# PACMotion VFD PROFINET Configuration

## USER MANUAL

EMERSON

# Contents

# Warnings and Caution Notes as Used in this Publication

## ⚠ WARNING

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

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

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

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# Section 1: Overview

PACMotion Variable Frequency Drives (VFD) equipped with the PROFINET Interface Option Card are capable of being installed on a PROFINET network. The redundancy capable version, IC866-OC-PR, incorporates support for Hot Standby Redundancy and Media Redundancy. This user manual describes the steps required to configure and communicate with a PACMotion VFD utilizing the IC866-OC-PR over a PROFINET network. Another version of the option card, IC866-OC-P, is available with the same features except without support for Hot Standby Redundancy.

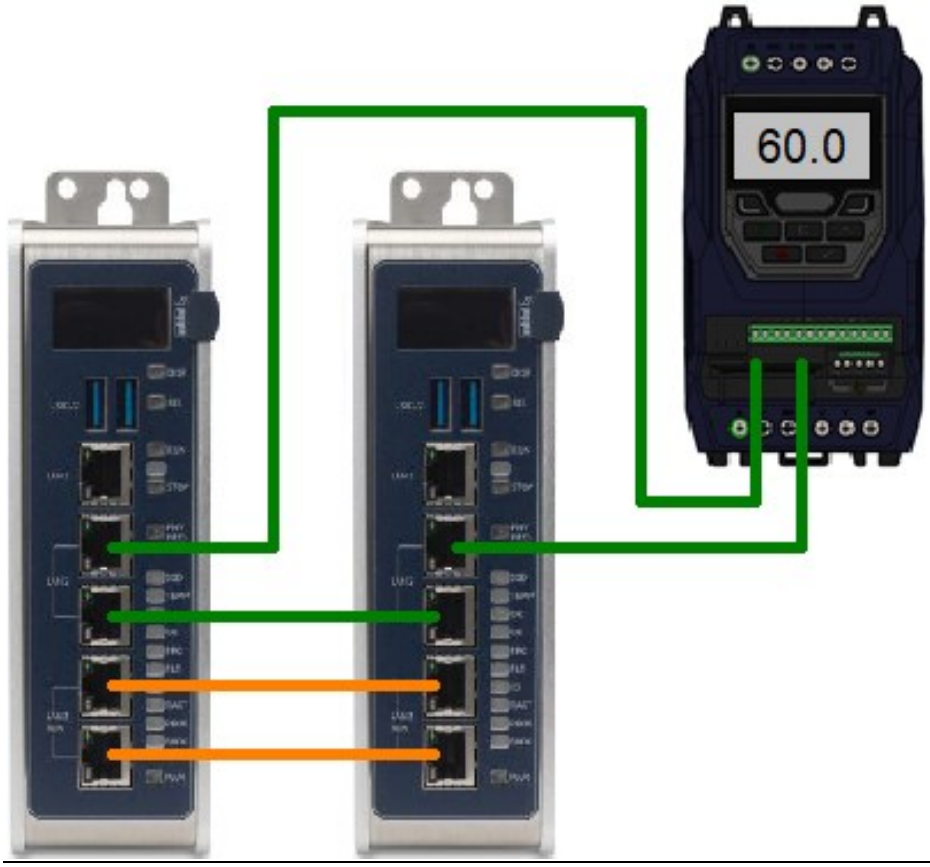
In this user manual, we will utilize a CPL410 system to establish base PROFINET network communications, enable Hot Standby Redundancy, and configure Media Redundancy.

The PLC controller will require a PROFINET Controller Device, either an embedded PNC such as those incorporated into the CPL410 or CPE330, or a standalone PNC such as the PNC001.

This procedure assumes a CPL410 controller system and the PROFINET network has been connected.

**Note:** If Media Redundancy is required, the PROFINET network ring must be left open (i.e. one of the network connections left disconnected) until the controllers and network devices are fully configured.

**Figure 1: PACMotion VFD with CPL410 HSB and MRP**



# 1.1 Configuration Tools

The following tools are required:

**PAC Machine Edition (PME):** Software used to configure the PACSystems Controller and associated I/O. The VFDs are treated as I/O devices within the controller framework. PME is also used to develop PLC logic that resides in the controller and to monitor the application. Refer to Section 2: *PROFINET Configuration Steps.*

**PROFINET DCP**: This is a discovery tool launched from within PME. It is used for PROFINET networks only. Refer to Section 2: *PROFINET Configuration Steps.*

**PACMotion VFD Studio:** This is also launched from within PME. It is used to perform PACMotion VFD commissioning activities. Refer to *Commissioning using PACMotion VFD Studio*. Note that PME Release 9.50 SIM10 or later incorporates VFD Studio. USB to RS-485 adaptor (IC866-CABL-USB485) is required for the VFD Studio tool to communicate with the drive.

# 1.2 Revisions in this Manual

| Revision | Date | Description |
|---|---|---|
| A | Jul 2021 | Initial Release |

# Section 2: PROFINET Configuration Steps

## 2.1 Simplex Configuration

The following steps are required for a simple PROFINET connection.

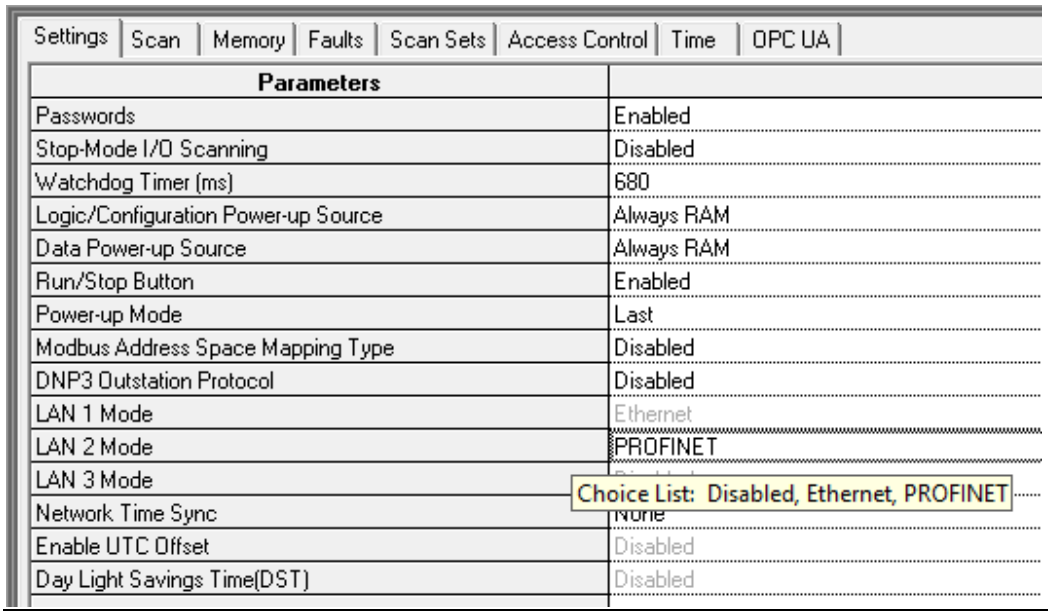
**1. Connect PME**

Attach the computer running PAC Machine Edition (PME) to the PACSystems Controller to be configured.

