Position Control Connected Components Building Block

Quick Start

ALLEN-BRADLEY • ROCKWELL SOFTWARE

Rockwell Automation

Important User Information

Solid state equipment has operational characteristics differing from those of electromechanical equipment. Safety Guidelines for the Application, Installation and Maintenance of Solid State Controls (publication SGI-1.1 available from your local Rockwell Automation sales office or online at http://literature.rockwellautomation.com) describes some important differences between solid state equipment and hard-wired electromechanical devices. Because of this difference, and also because of the wide variety of uses for solid state equipment, all persons responsible for applying this equipment must satisfy themselves that each intended application of this equipment is acceptable.

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The examples and diagrams in this manual are included solely for illustrative purposes. Because of the many variables and requirements associated with any particular installation, Rockwell Automation, Inc. cannot assume responsibility or liability for actual use based on the examples and diagrams.

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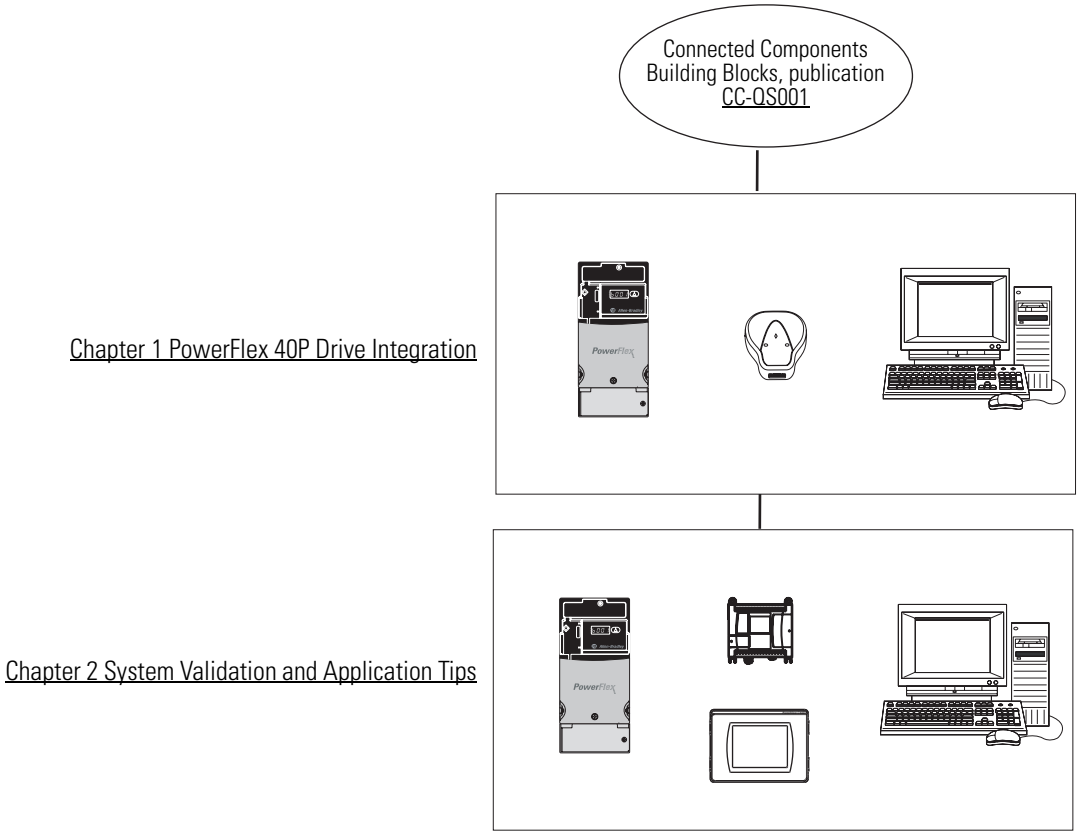
Throughout this manual, when necessary, we use notes to make you aware of safety considerations.

WARNING 	Identifies information about practices or circumstances that can cause an explosion in a hazardous environment, which may lead to personal injury or death, property damage, or economic loss.
IMPORTANT	Identifies information that is critical for successful application and understanding of the product.
ATTENTION 	Identifies information about practices or circumstances that can lead to personal injury or death, property damage, or economic loss. Attentions help you identify a hazard, avoid a hazard, and recognize the consequence
SHOCK HAZARD 	Labels may be on or inside the equipment, for example, a drive or motor, to alert people that dangerous voltage may be present.
BURN HAZARD 	Labels may be on or inside the equipment, for example, a drive or motor, to alert people that surfaces may reach dangerous temperatures.

