **Refresh Device List**. Then the connected I/O Device is listed in the following table.

Figure 133: Select the Target I/O Device



There are I/O Devices and their status are 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 134: Configuration Overview



Click **Edit Device**, set Device Name to **ge-glm104-pn-sw-1** and click 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 135: 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 136: 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

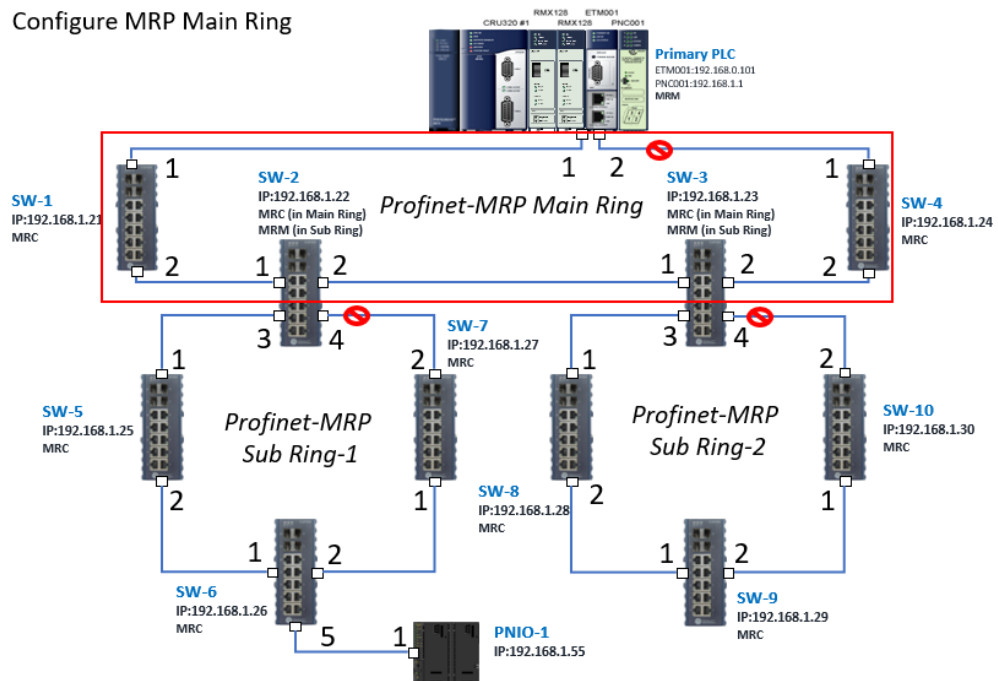
The steps to enable MRP functionality on the I/O controller and I/O devices will be the same for all components in the figure below. Refer to this section to configure SW1-SW10.

5.2.6.1 SW1 through SW4

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

Figure 137: MRP Setting for Main Ring

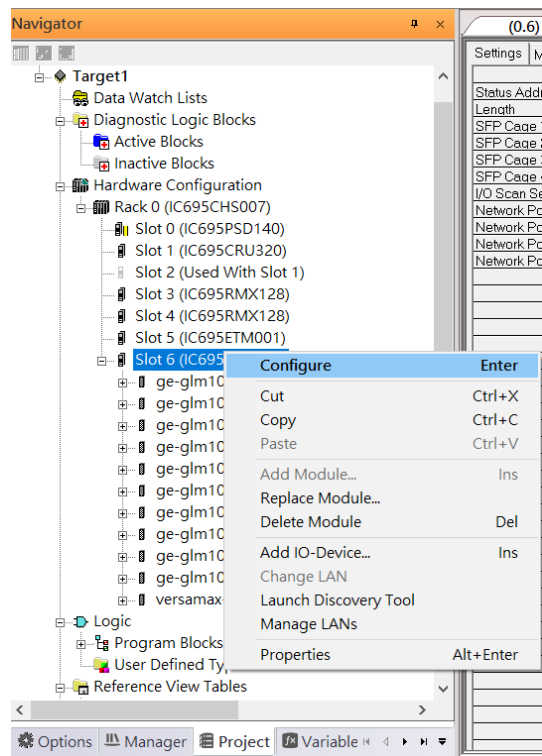
Configure MRP Main Ring



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

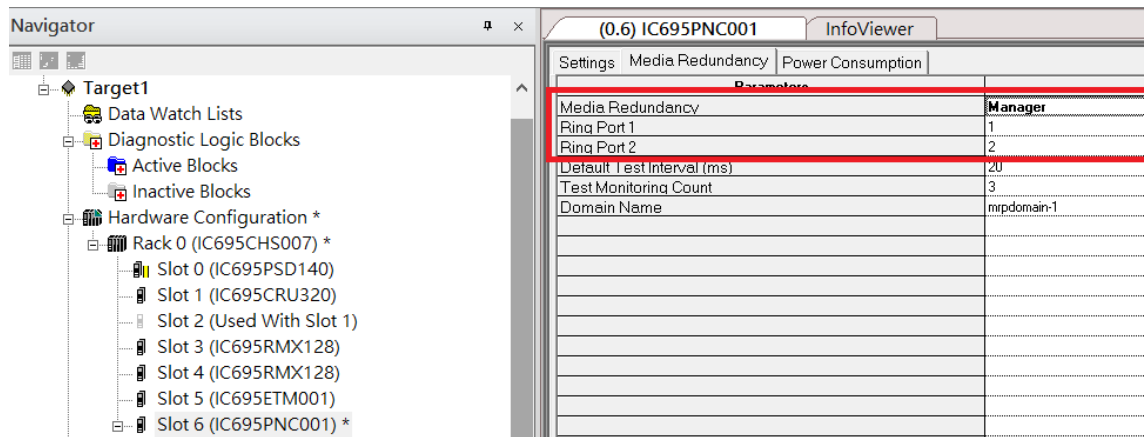
It will show **Media Redundancy** on the right window.

Figure 138: Configure the Target I/O Controller



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

Figure 139: Media Redundancy Parameters

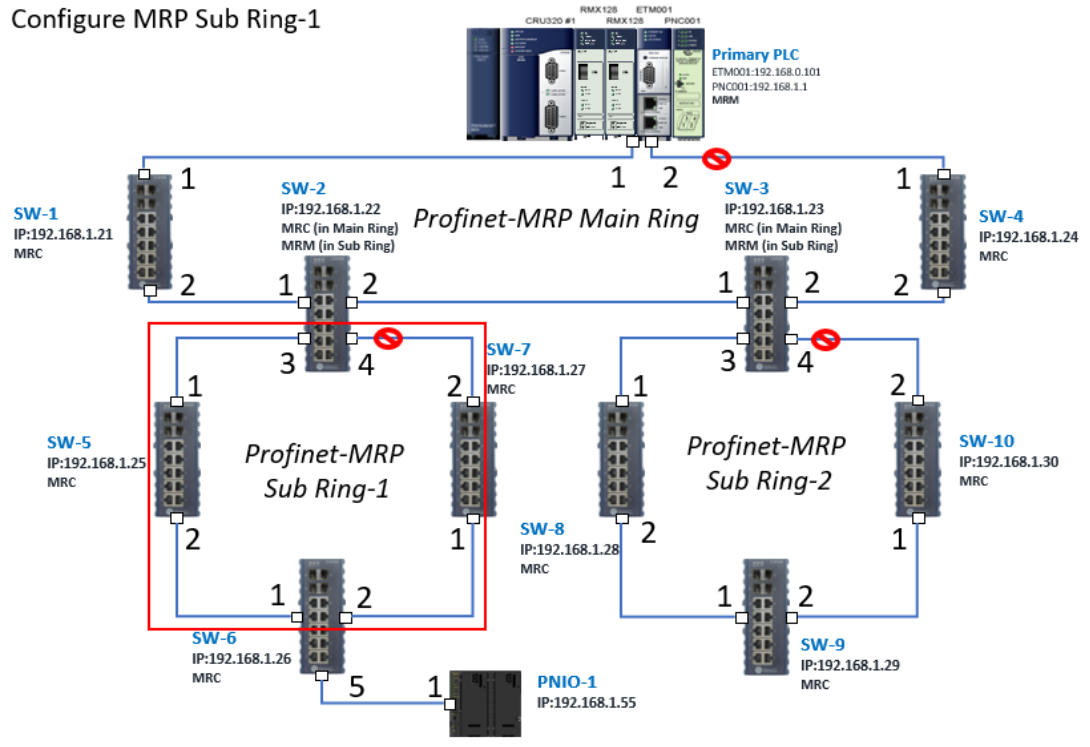


5.2.6.2 SW5 through SW7

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 140: PROFINET-MRP Sub-Ring1

Configure MRP Sub Ring-1

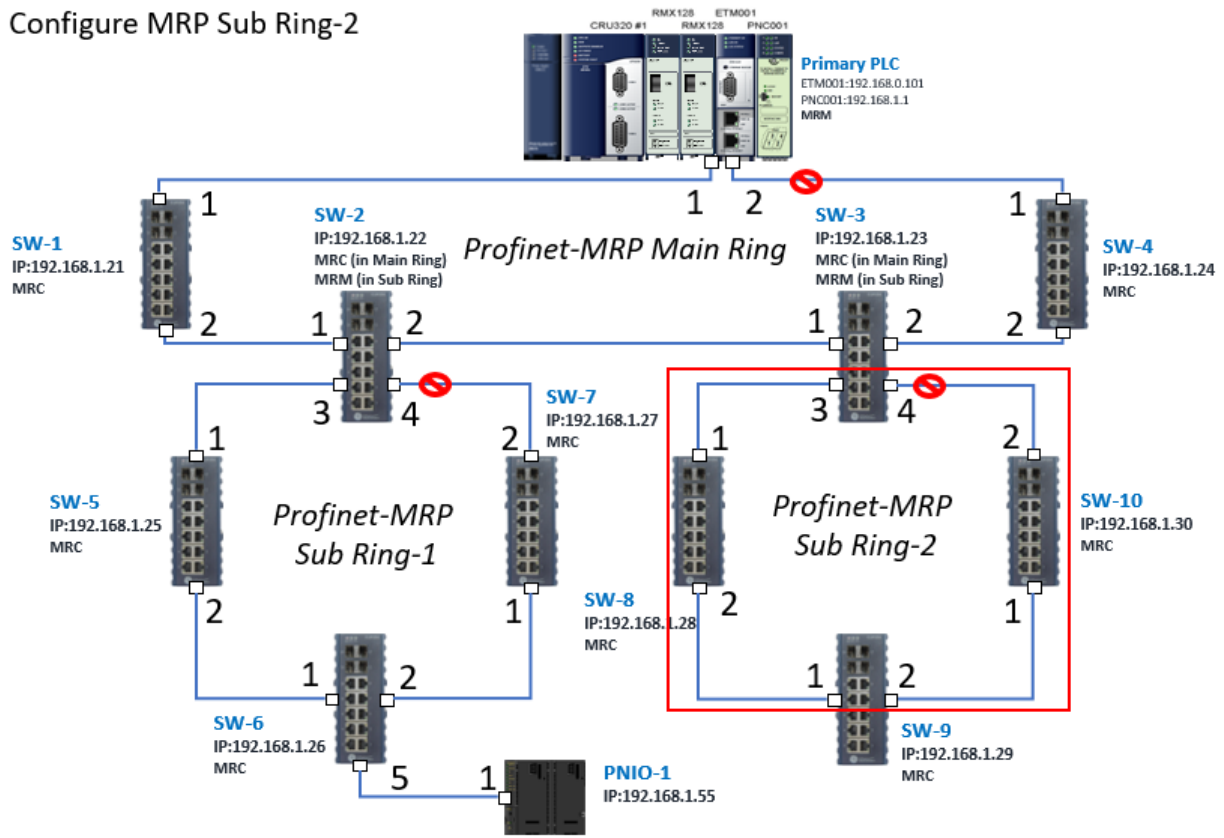


5.2.6.3 SW8 through SW10

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 141: 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 I/O Controller shall be specified.

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

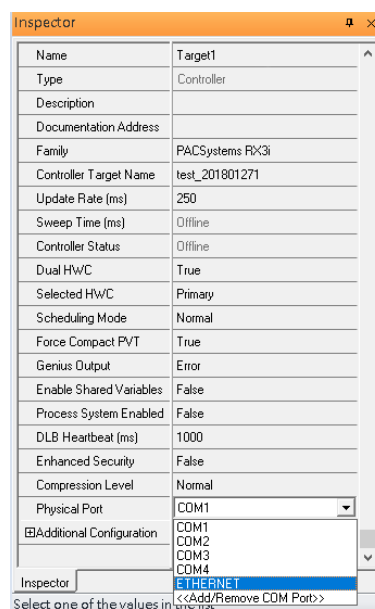
I/O Controller Communication Rule

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**.

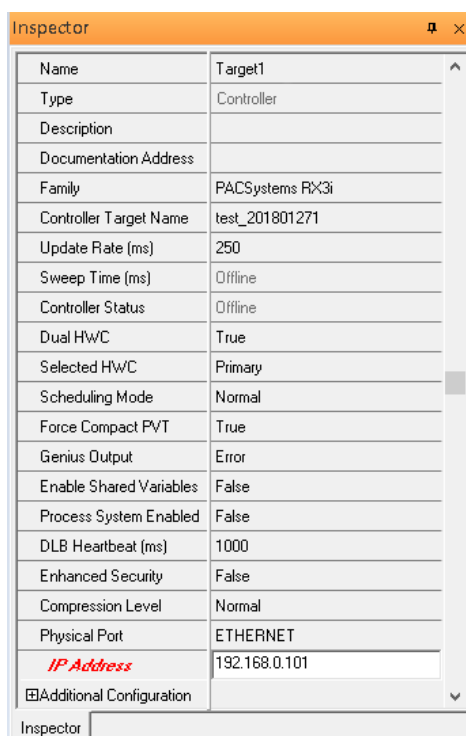
Figure 142: Changing the Physical Port Parameter



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 143: Specified IP Address Appears

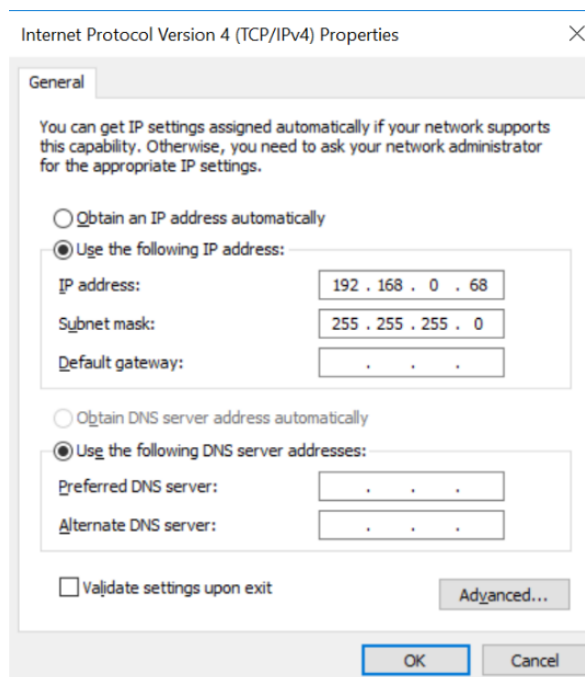


Inspector	
Name	Target1
Type	Controller
Description	
Documentation Address	
Family	PACSystems RX3i
Controller Target Name	test_201801271
Update Rate (ms)	250
Sweep Time (ms)	Offline
Controller Status	Offline
Dual HWC	True
Selected HWC	Primary
Scheduling Mode	Normal
Force Compact PVT	True
Genius Output	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	

5.2.8 PC Network

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

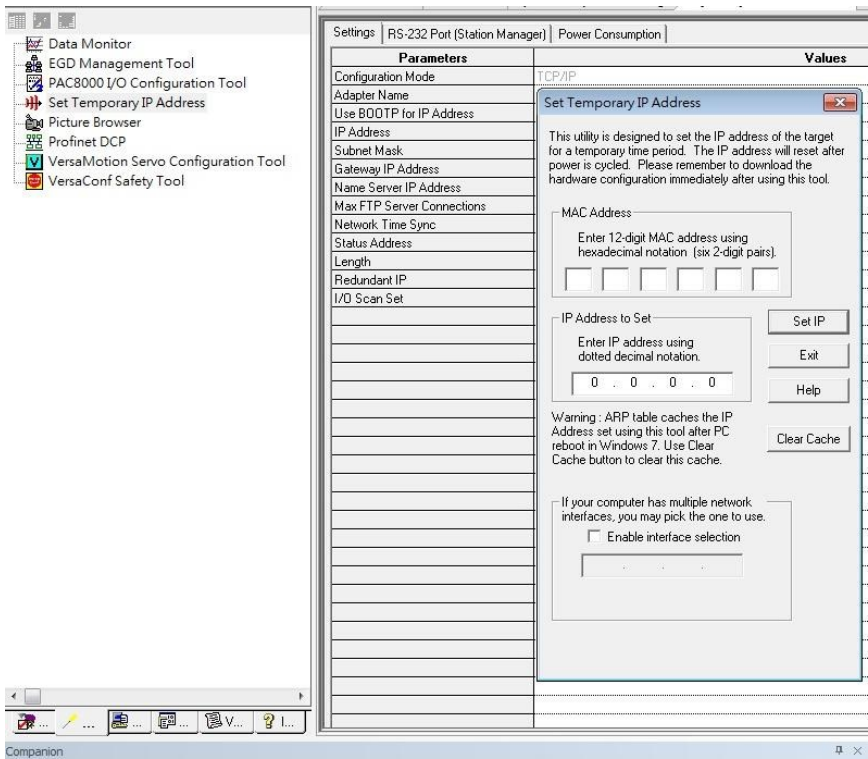
Figure 144: Setting the IP Address of the PC with PME



5.2.9 Temporary IP

However, if the IP address of ETM001 is lost or forgotten, the IP address can be changed by the function **Set Temporary IP Address** according to the MAC address of ETM001. In the following figure, the MAC address is referenced to the ETM001, and the IP address can be defined by user.

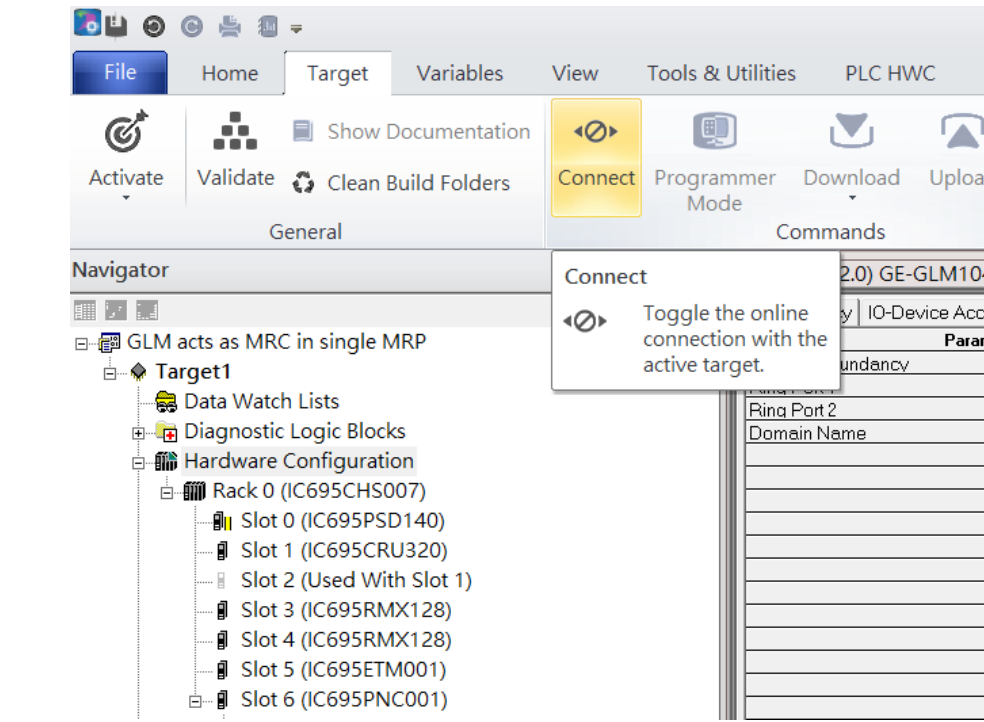
Figure 145: Set Temporary IP Address



5.3 Implementation

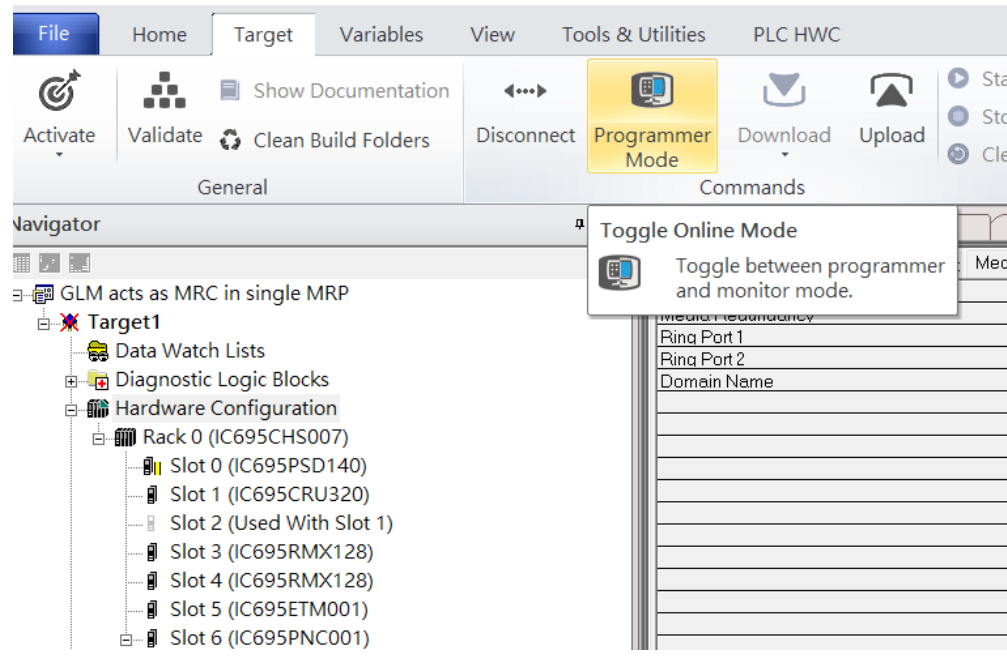
To download the configuration to hardware, the following steps shall be applied.
First, press the **Connect** icon.

Figure 146: Connecting to Target



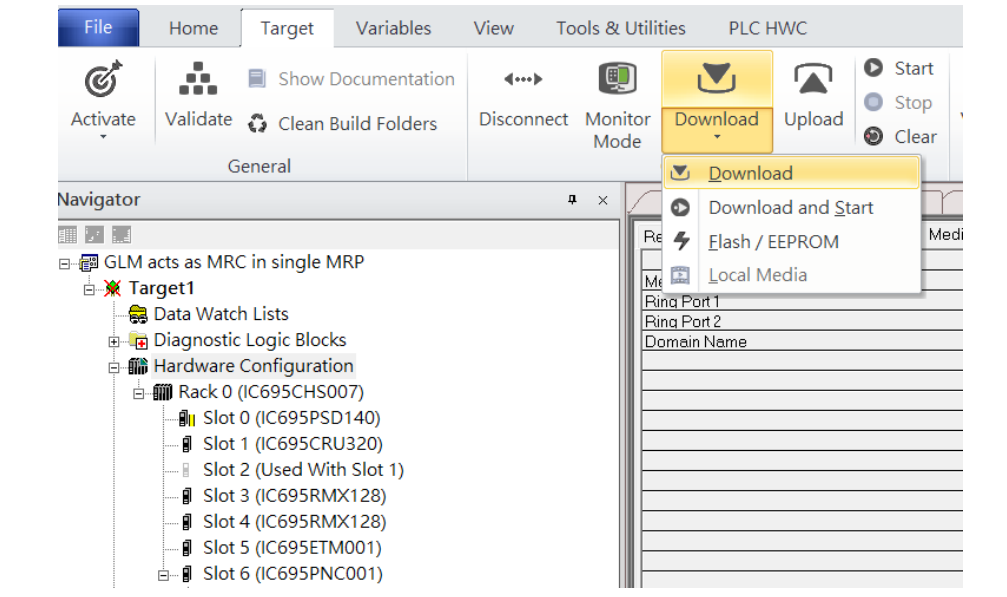
Then press the icon **Programmer Mode**.

Figure 147: Programmer Mode



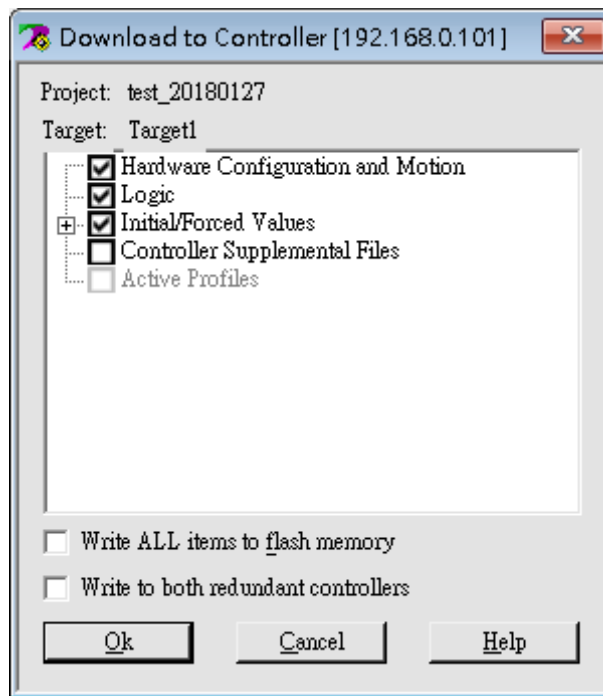
Then press icon **Download** and select **Download**.

Figure 148: Download



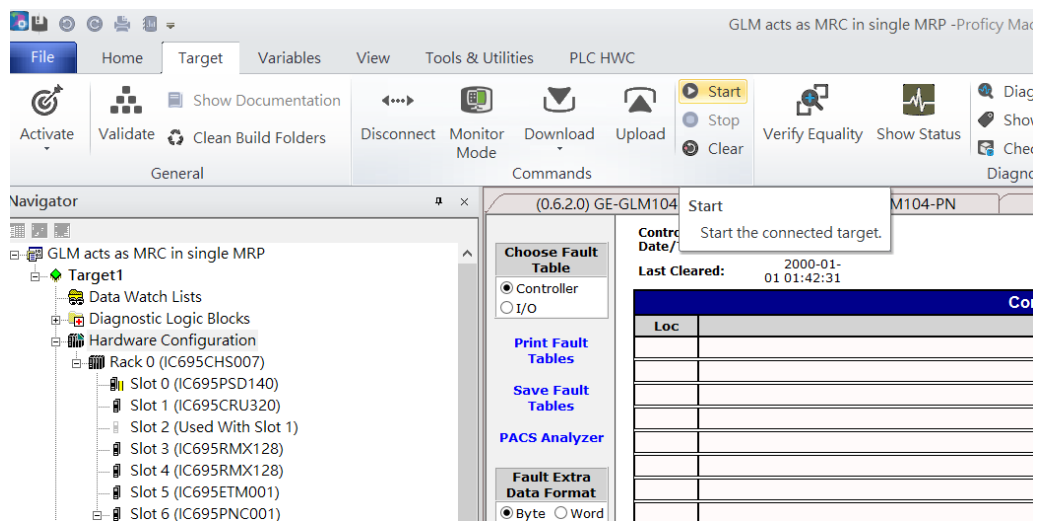
Then the dialogue is appeared to make sure the initialization procedure, select **OK**.

Figure 149: 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”.

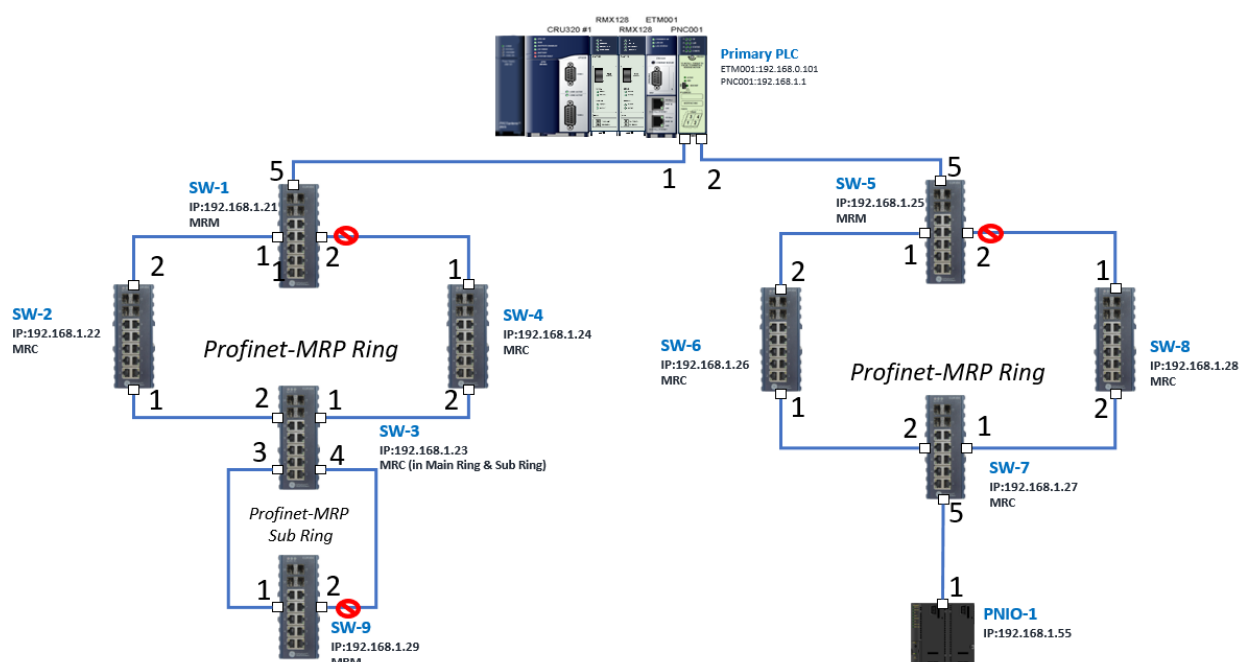
Figure 150: Start



Section 6 Multiple PROFINET MRP Ring and Subring

6.1 Network Topology

Figure 151: 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 imbedded on CRU320.

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

6.2.1 Project Open

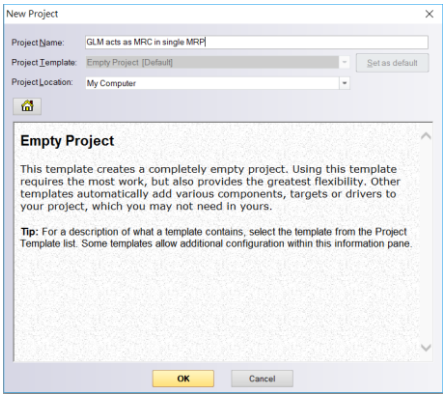
To start the software PAC Machine Edition, please follow the steps below:

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 152: Create a new project



Figure 153: New Project Name



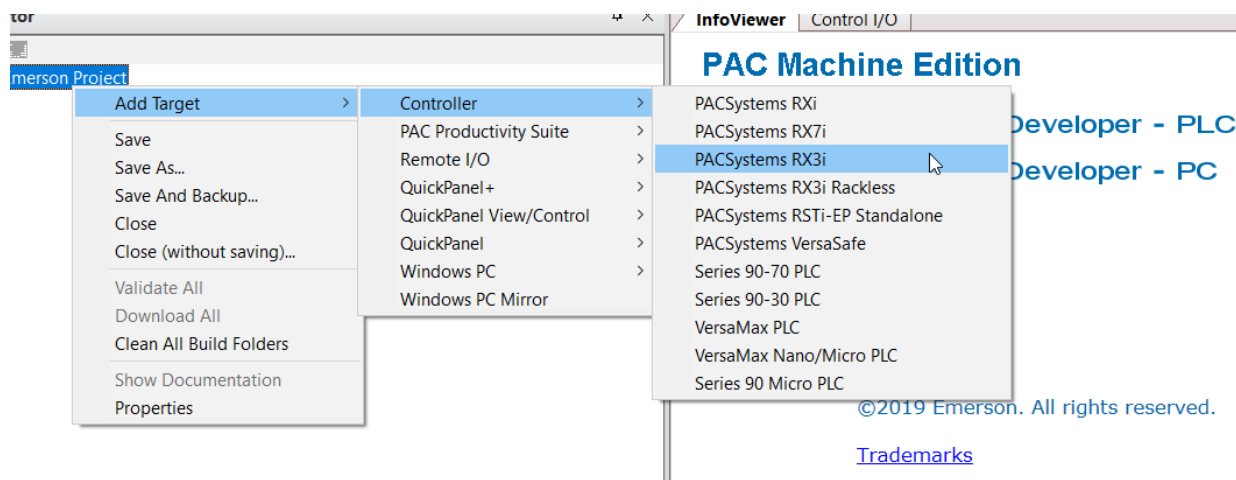
6.2.2 I/O Controller Setting

Next step is to add a target for this project.

Click 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 figure:

Figure 154: Adding an I/O Controller

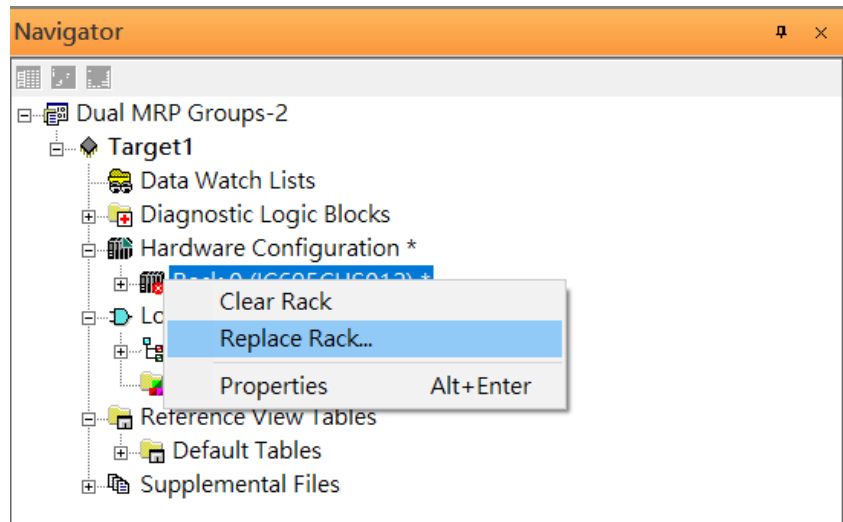


Originally the I/O Controller is described as the rack with 12 slots, each slot can be regarded as the chassis for device installation such as power card, communication module, or bus controller.

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

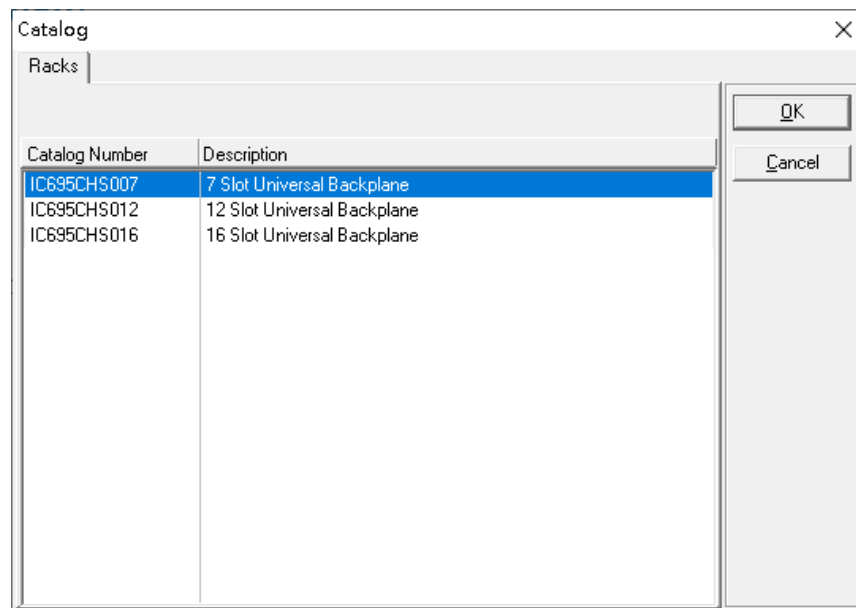
Click right button on **Rack 0 (IC695CHS012)** and select **Replace Rack...**

Figure 155: Replace Rack



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

Figure 156: Select CHS007



After the rack and the number of slots is 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 157: Rack Configuration for this Application



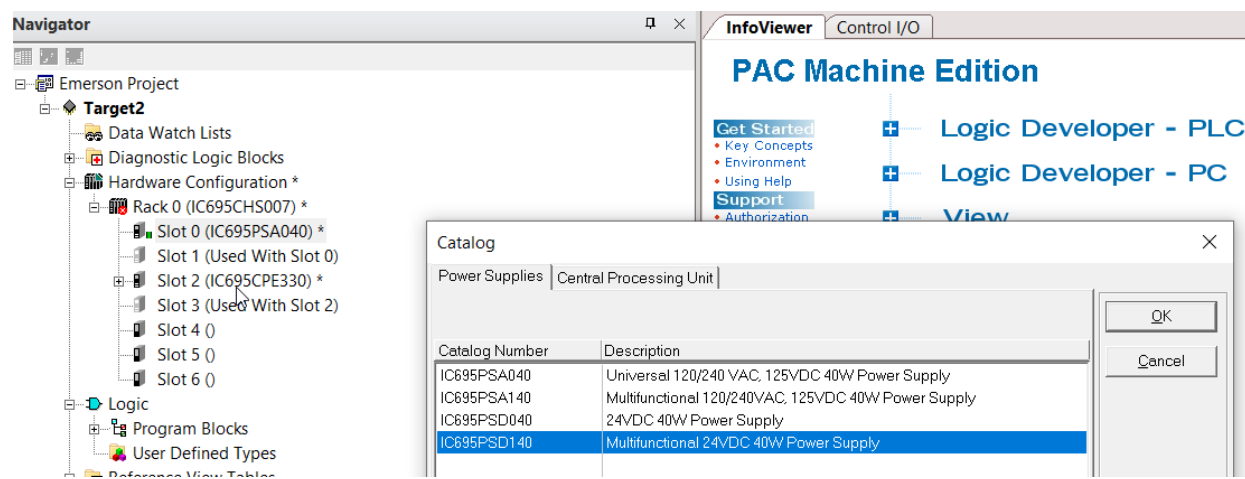
From left to right, the installed devices on the I/O Controller are

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.

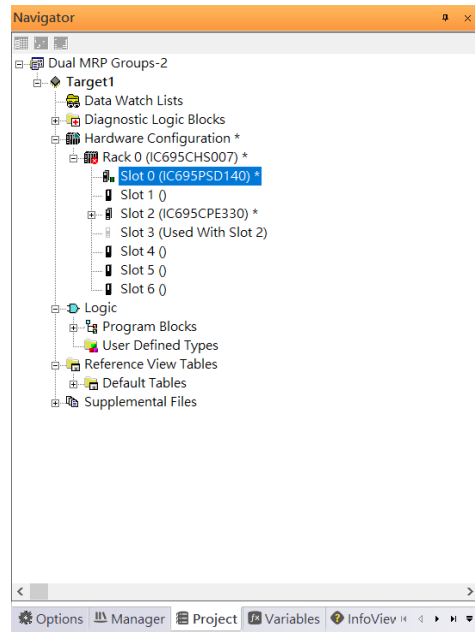
First, replace the power card. Click slot 0 and click the right button, select **Replace Module**, and specify the installed power card, PSD140, then click **OK**.

Figure 158: Replace Module



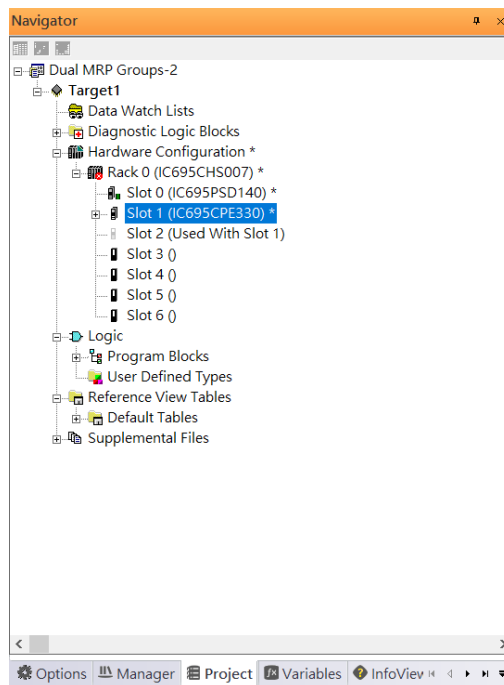
Slot 0 is replaced by current power card, PSD140.