**2. Configure the PROFINET Controller**

On PME, select the hardware configuration for CPL410 and set **LAN 2 Mode** to **PROFINET** (Figure 2). For additional details on programming a controller for a PROFINET network, refer to the GFK-2571, *PACSystems RX3i & RSTi-EP PROFINET I/O Controller User Manual.*

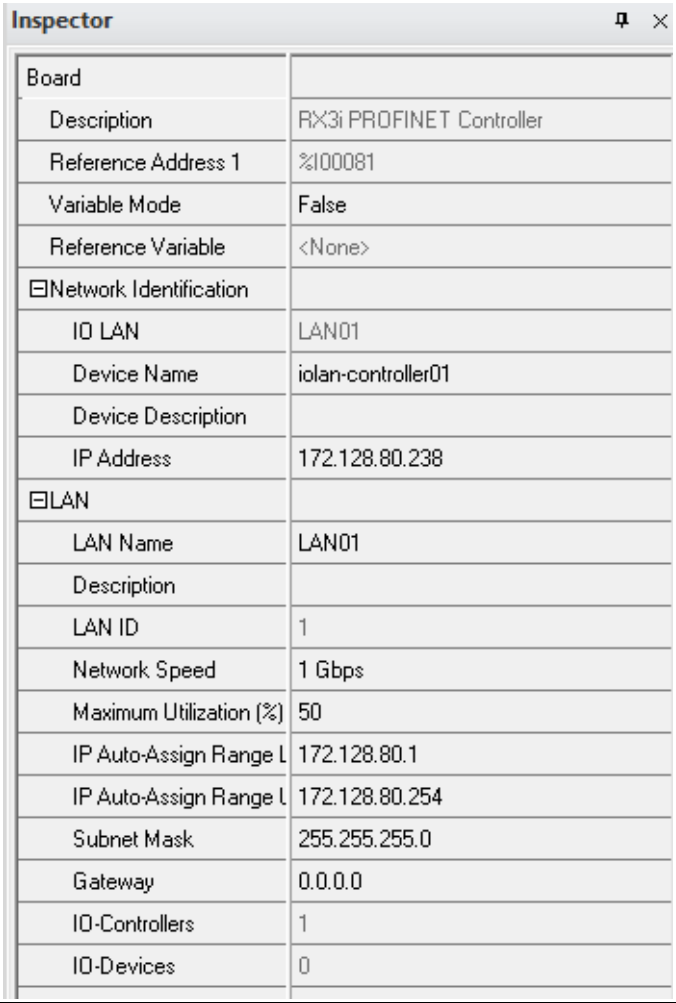
**Figure 2: Enable Embedded PROFINET Controller**



### 3. Assign the PNC Device Name and IP Address

Select the embedded PROFINET controller in the Navigator window to display the properties in the Inspector window. In the Inspector window set the PNC Device name and IP address (Figure 3).

**Figure 3: Assign Device Name and IP Address**

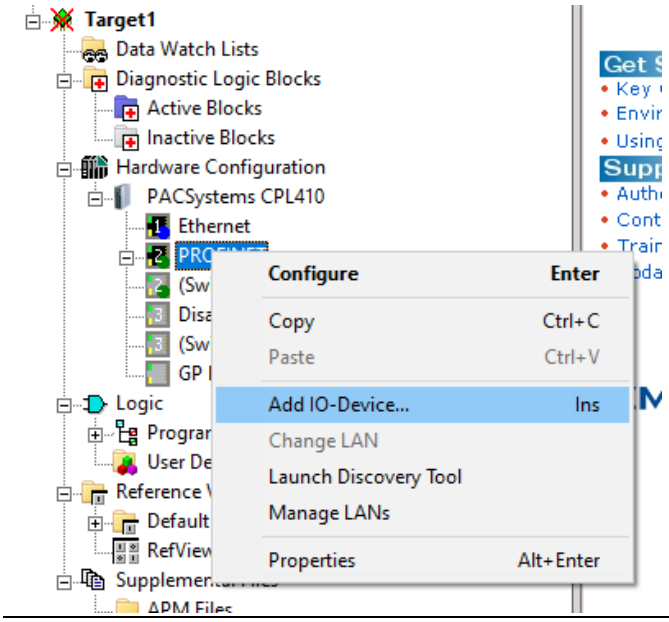


### 4. Add Drives to the Network

Once the supervising PROFINET controller has been set up, each associated drive may be set up as a node on that network.

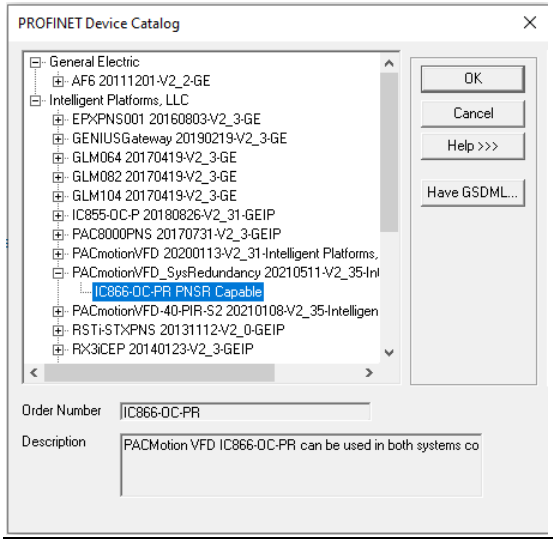
a) Right-click on the target PROFINET controller to bring up the pop-up menu and click on **Add IO-Device** (Figure 4)

**Figure 4: Add IO Device**




b) From the PROFINET Device Catalog, expand the PACMotion VFD entry and select the model of the drive to be networked at the current node (Figure 5). Select the **IC866-OC-PR** device.

**Figure 5: PACMotion VFD Device Selection**



5. (**Optional**) If the specific PACMotion VFD model does not show up in the Device Catalog, access the Emerson support website to download the corresponding PACMotion VFD GDSML file. (Links are provided at the end of this document.) Then select **Have GSDML**, browse to the downloaded file, and select **Open**. The imported GSDML will create a new device in the PROFINET Device Catalog.

   a) Select the device corresponding to the current version of the GSDML file, then add that device at the current node

   b) Click **OK** to complete the device addition.

**Important**

Repeat until all drives have been attached to the network.

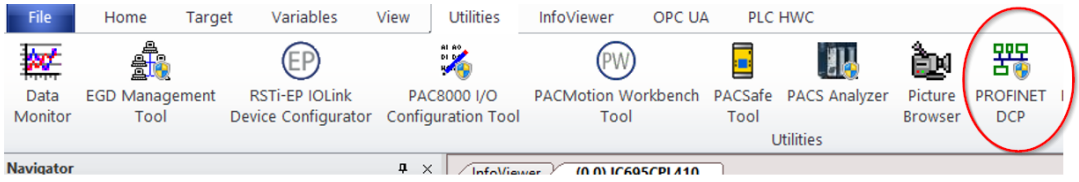
### 6. Connect to the PROFINET network

Establish an Ethernet connection between the host PC and the PROFINET network.

### 7. Launch the Discovery Tool

Under **Utilities**, launch the **PROFINET DCP** Tool (Figure 6).