Connected Components Building Block Outline

Follow the path below to complete your connected components building block.



About This Publication

This quick start is designed to provide a way to implement a connected component for position control.

IMPORTANT Use the Position Control Connected Components Building Block Quick Start in conjunction with the Connected Components Building Blocks Quick Start, publication CC-QS001.

Refer to Additional Resources on page 9 for a listing of quick starts.

To assist in the design and installation of your system, application files and other information are provided on the Connected Components Building Blocks Overview CD, publication CC-QR001. The CD provides bills of materials (BOM), CAD drawings for panel layout and wiring, control programs, Human Machine Interface (HMI) screens, and more. With these tools and the built-in best-practices design, the system designer is free to focus on the design of their machine control and not on design overhead tasks.

The beginning of each chapter contains the following information. Read these sections carefully before beginning work in each chapter:

- **Before You Begin** - This section lists the steps that must be completed and decisions that must be made before starting that chapter. The chapters in this quick start do not have to be completed in the order in which they appear, but this section defines the minimum amount of preparation required before completing the current chapter.
- **What You Need** - This section lists the tools that are required to complete the steps in the current chapter. This includes, but is not limited to, hardware and software.
- **Follow These Steps** - This illustrates the steps in the current chapter and identifies which steps are required to complete the examples.

Conventions

Convention	Meaning	Example
Check or uncheck	To activate or deactivate a checkbox.	Check Disable Keying.
Click	Click the left mouse button once while the cursor is positioned on object or selection.	Click Browse.
Double-click	Click the left mouse button twice in quick succession while the cursor is positioned on object or selection.	Double-click the application icon.
Expand	Click the + to the left of a given item /folder to show its contents.	Expand 1768 Bus under I/O Configuration.
Right-click	Click the right mouse button once while the cursor is positioned on object or selection.	Right-click the 1768 Bus icon.
Select	Using the mouse to highlight a specific option.	Select the New Module folder.
Enter	What you type.	Enter your choice.
Press	Pressing a specific key on the keyboard.	Press Enter.
>	Use this symbol to indicate the sub-menu name.	Choose File>Menu>Options.

Additional Resources

Resource	Description
Connected Components Building Blocks Quick Start, publication CC-QS001	Provides information on how to select products and gain access to panel and wiring information.
Speed Control Connected Components Building Block Quick Start, publication CC-QS002	Provides information on installing and setting up the PowerFlex 40P drive parameters with the pre-configured RSLogix 500 program that controls your base system including application tips, as well as implementing the drive parameter backup and restore functionality.
Connected Components Building Blocks Overview CD, publication CC-QR001	Provides files for the Connected Components Building Blocks.
MicroLogix 1100 Programmable Controllers User Manual, publication 1763-UM001	Provides information on using the MicroLogix 1100 Programmable Controller.
MicroLogix 1400 Installation Instructions, publication 1766-IN001	Provides information on using the MicroLogix 1400 Programmable Controller.
PanelView Component Operator Terminals User Manual, publication 2711C-UM001	Provides information on using the PanelView Component HMI Terminals.
PowerFlex 4M User Manual, publication 22F-UM001	Provides information on installing the PowerFlex 4M Adjustable Frequency AC Drive including wiring and parameter setup.
PowerFlex 4 User Manual, publication 22A-UM001	Provides information on installing the PowerFlex 4 Adjustable Frequency AC Drive including wiring and parameter setup.
PowerFlex 40 User Manual, publication 22B-UM001	Provides information on installing the PowerFlex 40 Adjustable Frequency AC Drive including wiring and parameter setup.
PowerFlex 40P User Manual, publication 22D-UM001	Provides information on installing the PowerFlex 40P Adjustable Frequency AC Drive including wiring and parameter setup.
PowerFlex 400 User Manual, publication 22C-UM001	Provides information on installing the PowerFlex 400 Adjustable Frequency AC Drive including wiring and parameter setup.
http://www.ab.com	Provides access to the Allen-Bradley website.
http://rockwellautomation.com/knowledgebase	Provides access to self-service support.
http://rockwellautomation.com/components/ccbb	Provides access to the Connected Components website.
http://www.ab.com/drives/driveexplorer/index/html	Provides access to DriveExplorerLite software.

PowerFlex 40P Drive Integration

Introduction

This chapter provides the PowerFlex 40P drive with simple-position logic-control created in the StepLogic Setup Position Wizard within DriveExplorer software.

You will download a pre-configured parameter file to the drives necessary for the MicroLogix controller to communicate with them.