Figure 159: PSD140



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

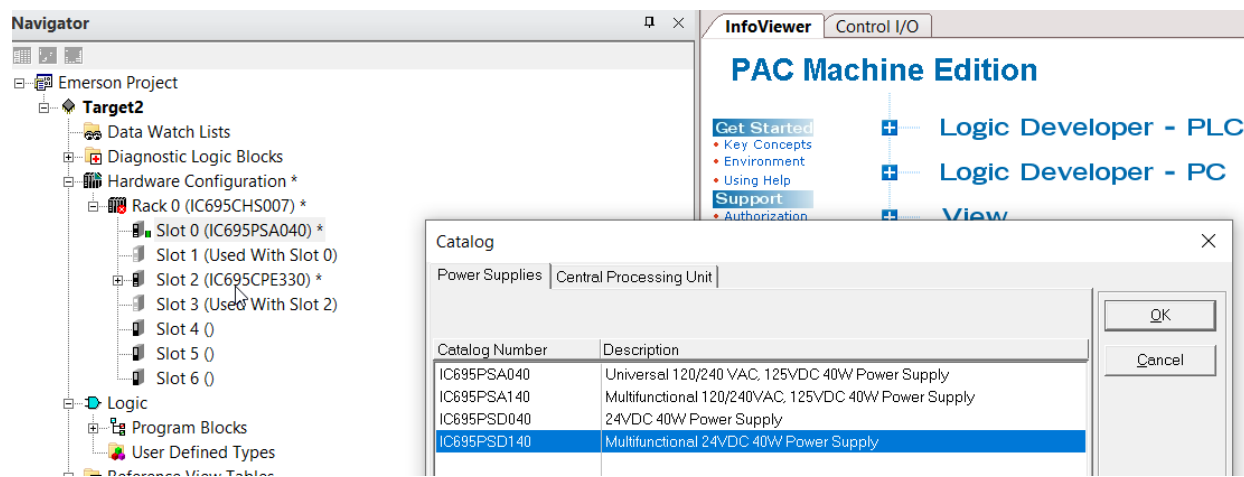
Figure 160: Slot 1 and 2 are Integrated



Now the 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 161: Replace Module

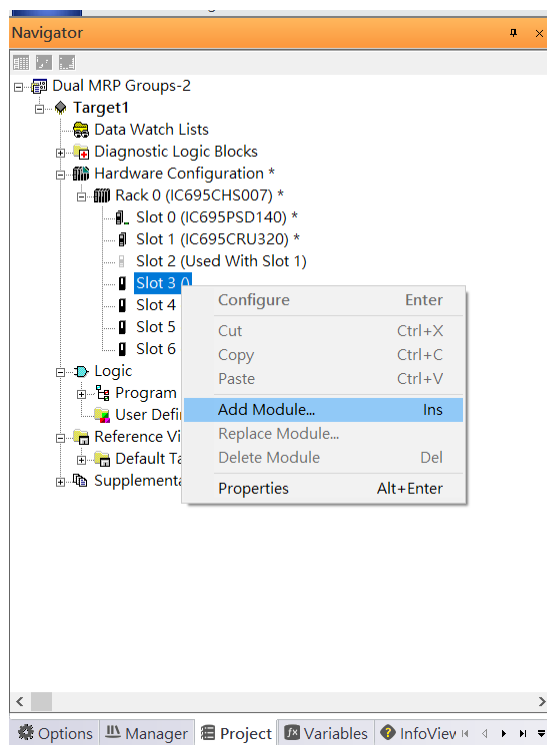


6.2.2.1 Slot 3

Next, add RMX128 module for slot 3.

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

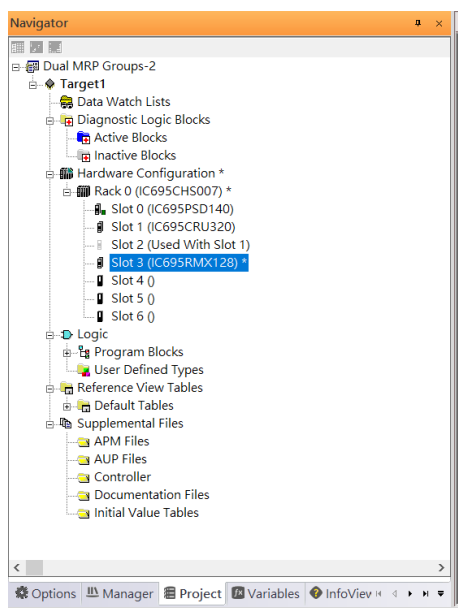
Figure 162: Add Module



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

Now the RMX128 is ready on slot 3.

Figure 163: 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

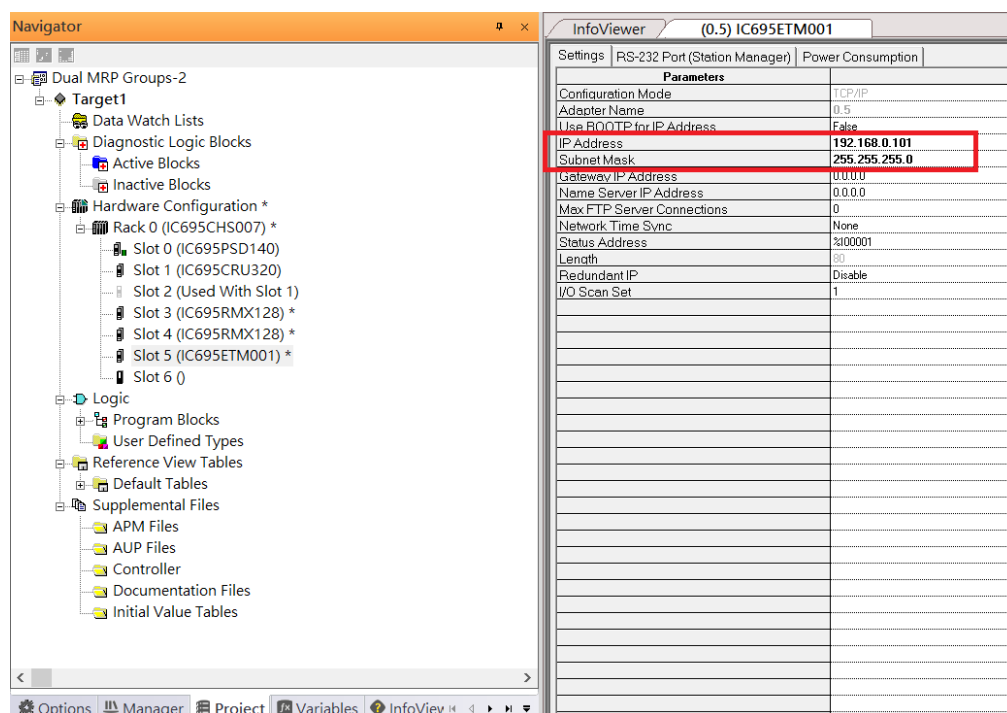
Repeat these steps to select the ETM001 for slot 5.

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 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 164: ETM001 Configured Parameters



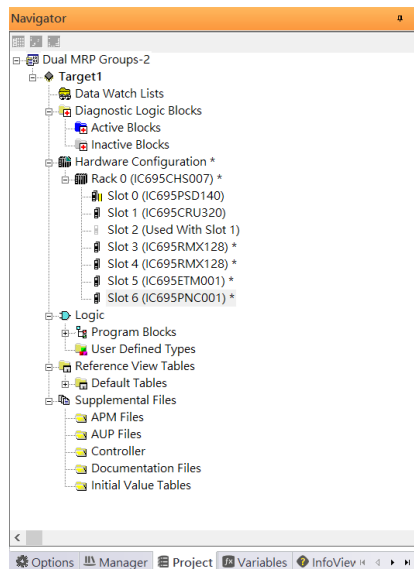
6.2.2.4 Slot 6

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.

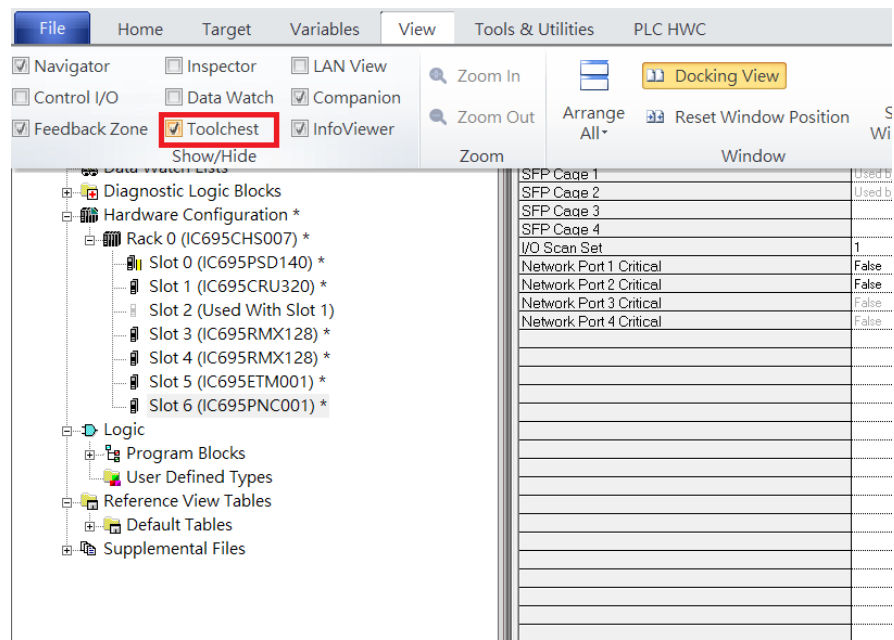
Figure 165: Final Configuration



6.2.3 I/O Device Setting

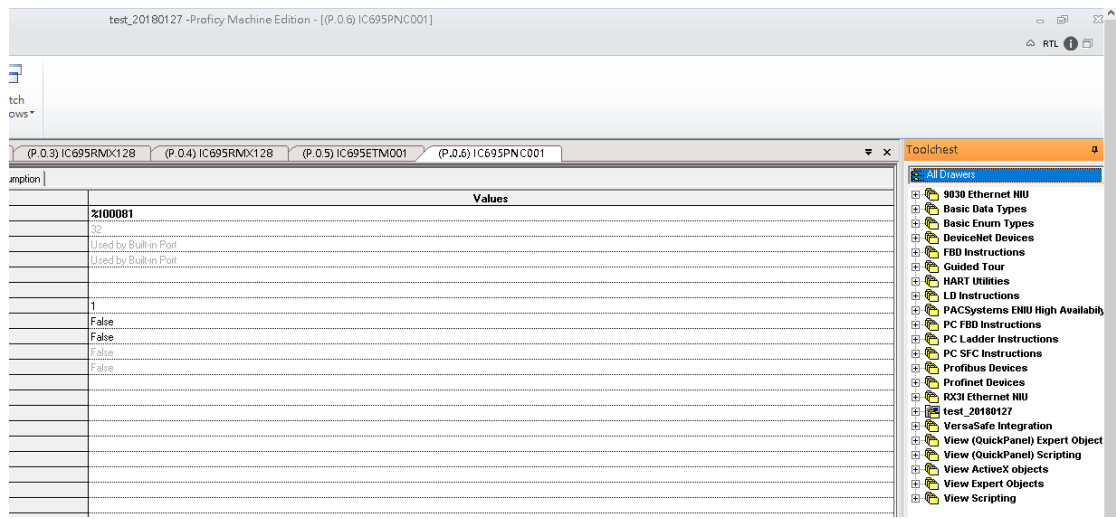
This section introduces the I/O Device integration. To configure the I/O Device, the GSDML file is necessary. Now we create another interface to load the GSDML file by using Toolchest.

Figure 166: Location of Toolchest button



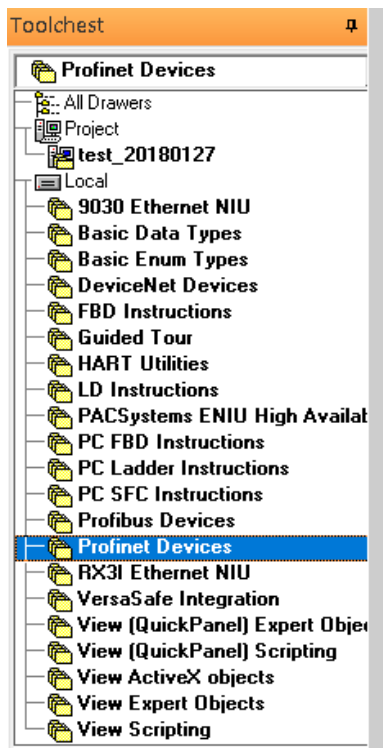
As shown in the following picture, a new interface is created on the right-hand side.

Figure 167: Toolchest Panel



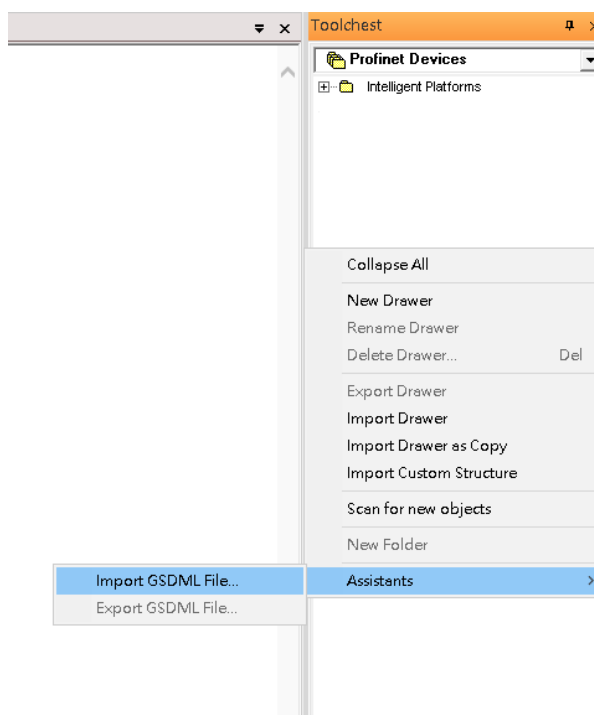
Select Profinet Devices.

Figure 168: Select Profinet Devices from the Toolchest



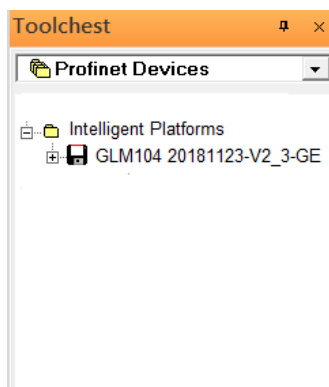
Click right button, select **Assistants** -> **Import GSDML File** and select the target file.

Figure 169: Select the GSDML File



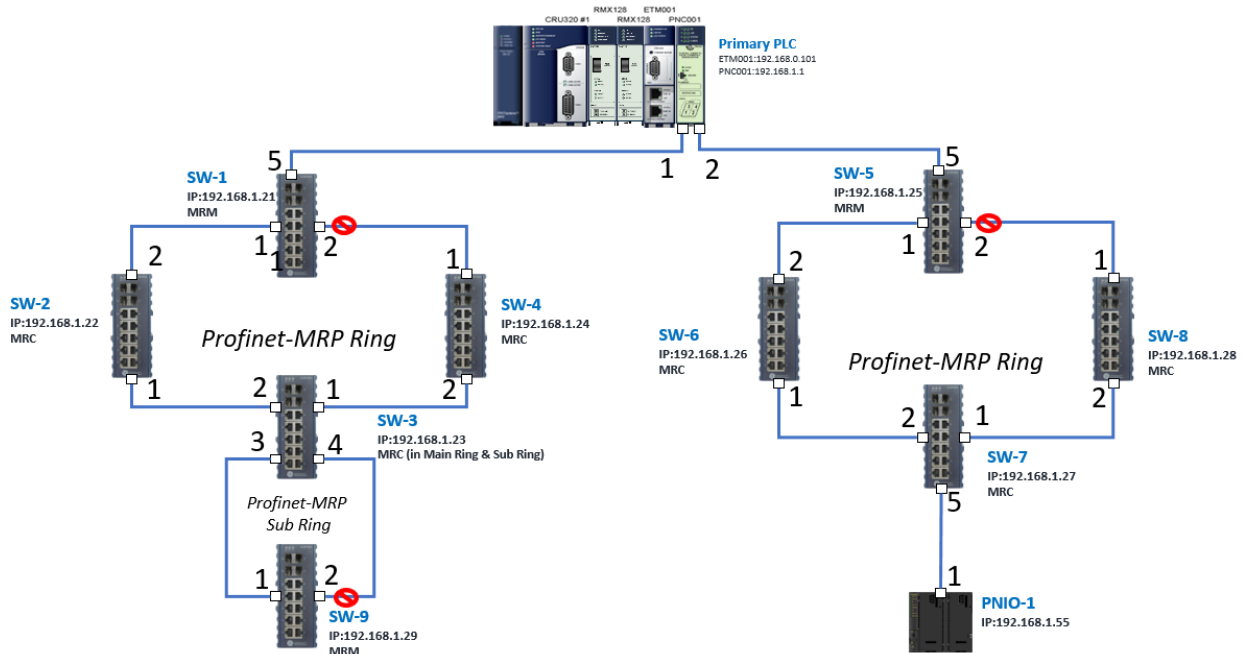
Then the corresponding I/O Device of GSDML File is added in the **Toolchest**.

Figure 170: Imported GSDML File



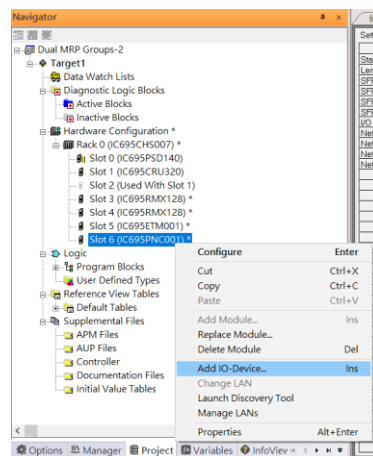
In this section, there are ten I/O devices and one I/O controller. I/O devices are nine switches and one Emerson VersaMax PROFINET I/O Scanner.

Figure 171: 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 the slot 6 and click the right button to add the I/O Device on the PNC001.

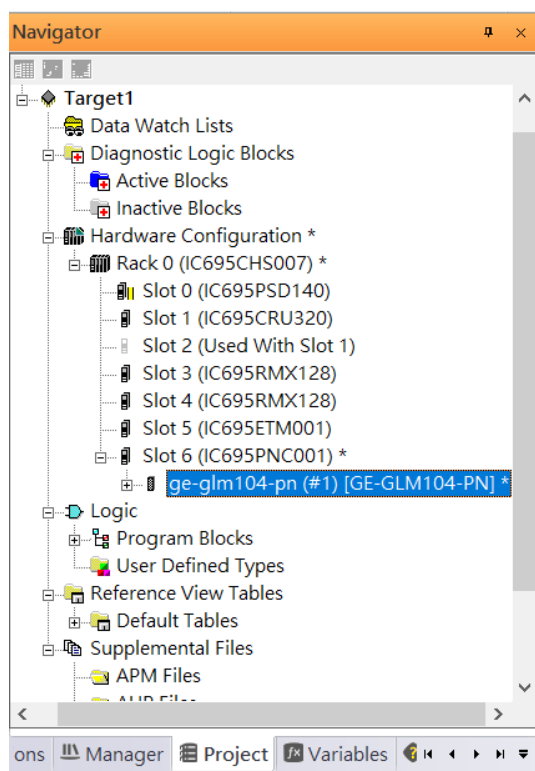
Figure 172: Add I/O Device



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 173: GLM104 (SW1)

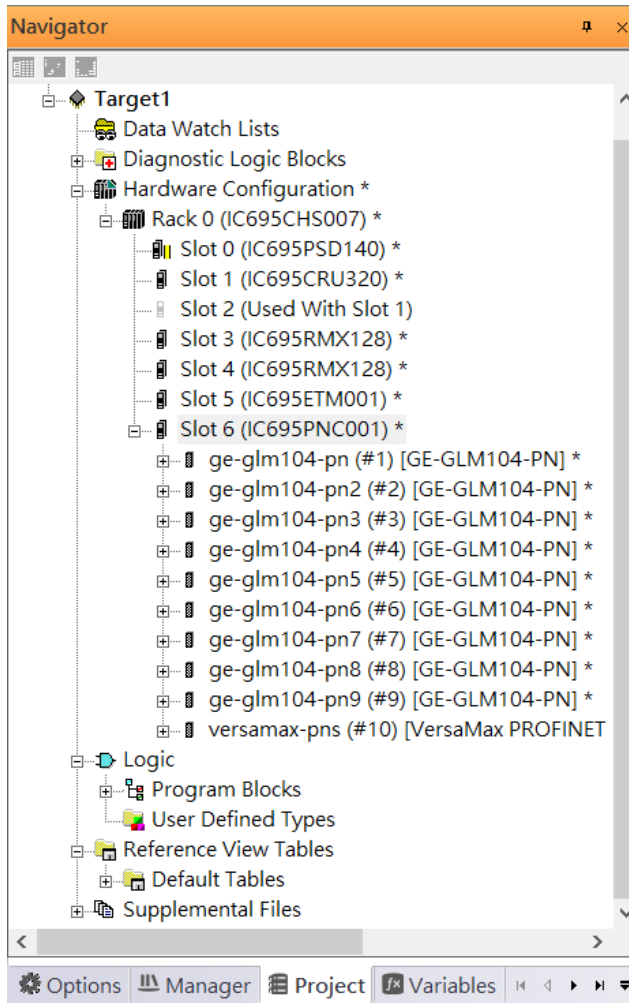


6.2.3.1 SW2 – SW10

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 174: Completed Configuration



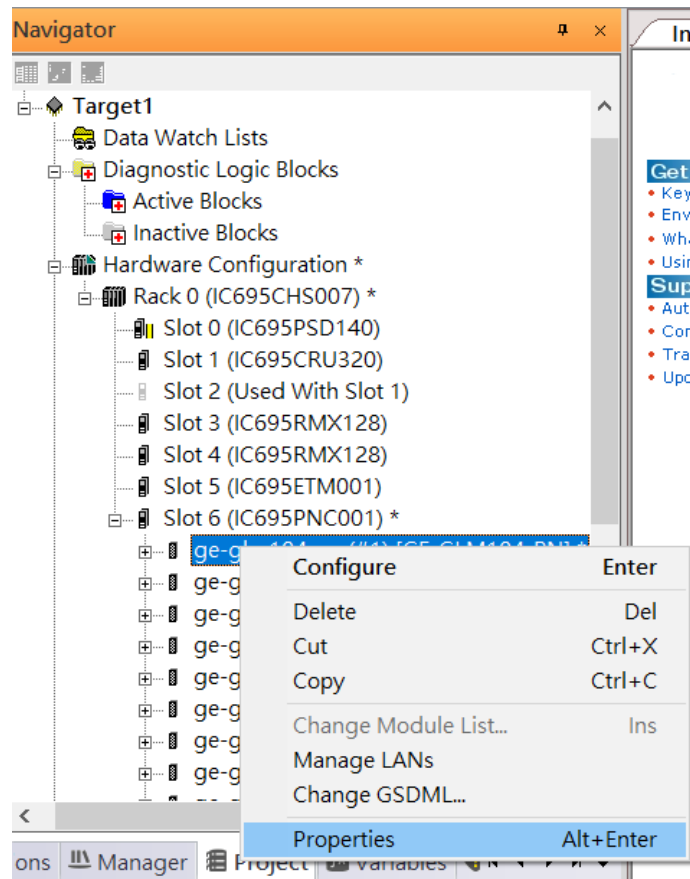
6.2.4 DCP Set Command

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

Under the slot 6, PNC001, select the I/O Device, ge-glm104-pn, and click the right button.

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

Figure 175: Select Properties



In this table, the I/O Device name can be specified in field **Device Name**, and the IP address can be set in field **IP address**. We modify 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 observed 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

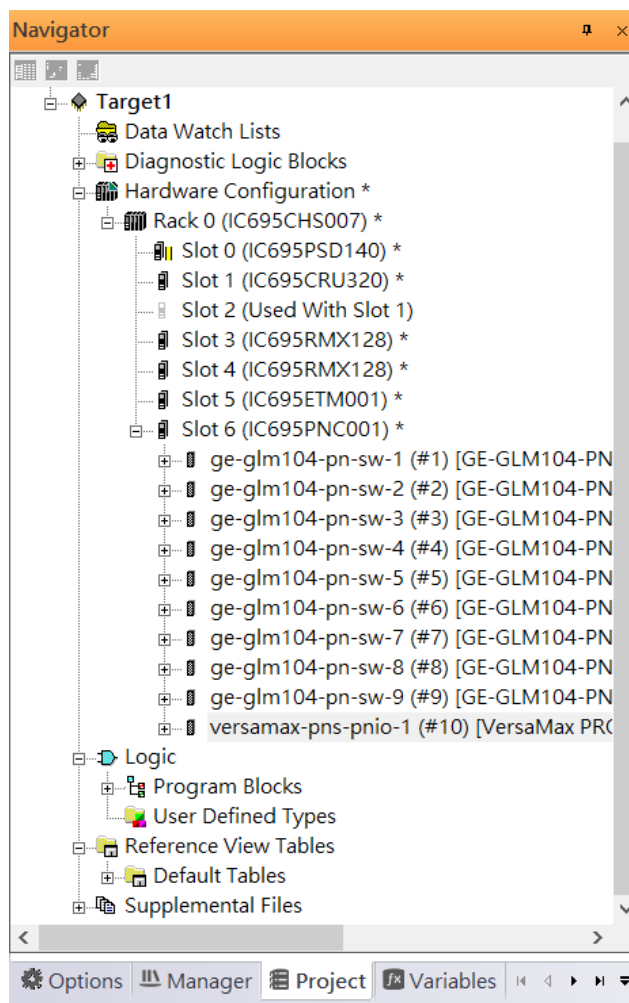
6.2.4.1 GLM104-PN2 through VERSAMAX-PNS-PNIO-1

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 176: Completed Configuration

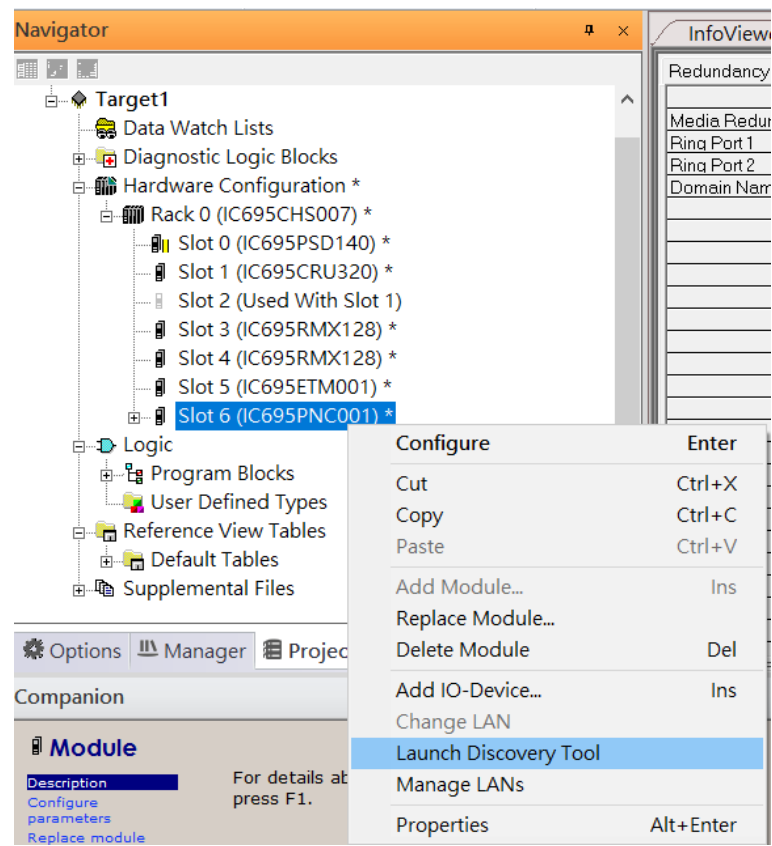


6.2.5 I/O Device Scan

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**.

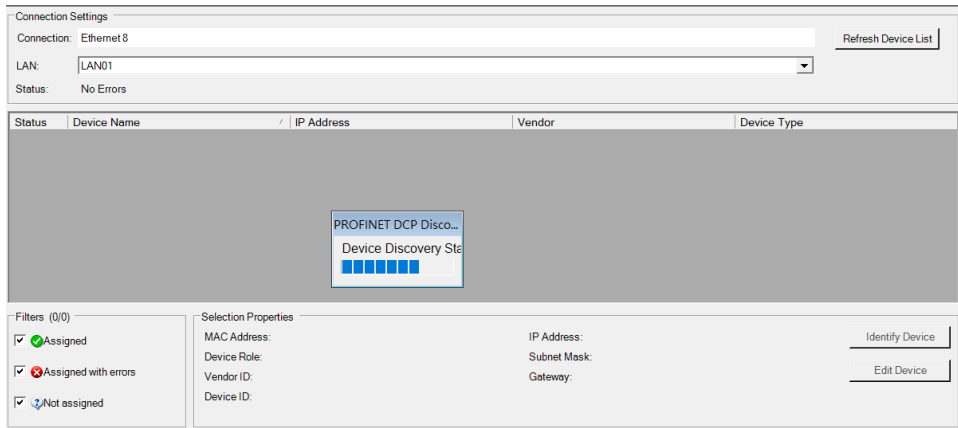
Note: Before we finish downloading the configuration to CRU320, need to unplug the block port according to the hardware topology to avoid loop.

Figure 177: Launch Discovery Tool



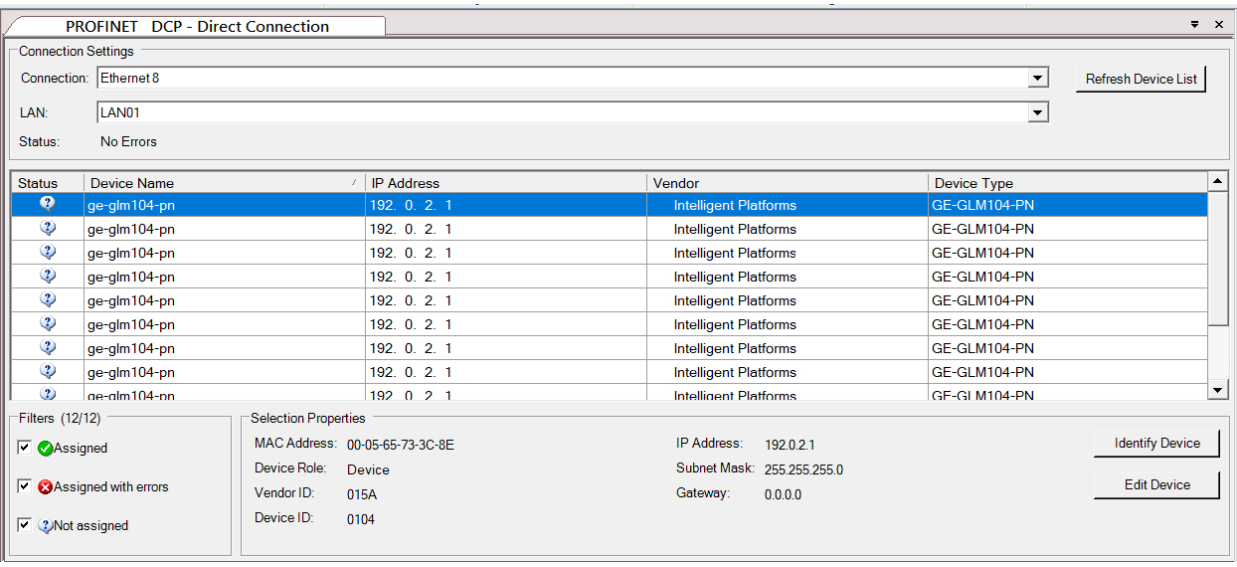
The tool is shown in the following picture, then press **Refresh Device List**.

Figure 178: Refresh Device List



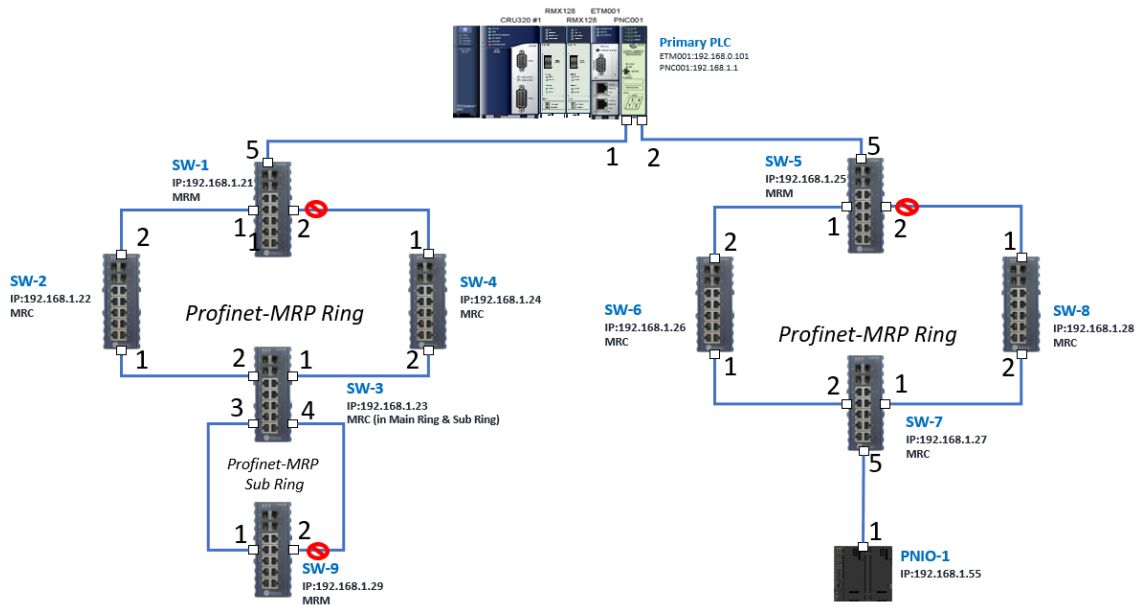
Then the connected I/O Device is listed in the following table.

Figure 179: Identify Device



There are I/O Devices and their status are 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 180: Multiple PROFINET MRP Ring and Subring



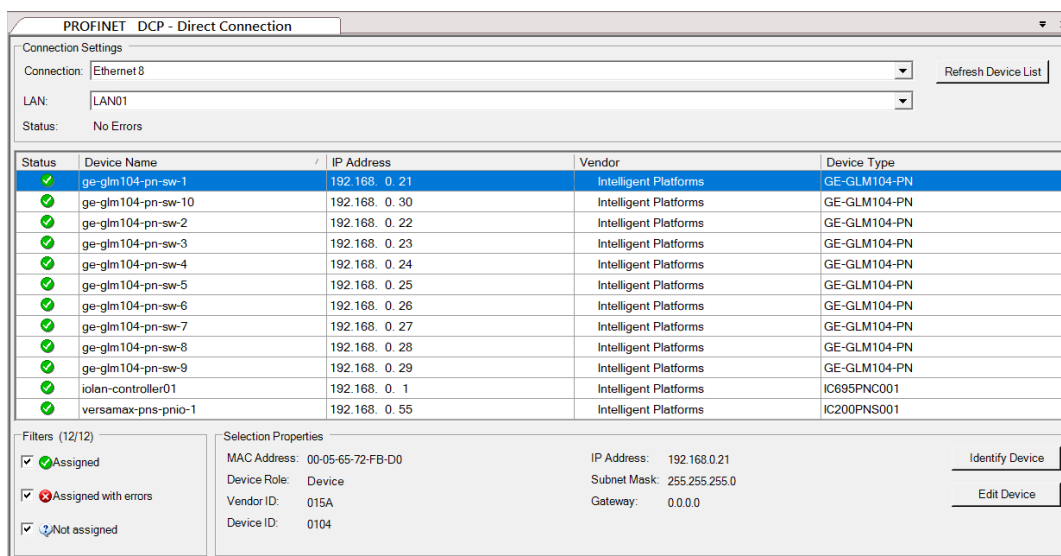
Click **Edit Device**, set Device Name to “ge-glm104-pn-sw-1” and click **Set Device Name** button, then set IP Address to “192.168.0.21”, Subnet Mask to “255.255.255.0” and click **Set IP Information** button.

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 181: 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 I/O controller and I/O devices highlighted in the red box below. First, configure the MRPe in Profinet MRP Main Ring.