**Figure 6: Launch PROFINET DCP Tool**

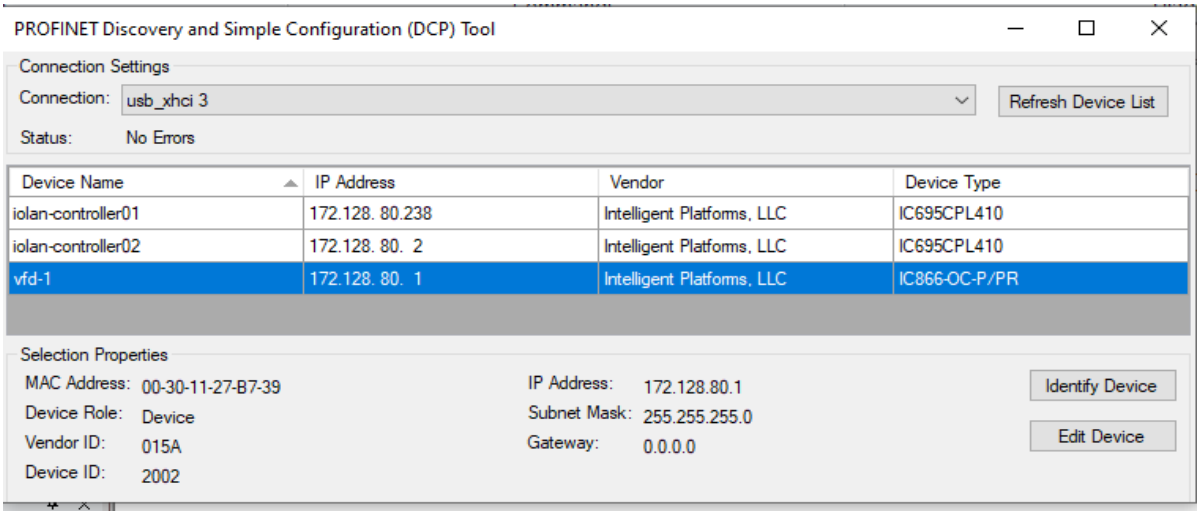


### 8. Refresh the Device List

a) Verify the correct interface is selected in the Connection Settings window and change if necessary.

b) Click on the **Refresh Device List** button to generate a list of devices on that network (Figure 7).

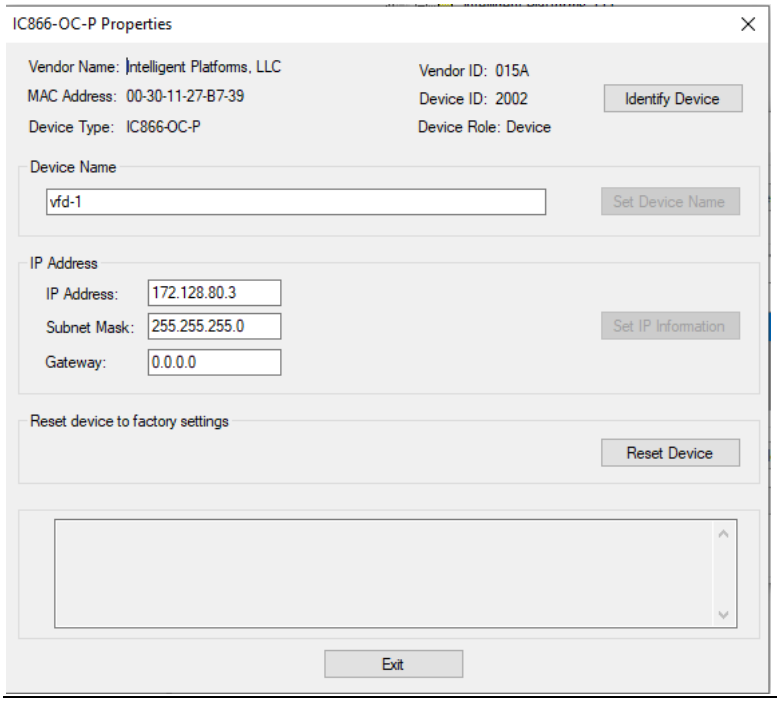
**Figure 7: List of Discovered Devices on PROFINET Network**




c) Click on the row representing the drive to which a Device Name is to be assigned.

d) Assign a valid Device Name (Figure 8), then click on the **Set Device Name** button (Figure 8).

**Figure 8: Set Device Name & (Optionally) IP Address**



**Note:** Device names must consist of lower-case letters, digits, and hyphens and be unique on the PROFINET network. In the event an incompatible character is entered, the **Set Device Name** button will be grayed out.

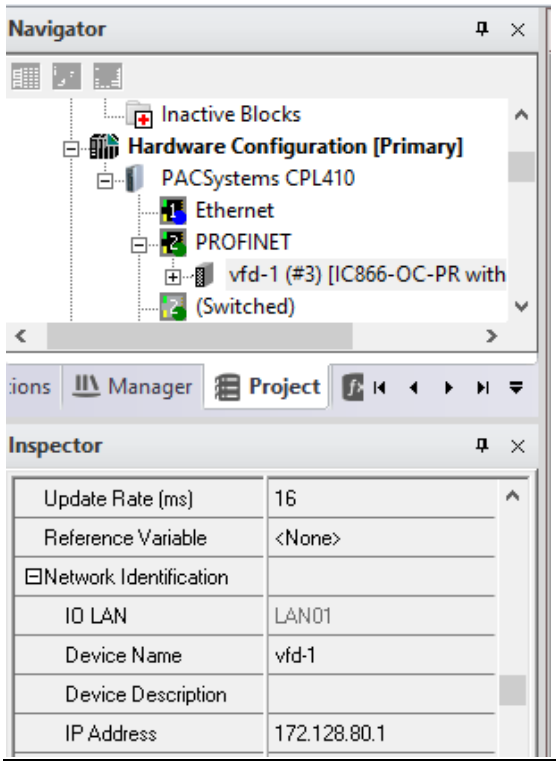
**Note***:* The Device Name must be unique on the PROFINET network on which the device will be connected.

It is not necessary to enter the IP Address and Subnet Mask as these are assigned automatically. Automatic assignment avoids the risk of introducing conflicting IP addresses which will disrupt the network. However, if you wish to assign a specific IP Address to the device, you may do so here.

**Note***:* The IP address must be within the IP address Auto-Assign range specified in the supervising PROFINET Controller PME Hardware Configuration.

The Device Name assigned to the device must also be entered into the PROFINET Network Configuration in PME's Hardware Configuration. *These two names must match.* To accomplish this, in the PME Navigator window choose the VFD in the PNC device tree and assign the Device Name (Figure 9).

**Figure 9: Assign Device Name at the PROFINET Controller**




If a fixed IP address is to be assigned to this device, enter it on the form shown in Figure 8.

If the device has been previously configured, and an incompatible subnet has been assigned as part of the IP address, use the **Reset Device** button (Figure 8) to reset the device to its factory default.

For additional information on setting up Device Names and IP addresses, refer to GFK-2571, *PACSystems RX3i & RSTi-EP PROFINET I/O Controller User Manual.*.

The default PROFINET Update Rate is 128 ms. If a different Update Rate is required that may be changed here as well.

**Note:** 16 mS is the fastest update rate supported by the VFD if Hot Standby Redundancy is enabled. Each drive is automatically assigned the required number of words in the Analog Input (%AI) (Figure 10) and Analog Output (%AQ) (Figure 11) tables of the supervising controller.

**Note:** There are two Analog Input tables. The starting references are automatically assigned to avoid any conflict. These assignments may be changed but *should not overlap* any other existing usages in the application. The reference address configuration is accessed by double-clicking the Input or Output slots under the VFD in the PME Navigator window. The data passed between the PROFINET controller and VFD (%AI, %AQ) is defined in GFK-3111 *PACMotion Variable Speed Drives User Manual*..