In addition, this application example simulates a smart position sequence where position, logic, and dwell time at position are dependent on the operations being performed on the motor shaft.

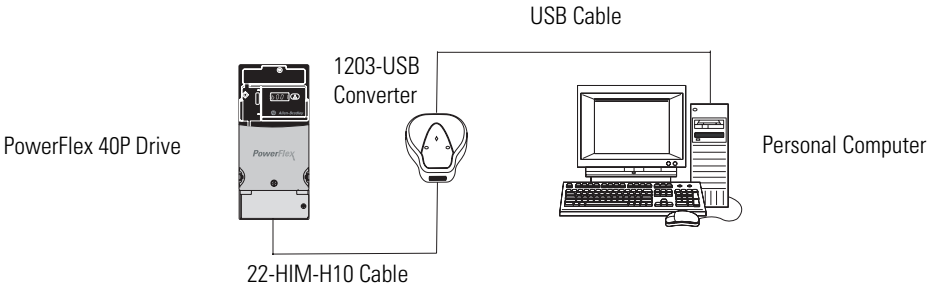
Before You Begin

- Review the Connected Components Building Blocks Quick Start, publication CC-QS001, verifying that you have completed hardware design and installation as well as software installation.
- Apply power to your drive.

What You Need

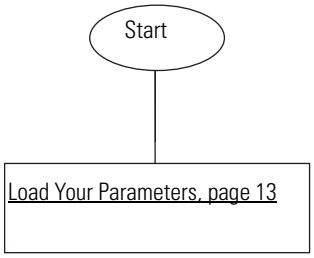
- PowerFlex 40P drive
- Personal computer
- DriveExplorer Full software installed
- 1203-USB converter
- SimplePosition.csf file available from the Connected Components Building Blocks Overview CD, publication CC-QR001
- Connected Components Building Blocks Overview CD, publication CC-QR001

PowerFlex 40P Drive Integration



Follow This Step

Follow this step to adjust your drive parameters.



Load Your Parameters

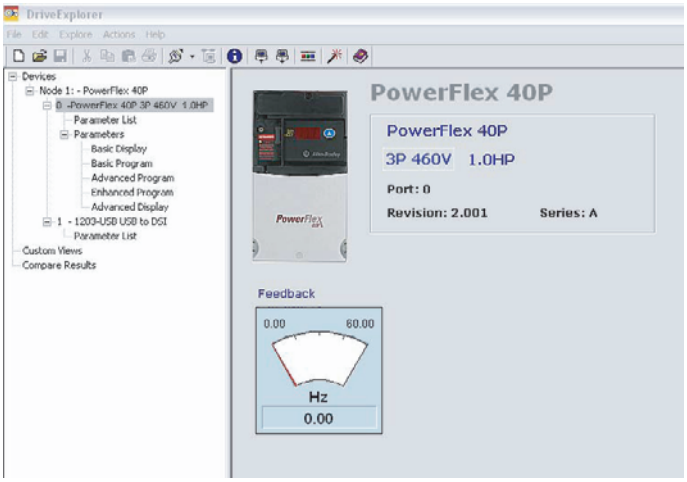
Follow these steps to load your drive parameters.

1. Disconnect the RJ45 cable with the RJ45 connector from the PowerFlex 40P drive.
2. Connect the personal computer to the drive by using the 1203-USB module.
3. Launch DriveExplorer software and click OK.
   a. From the Explore menu, choose Configure Communications.
   b. Choose Serial>Comm *x*>Baud 11500>OK.

      The *x* represents the name of your USB comm port.

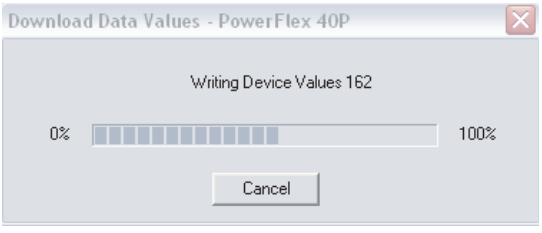
   c. Choose Explore>Serial>Point-to-Point.

Once you are connected, the following dialog box appears.



4. Download the default parameters set from the file provided on the Connected Components Building Blocks Overview CD, publication CC-QR001.
   a. From the Actions menu, choose Download Saved File...
   b. Browse to file on your CD drive and click Open.

      The following dialog box appears.



5. Double-click parameter A127 (Autotune).
   a. From the Rotate Tune menu, click OK.
   b. From the Actions menu, choose Control Bar.
   c. Check the box and click OK.
   d. Click Start.