Figure 182: Configuring the Main Ring

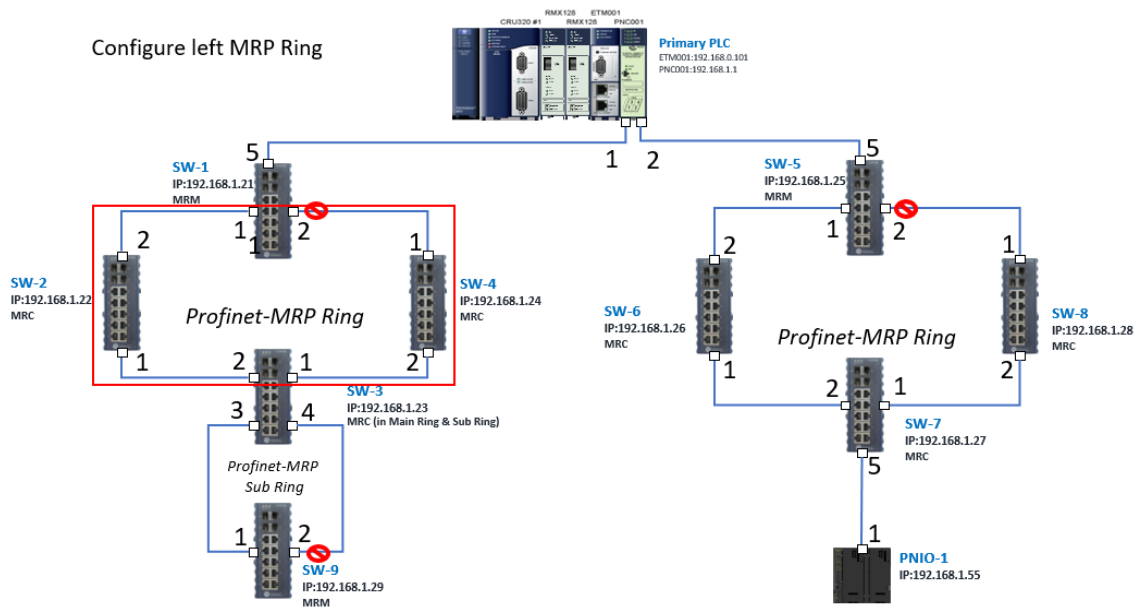
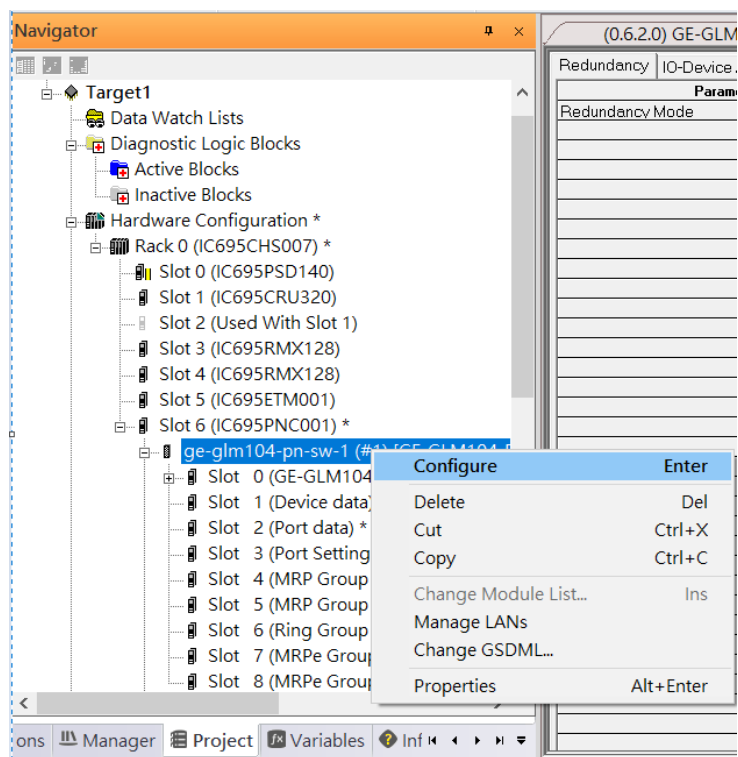
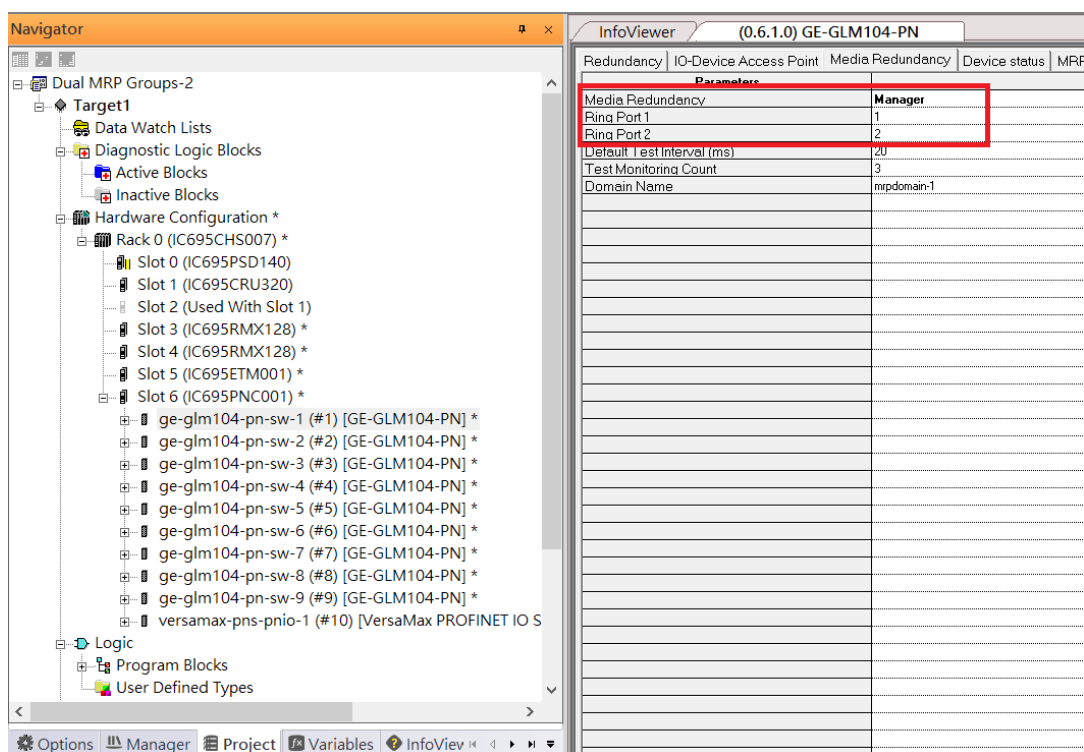


Figure 183: Configure SW1



PROFINET MRP Main Ring Couples Multiple PROFINET MRP Subrings

Figure 184: Configuring the Media Redundancy Parameters

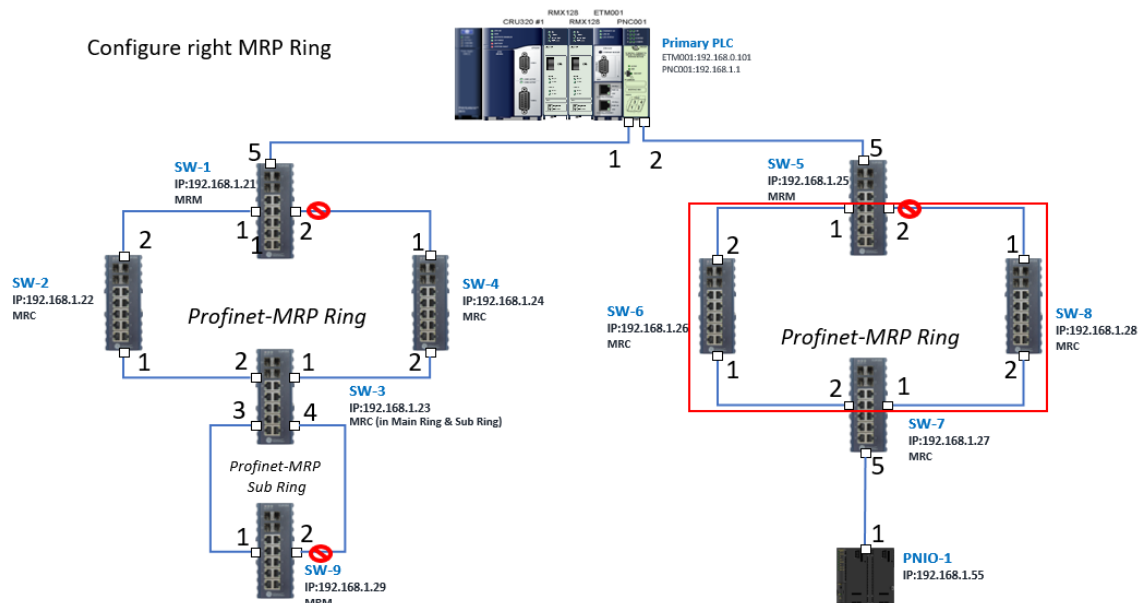


Repeat these steps to enable MRP functionality for SW2, SW3, and SW4.

6.2.6.2 SW5 through SW8

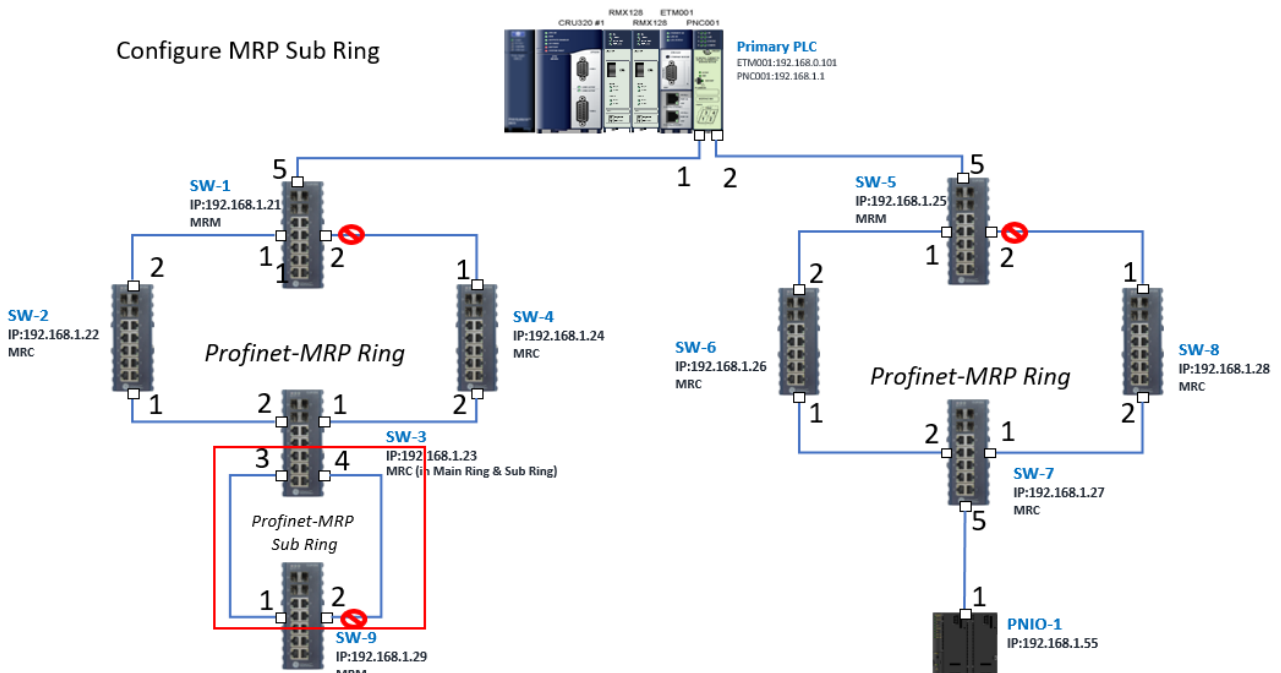
Next, configure the MRP in Profinet MRP Ring-2 (highlighted in the red box below). Refer to the steps outlined in Section 6.2.6.1 to enable MRP functionality for SW5-SW7.

Figure 185: SW5 - SW8

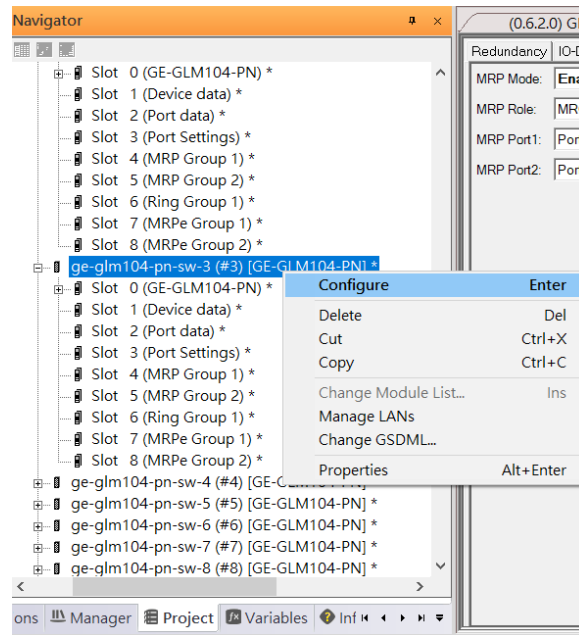


6.2.6.3 SW3 (Ports 3 and 4) and SW9

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

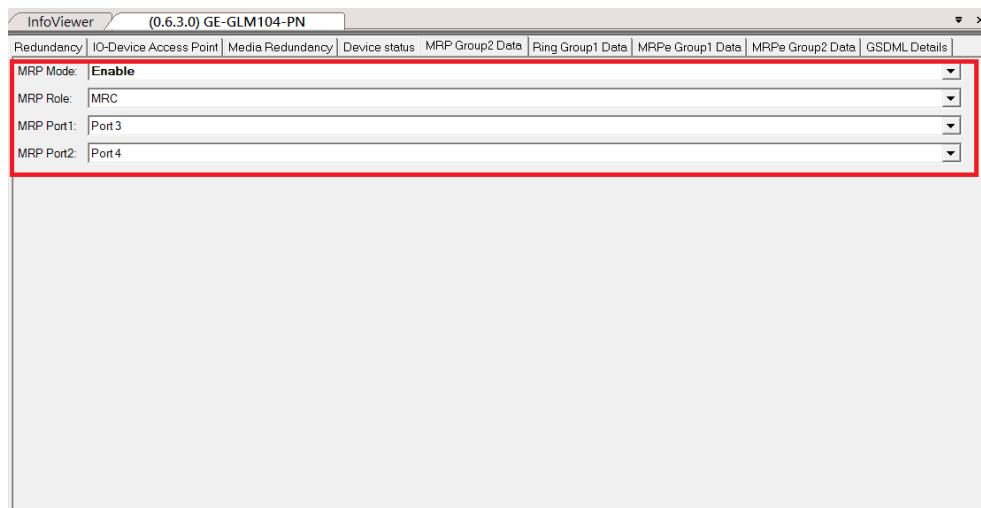


In order to enable MRP function in SW3, click the right button and choose **Configure**.
It will show “Media Redundancy” on the right window.



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

Figure 186: SW3 Ports



To enable MRP function in SW9, click the right button and choose **Configure**.
Enable MRP function by changing the value of “Media Redundancy” to 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 I/O Controller shall be specified.

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

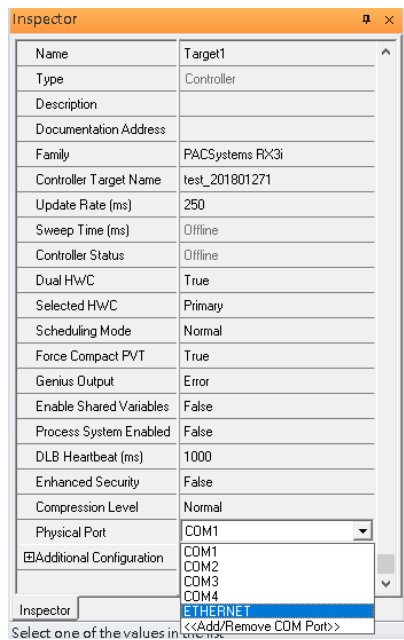
I/O Controller Communication Rule

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**.

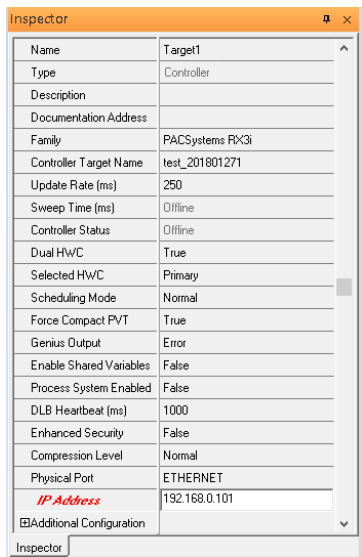
Figure 187: Changing the Physical Port Parameter



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.

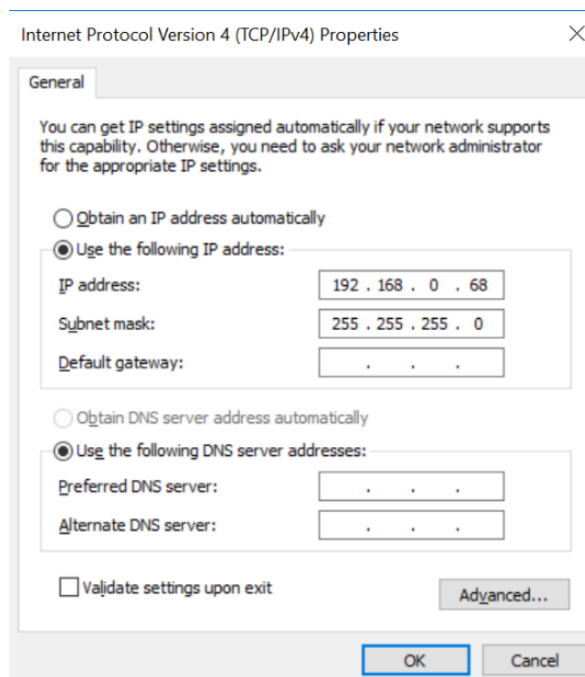
Figure 188: Specified IP Address Appears



6.2.8 PC Network

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

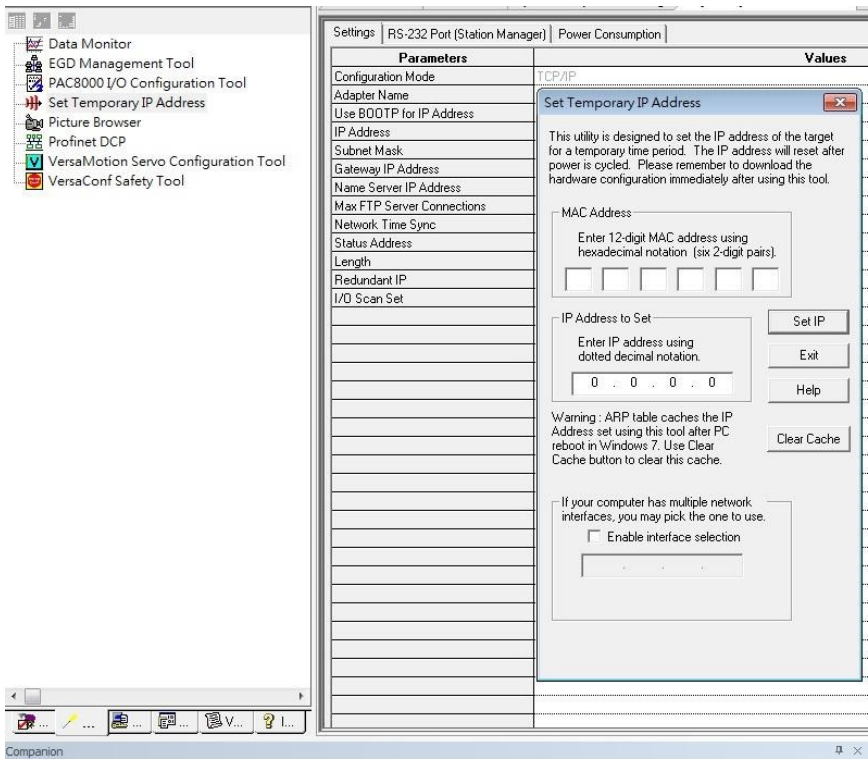
Figure 189: Setting the IP Address of the PC with PME



6.2.9 Temporary IP

However, if the IP address of ETM001 is lost or forgotten, the IP address can be changed by the function **Set Temporary IP Address** according to the MAC address of ETM001. In the following figure, the MAC address is referenced to the ETM001, and the IP address can be defined by user.

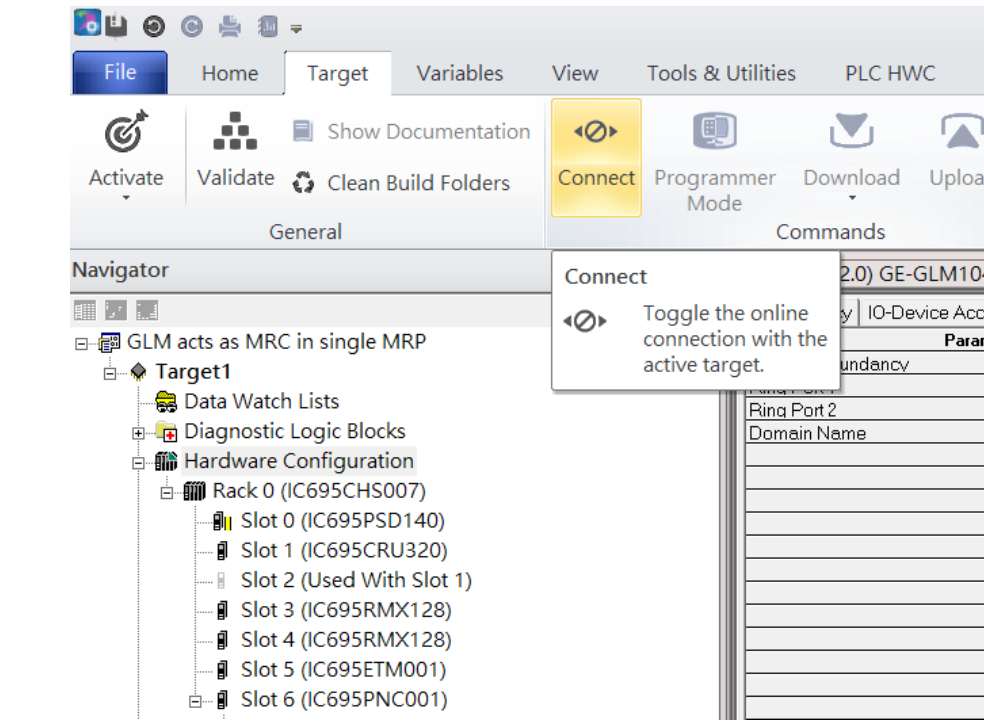
Figure 190: Set Temporary IP Address



6.3 Implementation

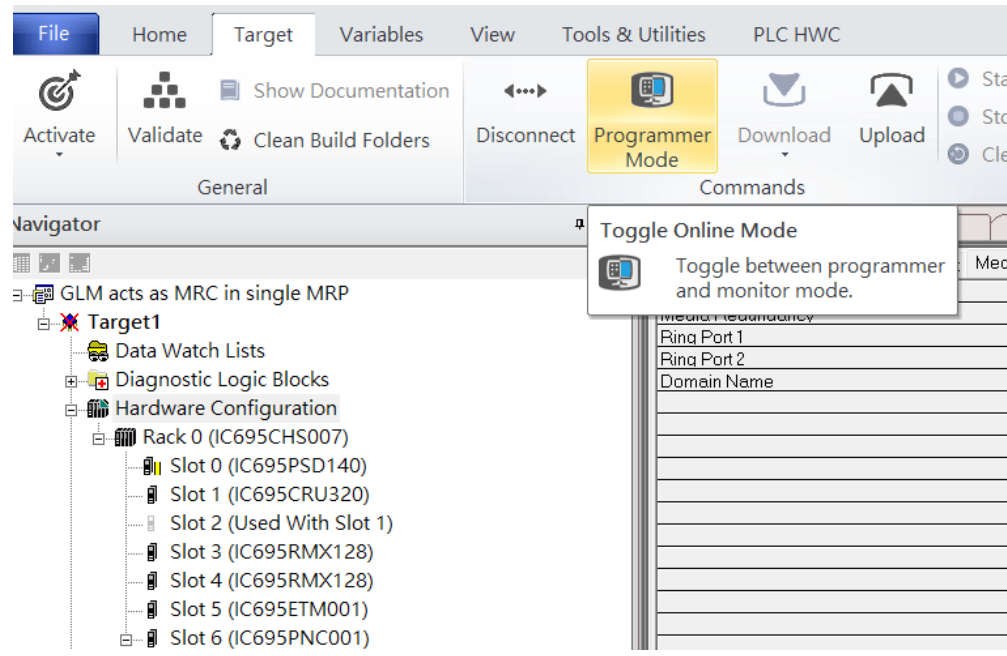
To download the configuration to hardware, the following steps shall be applied.
First, press the **Connect** icon.

Figure 191: Connecting to Target



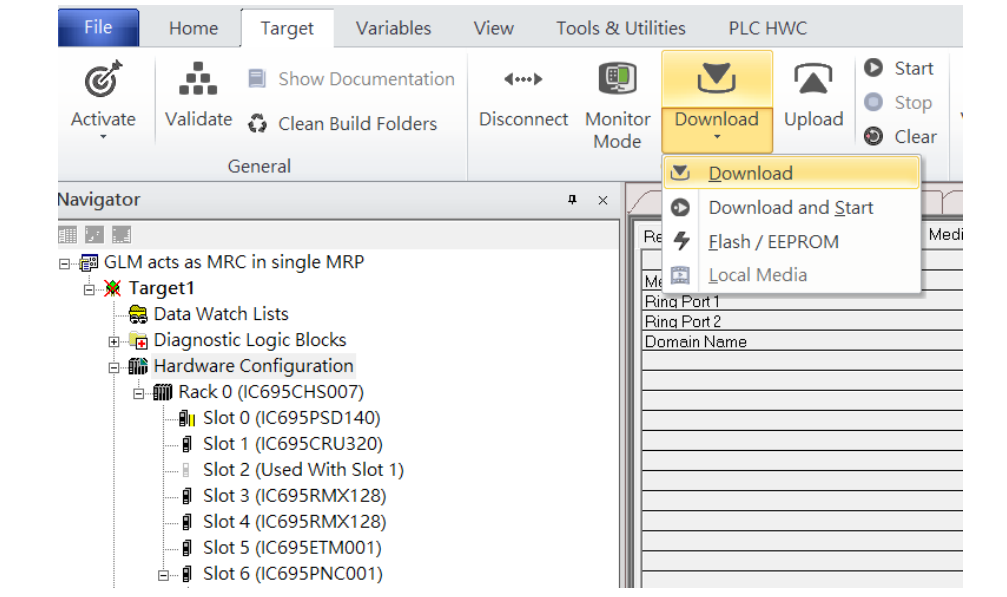
Then press the icon **Programmer Mode**.

Figure 192: Programmer Mode



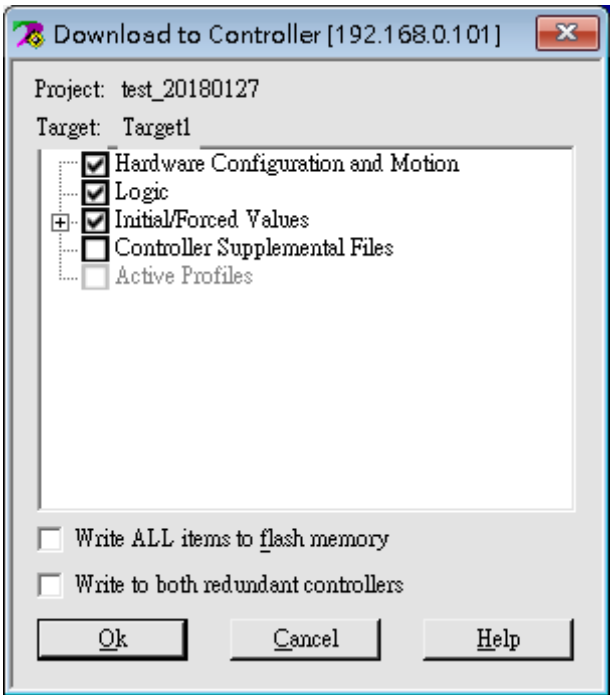
Then press icon **Download** and select **Download**.

Figure 193: Download



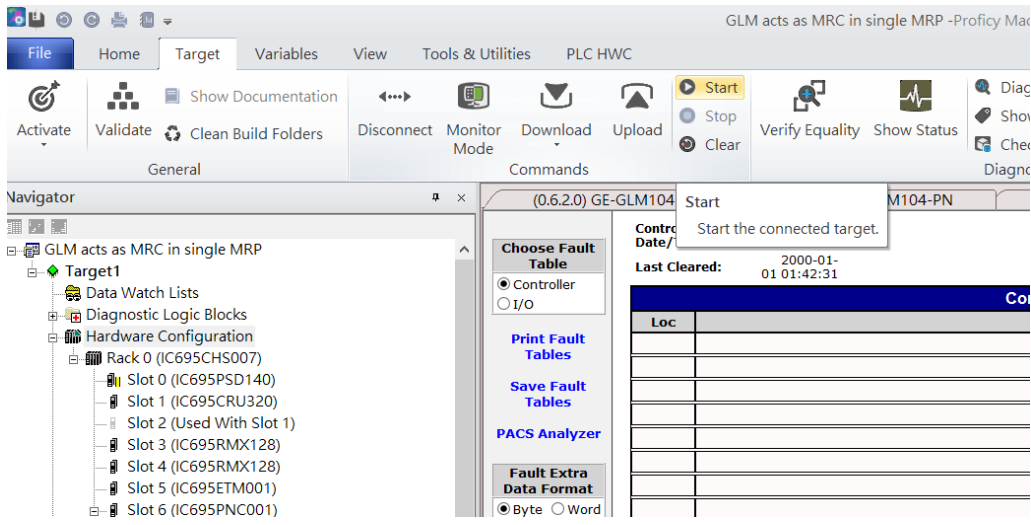
Then the dialogue is appeared to make sure the initialization procedure, select **OK**.

Figure 194: 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 195: Start



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

7.1 Network Topology

Figure 196: PROFINET-MRP Main Ring couples with Coupled Two PROFINET-MRP Subrings

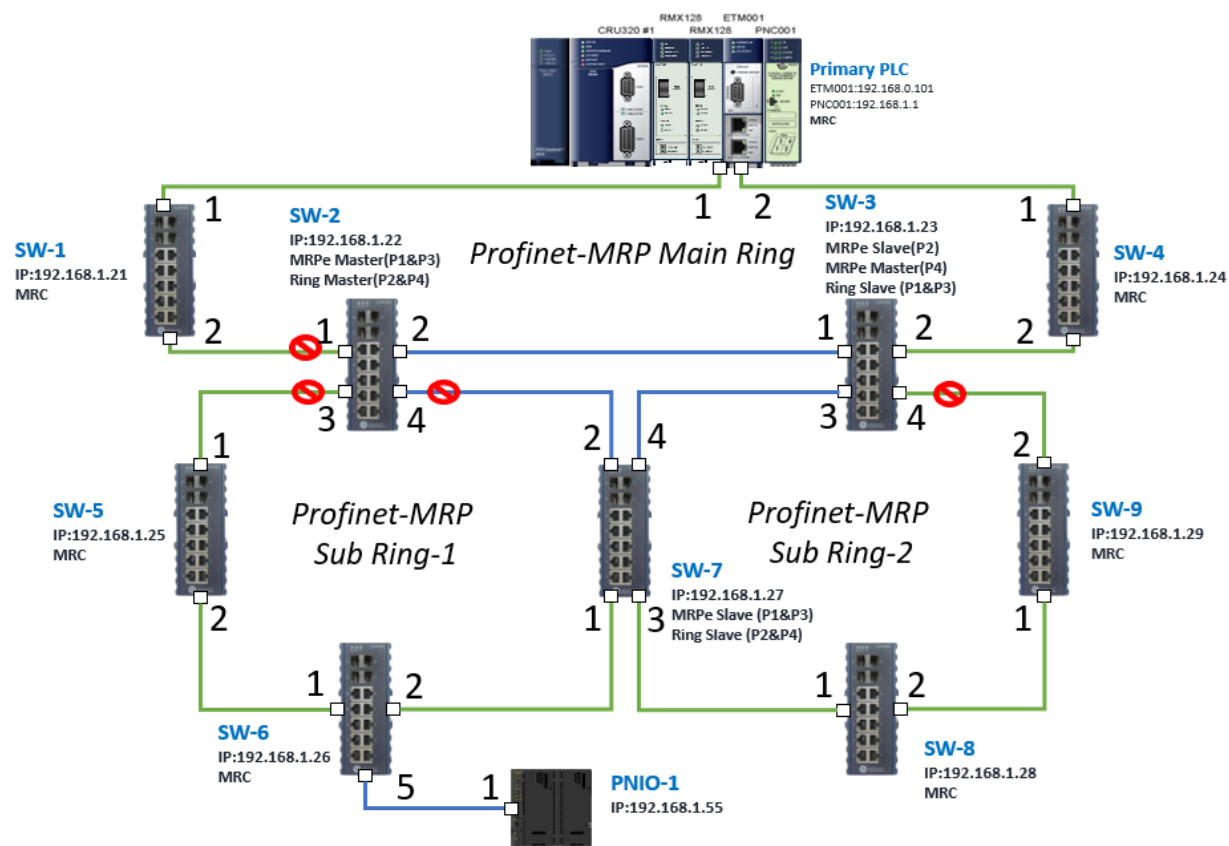


Figure 197

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 imbedded 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 198: Create a new project

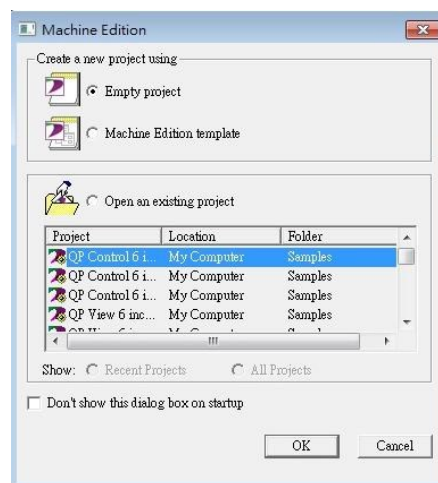
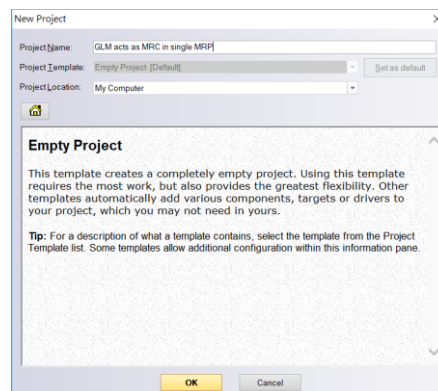


Figure 199: New Project Name



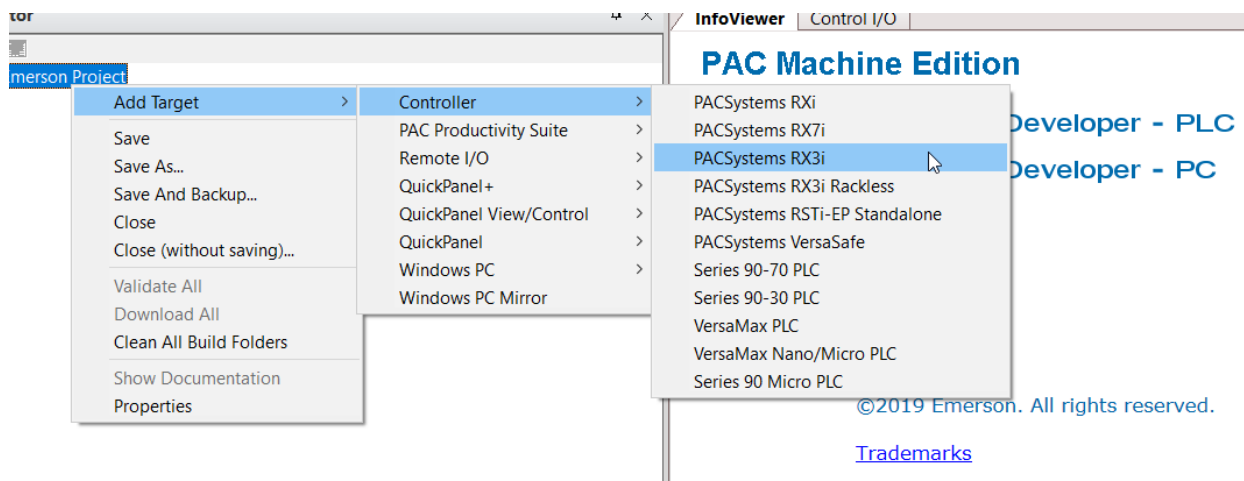
7.2.2 I/O Controller Setting

Next step is to add a target for this project.

Click 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.

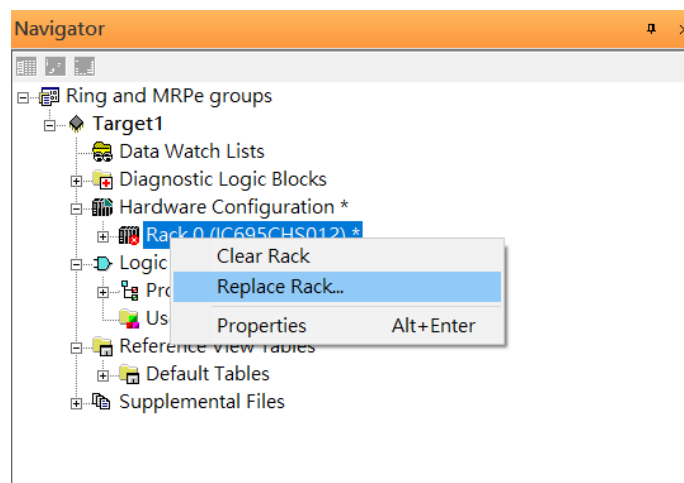
Figure 200: Adding I/O Controller



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 power card, communication module, or bus controller. However, there are only 7 chassis can be used in the I/O Controller CRU320. Thus, replace the rack for 7 slots.

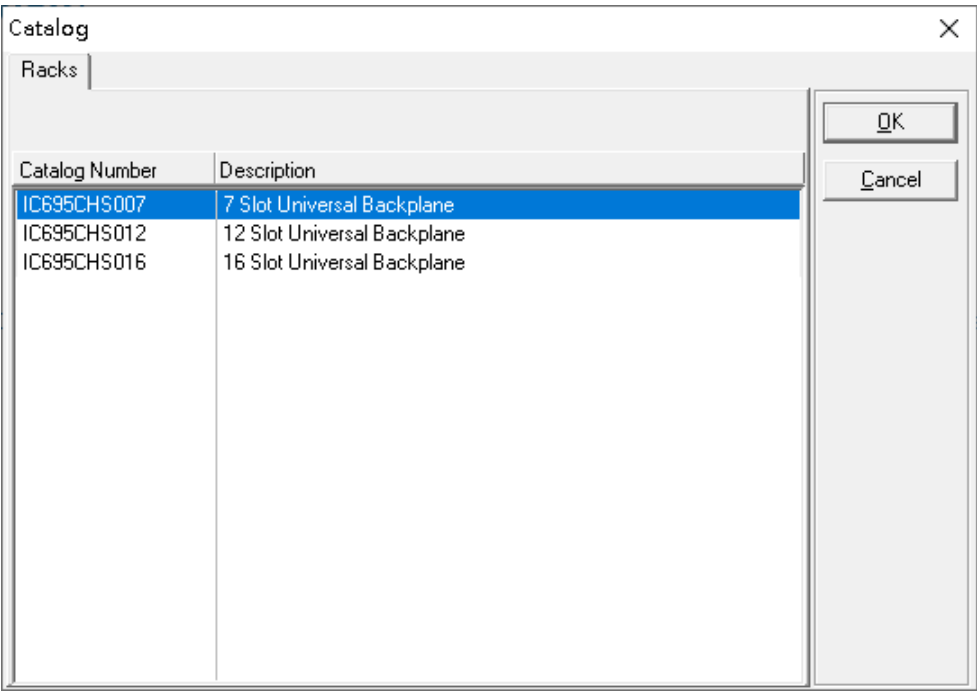
Click right button on **Rack 0 (IC695CHS012)** and select **Replace Rack**.

Figure 201: Replace Rack



Select “IC695CHS007” and click OK.

Figure 202: Select the Catalog Number



After the rack and the number of slots is 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 203: Rack Configuration



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

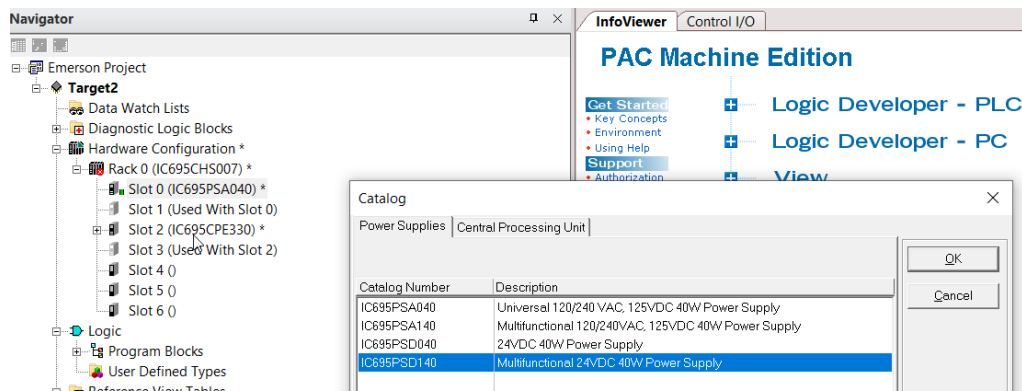
Devices on I/O Controller

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**.

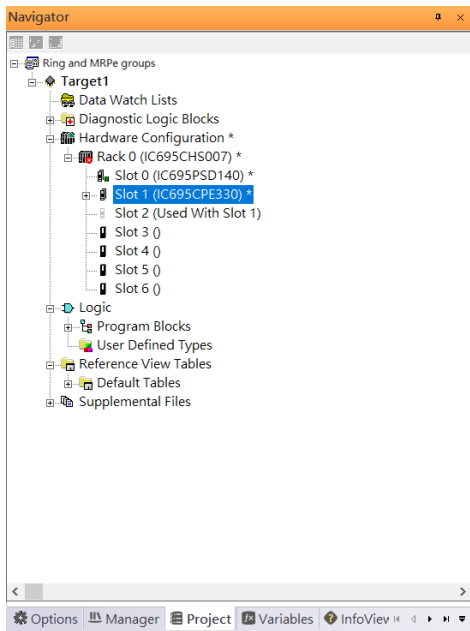
Figure 204: Replace Module



Slot 0 is replaced by current power card, PSD140.

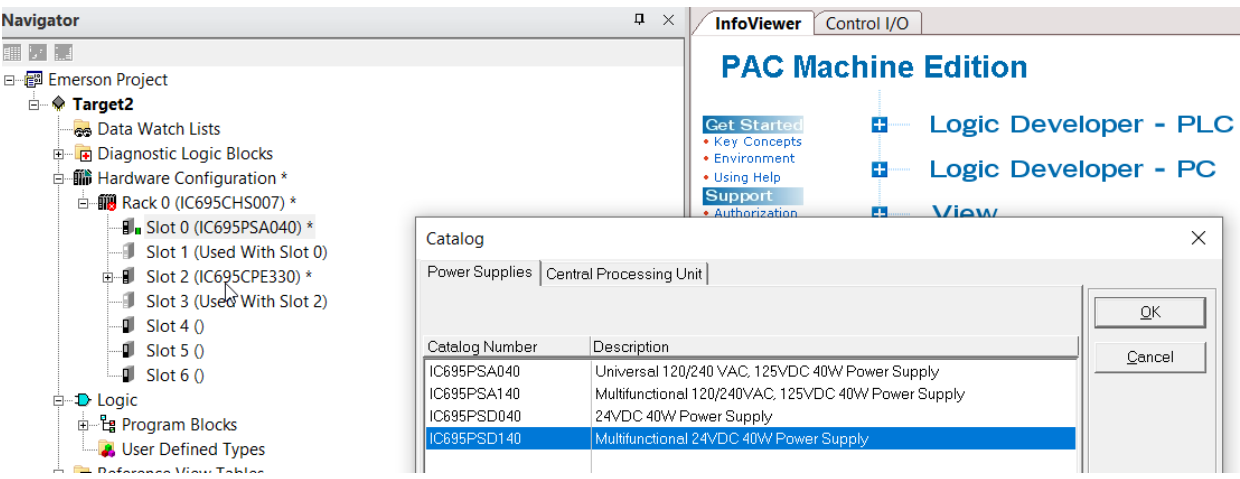
For slot 1 and 2, 2 chassis (1 and 2) is occupied by the Central Processing Unit, CRU320. To integrate slot 1 and 2, pull the slot 2 to slot 1. The slot is not cleared.