**Figure 10: Analog Input (%AI) Assignment**

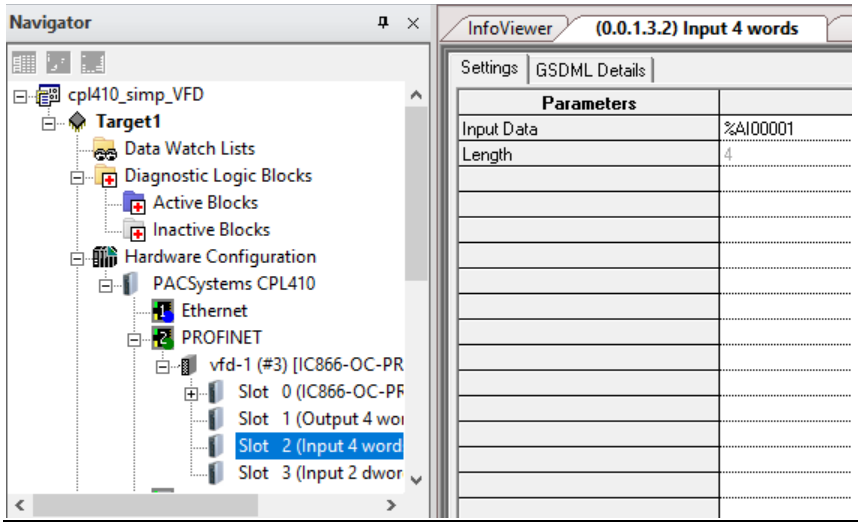
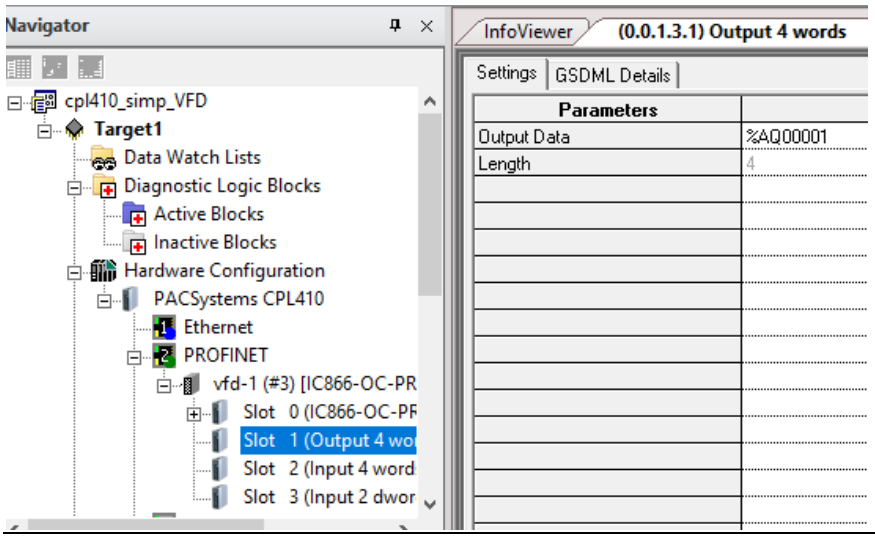



**Figure 11: Analog Output (%AQ) Assignment**



# 2.2 Hot Standby Redundancy

**Note:** If Hot Standby or Media Redundancy are not required, proceed to Section 3:*Commissioning using PACMotion VFD Studio*. Configuring Media Redundancy is described in 2.3 *Media Redundancy Configuration*.

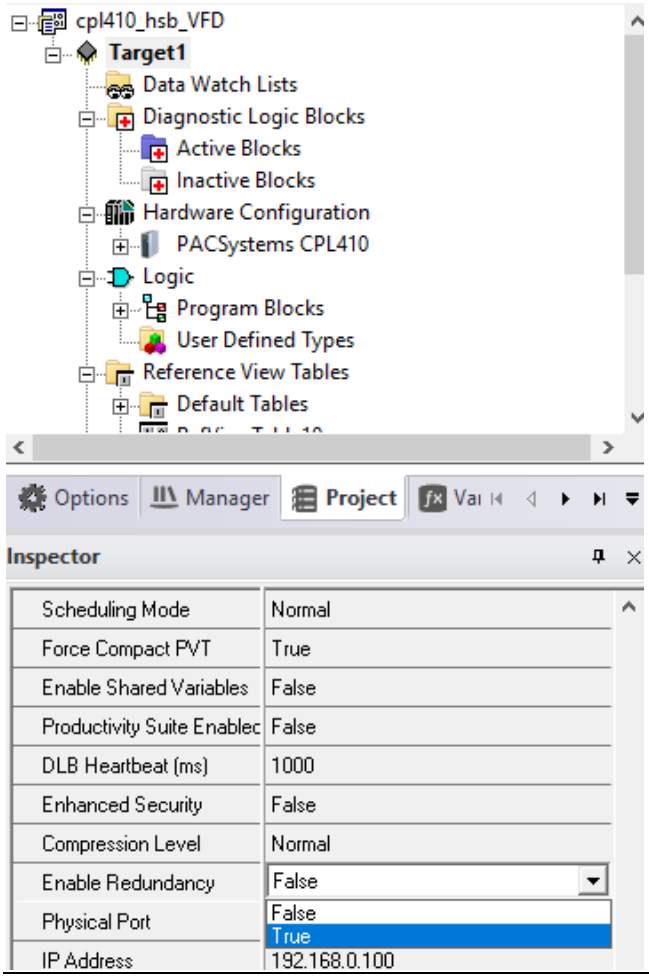
Hot Standby CPU Redundancy allows a critical application or process to continue operating should a failure occur in any single component.

Hot Standby Redundancy requires a secondary controller. In a rack-less system, the controllers stay synchronized and exchange data using the LAN 3 Ethernet ports.

### 1. Enable Redundancy

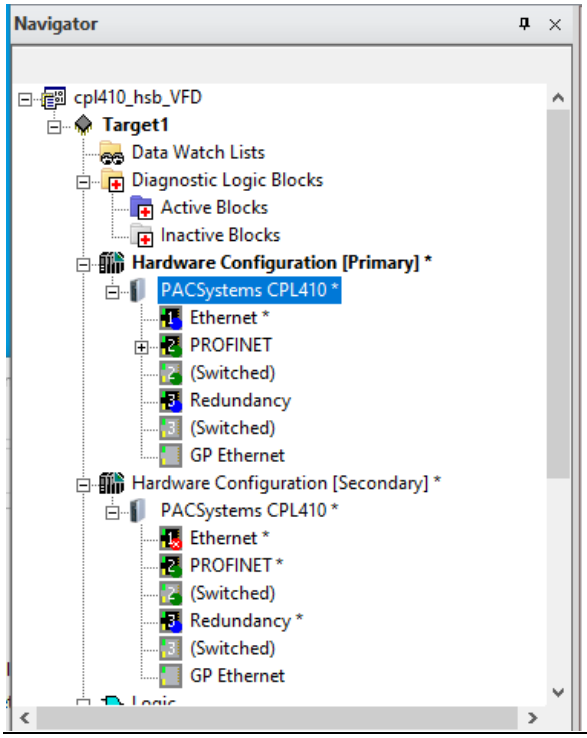
Working with the folder already created in the Simplex Configuration, enable Redundancy by selecting the folder top-level Target icon in the PME Navigator window, and in the Inspector window set the **Enable Redundancy** entry to **True** (Figure 12).

**Figure 12: Enable Redundant Configuration**



PME will duplicate the rack, labeling the original as **[Primary]** and the duplicate as **[Secondary]** (Figure 13).

**Figure 13: Redundant Hardware Configurations**

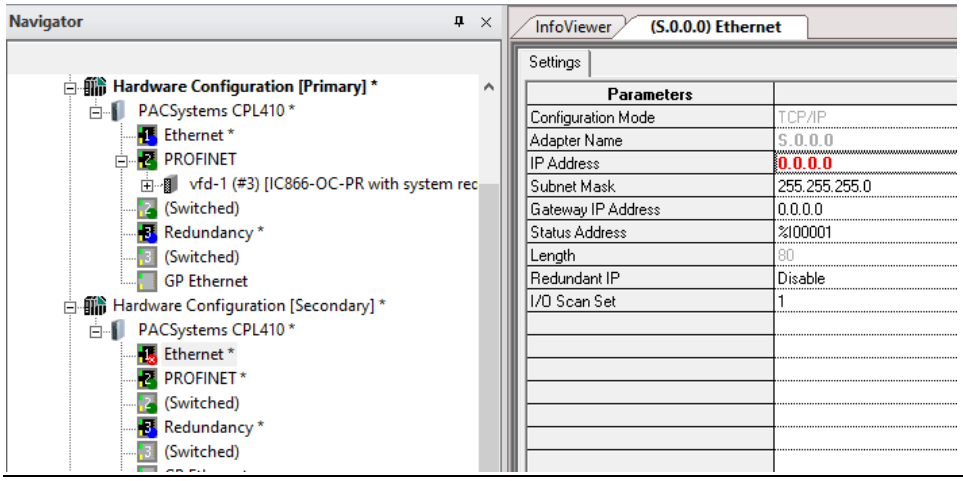



### 9. Assign Secondary IP Address

a) In the Secondary hardware configuration, expand the CPL410 and double-click the embedded Ethernet to open the Ethernet configuration page.

b) Enter the Secondary CPL410 Ethernet IP address (Figure 14).

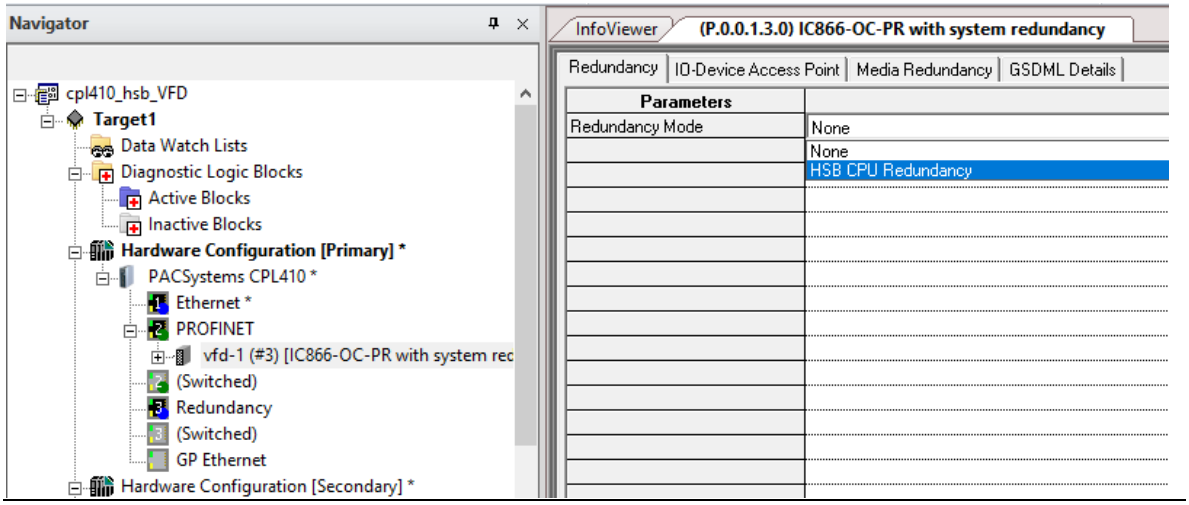
**Figure 14: Set Secondary IP Address**



### 2. Enable Hot Standby

In the Navigator window Primary hardware configuration, expand the embedded PROFINET Controller and double-click the VFD to access the top-level configuration. On the Redundancy tab change the Redundancy Mode from **None** to **HSB CPU Redundancy** (Figure 15). Repeat this step for all VFDs on the network.

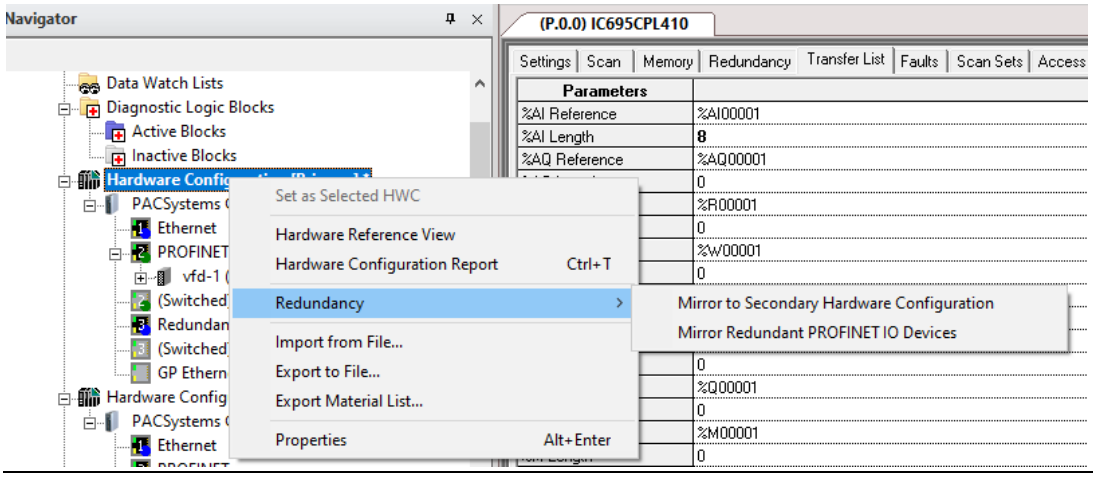
**Figure 15: Enable Hot Standby Redundancy**




### 3. Mirror the Configuration

Right-click on **Hardware Configuration [Primary]**. In the pop-up menu select **Redundancy > Mirror to Secondary Hardware Configuration** to duplicate changes in the Secondary hardware configuration (Figure 16).

**Figure 16: Mirror Configuration to Secondary**




If the configuration for Media Redundancy is not required, proceed to Section 3: *Commissioning using PACMotion VFD Studio.*

# 2.3 Media Redundancy Configuration

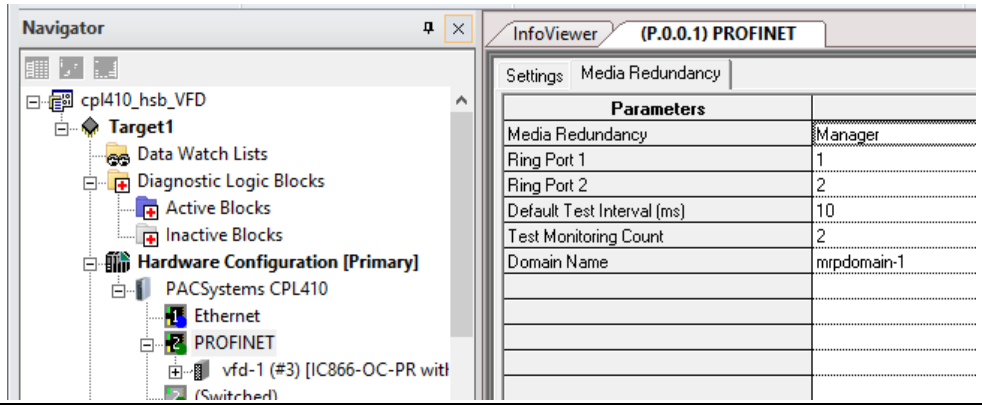
Media Redundancy allows devices so configured to have dual network connections, providing an alternate connection if one of the network connections is damaged. Media Redundancy may be configured in a Simplex or Hot Standby Redundancy system. This guide assumes Hot Standby Redundancy has been configured. Unless otherwise stated, the edits described below should be made to the Primary hardware configuration. When complete, they will be mirrored to the Secondary HWC if Hot Standby Redundancy has been configured.

Media Redundancy requires that the PROFINET network be wired as a ring so that the network controller(s) has two data paths to each device. **The ring must remain open until all devices on the ring have been configured for Media Redundancy.** This can be accomplished by leaving one leg of the ring disconnected at the PROFINET Controller until Hardware Configuration has been successfully downloaded to the Controller(s).