Figure 205: Integrate Slot 1 and Slot 2



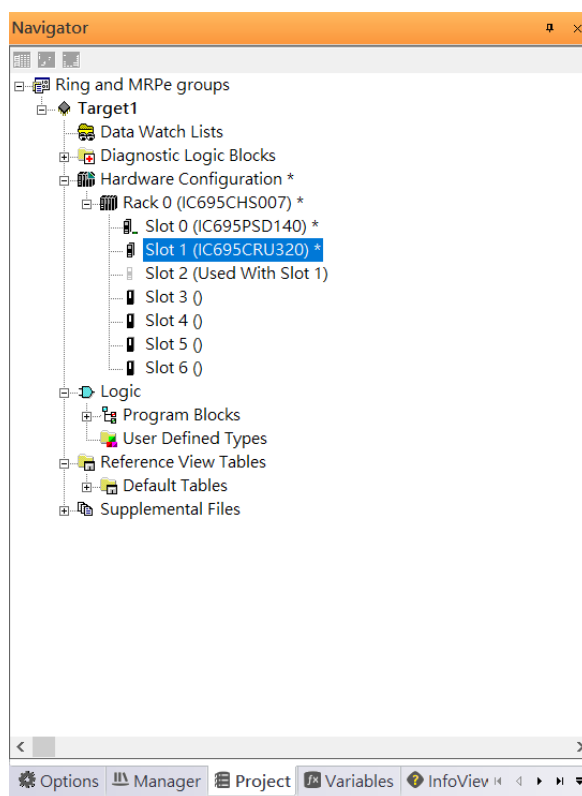
To select the Central Processing Unit, click slot 1 and click the right button, select **Replace Module** to choose CRU320 and select **No**.

Figure 206: Replace Module



Now the CRU320 is specified.

Figure 207: CRU320 is Specified

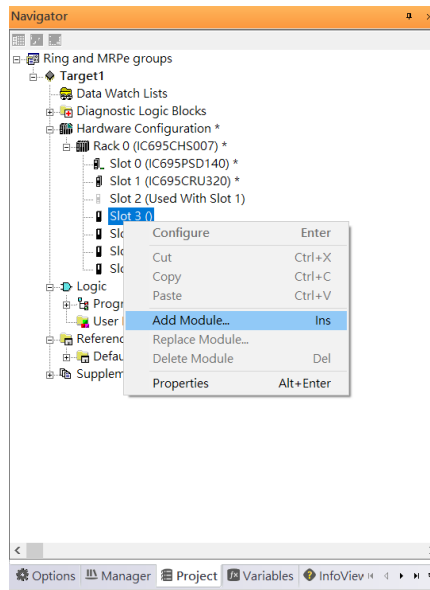


7.2.2.1 Slot 3

Next is to add RMX128 module for slot 3.

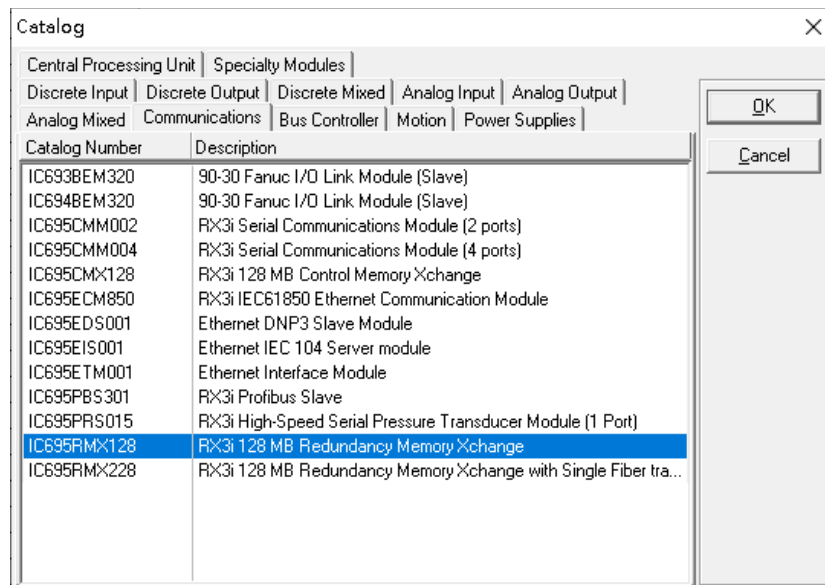
Click the right button on slot 3, select **Add Module**.

Figure 208: Add Module



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

Figure 209: 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

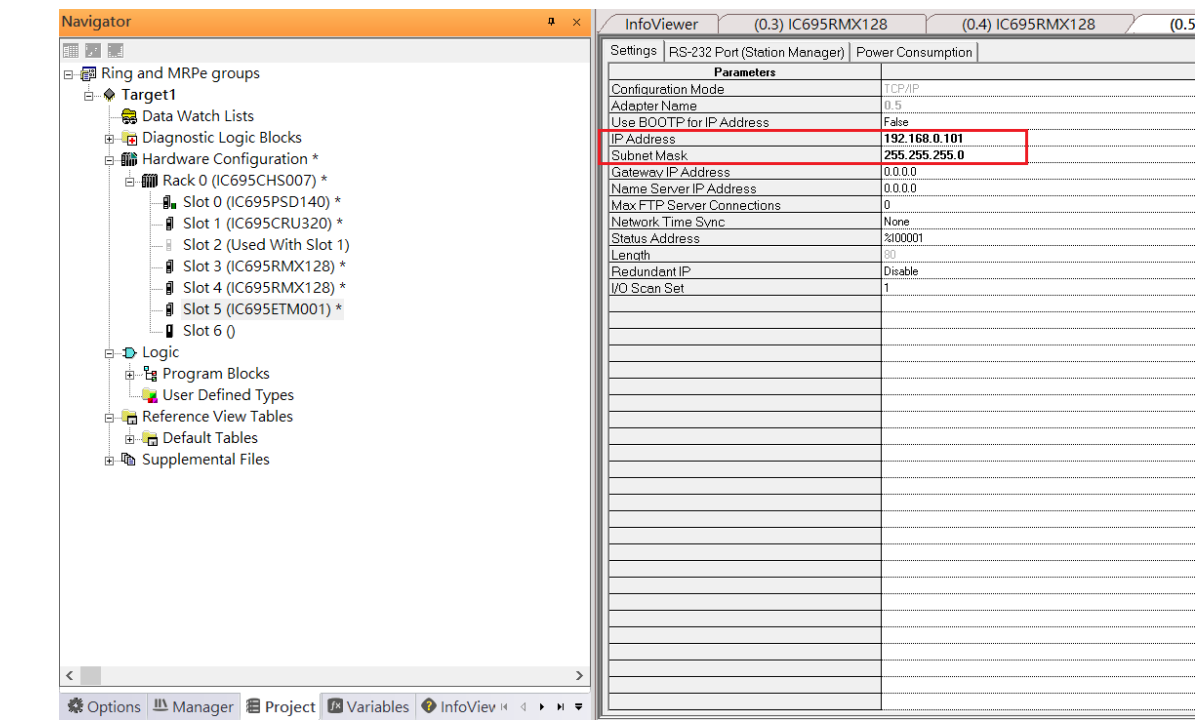
Next, select ETM001 for slot 5.

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

It should be note that the ETM001 is the management device for PAC Machine Edition. The communication interface is 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 210: ETM001 Parameters



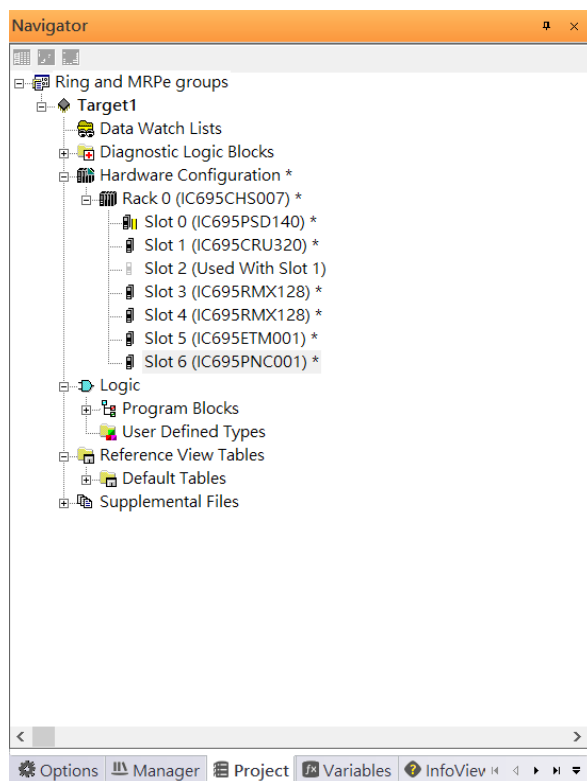
7.2.2.4 Slot 6

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.

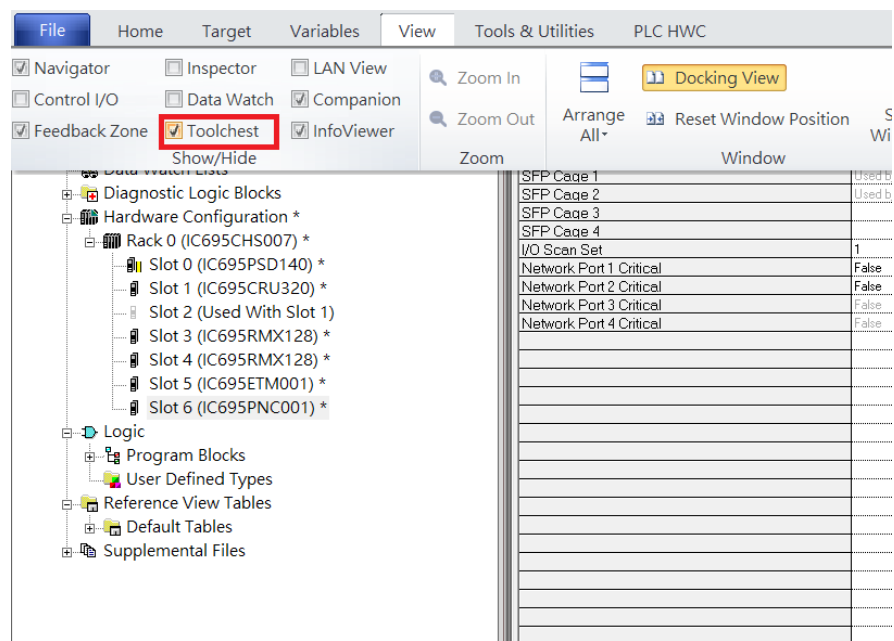
Figure 211: Final Configuration



7.2.3 I/O Device Setting

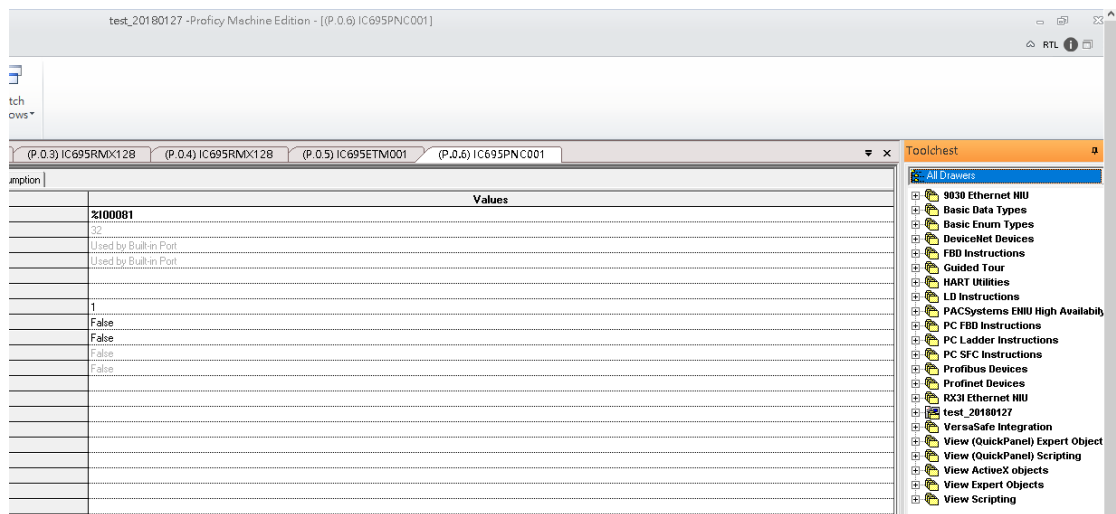
This section introduces the I/O Device integration. To configure the I/O Device, the GSDML file is necessary. Now we create another interface to load the GSDML file by using Toolchest.

Figure 212: Location of Toolchest button



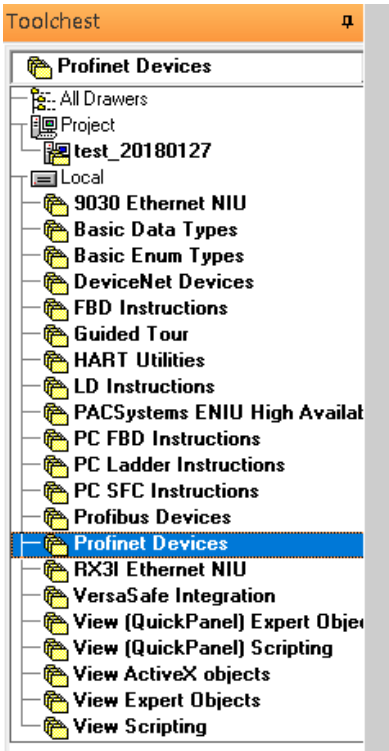
As shown in the following picture, a new interface is created on the right-hand side.

Figure 213: Toolchest Panel



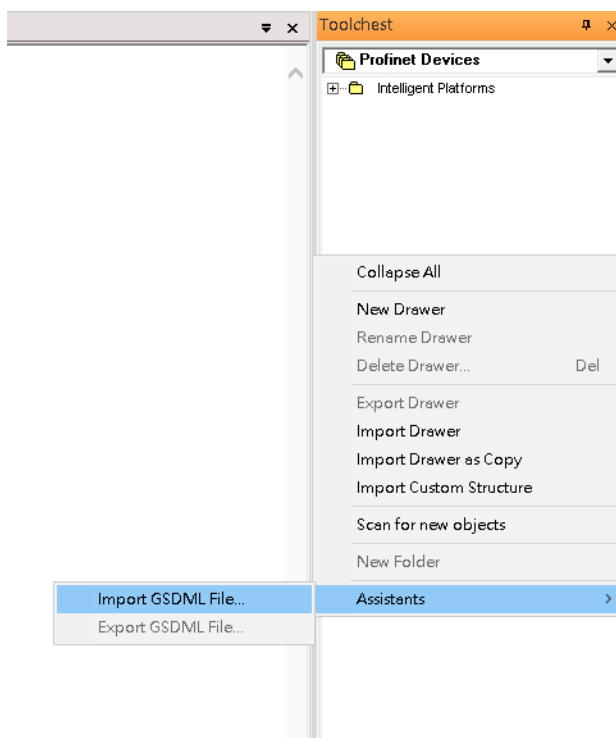
Select Profinet Devices.

Figure 214: Select Profinet Devices from the Toolchest



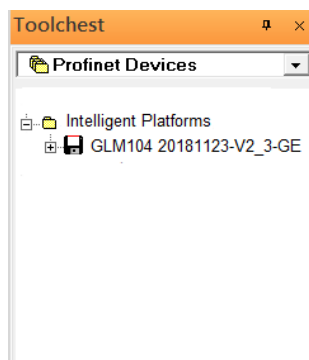
Click right button, select **Assistants** -> **Import GSDML File** and select the target file.

Figure 215: Select the GSDML File



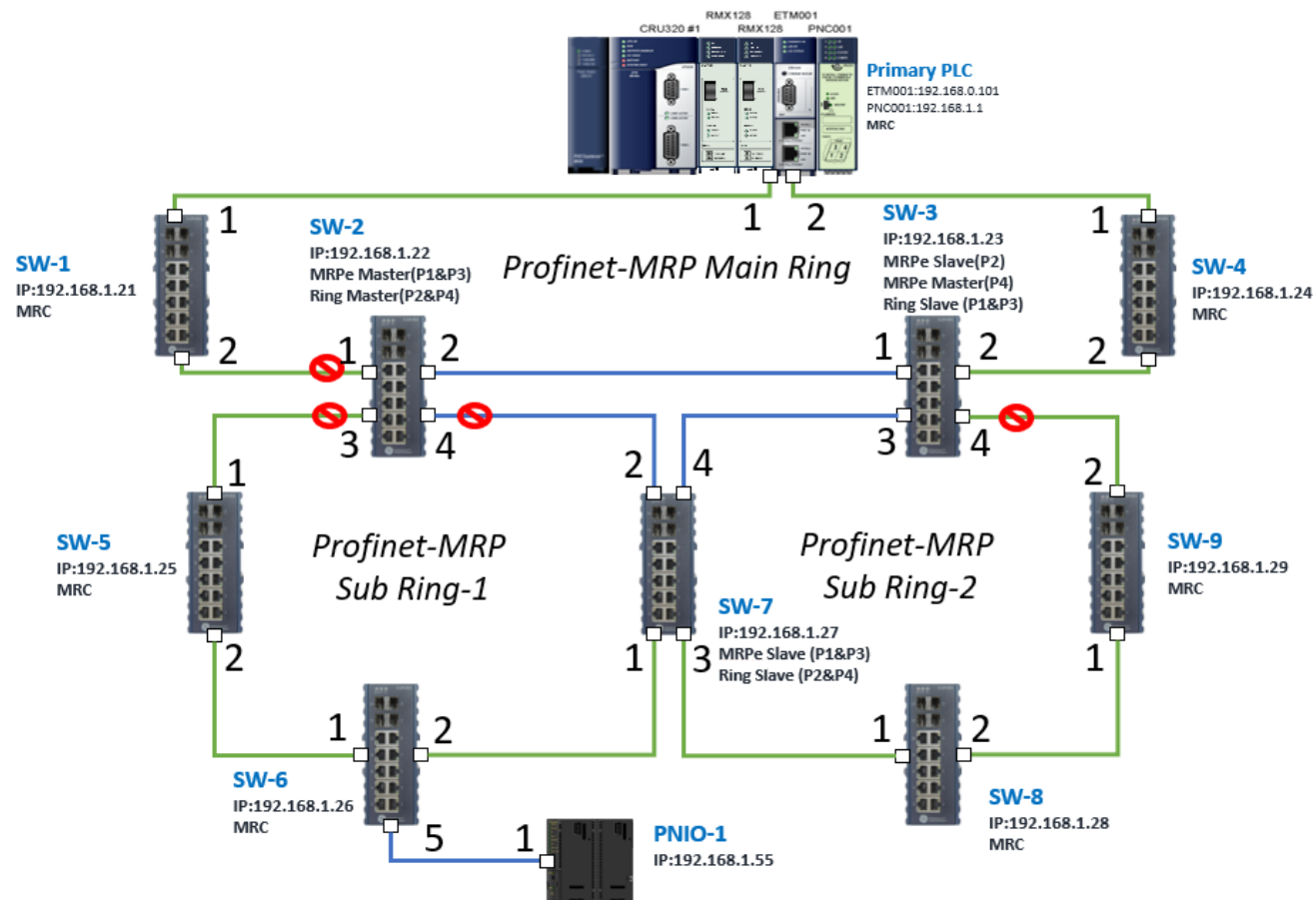
Then the corresponding I/O Device of GSDML File is added in the **Toolchest**.

Figure 216: Imported GSDML File



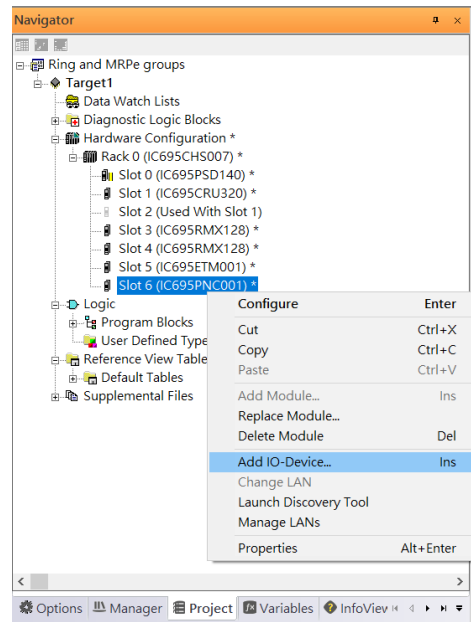
In this document, there are ten I/O devices and one I/O controller. I/O devices are nine switches and one Emerson VersaMax PROFINET I/O Scanner.

Figure 217: 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 the slot 6 and click the right button to add the I/O Device on the PNC001.

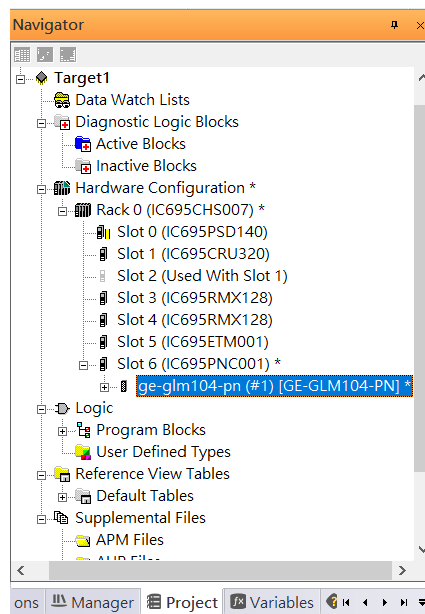
Figure 218: Add I/O Device on the PNC001



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.

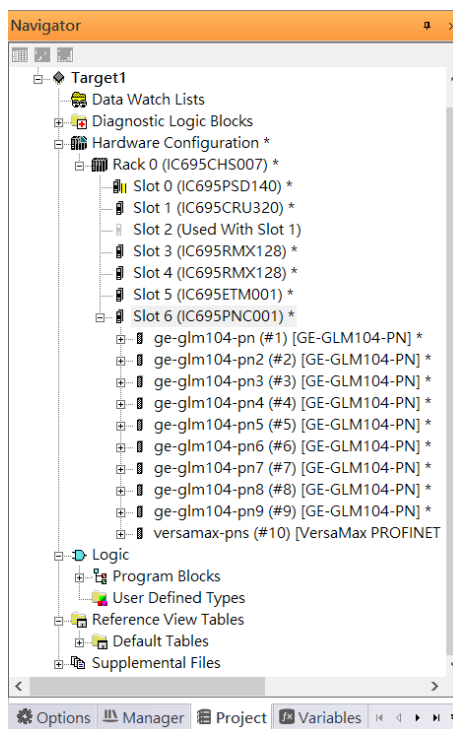
Figure 219: Device is now ready



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 220: Finished Configuration



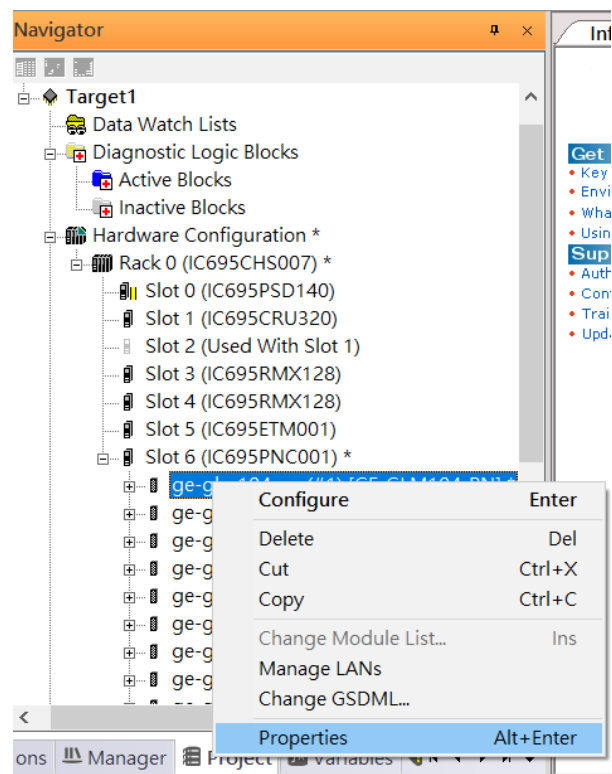
7.2.4 DCP Set Command

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

Under the slot 6, PNC001, select the I/O Device, ge-glm104-pn, and click the right button.

Select **Properties**.

Figure 221: Properties



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

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

Figure 222: Discovery Tool

Inspector	
IO-Device	
Device Number	1
Update Rate (ms)	128
Reference Variable	<None>
Network Identification	
IO 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 IO References	True

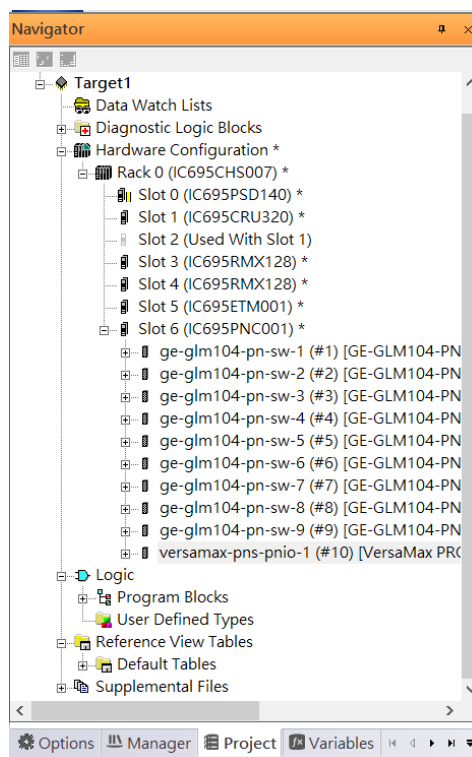
7.2.4.1 GLM104-PN2 through VERSAMAX-PNS-PNIO-1

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 223: Finished Configuration

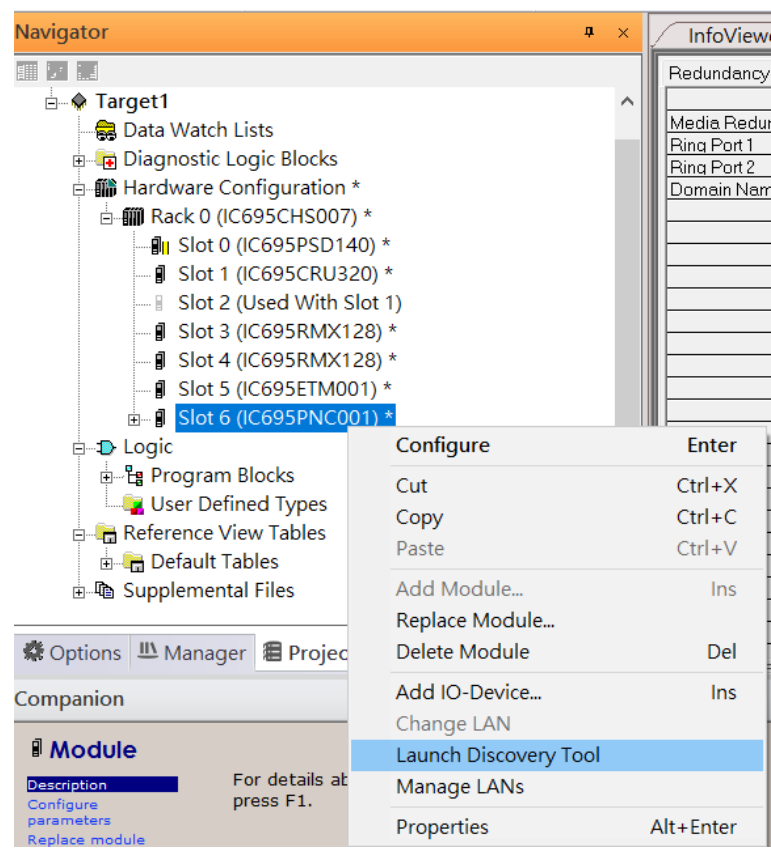


7.2.5 I/O Device Scan

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**.

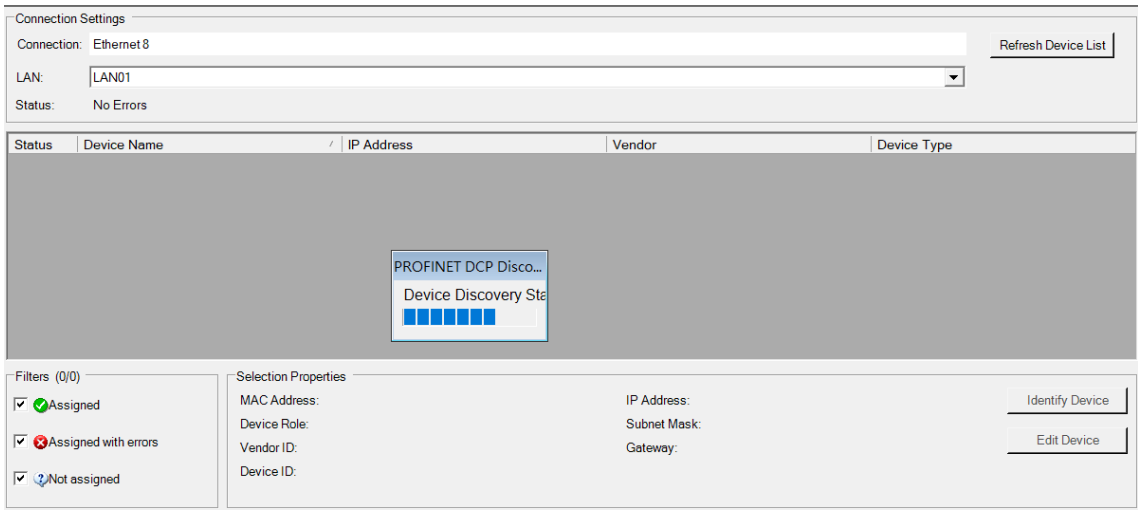
Note: Before we finish downloading the configuration to CRU320, need to unplug the block port according to the hardware topology to avoid loop.

Figure 224: Launch Discovery Tool



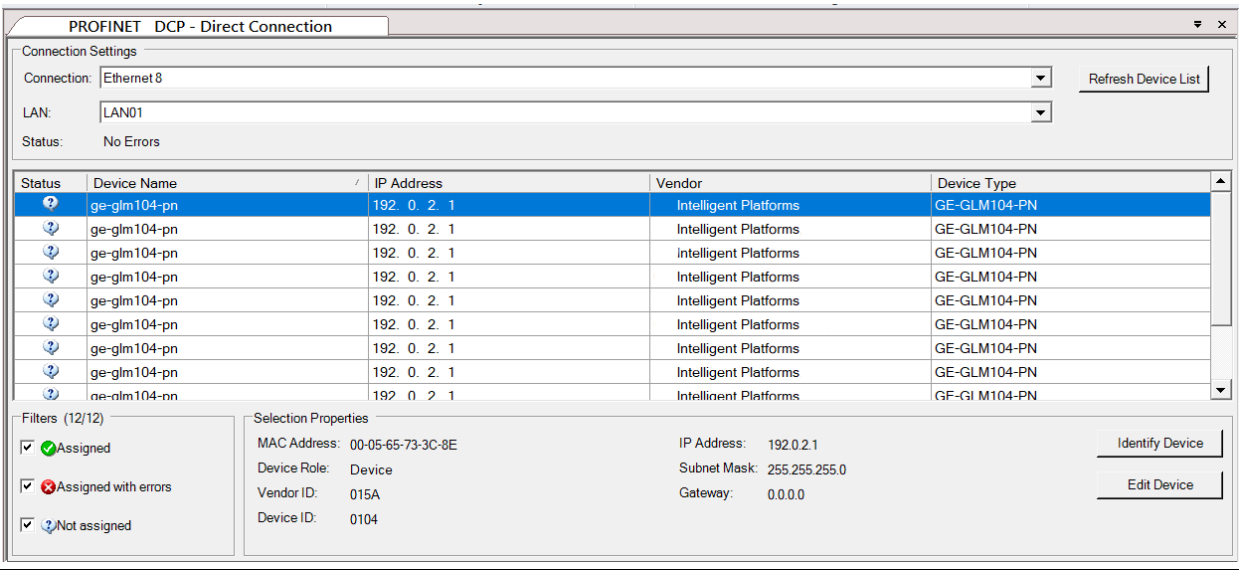
The tool is shown in the following picture, then press **Refresh Device List**.

Figure 225: Refresh Device List



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

Figure 226: Identify Device



There are I/O Devices and their status are 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 **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 227: 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 **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 228: 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

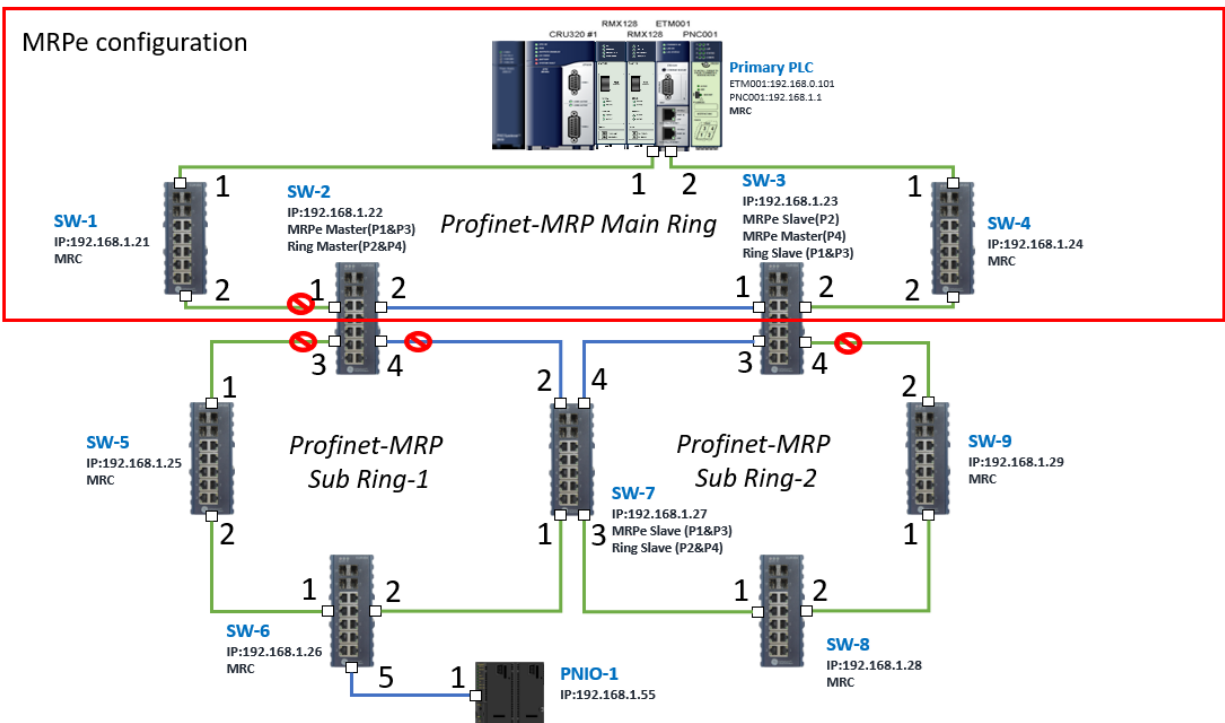
7.2.6 MRP Setting

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 I/O controller and I/O devices highlighted in the red box below. First, configure the MRPe in Profinet MRP Main Ring.

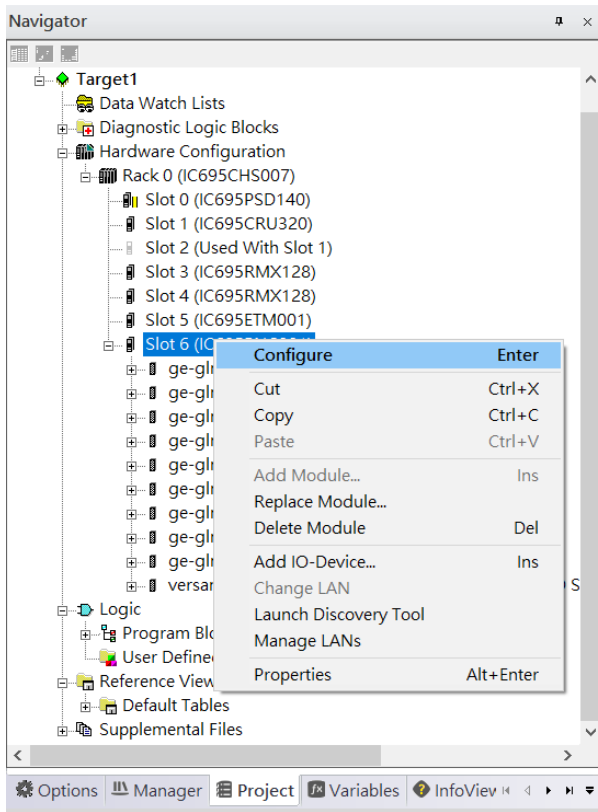
Figure 229: Profinet MRP Main Ring



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

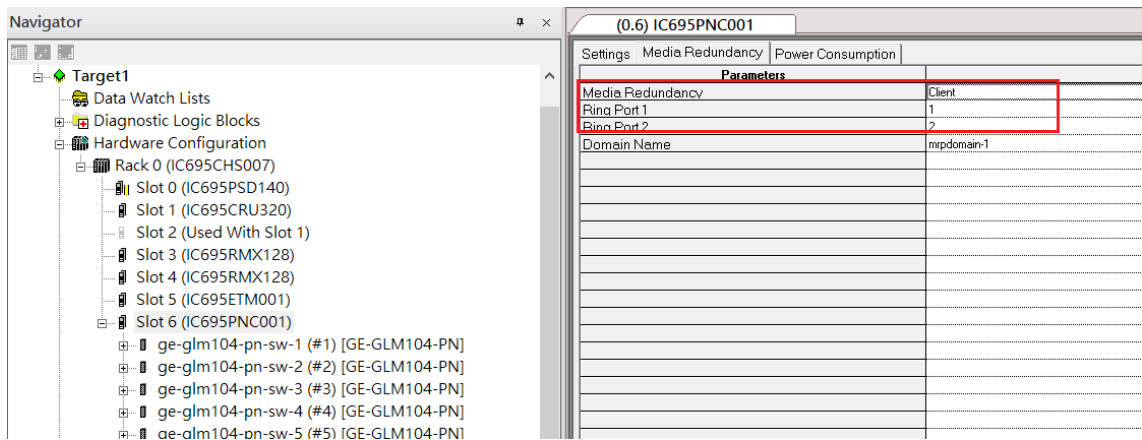
It will show “Media Redundancy” on the right window.

Figure 230: Configure



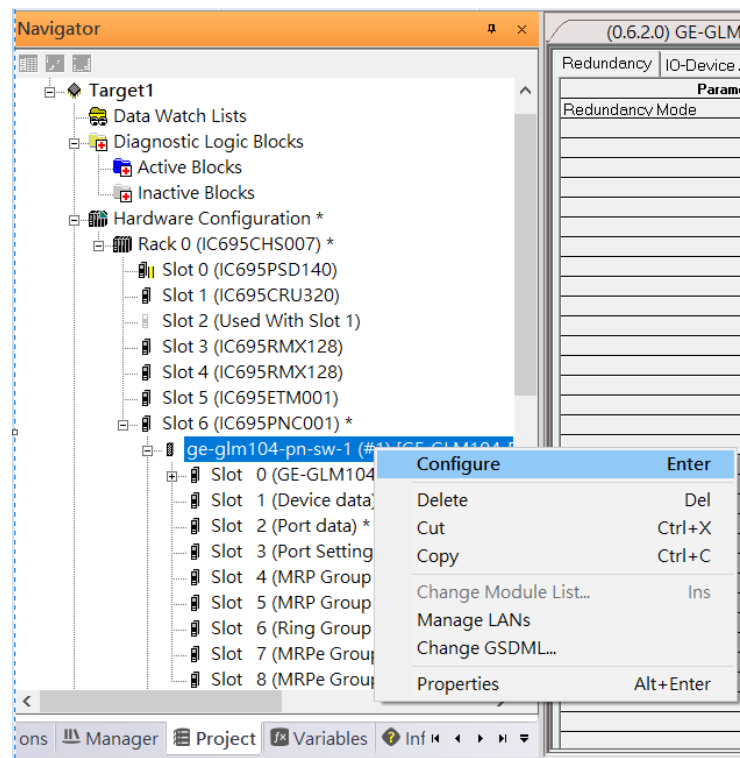
Enable MRP function by changing the value of “Media Redundancy” to client and select Ring Port 1 to 1, Ring Port 2 to 2.