### 1. Configure the Ring Manager

Open the PROFINET Controller configuration, select the Media Redundancy tab, and change the Media Redundancy setting to **Manager** (Figure 17). This change will expose several additional parameters. Set Default Test Interval (ms) to 10 and Test Monitoring Count to 2.

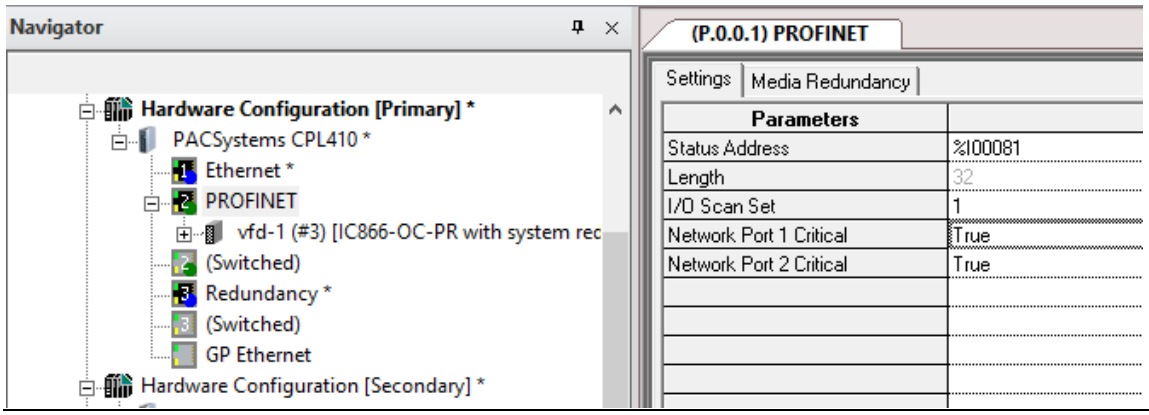
**Figure 17: Configuring the Ring Manager**



### 2. Enable Critical Ports

In a Hot Standby system, enabling the PROFINET Controller network ports as **Critical** will cause an automatic CPU role switch when the last critical port is disconnected from the network. This functionality is *not required* for proper Hot Standby or Media Redundancy operation but may be useful for some applications. To enable, double-click the PROFINET Controller, and on the **Settings** tab of the Controller, configuration set both **Network Port 1 and 2 Critical** to **True** (Figure 18).

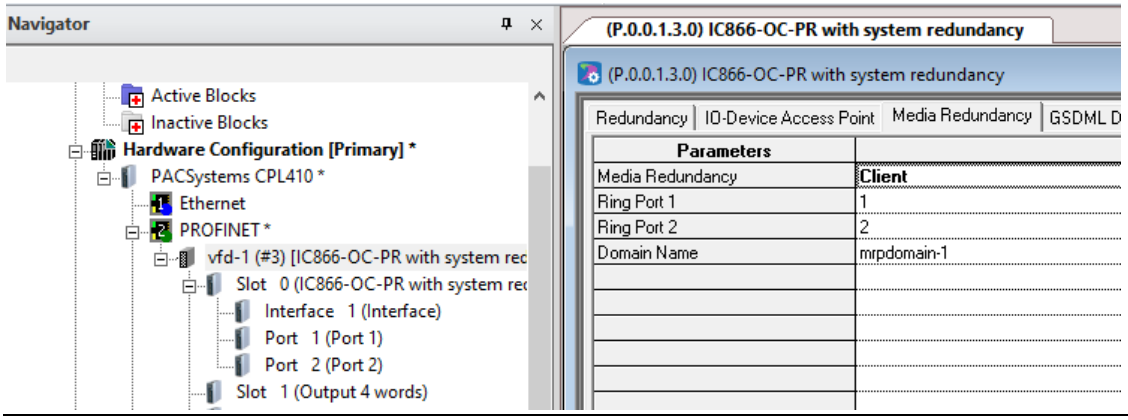
**Figure 18: Enable Critical Ports on PROFINET Controller**




### 3. Configure Ring Clients

Next, open the attached VFD's configuration, and on the Media Redundancy tab set Media Redundancy to **Client** (Figure 19).

**Figure 19: Configuring a Ring Client**

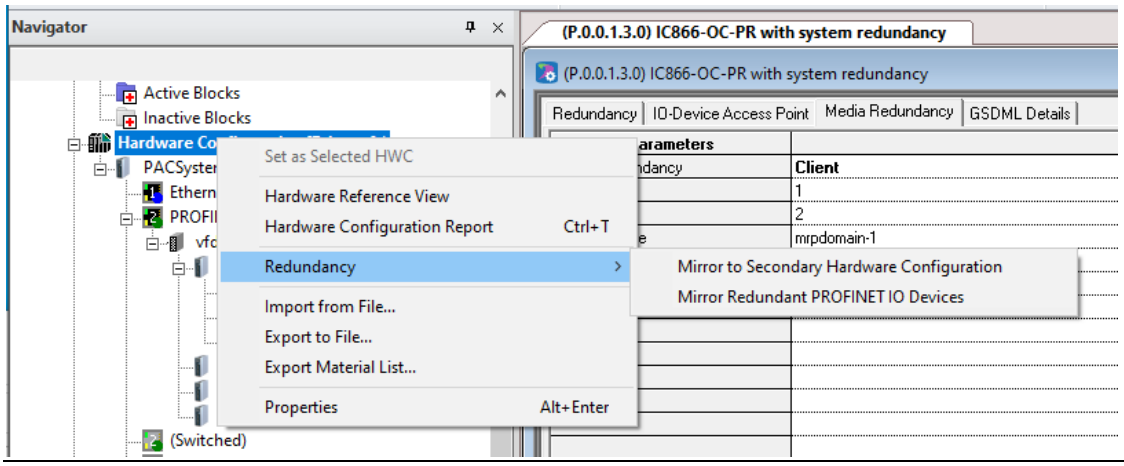



**Note**: If there are any other devices on the network set them as Clients as well.

### 4. Mirror the Configuration

If Hot Standby Redundancy is configured, these changes must be mirrored to the Secondary. In the PME Navigator window right-click on Hardware Configuration [Primary] and select **Redundancy > Mirror to Secondary Hardware Configuration** (Figure 20). This will duplicate the hardware configuration and PROFINET device changes into the Secondary configuration.

**Figure 20: Mirror MRP Settings**



# Section 3: Commissioning using PACMotion VFD Studio

Certain parameters in the drive need to be set up before the operation. This is most easily accomplished with PACMotion VFD Studio, a Utility launched from PAC Machine Edition.

### 1. Launch VFD Studio

The PACMotion VFD Studio (Figure 21) is launched from the Utility menu ribbon in PME.

**Figure 21: VFD Tool Button**

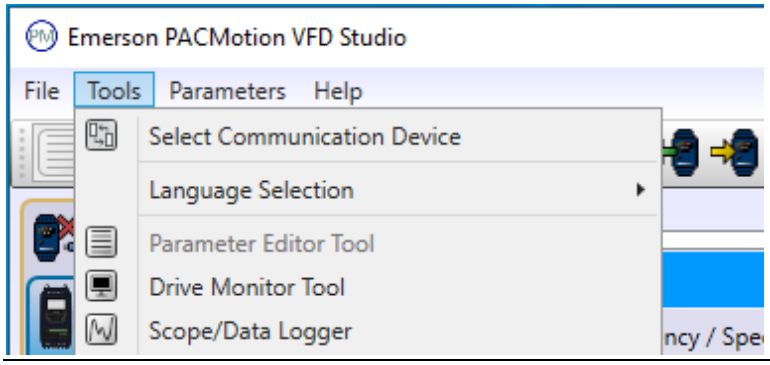

### 2. Connect VFD Studio to the Drive

The PC running PACMotion VFD Studio may be connected to the drive to be commissioned using the USB to RS-485 adaptor (IC866-CABL-USB485). Install the adapter before proceeding.