Figure 231: Media Redundancy Parameters



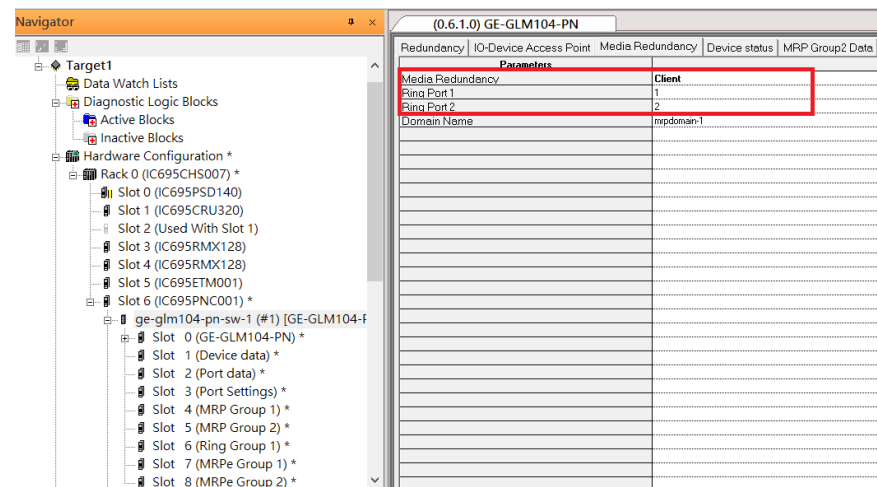
In order to enable MRP function in SW1, click the right button and choose **Configure**. It will show “Media Redundancy” on the right window.

Figure 232: Media Redundancy Parameters



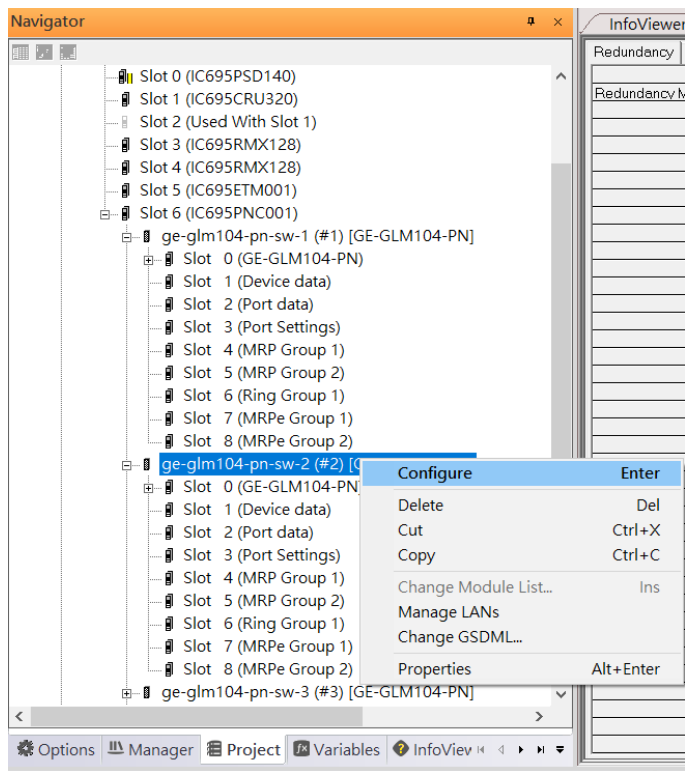
Enable MRP function by changing the value of “Media Redundancy” to manager and select Ring Port 1 to 1, Ring Port 2 to 2.

Figure 233: Media Redundancy Parameters



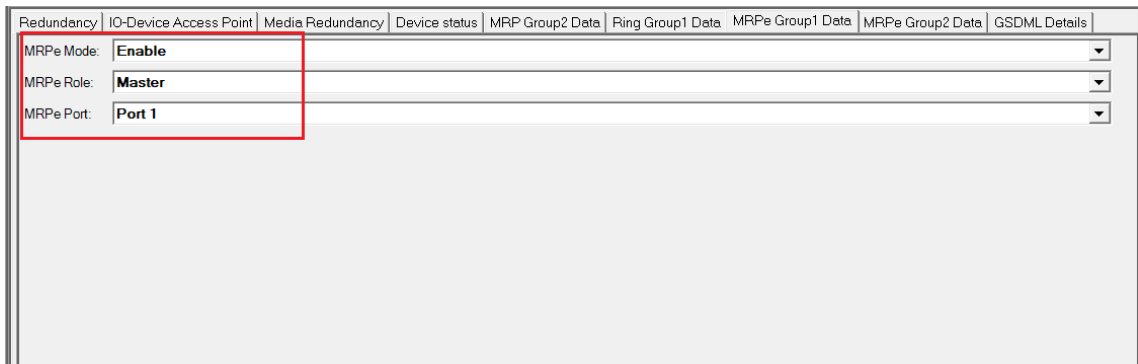
To enable MRPe functions in SW2, click the right button and choose **Configure**.

Figure 234: MRPe Functionality



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

Figure 235: 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 236: 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

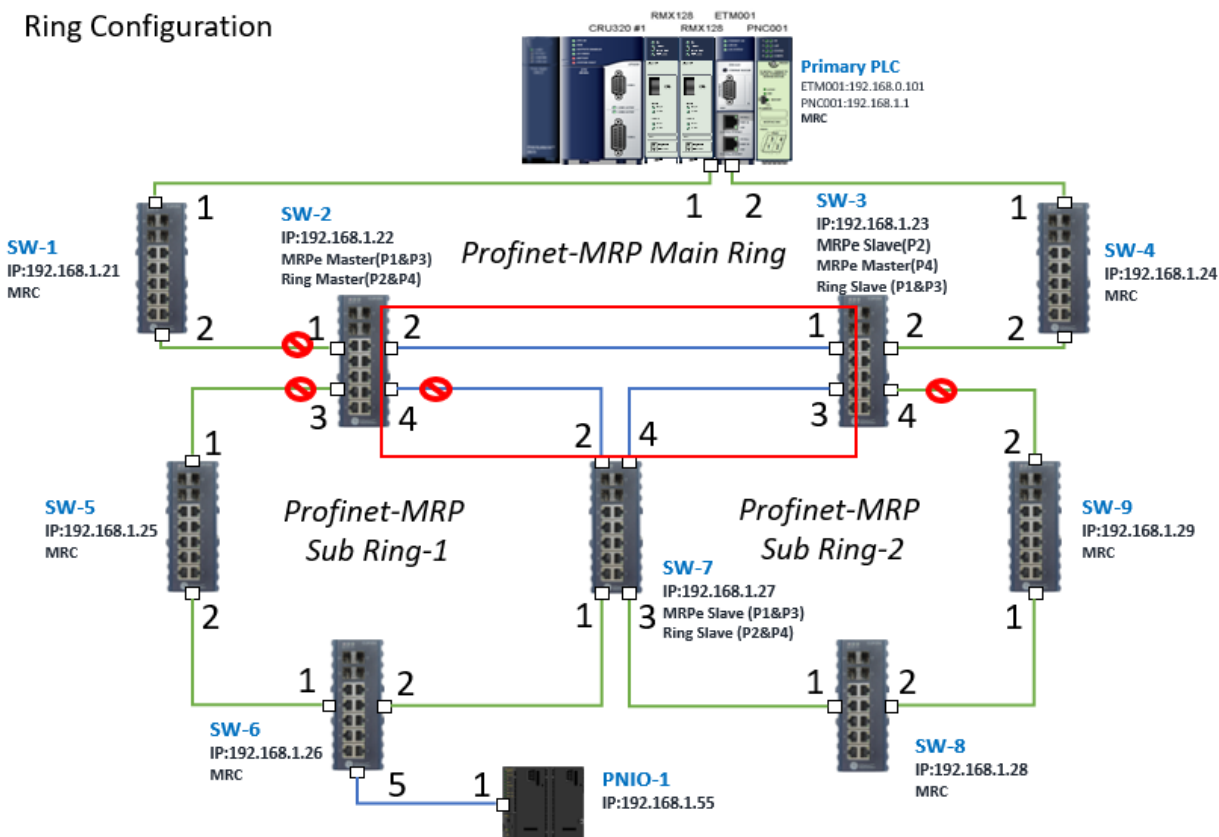
To enable MRP function in SW4, click the right button and choose **Configure**. It will show “Media Redundancy” on the right window.

Enable MRP function by changing the value of “Media Redundancy” to 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 237: Ring in Profinet Main Ring



7.2.6.4.1 Configuring SW2, SW3, and SW7

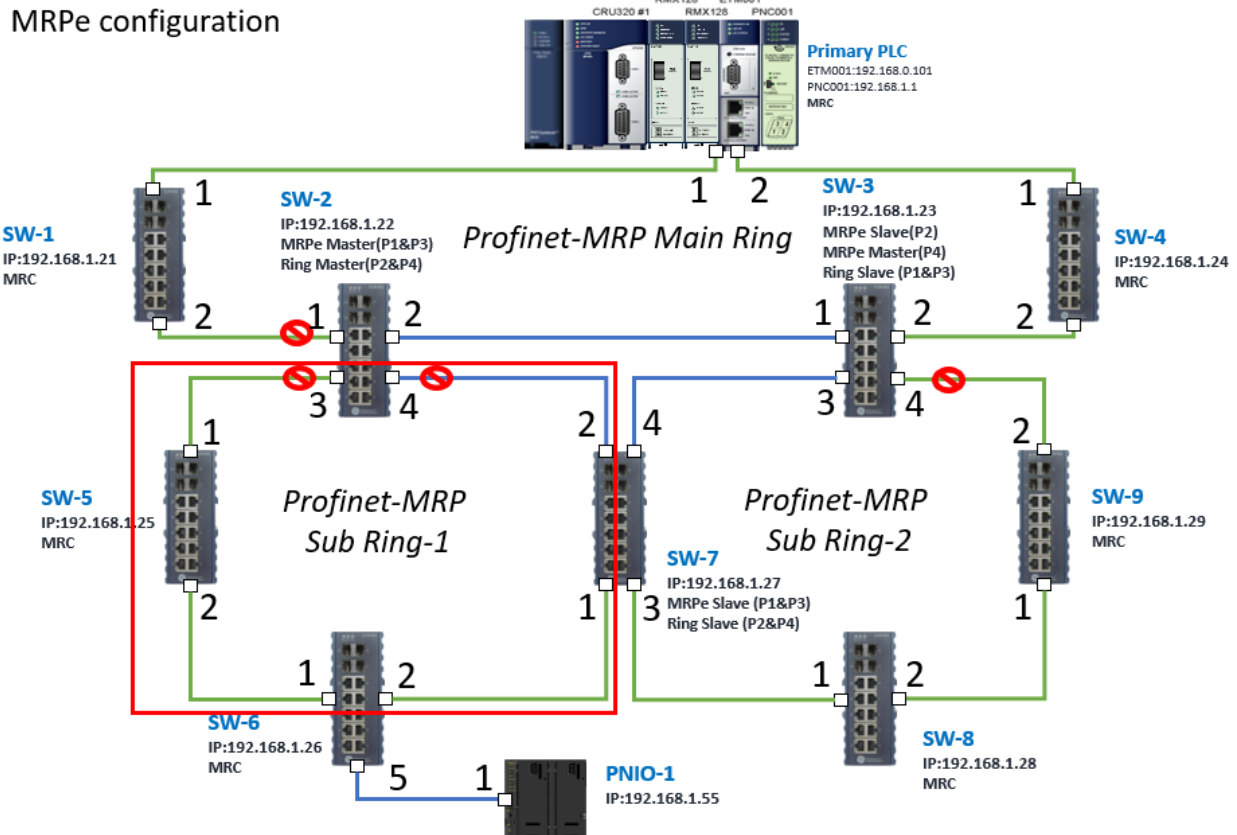
To enable Ring functionality for SW2, SW3, and SW7, right-click and choose **Configure**. Enable Ring function by changing the values to match the table below.

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 238: MRPe in Profinet MRP Sub Ring-1



7.2.6.5.1 Configuring SW2, SW5, SW6, and SW7

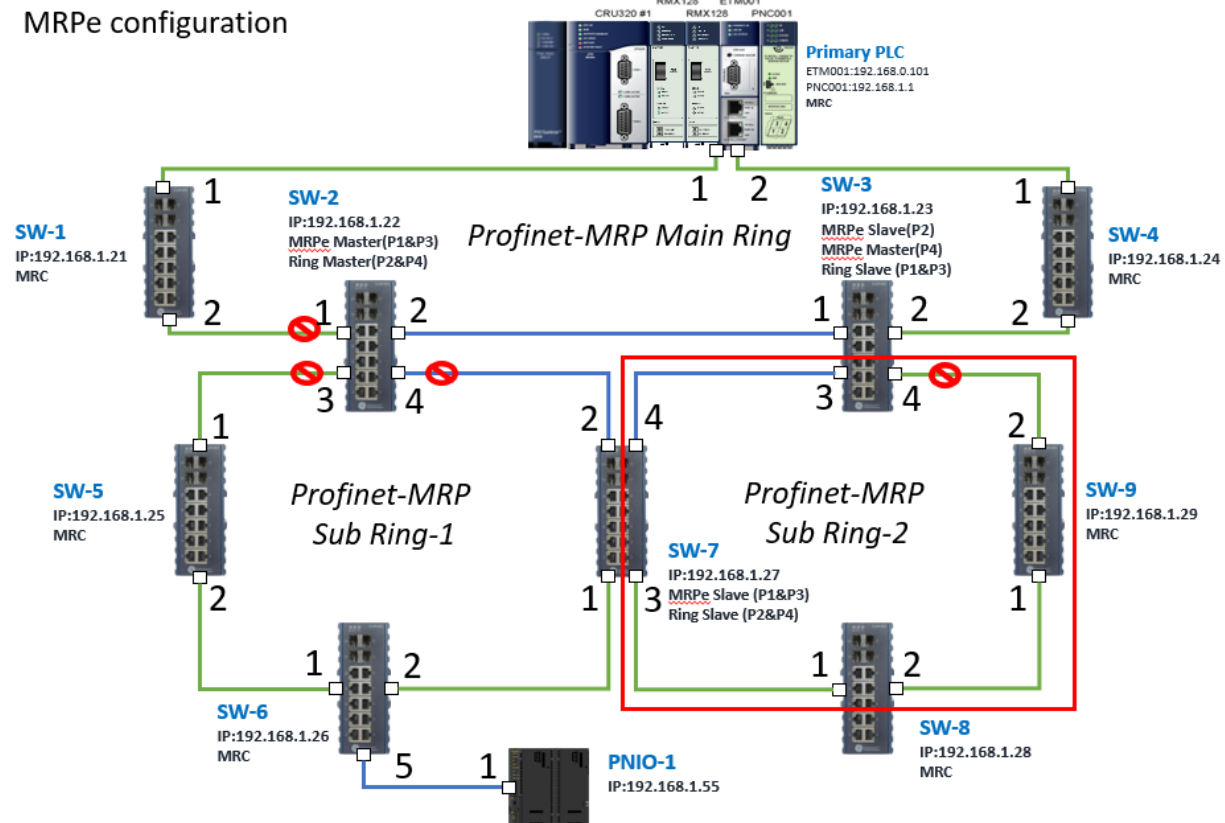
To enable Ring functionality for SW2, SW3, and SW7, right-click and choose **Configure**. Enable Ring function by changing the values to match the table below.

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 239: 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 I/O Controller shall be specified.

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

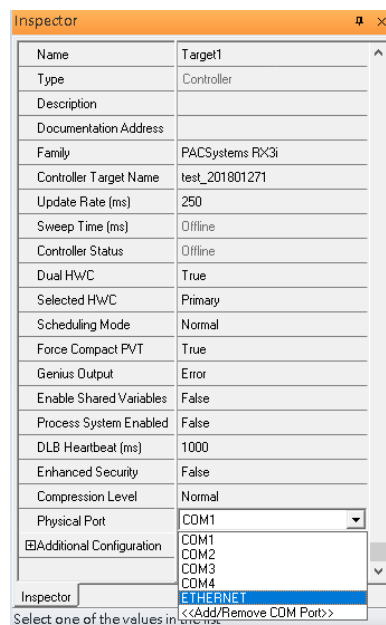
I/O Controller Communication Rule

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**.

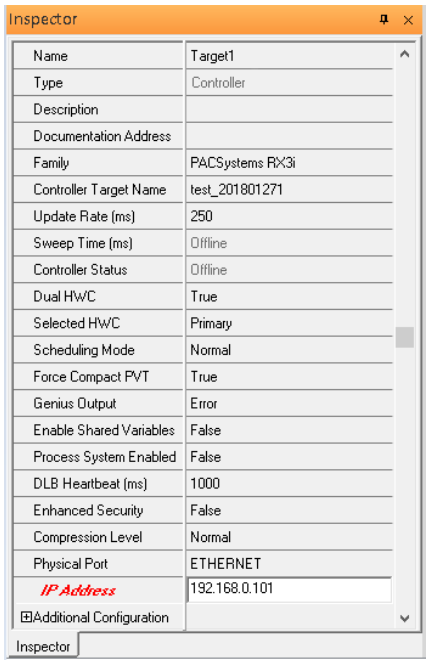
Figure 240: Changing the Physical Port Parameter



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.

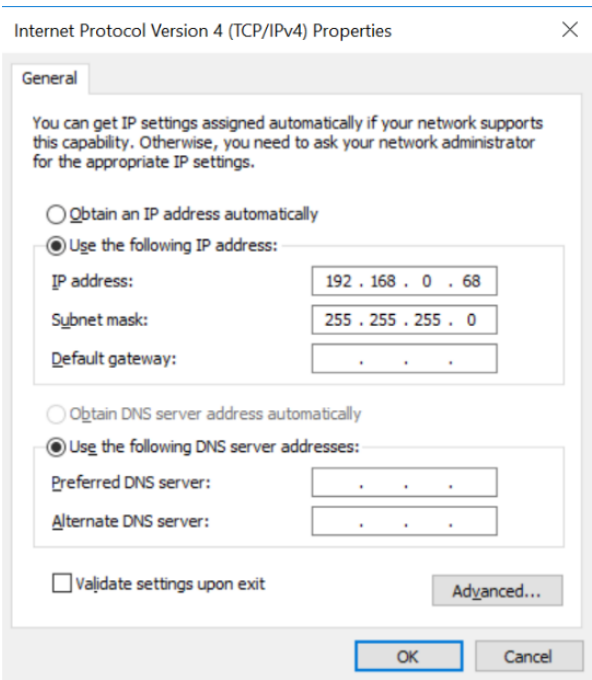
Figure 241: Specified IP Address Appears



7.2.8 PC Network

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

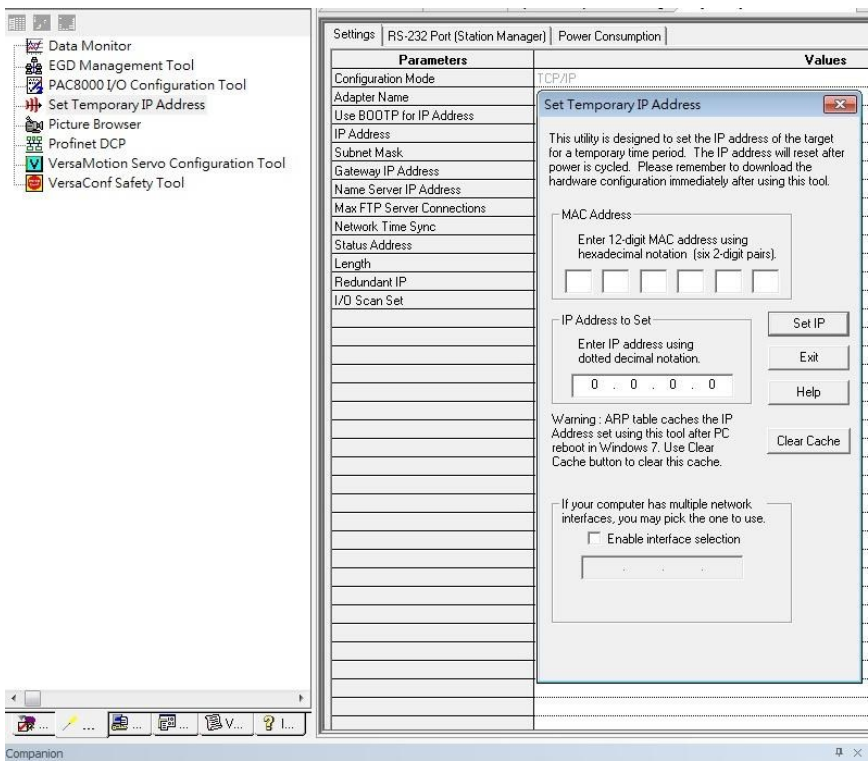
Figure 242: Setting the IP Address of the PC with PME



7.2.9 Temporary IP

However, if the IP address of ETM001 is lost or forgotten, the IP address can be changed by the function **Set Temporary IP Address** according to the MAC address of ETM001. In the following figure, the MAC address is referenced to the ETM001, and the IP address can be defined by user.

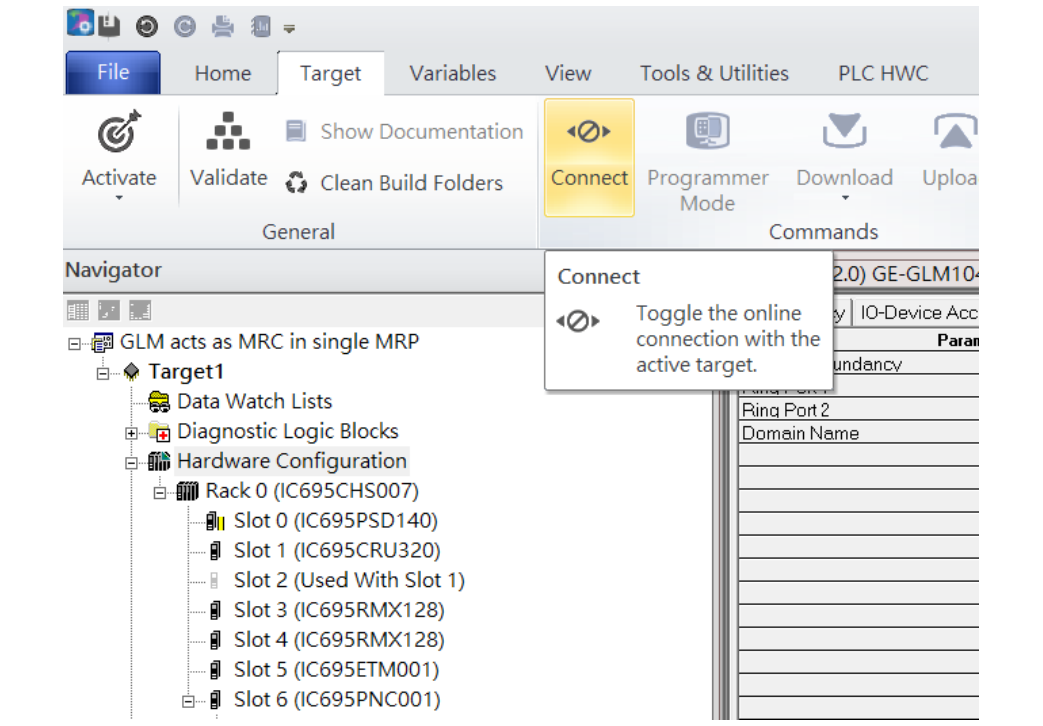
Figure 243: Set Temporary IP Address



7.3 Implementation

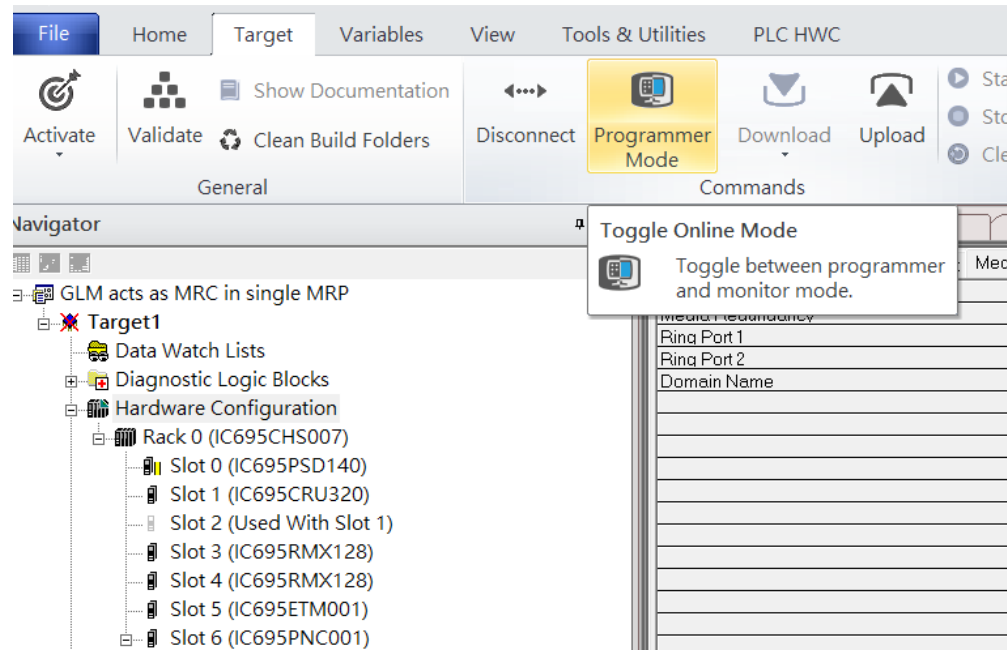
To download the configuration to hardware, the following steps shall be applied.
First, press the **Connect** icon.

Figure 244: Connecting to Target



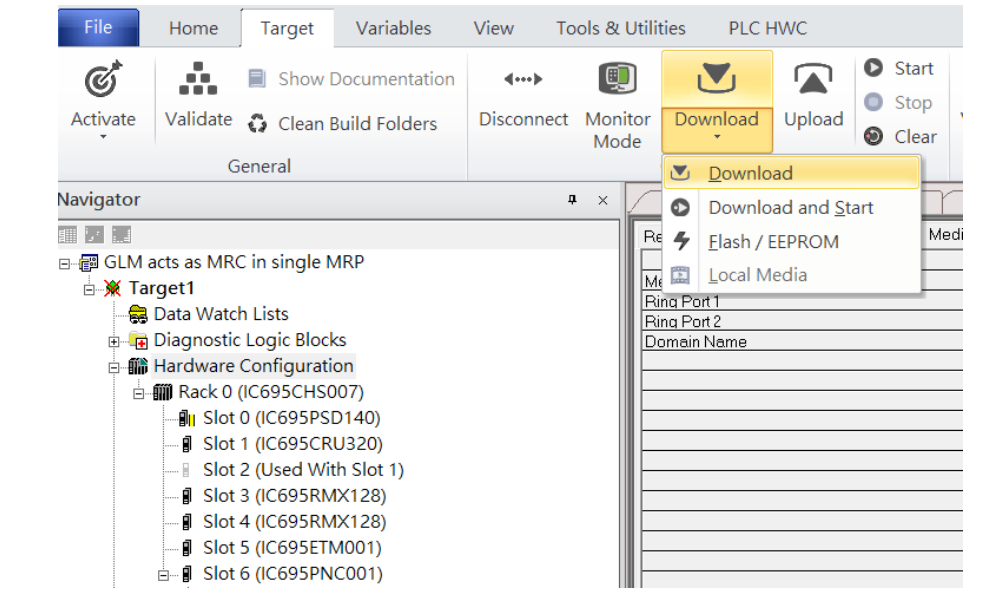
Then press the icon **Programmer Mode**.

Figure 245: Programmer Mode



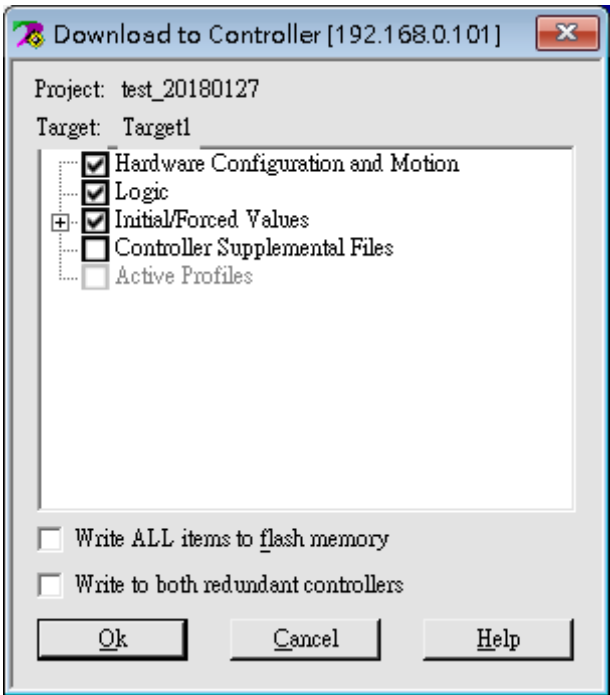
Then press icon **Download** and select **Download**.

Figure 246: Download



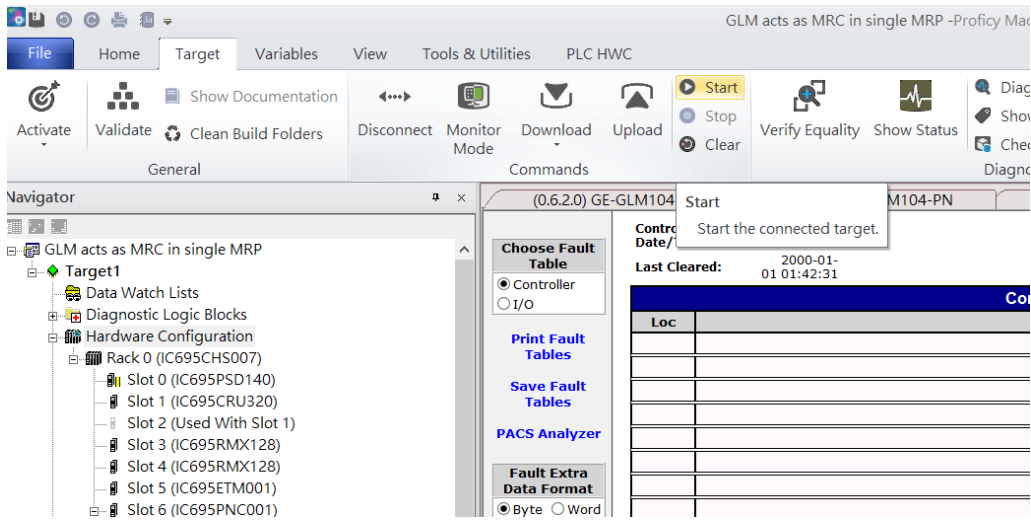
Then the dialogue is appeared to make sure the initialization procedure, select **OK**.

Figure 247: 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”.

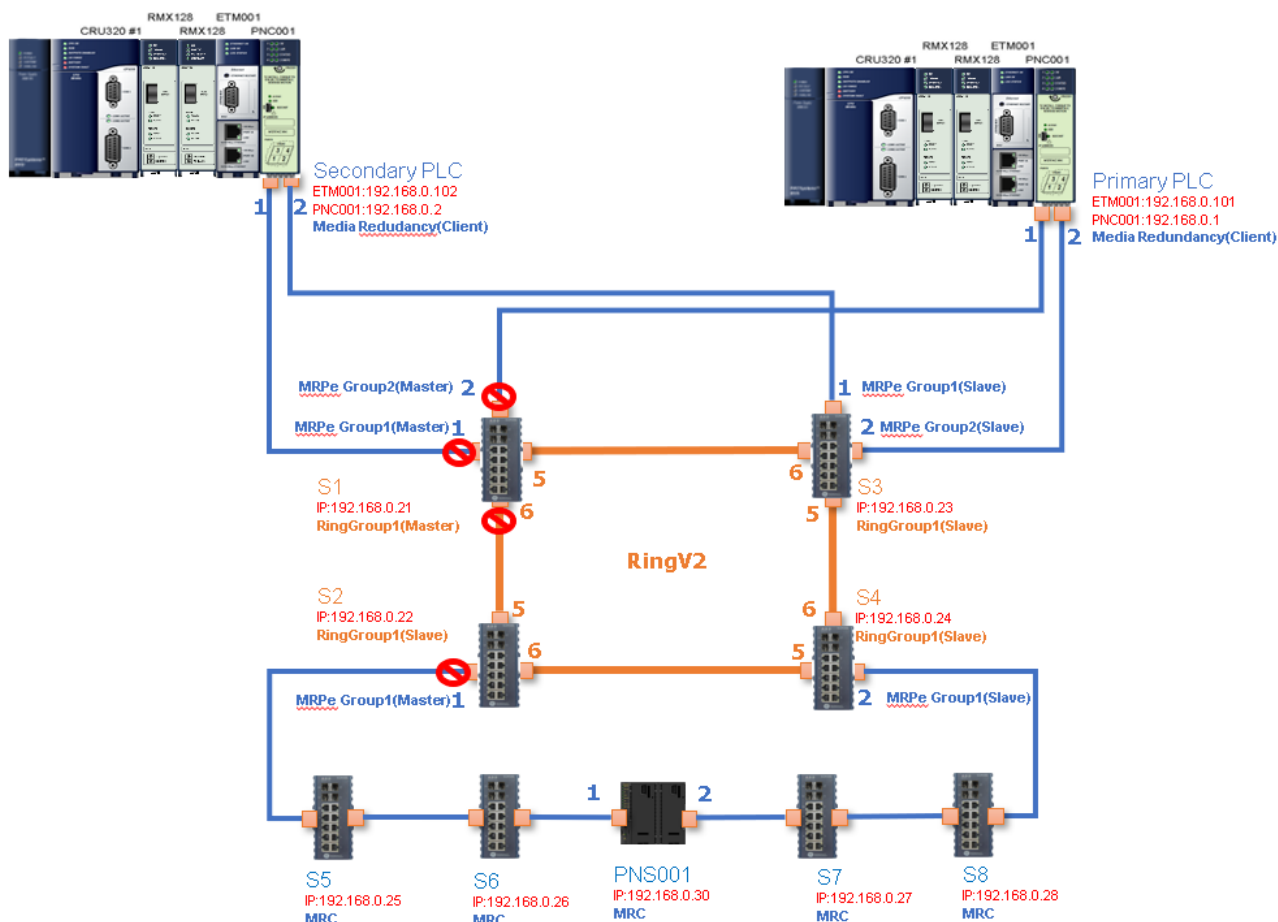
Figure 248: Start



Section 8 PROFINET System Redundancy

8.1 Network Topology

Figure 249: 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 imbedded 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 250: Create a new project

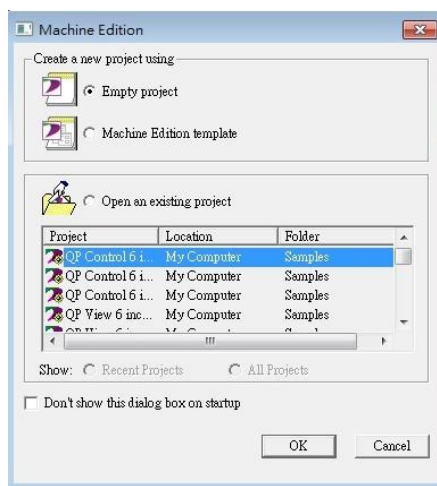
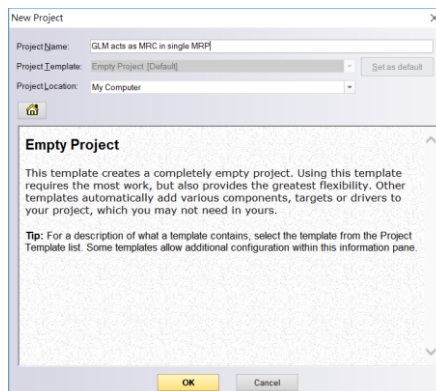


Figure 251: New Project Name



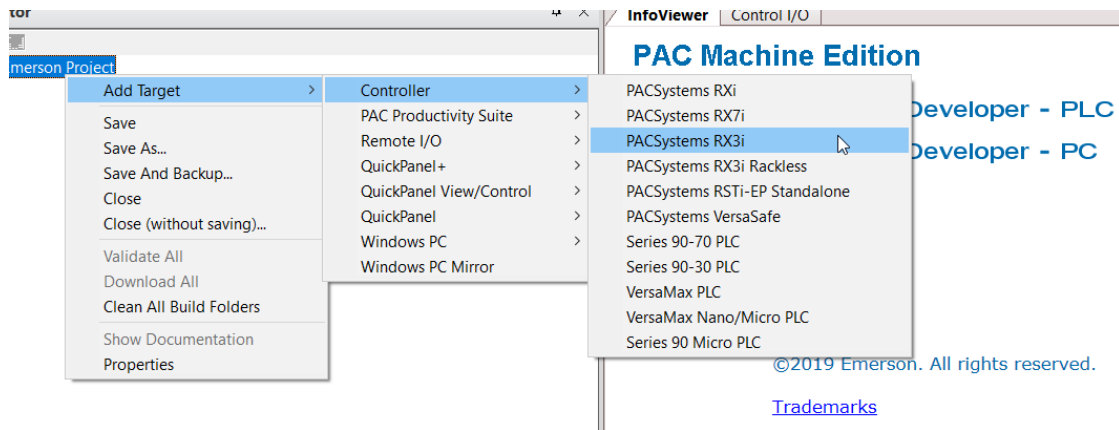
8.2.2 I/O Controller Setting

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 252: Adding I/O Controller



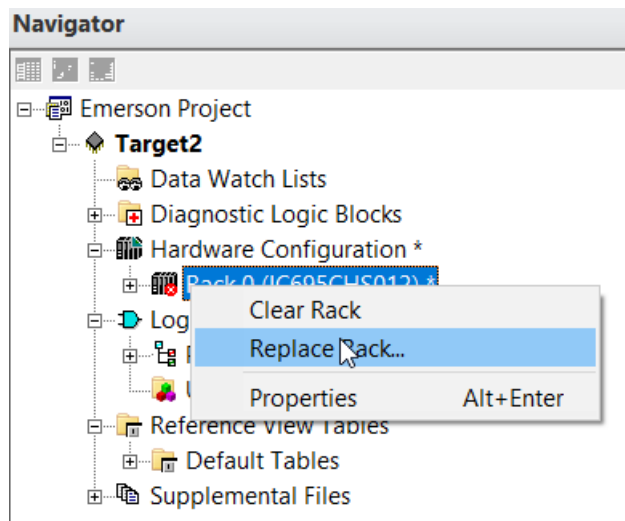
Originally the I/O Controller is described as the rack with 12 slots, each slot can be regarded as the chassis for device installation such as power card, communication module, or bus controller.

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

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

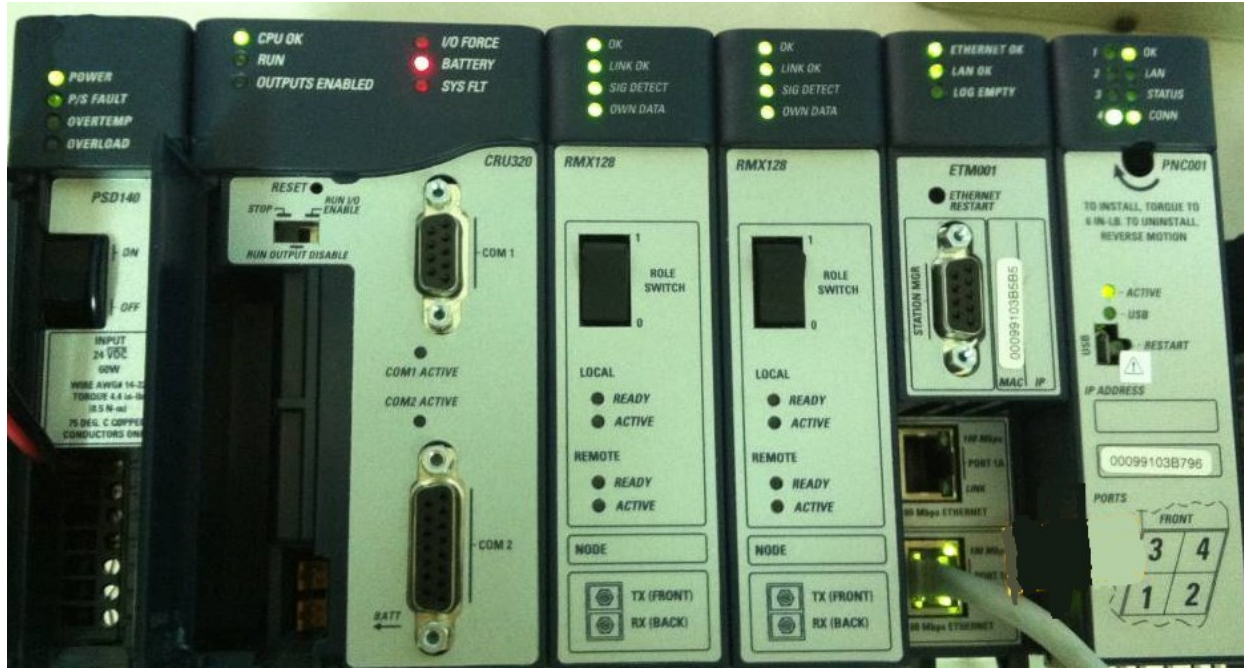
Select “IC695CHS007” and click **OK**.