### 3. Configure Serial Communication

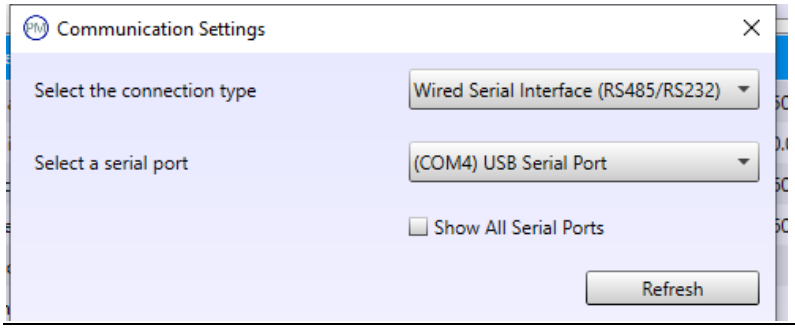
In VFD Studio, use the Tools drop-down menu and click **Select Communication Device** (Figure 22).

**Figure 22: Launching Communication Settings**



The Communications Settings pop-up allow the user to configure the USB serial adapter (Figure 23). After configuring the communications settings, click the **Connect** button.

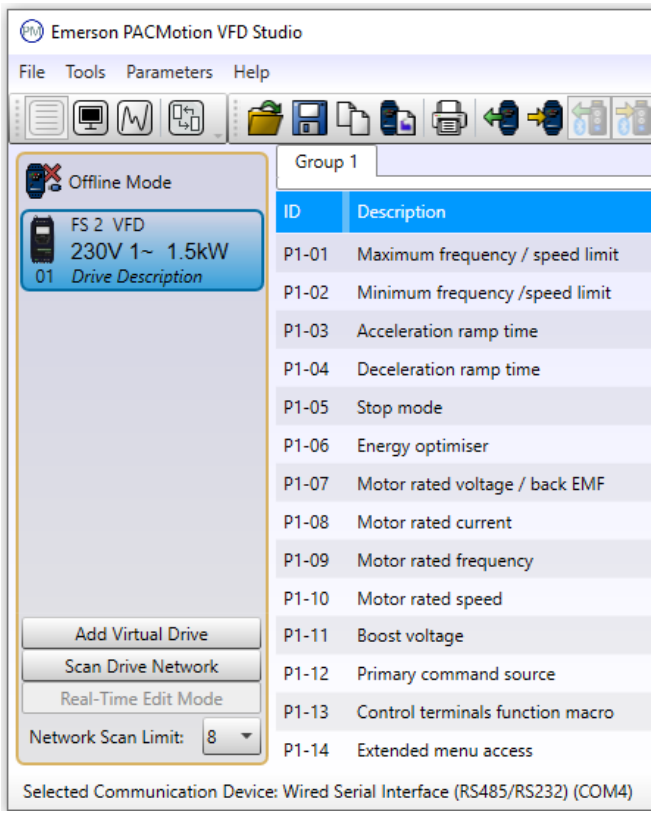
**Figure 23:Communication Settings**




### 4. Scan the Drive

Click the **Scan Drive Network** button to detect the Drive and upload its parameters into the tool (Figure 24).

**Figure 24: Scan Network Drive From VFD Studio**



## 5. Configuration for PROFINET Control

After scanning the existing parameter settings from the drive, the user can modify them as needed during the subsequent steps. Once satisfied, the parameters can be written back to the drive. If this is a new drive, then all parameters should be default values. Any non-default value is displayed, highlighted in blue (Figure 25). Many parameters will be specific to the motor and region where the drive is being used. (For more information on drive parameters, refer to GFK-3111, *PACMotion Variable Speed Drives User Manual*.) Once the motor and electrical parameters have been set, parameter **P1-12 - Primary Command Source** should be set to **4: Fieldbus Control**, which will enable PROFINET control of the drive.

**Parameter P1-13 - Control Terminals Function Macro** should be set to **1** for this example. Digital Input 1 must be **On** for the motor to run. This can be accomplished by wiring terminal 1 directly to terminal 2. Figure 26 shows an example of more complete wiring.

## ⚠ WARNING

**DANGER TO PERSONNEL AND EQUIPMENT**

It is imperative P1-07 Motor Rated Voltage, P1-08 Motor Rated Current, and P1-09 Motor Rated Frequency be set correctly for the attached motor before any attempt to operate the motor.

**Figure 25: Example VFD Studio Drive Settings**

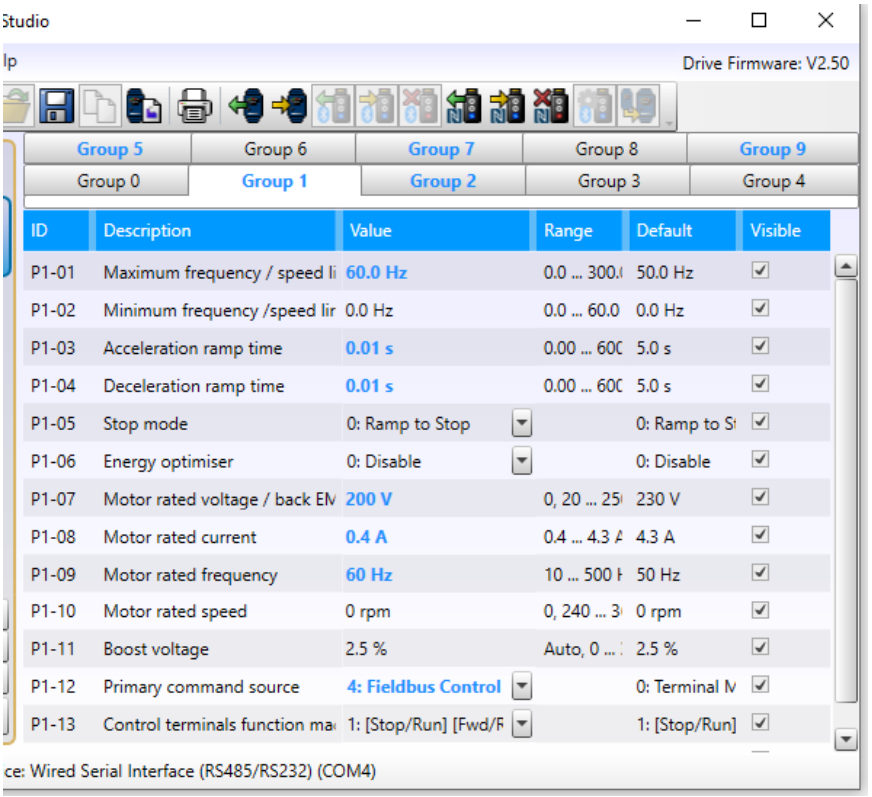
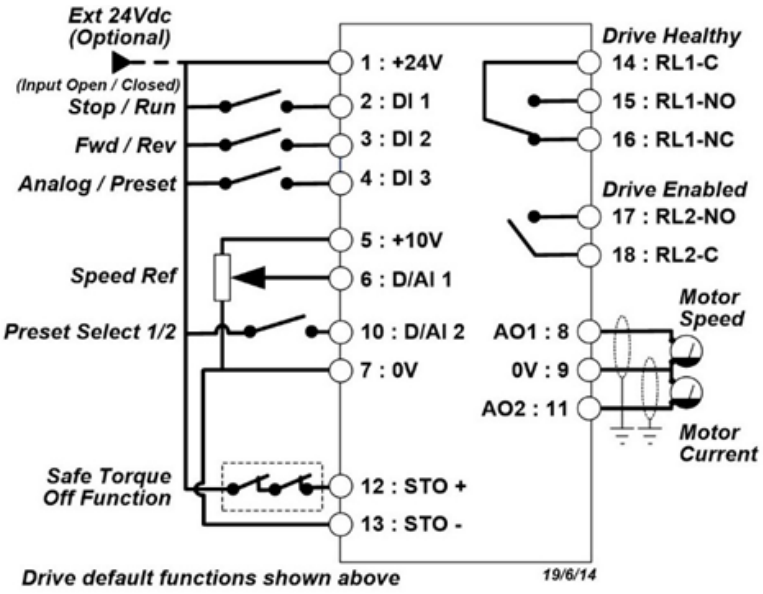


**Figure 26: Example Terminal Connections**

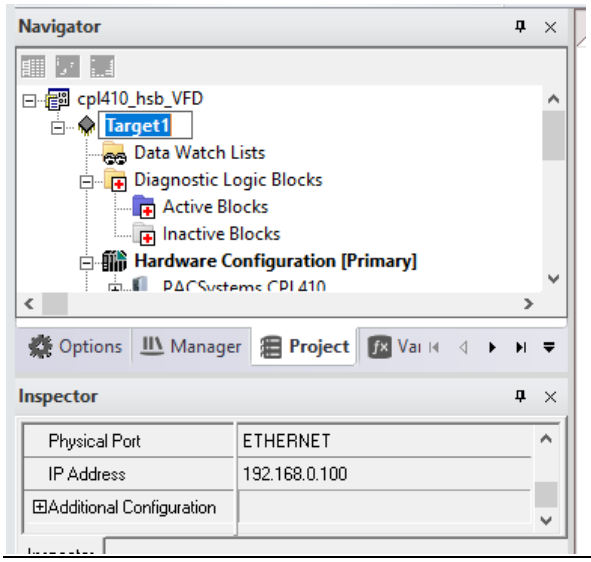


# Section 4: Going Online with PME

After completing the above configuration and commissioning procedures in VFD Studio, you should be ready to go online with PME and test your setup.

In PME, verify that the Target IP address(es) are correct by clicking on the top-level Target icon in the Navigator window, and checking the Physical Port and IP Address fields in the Inspector window (Figure 27).

**Figure 27: Verifying Target IP Address**




The Physical Port should be set to **Ethernet** and the IP Address should match the configured Ethernet interface.

If Hot Standby Redundancy has been enabled, set the other hardware configuration as the Active configuration, and verify that IP address too.

## 4.1 Store the Configuration

To store a hardware configuration to each controller, the connection IP Address must be set for each. Right-click on the Primary hardware configuration. If it is not already set as the selected hardware configuration, do so now by clicking on **Set as Selected HWC** on the pop-up menu. Then click on the **Target** node at the top of the folder tree. In the Inspector window, verify that the IP address is correct. Select the secondary hardware configuration and verify it is also correct for that controller.

Storing the configuration is the same as storing configuration for any of the PACSystems products with PROFINET devices. If Hot Standby Redundancy has been enabled, the configuration should be stored to both targets before putting the Controllers in Run mode. If Media Redundancy has been configured, you may now close the Ethernet ring.

Check the IO Fault table to ensure there is no Loss of Device reported for the VFD.

# 4.2 Run the Motor

**⚠ WARNING**

Before attempting to operate the motor, it is imperative P1-07 Motor Rated Voltage, P1-08 Motor Rated Current, and P1-09 Motor Rated Frequency be set correctly for the attached motor. Refer to *PACMotion Variable Frequency Drives User Manual,* GFK-3042 for additional information.

If all of the above steps have been successful, a simple test can be performed to operate the motor. Put the controller in Run Mode and open the Analog Output Reference Table (Figure 28).

Assuming the VFDs %AQ data has been assigned to %AQ0001, enter **1** in %AQ0001 to enable the drive, and the desired frequency **x 10** (e.g. 25.0 Hz x 10 = 250) in %AQ0002 (Figure 29). The motor should start spinning.

When complete, stop the motor by setting both back to **0**.

**Figure 28: Open the Analog Output Table**

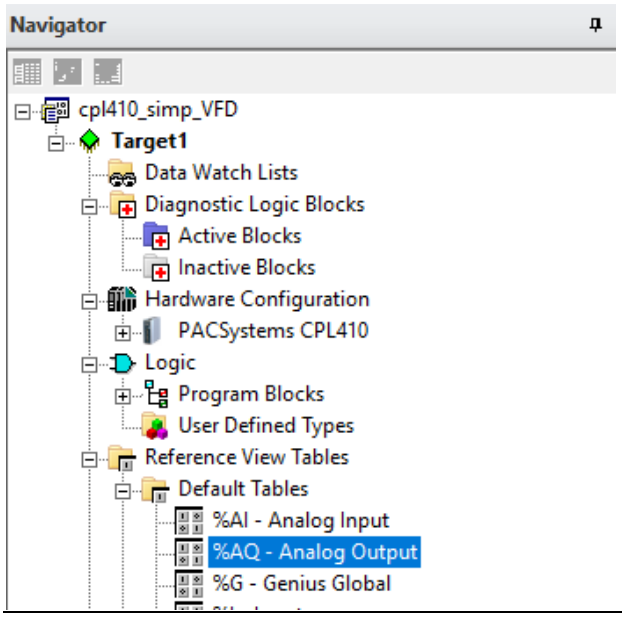
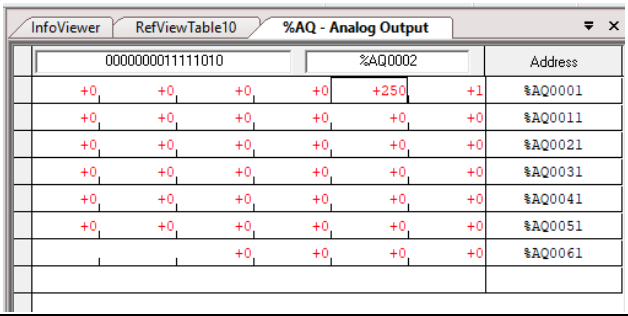



**Figure 29: Data to Operate the Motor**



# Section 5: Additional Information

| Documentation | Document Number |
|---|---|
| *PACMotion VFD Application Note (Syllabus)* | GFK-3167 |
| *PACMotion VFD AC Variable Speed Drive User Guide* | GFK-3111 |
| *PACMotion VFD AC Variable Speed Drive Advanced User Guide* | GFK-3112 |
| *PAC Logic Developer-PLC Getting Started* | GFK-1918 |
| *PACSystems RX3i and RSTi-EP CPU Reference Manual* | GFK-2222 |
| *PACSystems RX3i and RSTi-EP TCP/IP Ethernet Communications User's Manual* | GFK-2224 |
| *PACSystems Hot Standby CPU Redundancy User Manual* | GFK-2308 |
| *PACSystems RX3i System Manual* | GFK-2314 |
| *PACSystems RXi, RX3i, and RSTi-EP Controller Secure Deployment Guide* | GFK-2830 |
| *PACSystems RX3i PROFINET IO Controller User Manual* | GFK-2571 |
| *PACMotion VFD PNSR Syllabus* | GFK-3224 |

User manuals, product updates, and other information sources are available on the Support website. Links are provided at the end of this document.

# General Contact Information

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

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

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+39-0362-228-5555 (from Italy - if toll-free 800 option is unavailable or dialing from a mobile telephone)

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

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