Figure 253: Replace Rack



After the rack and the number of slots is 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 254: Rack Configuration



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

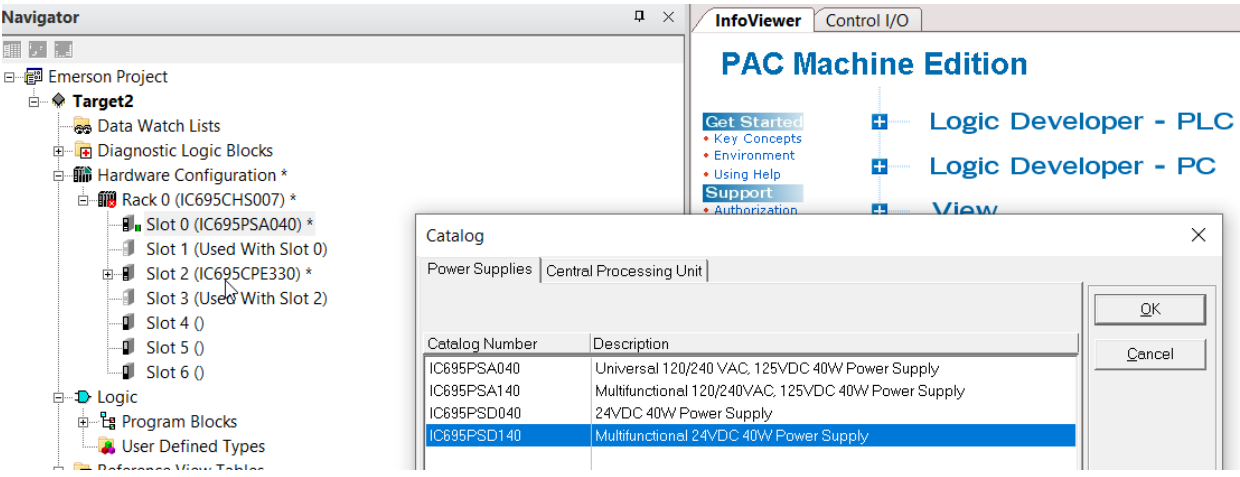
Devices on I/O Controller

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.

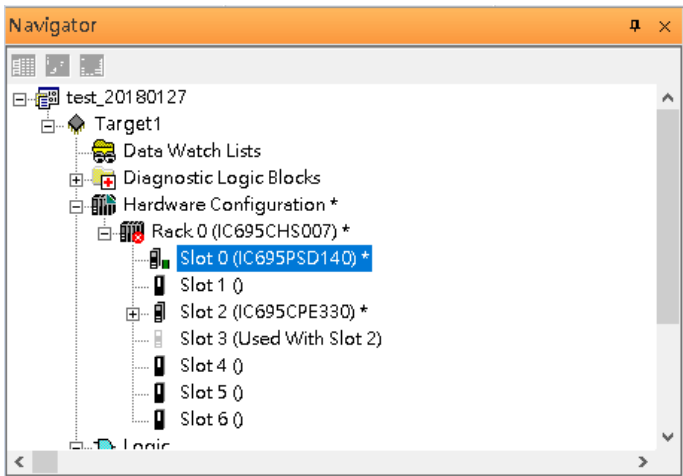
First, replace the power card. Click slot 0 and click the right button, select **Replace Module**, and specify the installed power card, PSD140, then click **OK**.

Figure 255: Replace Module



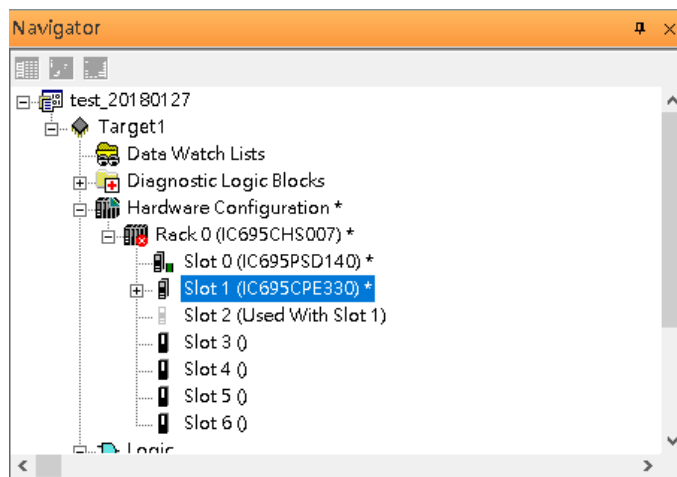
Slot 0 is replaced by current power card, PSD140.

Figure 256: PSD140



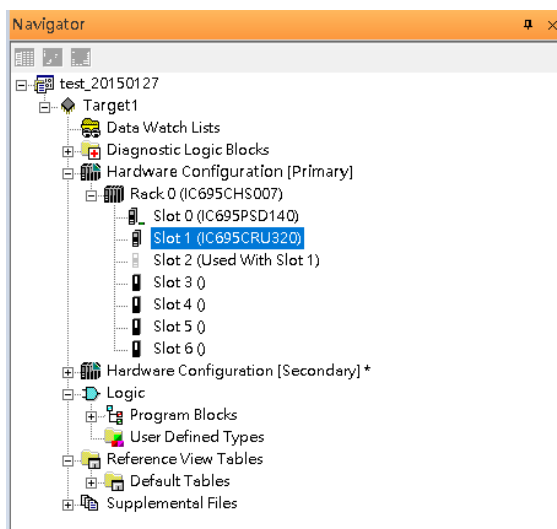
For slot 1 and 2, 2 chassis (1 and 2) is occupied by the Central Processing Unit, CRU320. To integrate slot 1 and 2, pull the slot 2 to slot 1. Slot 2 is now clear.

Figure 257: 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 258: 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 259: CRU320 Parameters

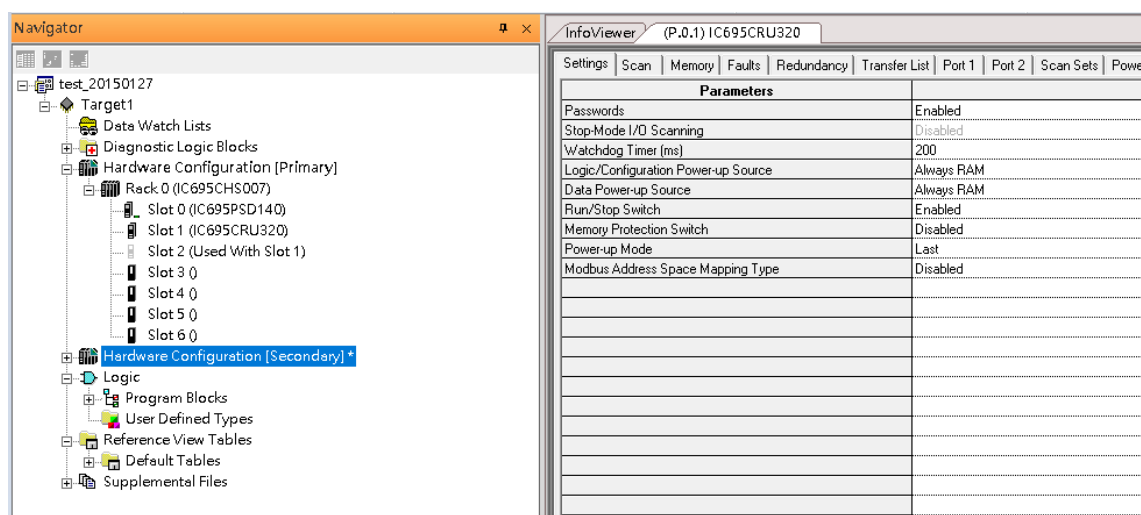


Figure 260

8.2.2.1 Sot 3

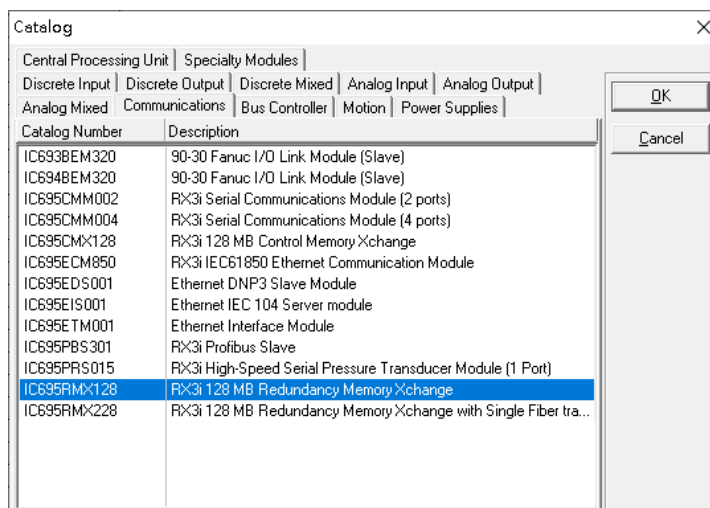
Next is to add RMX128 module for slot 3.

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

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

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

Figure 261: 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

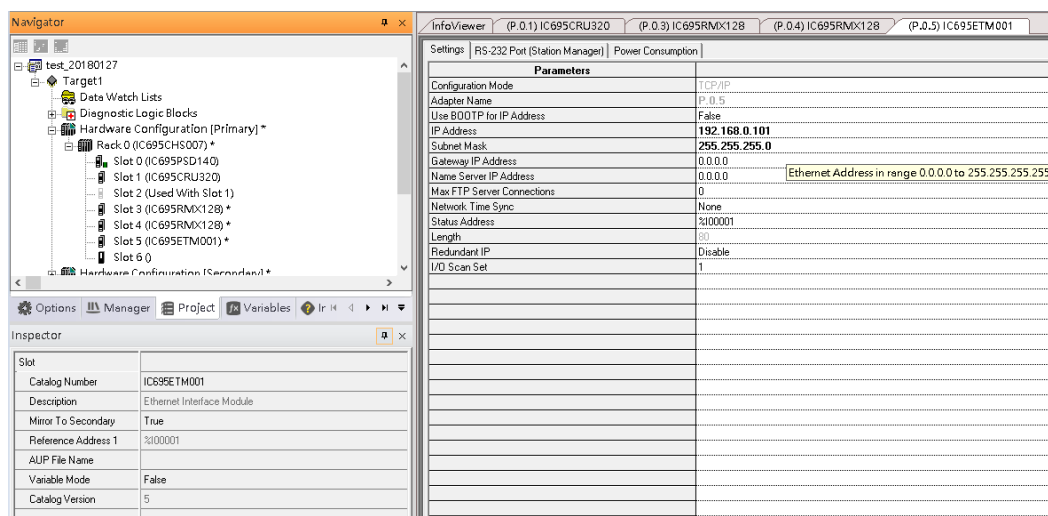
Next, select ETM001 for slot 5.

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

It should be note that the ETM001 is the management device for PAC Machine Edition. The communication interface is 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 262: ETM001 Parameters



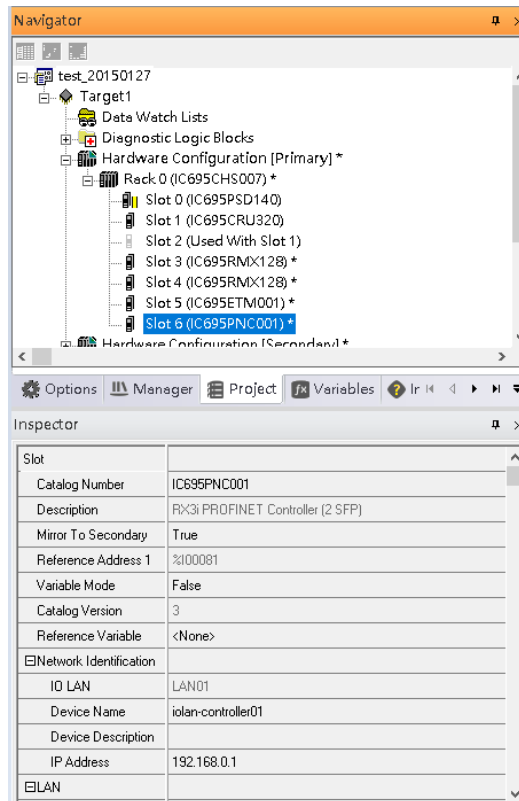
8.2.2.4 Slot 6

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.

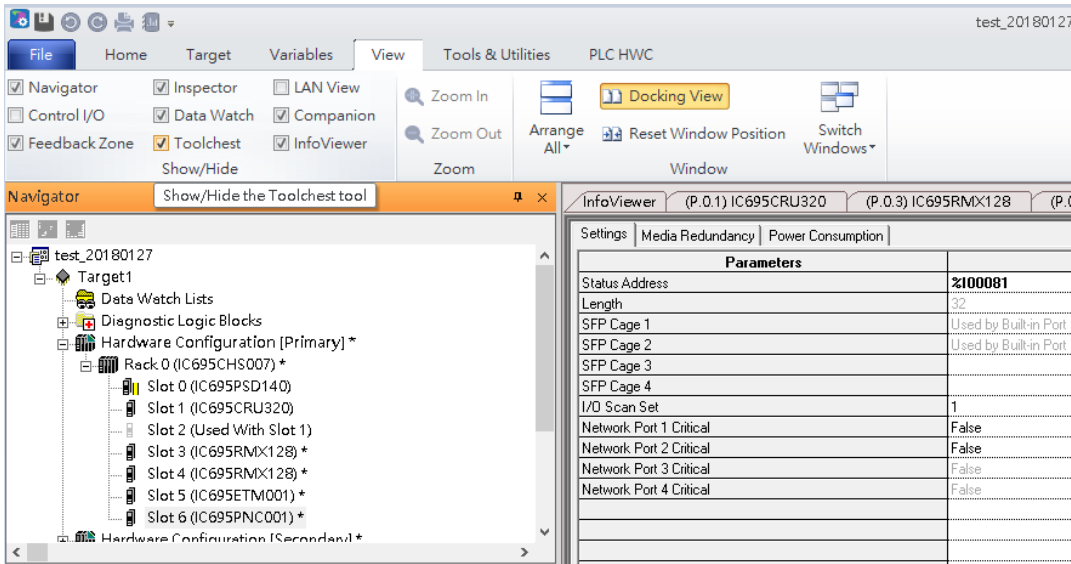
Figure 263: Final Configuration



8.2.3 I/O Device Setting

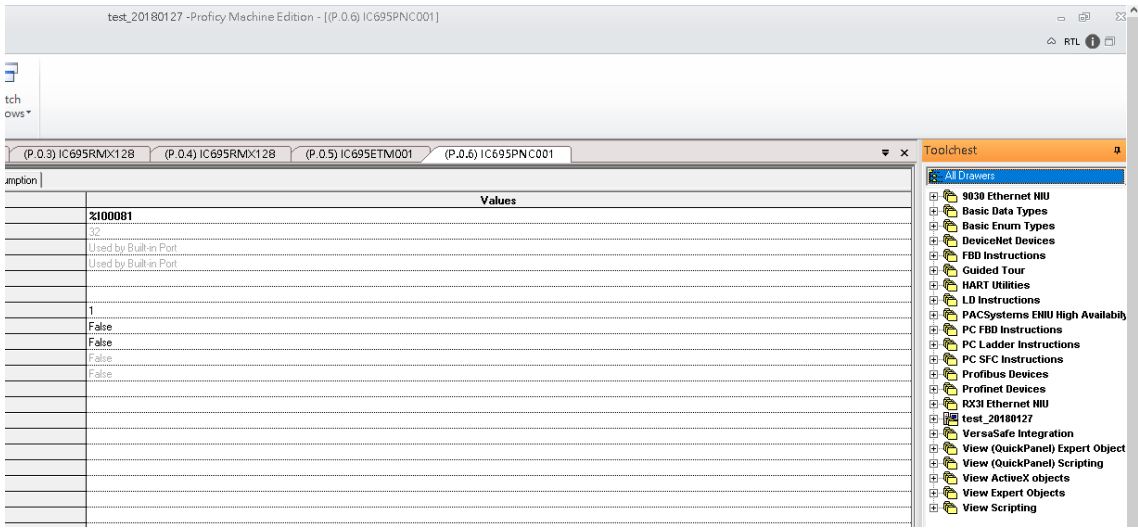
This section introduces the I/O Device integration. To configure the I/O Device, the GSDML file is necessary. Now we create another interface to load the GSDML file by using Toolchest.

Figure 264: Toolchest Button Location



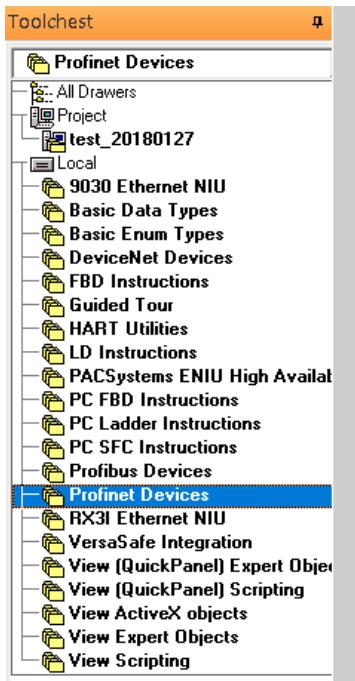
As shown in the following picture, a new interface is created on the right-hand side.

Figure 265: Toolchest Panel



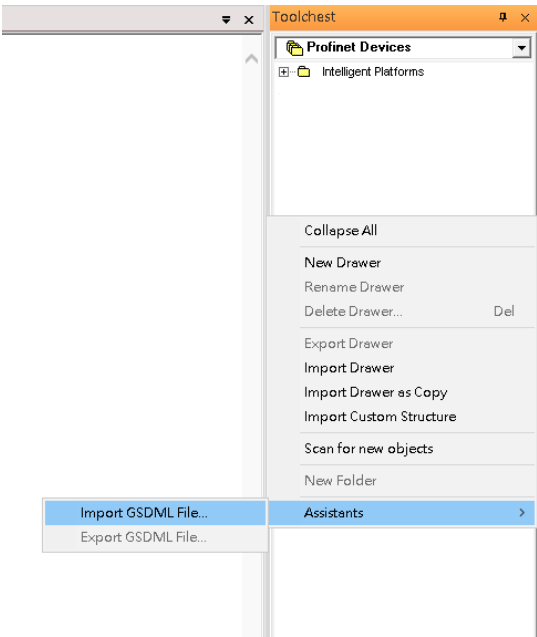
Select Profinet Devices.

Figure 266: Select PROFINET Devices

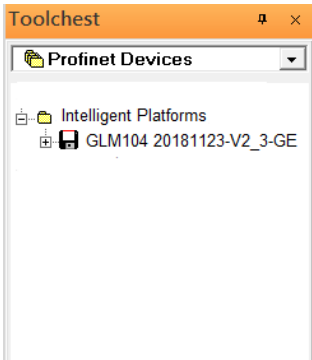


Click right button, select **Assistants** -> **Import GSDML File**.

Figure 267: Import GSDML File

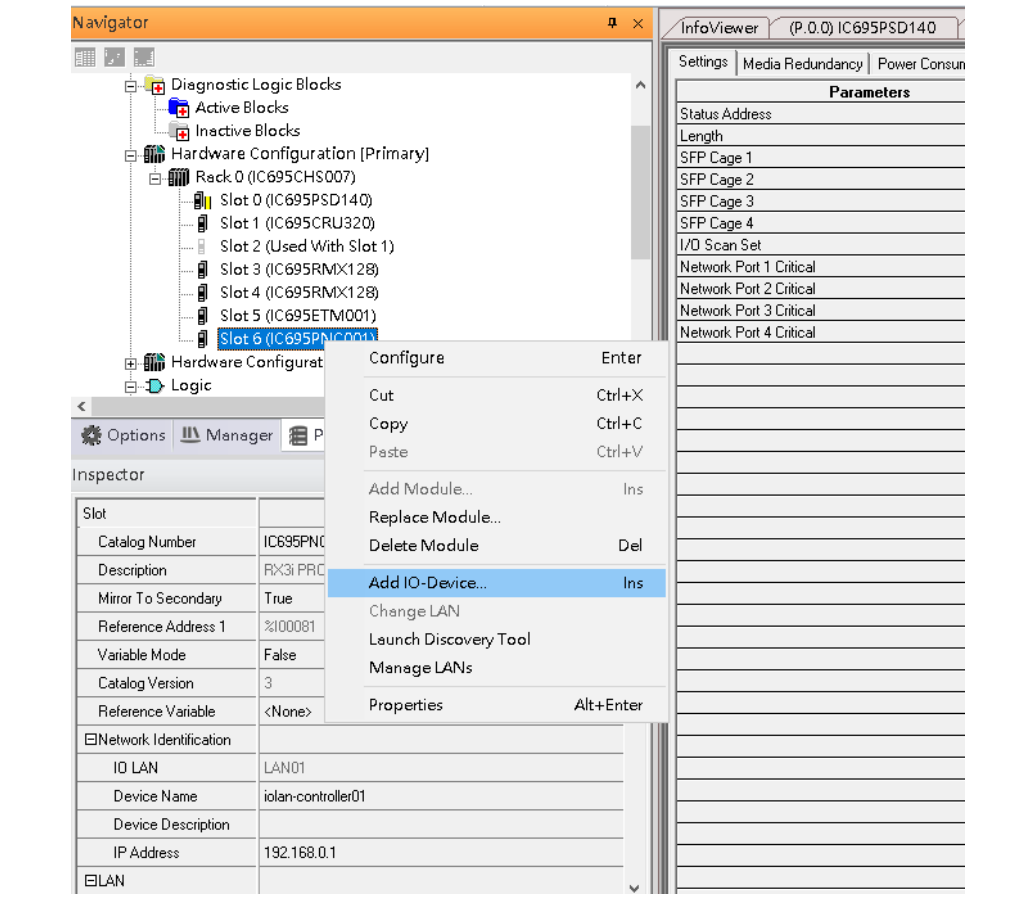


Select the GSDML File.
Then the corresponding I/O Device of GSDML File is added in the **Toolchest**.



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

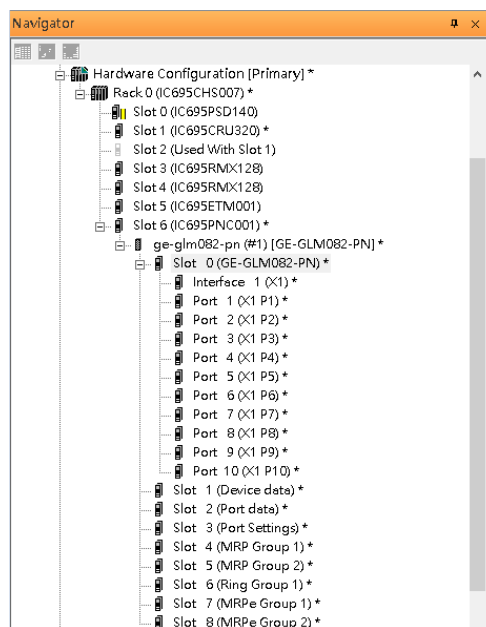
Figure 268: Add I/O Device



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 269: GLM082 is Now Configured

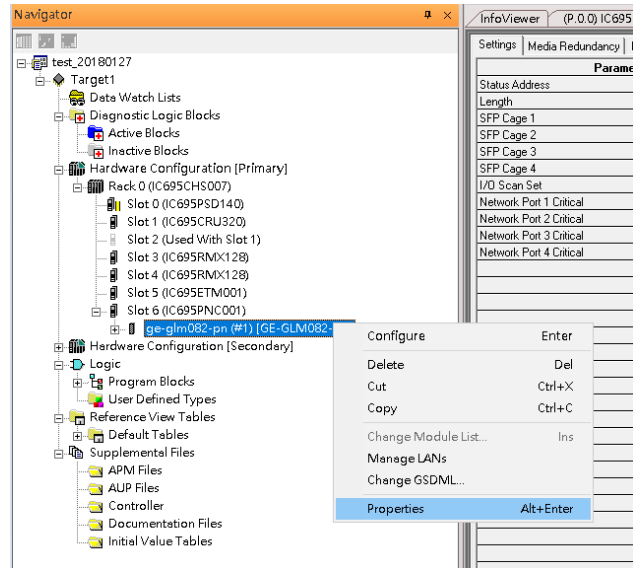


8.2.4 DCP Set Command

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

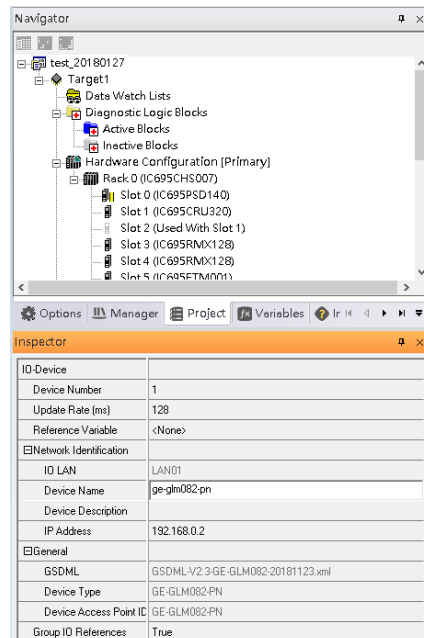
Under the slot 6, PNC001, select the I/O Device, GLM082, and click the right button.

Figure 270: Properties



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

Figure 271: Inspector Panel



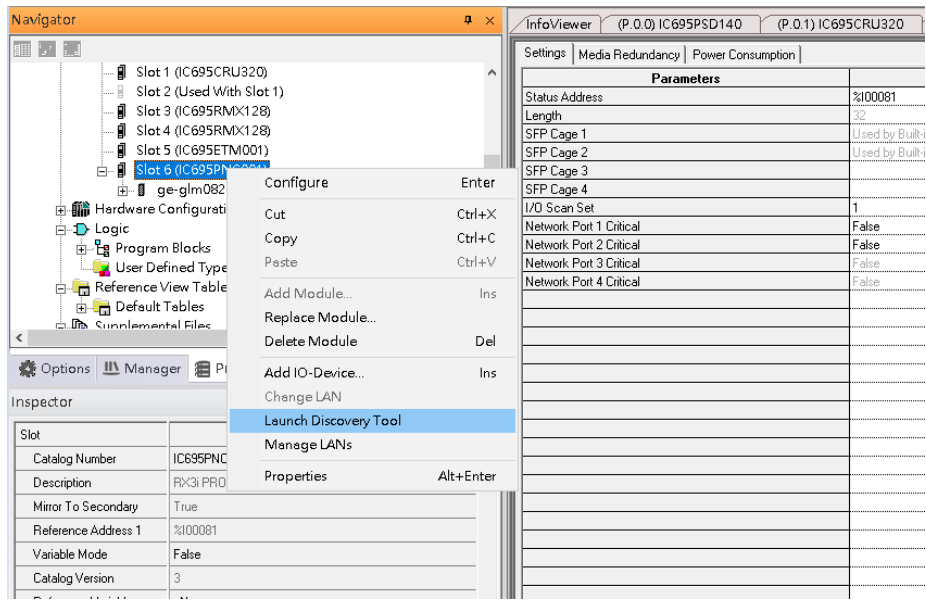
In this table, the I/O Device name can be specified in field **Device Name**, and the IP address can be set in field **IP address**. We modify device name to “ge-glm082-pn-02” then we use I/O Device Discovery Tool to observed an I/O Device and set I/O Device’s name to “ge-glm082-pn-02” later.

It should be noted that, both the **Properties** of I/O Device shall be synchronized between **Primary** and **Secondary** hardware configuration. The DCP setting will be effective when all the configurations are downloaded to the hardware from **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 272: 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 273: 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 previous configuration in Figure 37.

Click **Edit Device**, set Device Name to “ge-glm082-pn-02” and click **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 274: 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

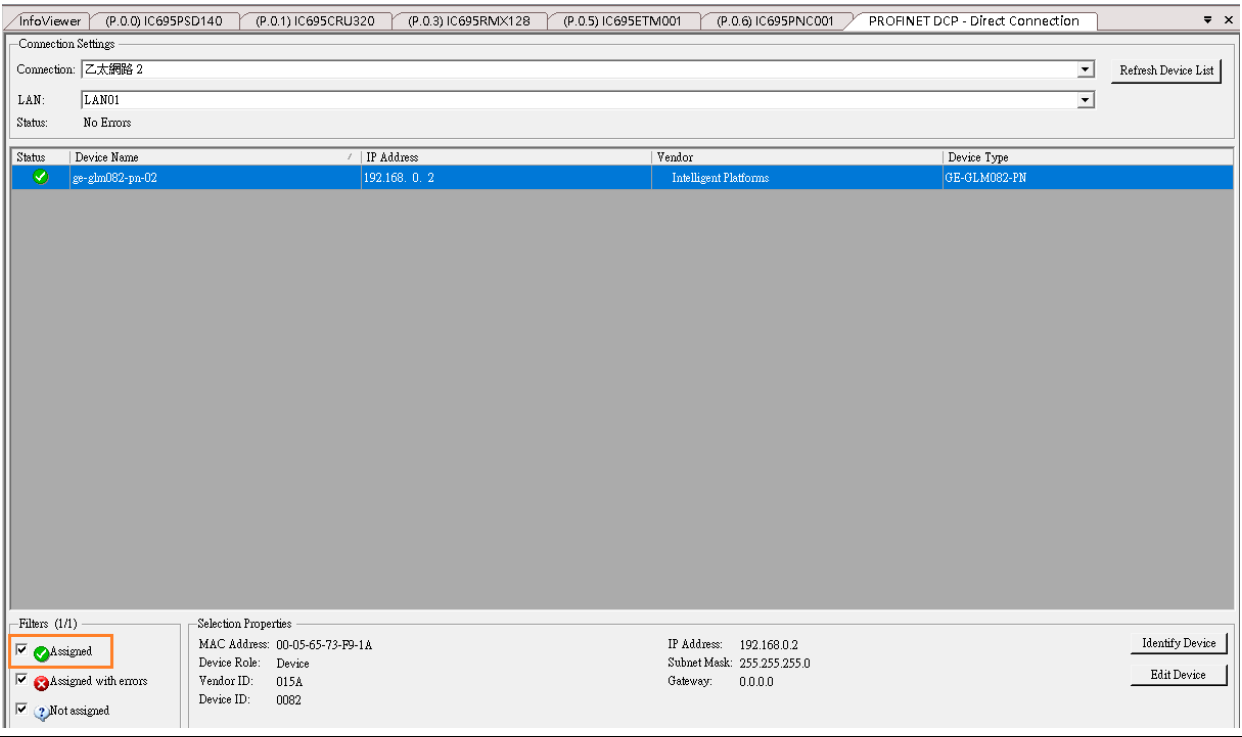
Reset device to factory settings

Reset Device

Exit

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

Figure 275: Status "Assigned"



8.2.6 MRP Setting

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

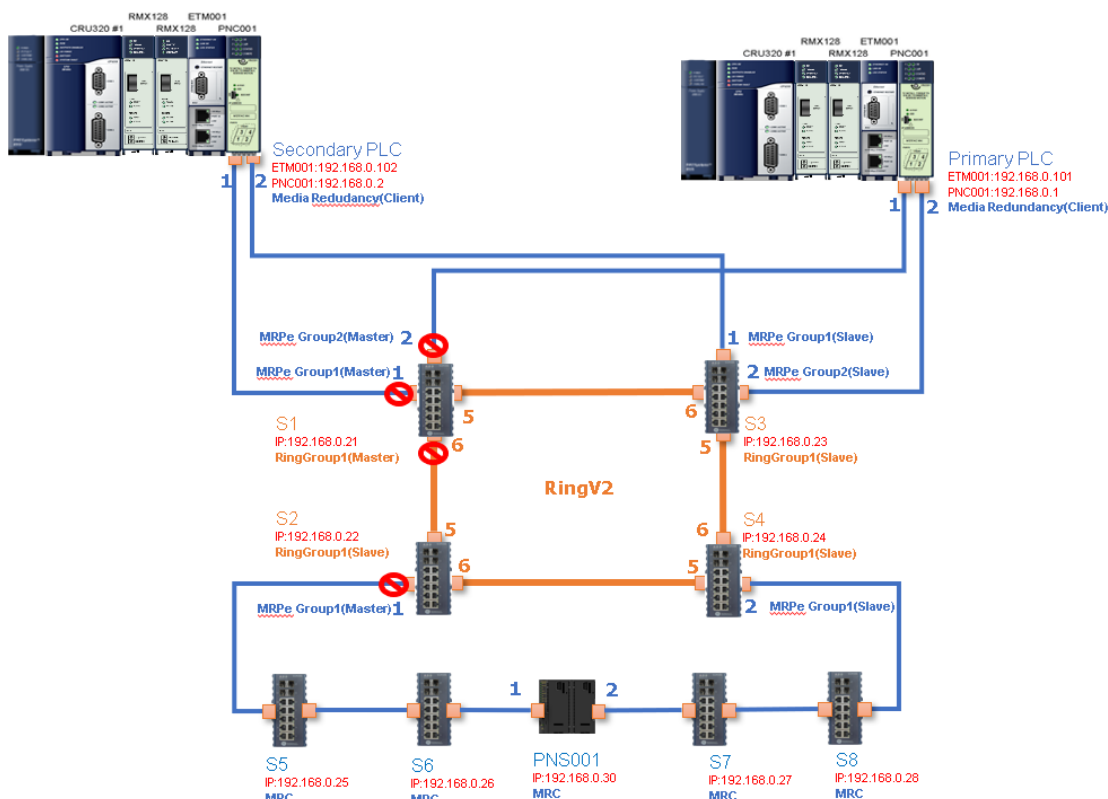
In this network topology shown in the figure below, switch port 5,6 of Switch S1, S2, S3 and S4 will use RingV2 to protect the link in the ring. Switch S1 runs as RingV2 Master role, Switch S2, S3 and S4 runs as RingV2 Slave role. In normal state, Master will block one of its ring ports for preventing broadcast storm in the ring. If anyone link between these 4 switches is failure, Master will set this blocked port to 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 blocked in Normal state. If MRPe Group2(Master) detects 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 blocked in Normal state. If MRPe Group1(Master) detects 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 blocked in Normal state. If MRPe Group1(Master) detects link-failure, it will set port1 of Switch S2 to forwarded.

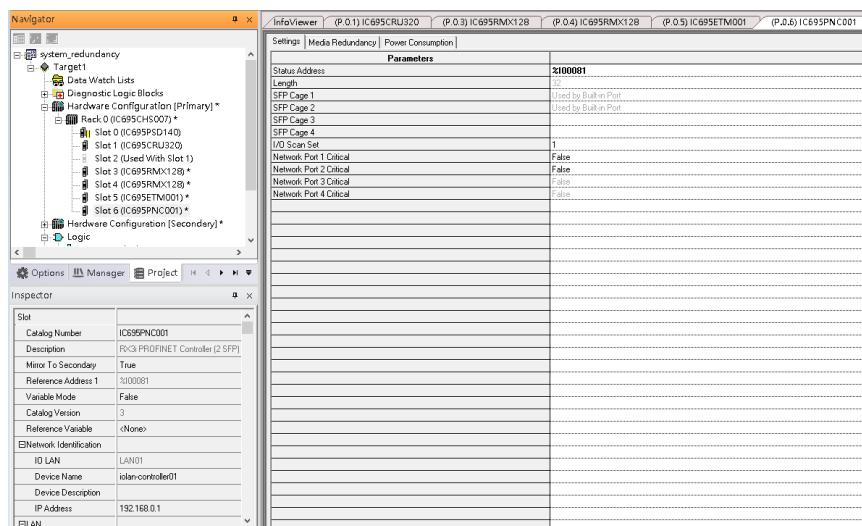
Figure 276: Network Topology



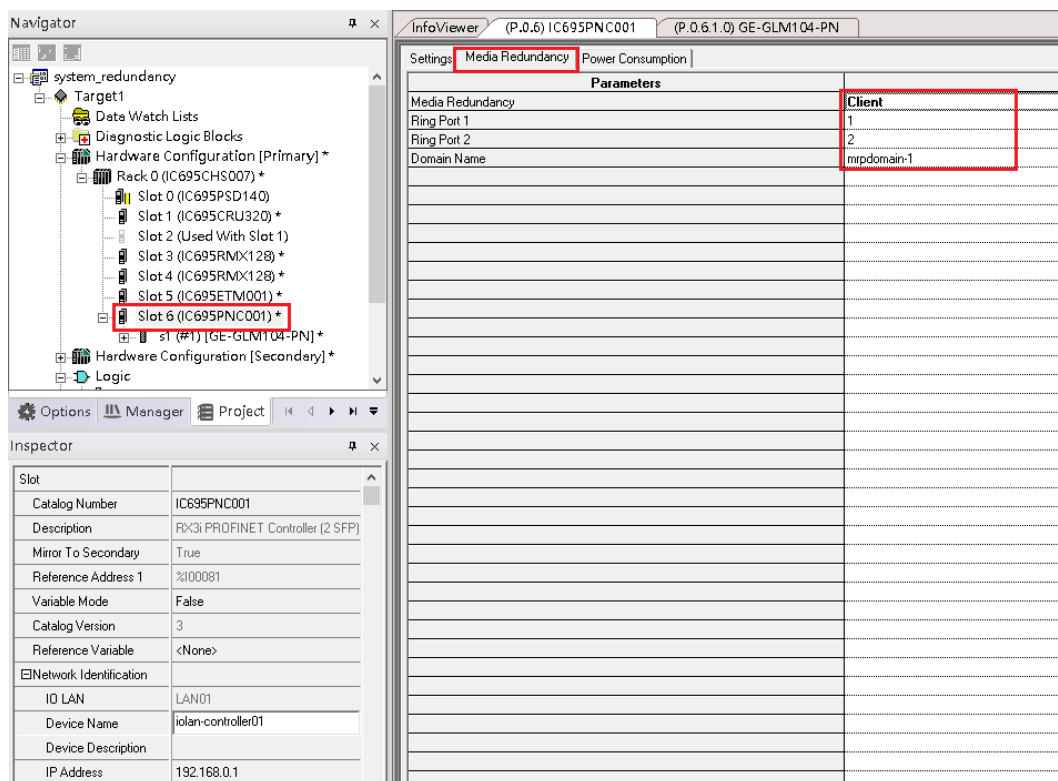
Follow the procedures to complete the configuration of the network:

1. Create PME project and add needed modules.

Figure 277: Create PME Project

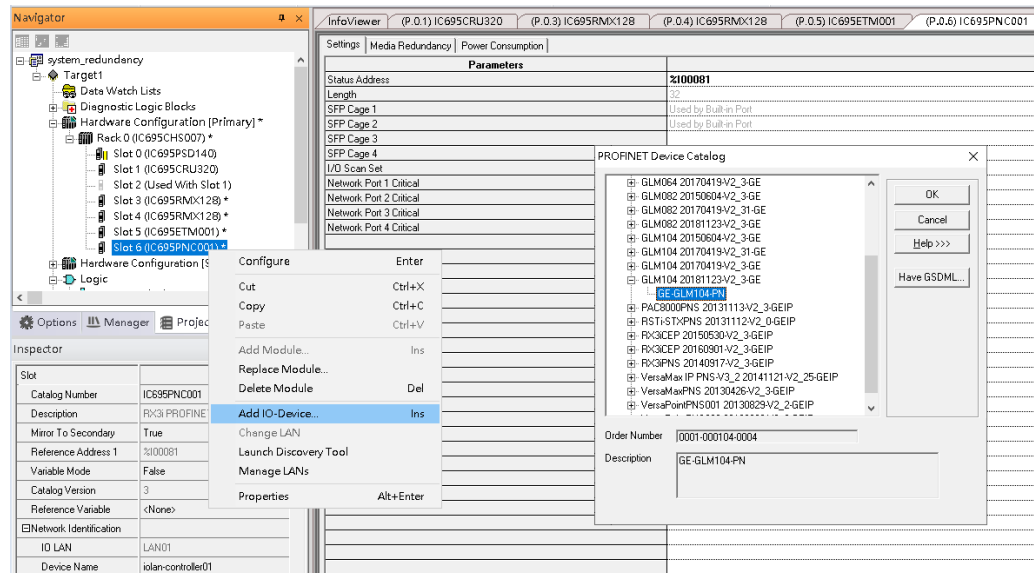


2. Config PNC001 to run as MRC



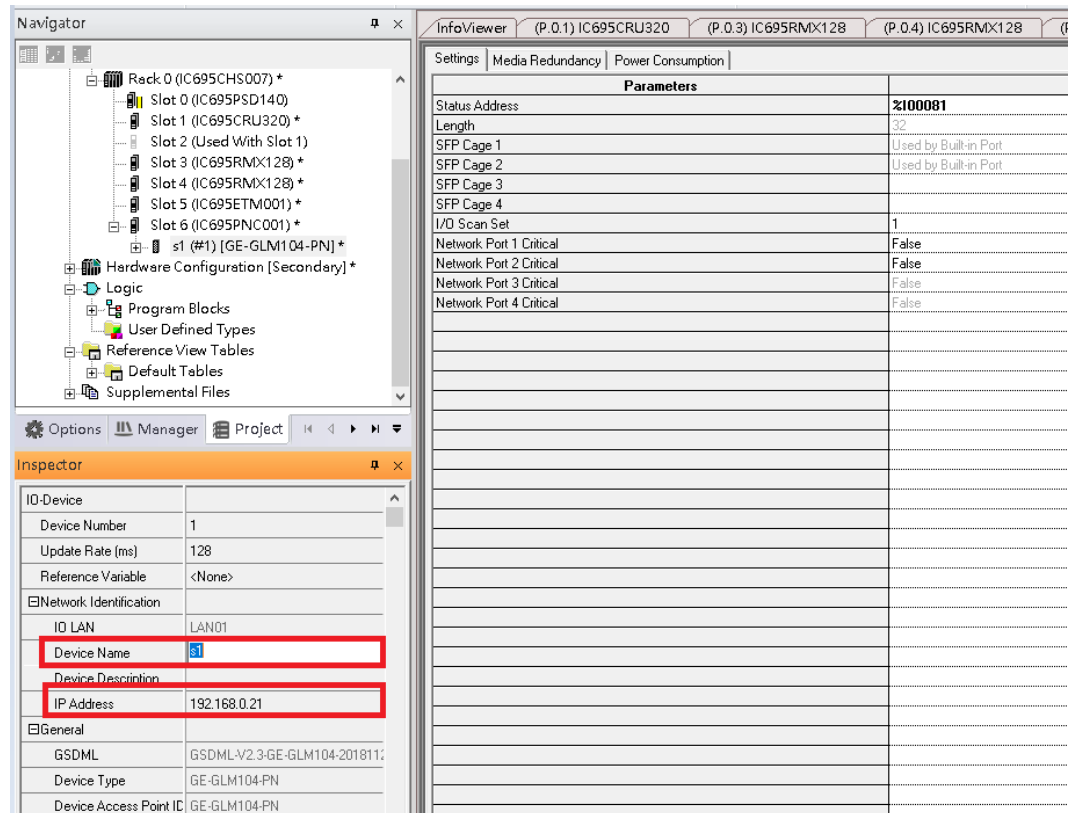
3. Add Switch S1

Figure 278: Add Switch S1



4. Set Switch S1 device name and IP address.

Figure 279: 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:

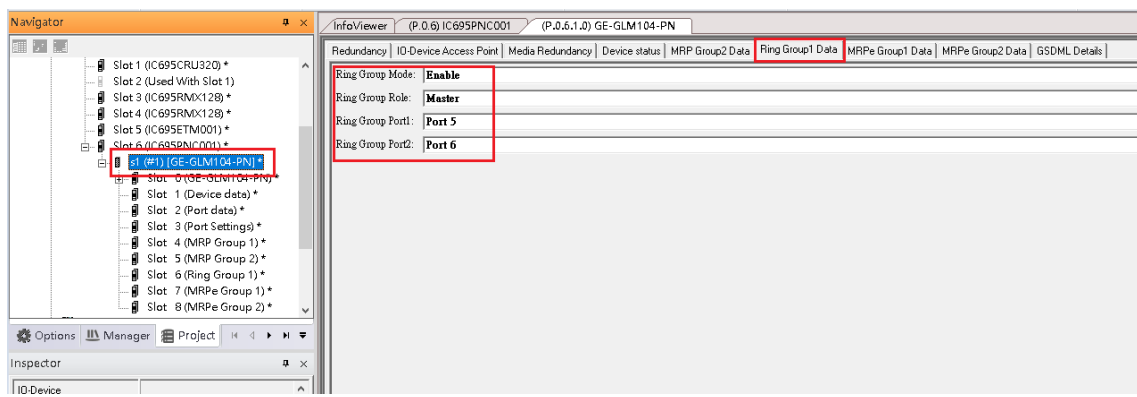
Ring Group Mode: Enable

Ring Group Role: Master

Ring Group Port1: Port5

Ring Group Port2: Port6

Figure 280: Ring Group1 Data



6. Set Switch S1 port 1 and port2 to run MRPe Master

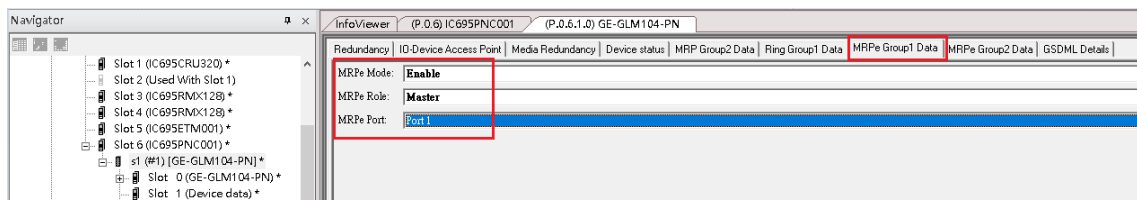
In **MRPe Group1 Date**, set:

MRPe Mode: Enable

MRPe Role: Master

MRPe port: Port 1

Figure 281: MRPe Group1 Data



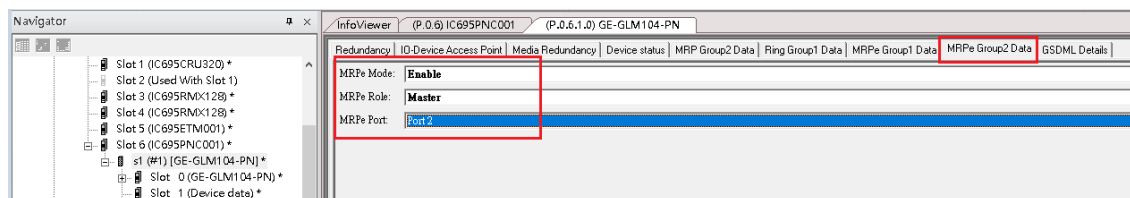
7. In **MRPe Group2 Date**, set:

MRPe Mode: Enable

MRPe Role: Master

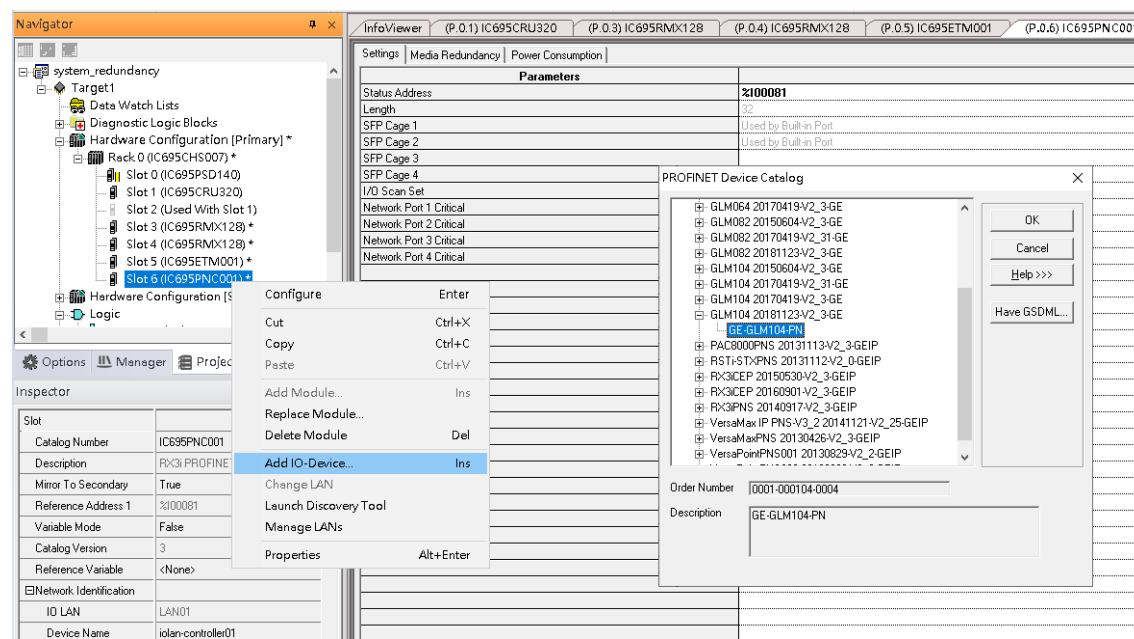
MRPe port: Port2

Figure 282: MRPe Group2 Date



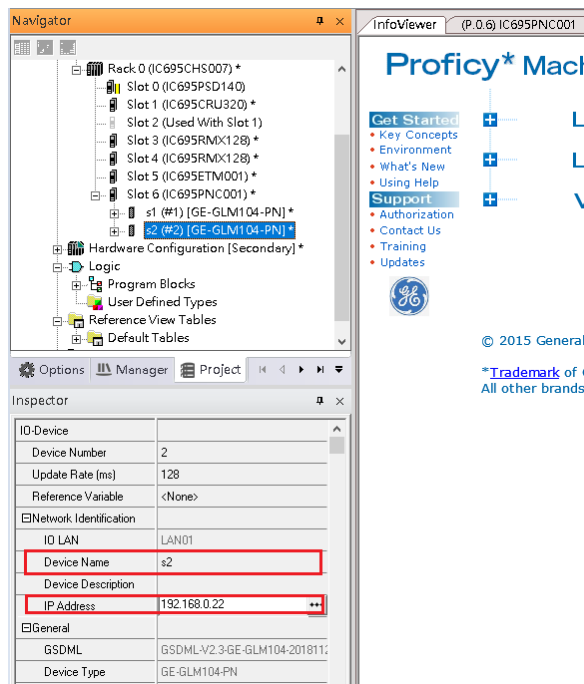
8. Add Switch S2

Figure 283: Add I/O Device



9. Set Switch S2 device name and IP address

Figure 284: 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:

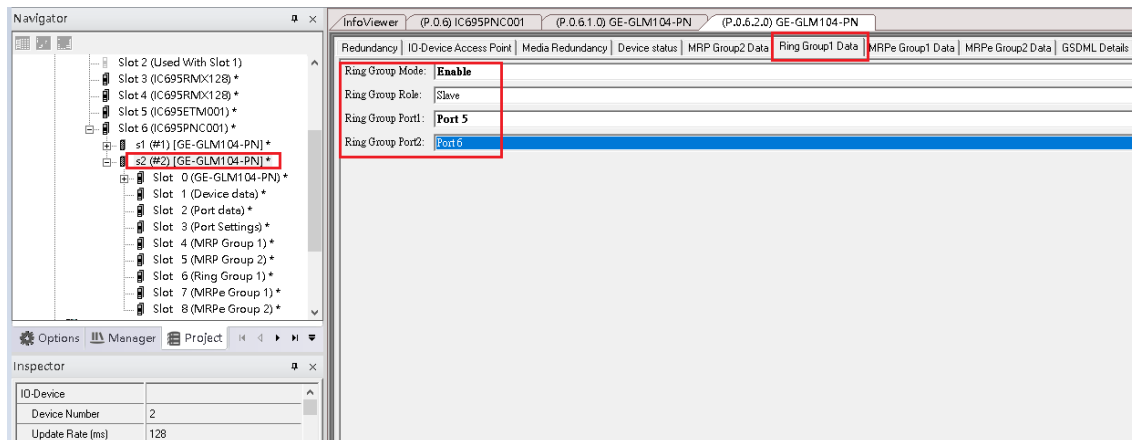
Ring Group Mode: Enable

Ring Group Role: Slave

Ring Group Port1: Port5

Ring Group Port2: Port6

Figure 285: Ring Group1 Data



11. Set Switch S2 Port1 to run MRPe Master

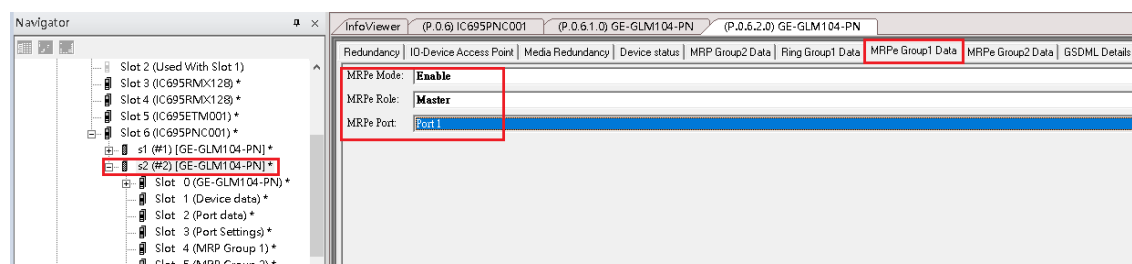
In MRPe Group1 Date, set:

MRPe Mode: Enable

MRPe Role: Master

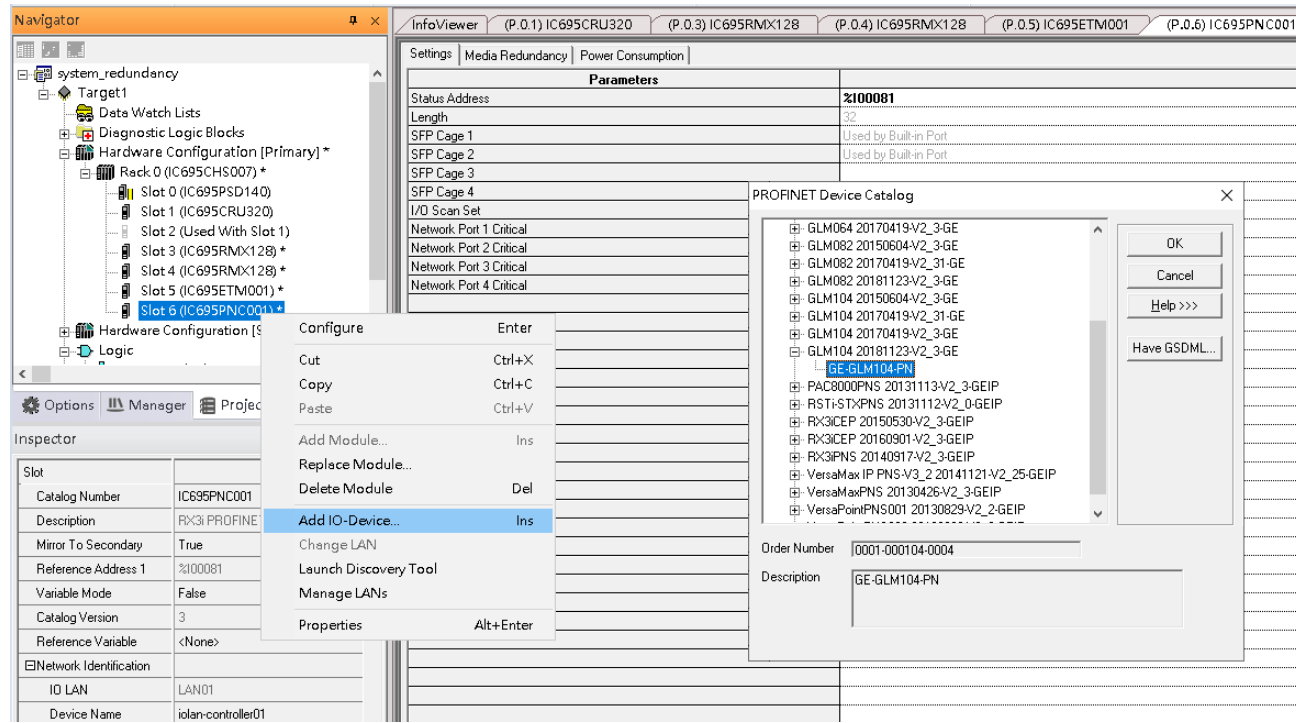
MRPe port: Port1

Figure 286: Switch SW Port1 to MRPe Master



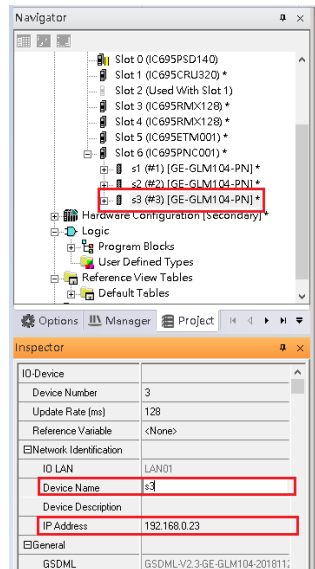
12. Add Switch S3

Figure 287: Add Switch S3



13. Set Switch S3 Device Name and IP Address

Figure 288: 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:

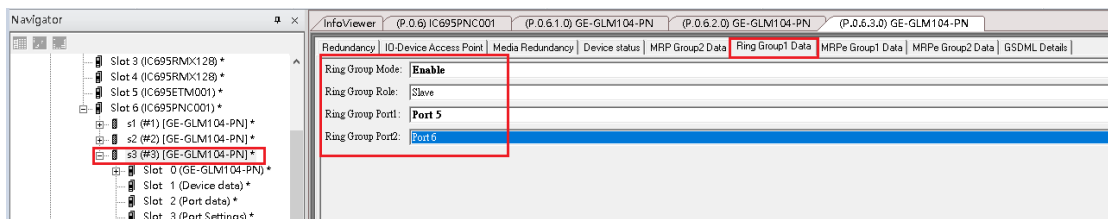
Ring Group Mode: Enable

Ring Group Role: Slave

Ring Group Port1: Port5

Ring Group Port2: Port6

Figure 289: Switch S3 to RingV2 and MRPe



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

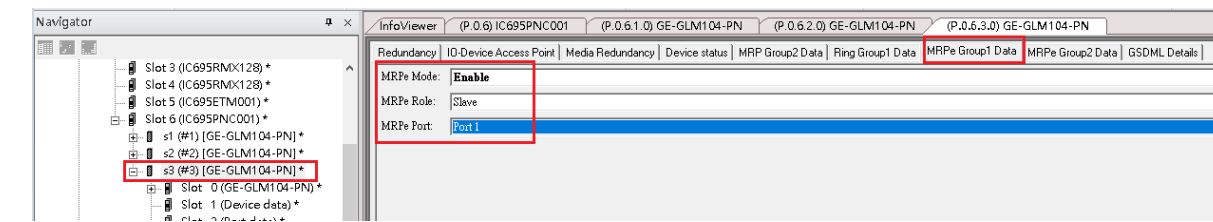
In **MRPe Group1 Date**, set:

MRPe Mode: Enable

MRPe Role: Slave

MRPe port: Port1

Figure 290: Switch S3 Port1 and Port2



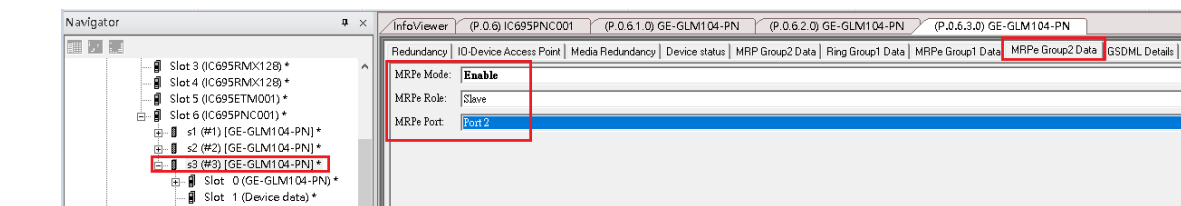
16. In **MRPe Group2 Date**, set:

MRPe Mode: Enable

MRPe Role: Master

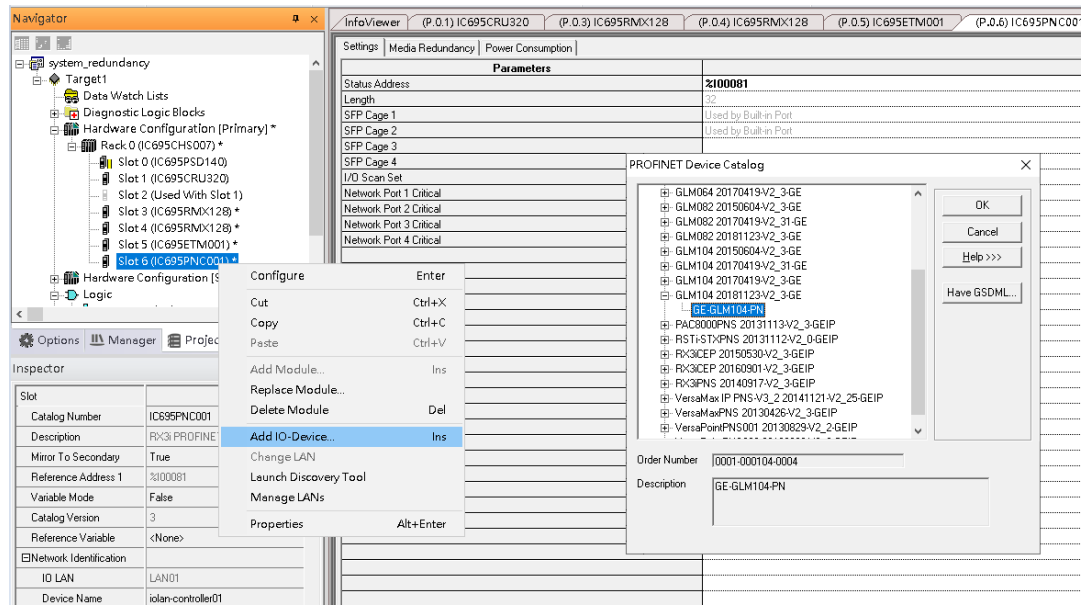
MRPe port: Port2

Figure 291: MRPe Group2 Date



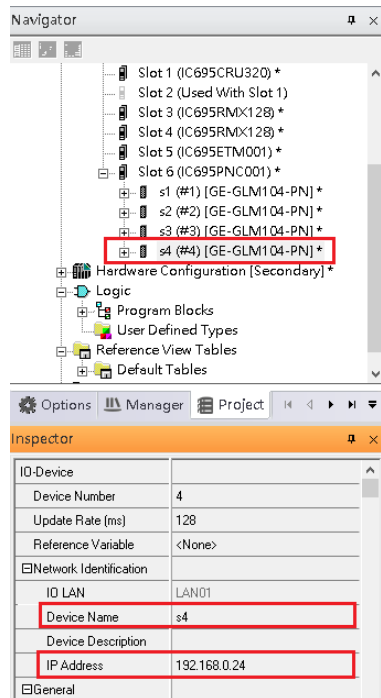
17. Add Switch S4

Figure 292: Add Switch S4



18. Set Switch S4 device name and IP address.

Figure 293: S4 Device Name and IP Address



19. Config Switch S4 to run RingV2 and MRPe.

Set Switch S4 to run RingV2 Slave Role

In **Ring Group1 Date**, set:

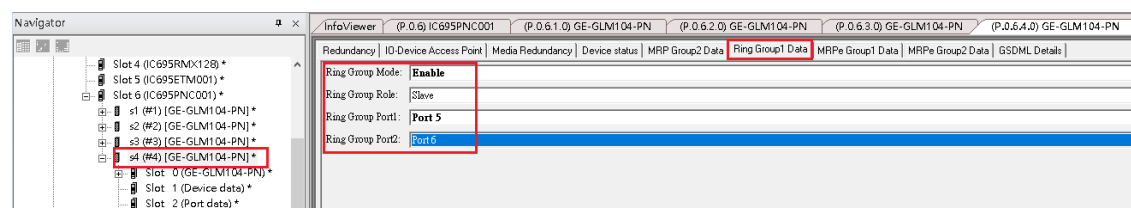
Ring Group Mode: Enable

Ring Group Role: Slave

Ring Group Port1: Port5

Ring Group Port2: Port6

Figure 294: Switch S4 to RingV2 and MRPe



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

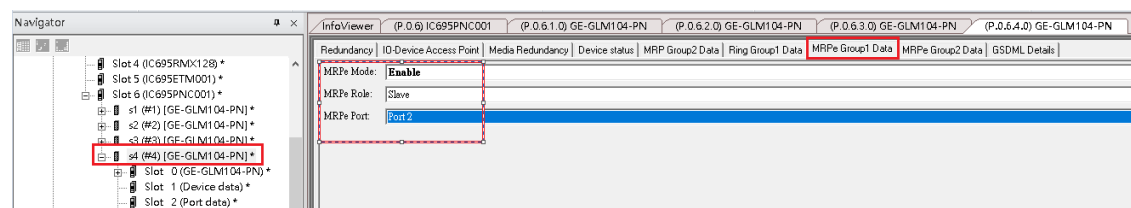
In **MRPe Group1 Date**, set:

MRPe Mode: Enable

MRPe Role: Slave

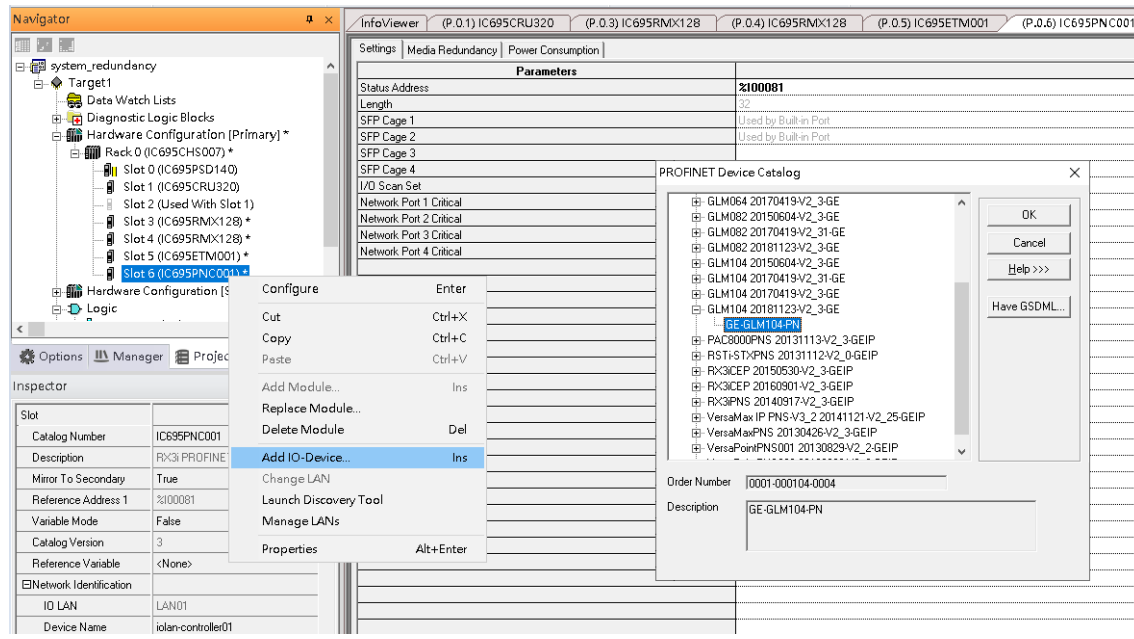
MRPe port: Port2

Figure 295: Switch S4 Port2 to Run MRPe Slave



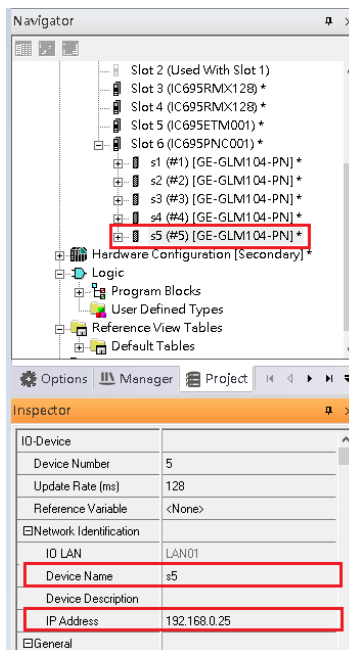
21. Add Switch S5

Figure 296: Switch S5



22. Set Switch S5 device name and IP address.

Figure 297: Switch S5 Device Name and IP Address



23. Config Switch S5 to run MRC.

Set Switch S5 to run MRC

In **Media Redundancy**, set:

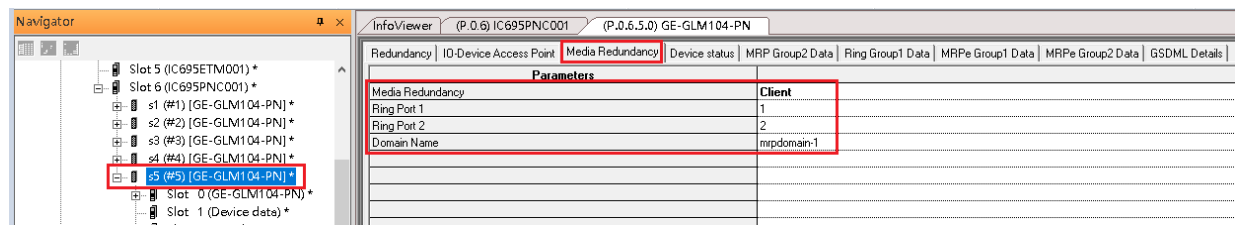
Media Redundancy: Client

Ring Port 1: 1

Ring Port 2: 2

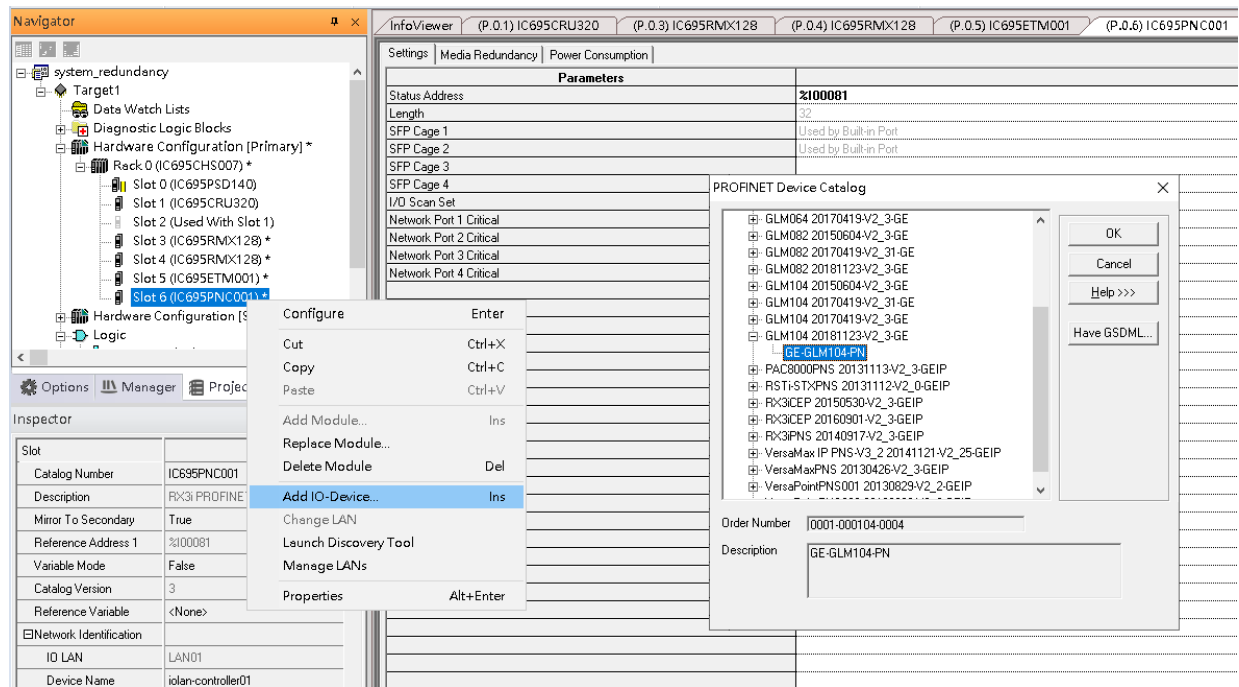
Domain Name: mrpdomain-1

Figure 298: Switch S5 to Run MRC



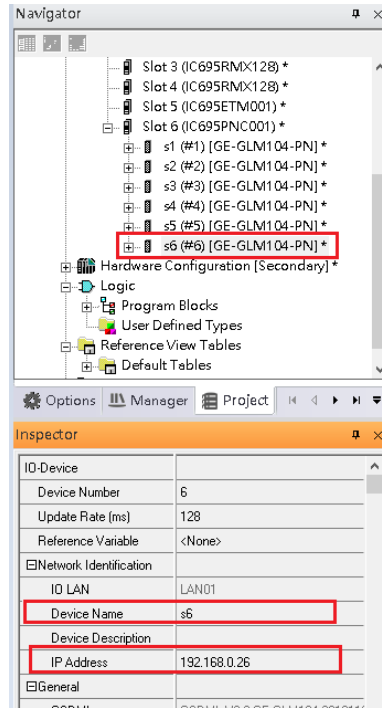
24. Add Switch S6

Figure 299: Switch S6



25. Set Switch S6 device name and IP Address.

Figure 300: Switch S6 Device Name and IP Address



26. Config Switch S6 to run MRC.

Set Switch S6 to run MRC

In **Media Redundancy**, set:

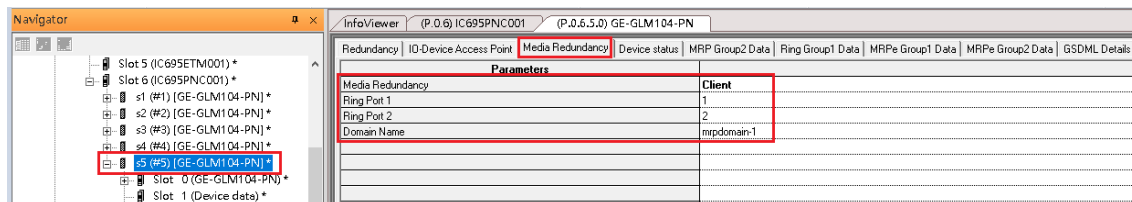
Media Redundancy: Client

Ring Port 1: 1

Ring Port 2: 2

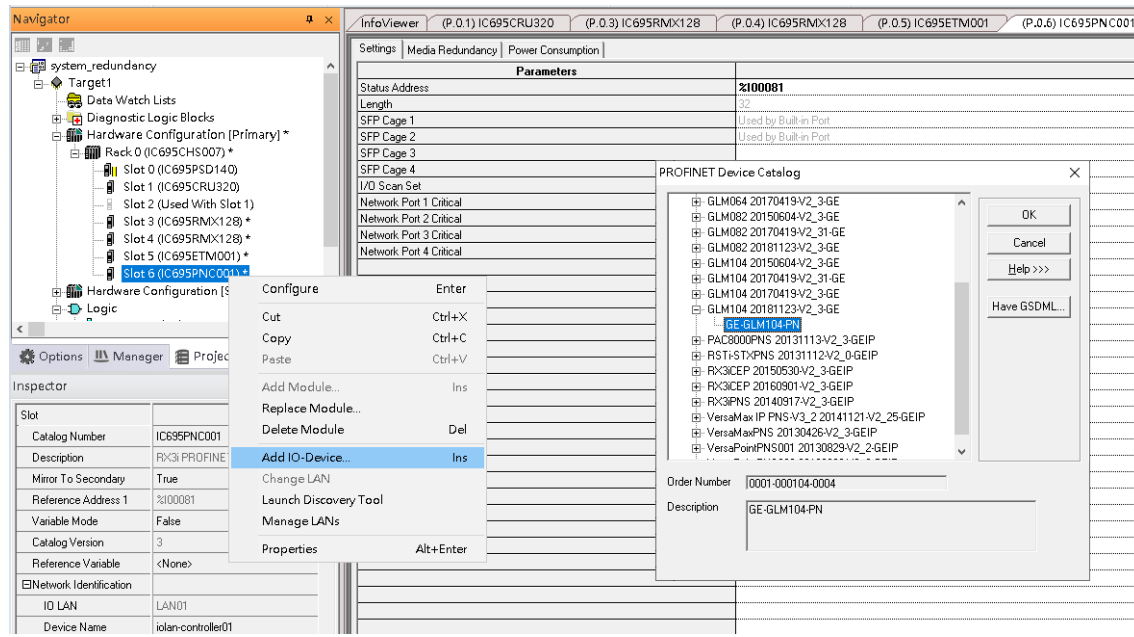
Domain Name: mrpdomain-1

Figure 301: Config Switch S6 to Run MRC



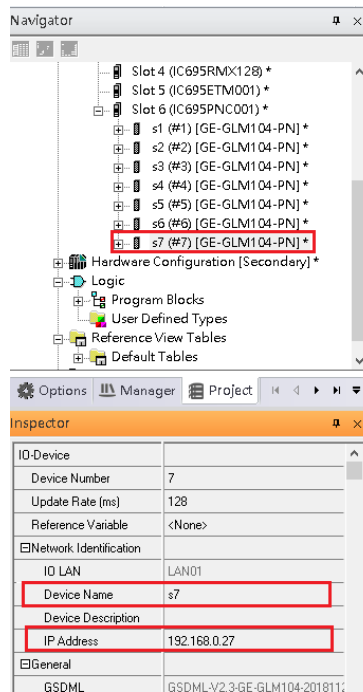
26. Add Switch S7

Figure 302: Add Switch S7



27. Set Switch S7 device name and IP address

Figure 303: Switch S7 Device Name and IP Address



28. Config Switch S7 to run MRC.

Set Switch S7 to run MRC

In **Media Redundancy**, set:

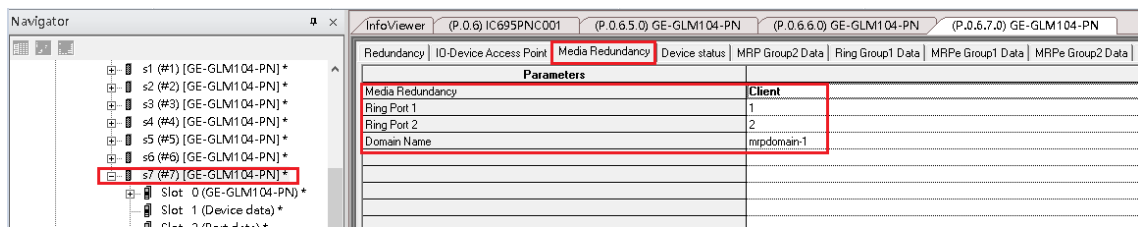
Media Redundancy: Client

Ring Port 1: 1

Ring Port 2: 2

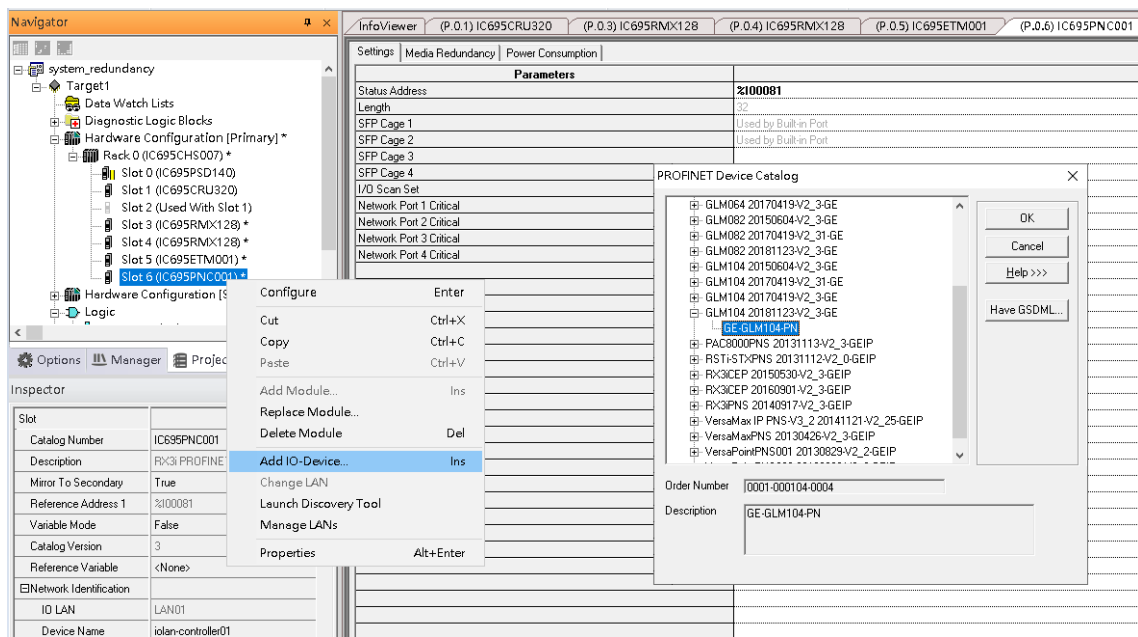
Domain Name: mrpdomain-1

Figure 304: Switch S7 to run MRC



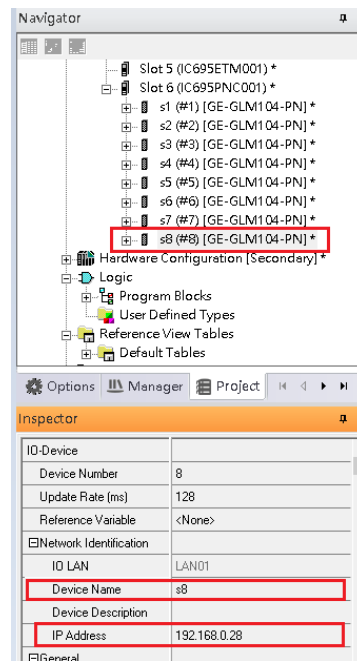
29. Add Switch S8

Figure 305: Add Switch S8



30. Set Switch S8 device name and IP address.

Figure 306: Switch S8 Device Name and IP Address



31. Config Switch S8 to run MRC.

Set Switch S8 to run MRC

In **Media Redundancy**, set

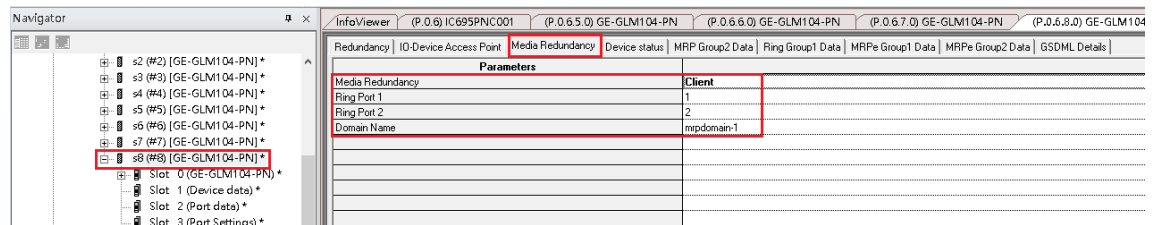
Media Redundancy: Client

Ring Port 1: 1

Ring Port 2: 2

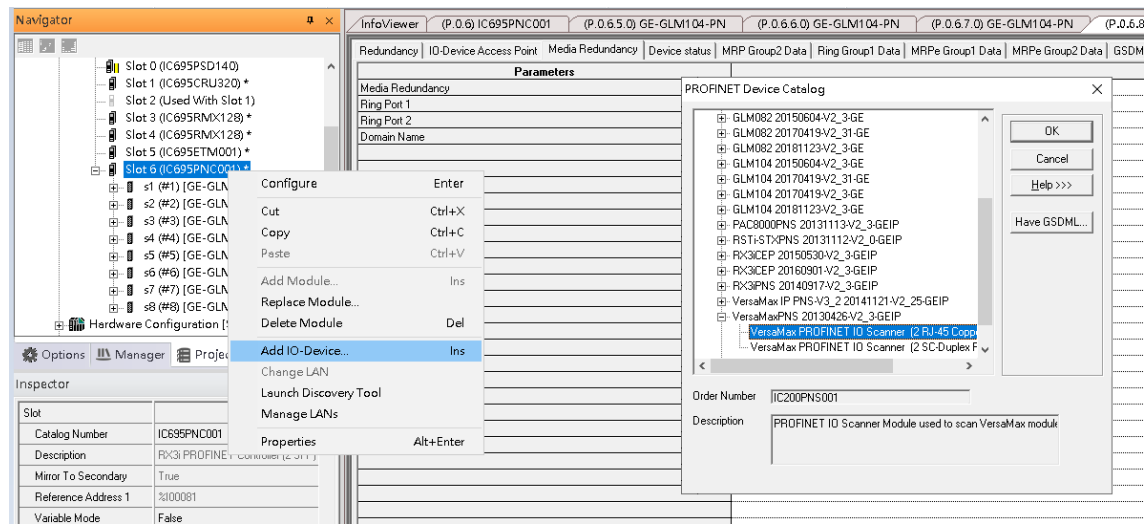
Domain Name: mrpdomain-1

Figure 307: Switch S8 to run MRC

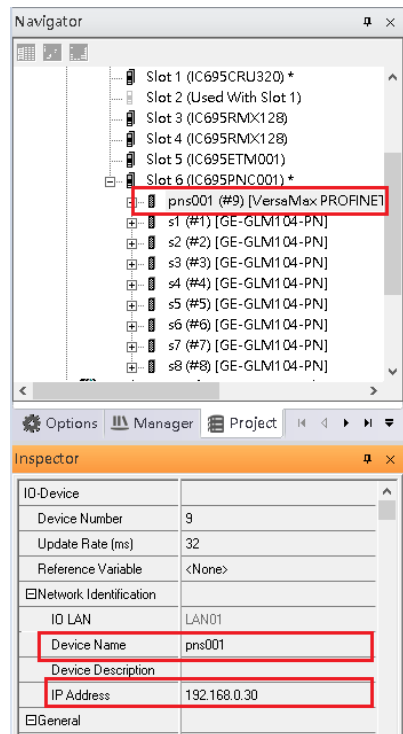


32. Add IO-Device PNS001

Figure 308: 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:

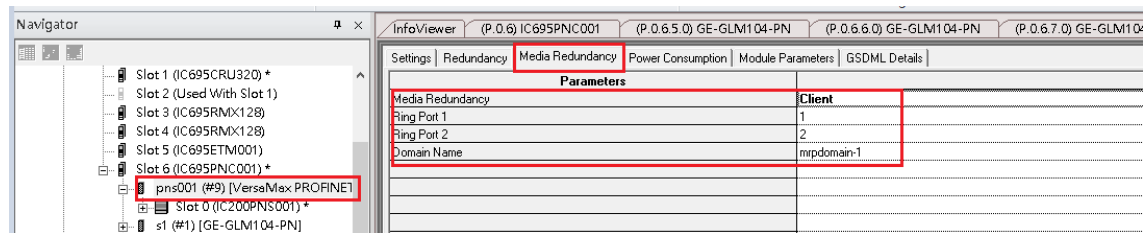
Media Redundancy: Client

Ring Port 1: 1

Ring Port 2: 2

Domain Name: mrpdomain-1

Figure 309: Switch PNS001 to run MRC



35. Mirror configuration to Secondary PLC

Figure 310: Secondary PLC

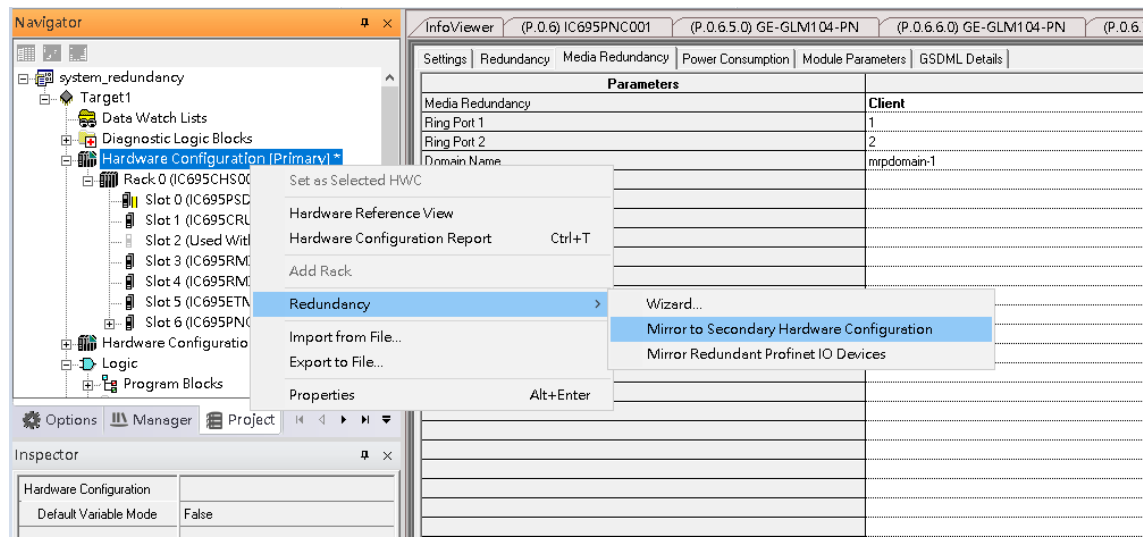
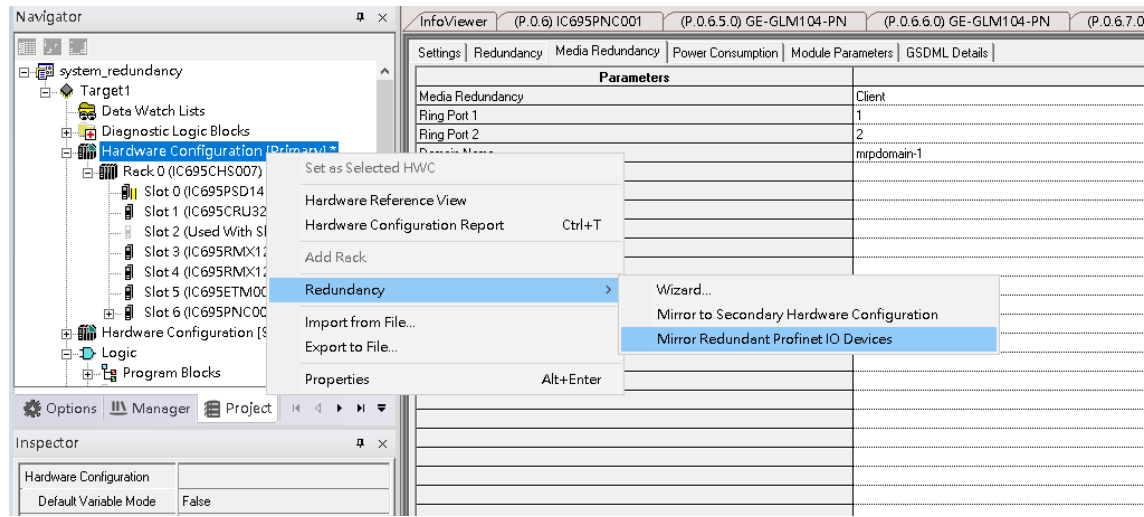
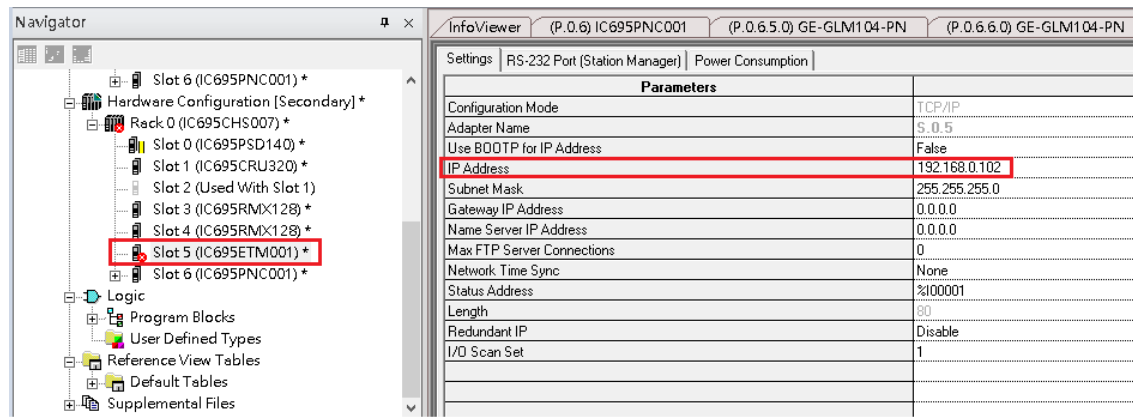


Figure 311: Mirror Redundant Profinet IO Devices



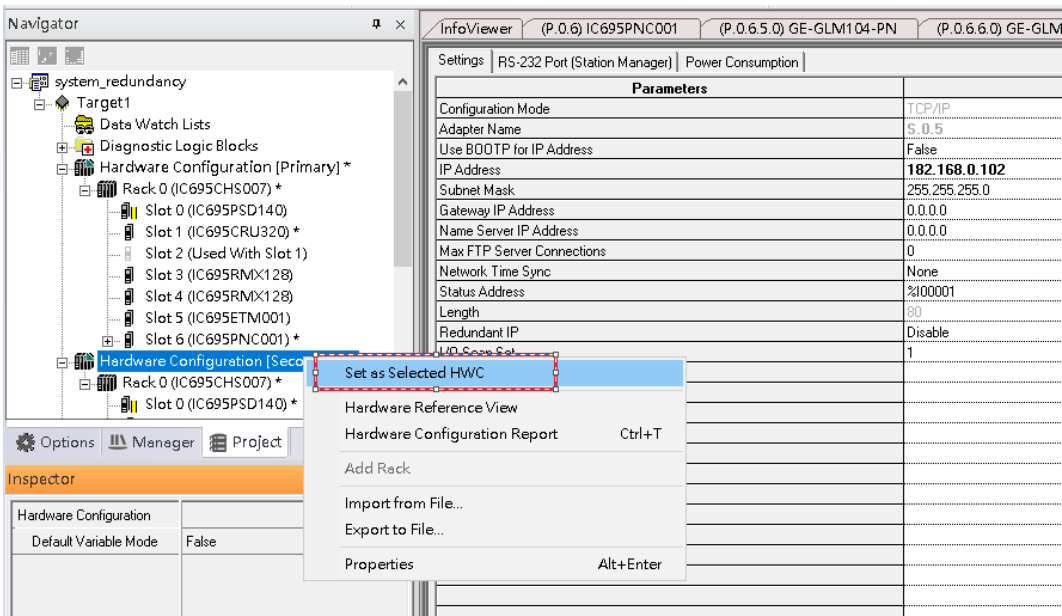
36. Set ETM001 IP Address of Secondary PLC to 192.168.0.102

Figure 312: Setting IP Address of Secondary PLC



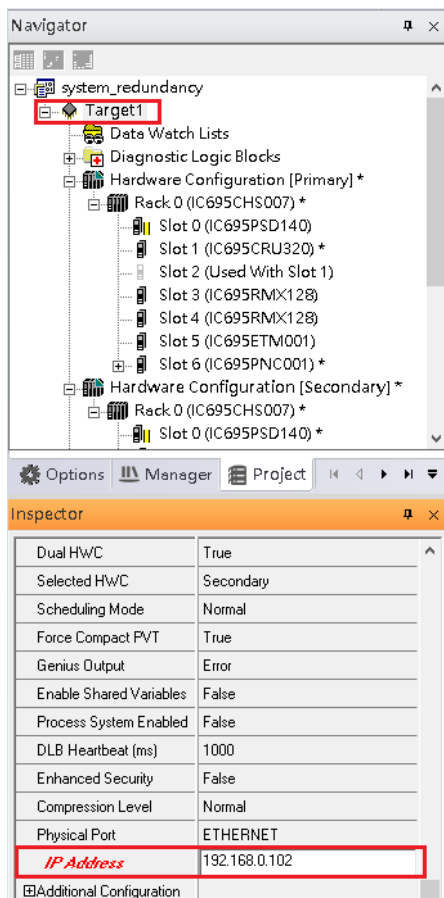
37. Set Secondary PLC as HWC

Figure 313: Set Secondary PLC as Hardware Configuration



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

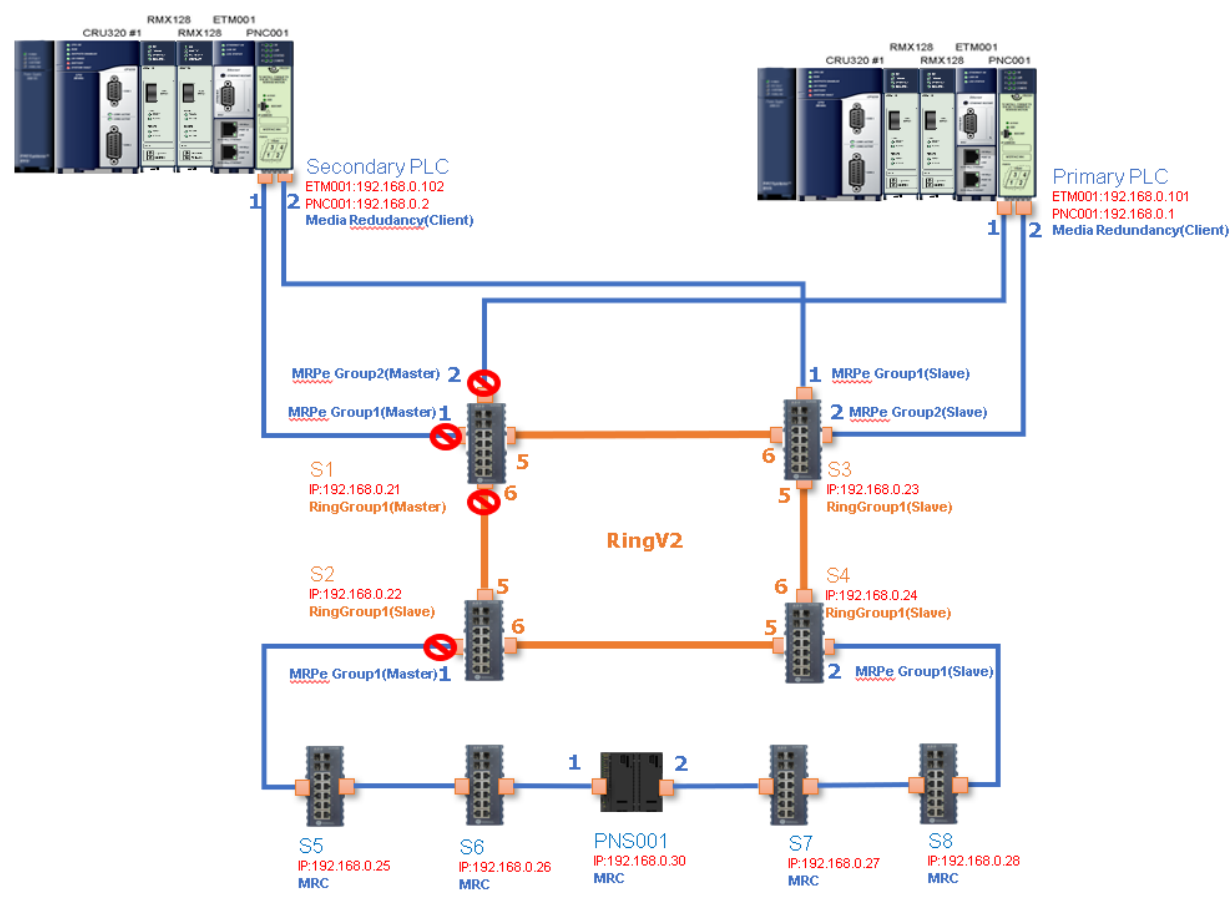
Figure 314: Set IP Address of Target1



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 315: 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.

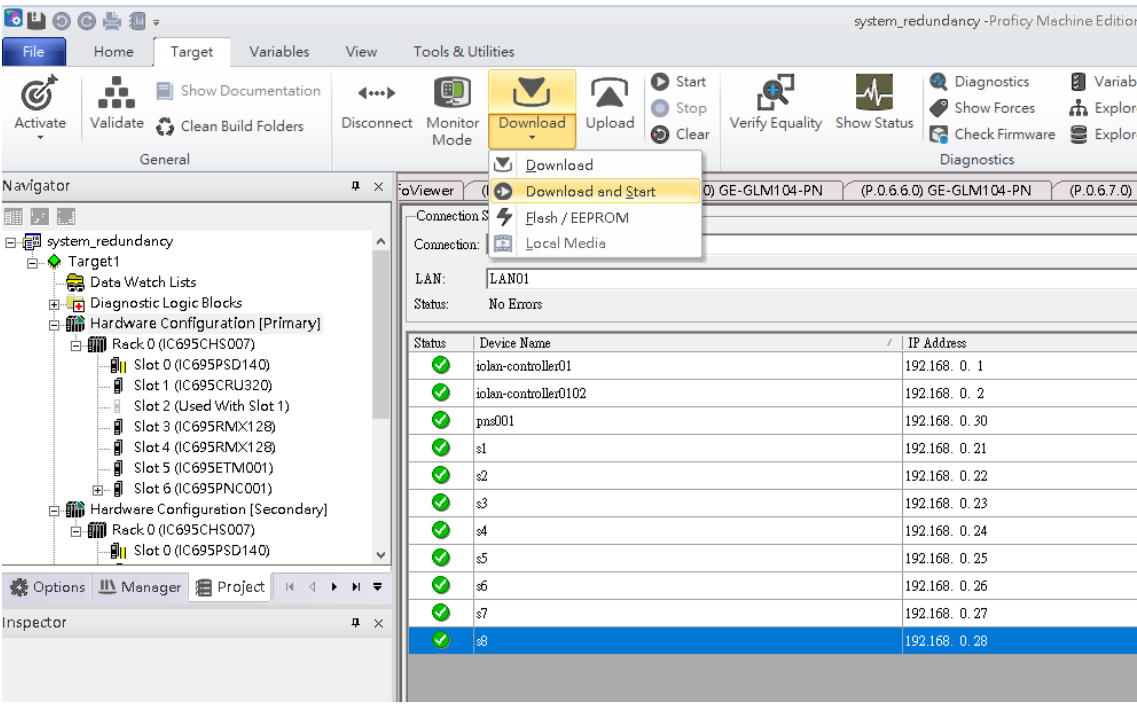
After correct setting, all the devices when into “Assigned” state.

Figure 316: 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		

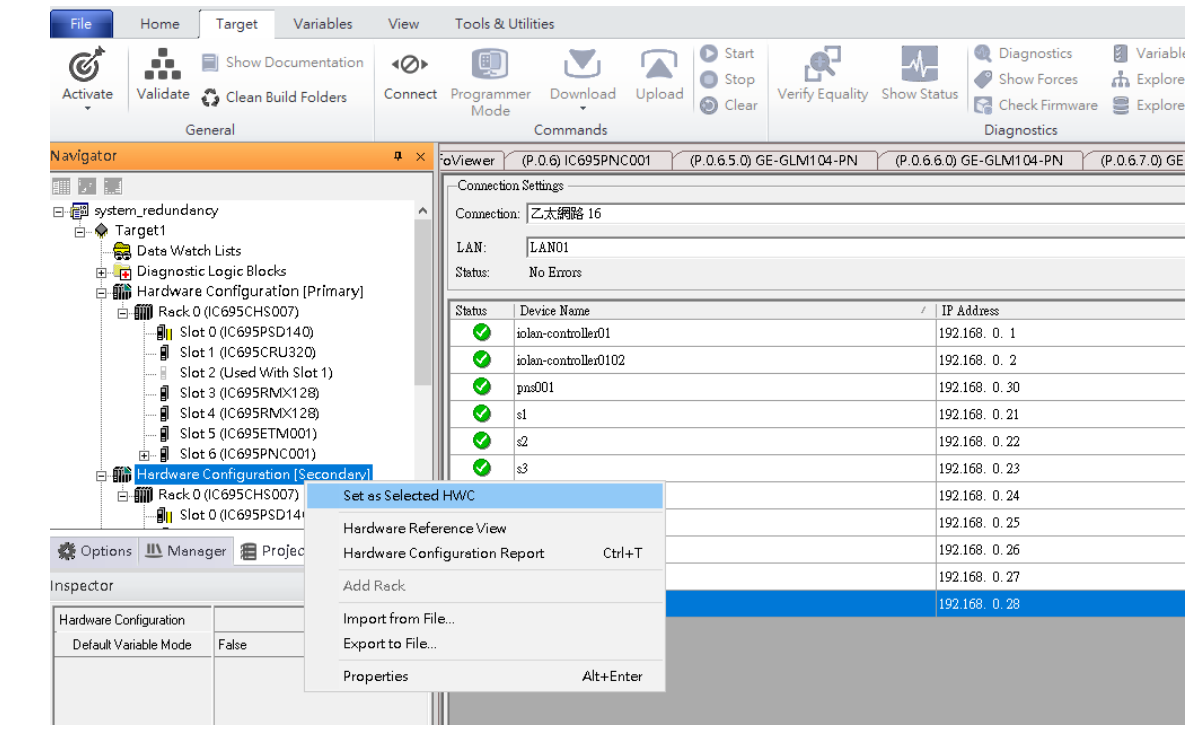
39. Download and Start for Primary PLC

Figure 317: Download and Start Primary PLC



40. Set Secondary PLC to HWC

Figure 318: Secondary PLC to Hardware Configuration



41. Download and Start for Secondary PLC

Figure 319: Download and Start Secondary PLC

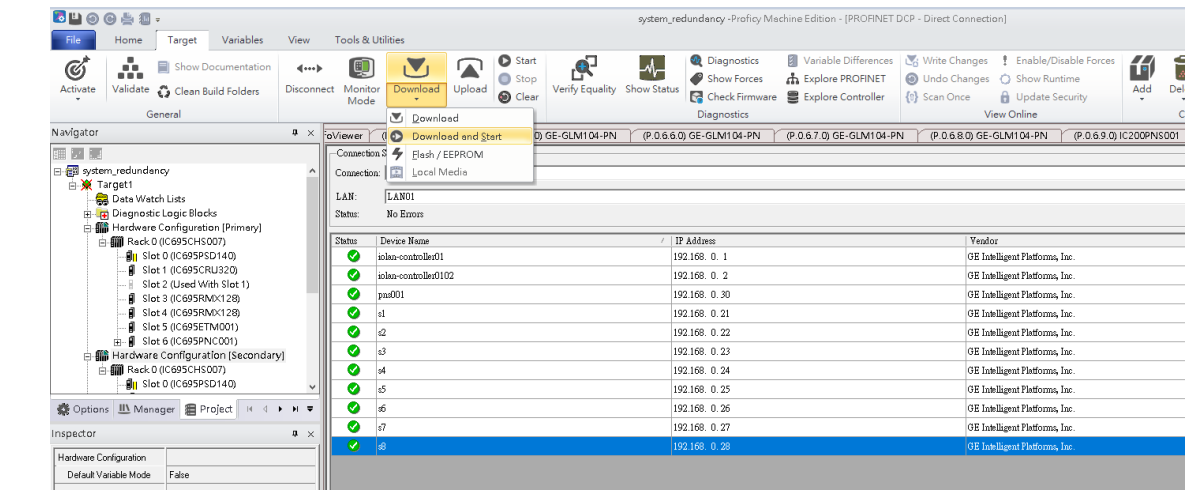


Figure 320

8.2.7 Network Setting

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

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

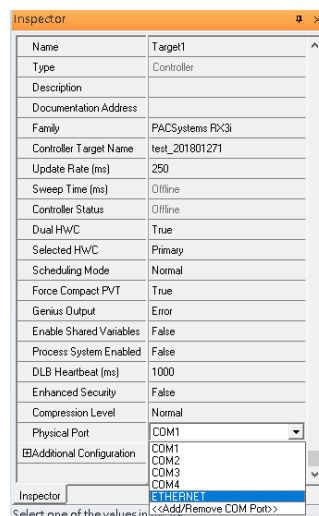
I/O Controller Communication Rule

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 321: 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.

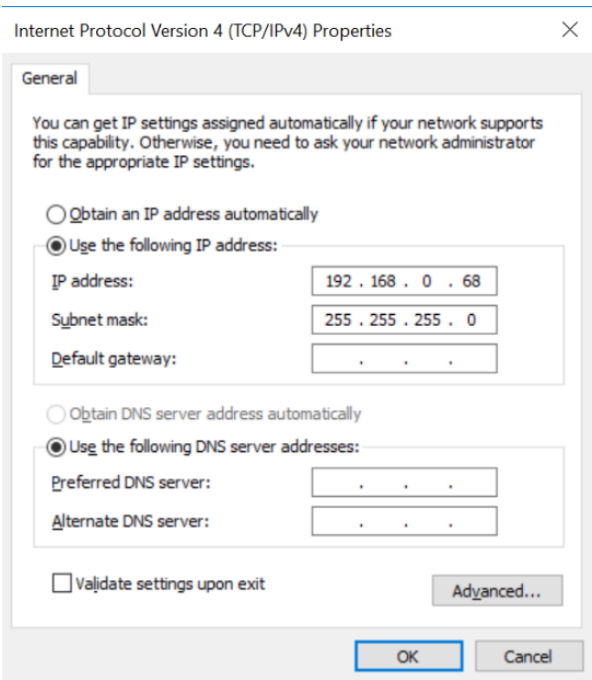
Figure 322: Specified IP Address Appears

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.

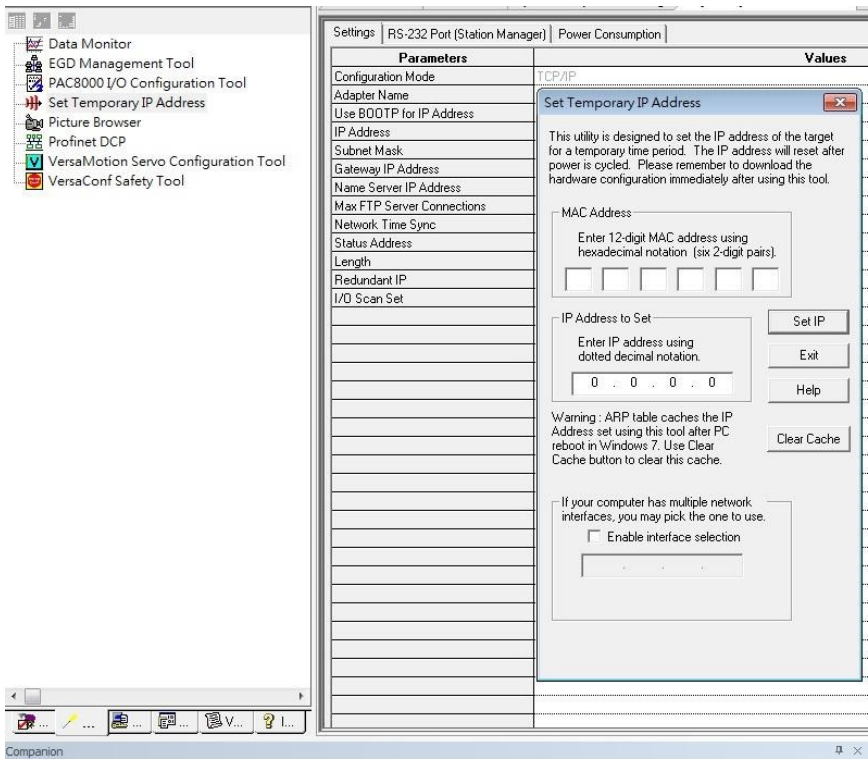
Figure 323: Setting the IP Address of the PC with PME



8.2.9 Temporary IP

However, if the IP address of ETM001 is lost or forgotten, the IP address can be changed by the function **Set Temporary IP Address** according to the MAC address of ETM001. In the following figure, the MAC address is referenced to the ETM001, and the IP address can be defined by user.

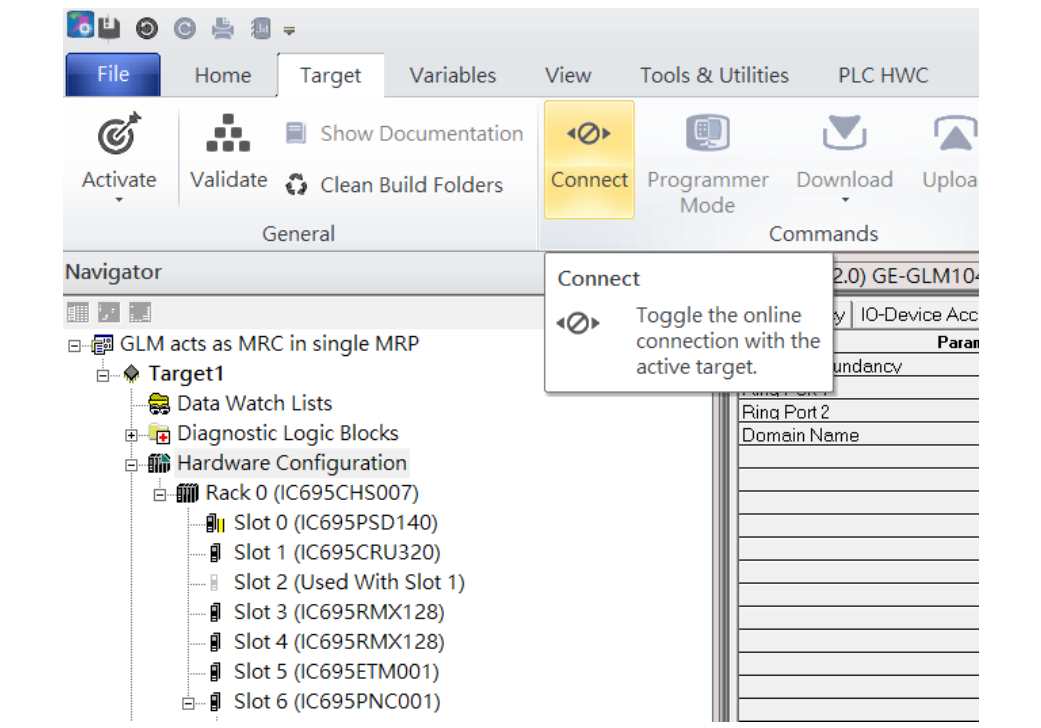
Figure 324: Set Temporary IP Address



8.3 Implementation

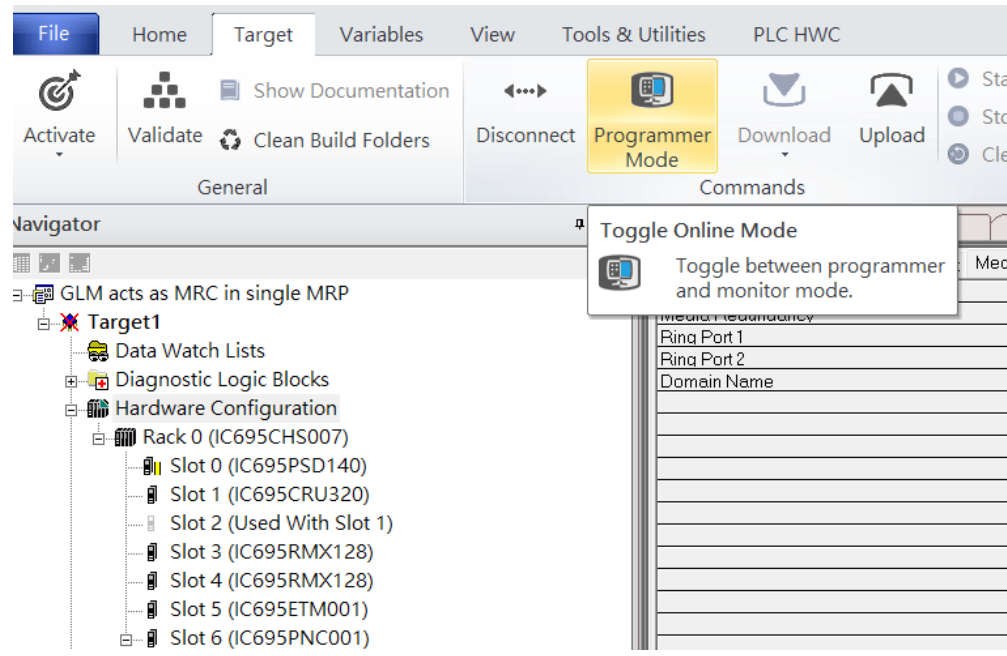
To download the configuration to hardware, the following steps shall be applied.
First, press the **Connect** icon.

Figure 325: Connecting to Target



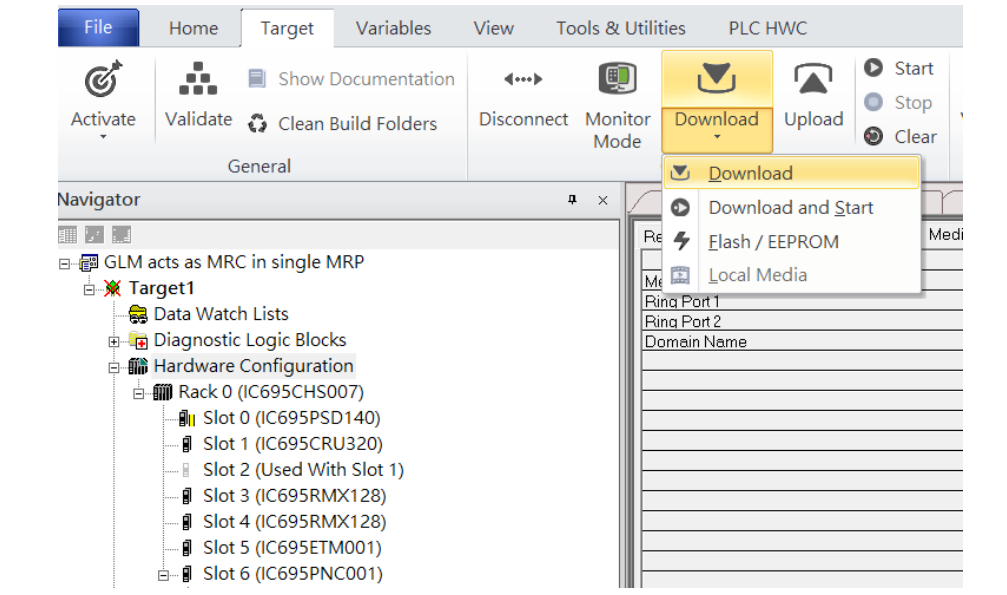
Then press the icon **Programmer Mode**.

Figure 326: Programmer Mode



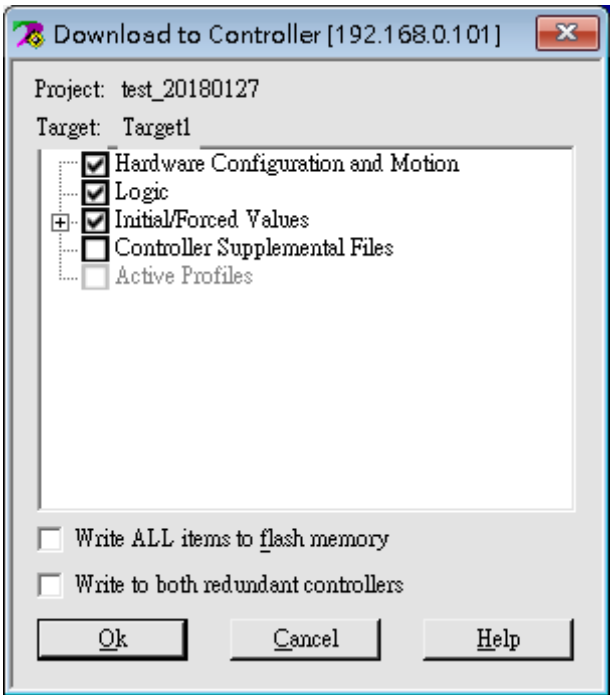
Then press icon **Download** and select **Download**.

Figure 327: Download



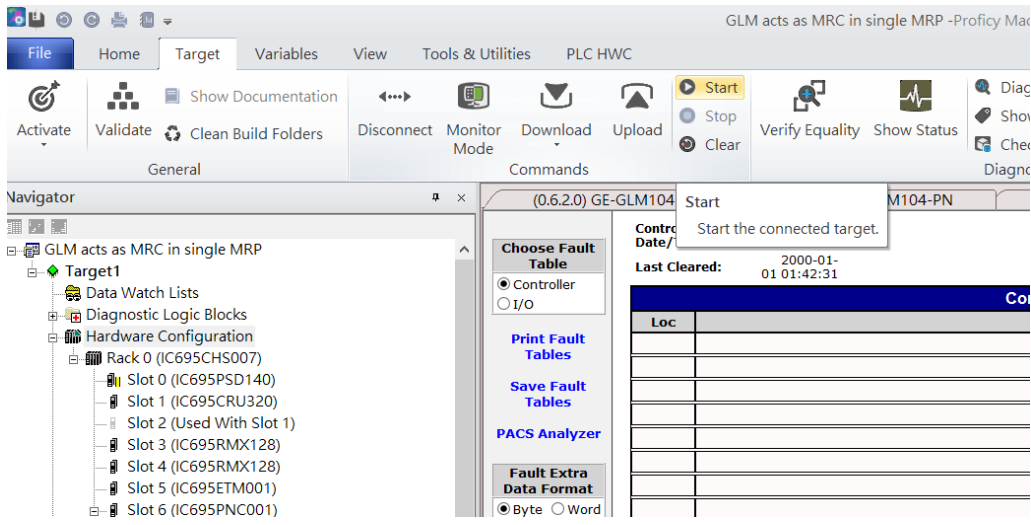
Then the dialogue is appeared to make sure the initialization procedure, select **OK**.

Figure 328: 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 329: Start



General Contact Information

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