ATTENTION

Stay clear of the motor shaft.

Failure to observe this safety precaution could result in personal injury or damage to equipment.

The motor ramps up to 45 Hz and back down to 0 Hz before stopping.

   e. Verify that A127 has returned to 'Ready/Idle'.

IMPORTANT You must autotune each drive/motor combination for optimal performance.

   f. Save all the configuration changes to your personal computer for further reference.

6. Disconnect the 1203-USB device from the PowerFlex 40P drive.

7. Connect the AK-U0-RJ45-TB2 connector and cable to the 40P drive.

8. Repeat the previous steps for each drive up to 6 drives, incrementing A104 (Comm Node Addr) by 1.

9. Cycle power or reset the drives.

Additional Resources

Refer to page 9 for a listing of product and information resources.

System Validation and Application Tips

Introduction

In this chapter, you validate that communication is occurring as intended between the MicroLogix controller and the PowerFlex drive, as well as between the MicroLogix controller and the PanelView terminal.

The operation of the Position Control sample screens is described, as well as the steps for merging in the drive Parameter Backup and Restore (PB&R) routine.

Before You Begin

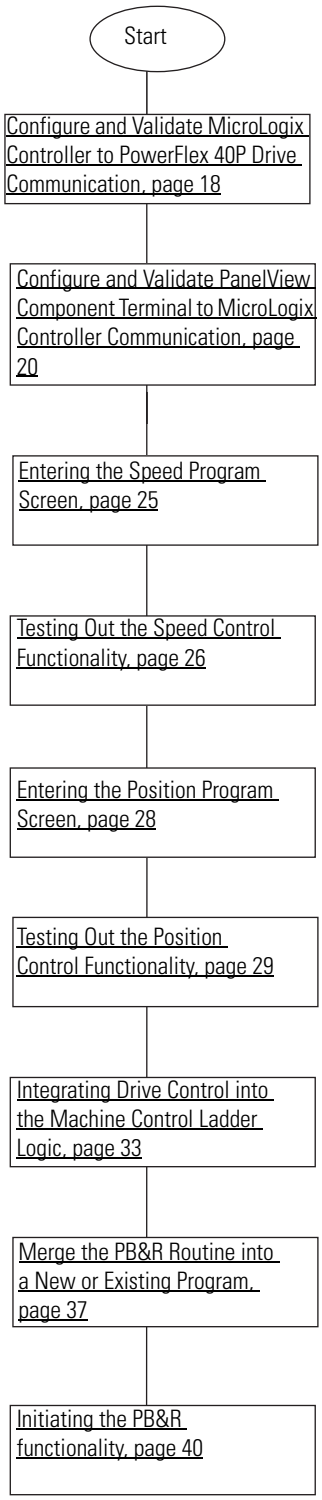
- Verify that all of the devices are connected per the Position Control CAD wiring diagram.
- Verify that the MicroLogix controller, PowerFlex drive, and PanelView terminal have power applied to them.
- Review the Connected Components Building Blocks Quick Start, publication CC-QS001, verifying that you have completed all of the steps in Chapter 3.
- Verify that you have completed all of the steps in Chapter 1 of this document.

What You Need

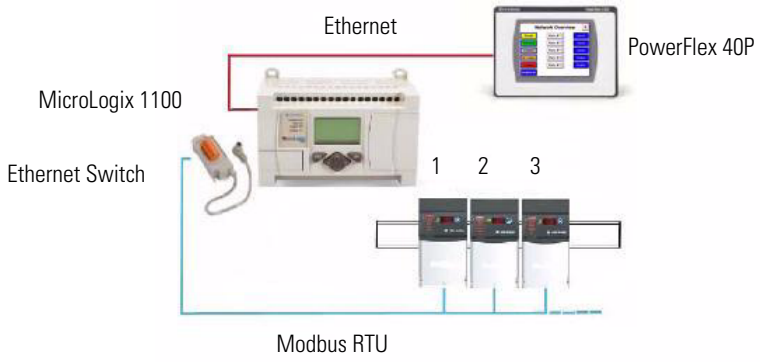
- PanelView Component TC600 terminal.
- PowerFlex 40P drive.
- MicroLogix 1100 or 1400 controller.
- Previously loaded software.
- Standalone Ethernet switch so that you can connect your personal computer to both the MicroLogix controller and PanelView terminal over an isolated Ethernet network.
- The Connected Components Building Blocks Overview CD, publication CC-QR001.

Follow These Steps

Follow these steps to verify that communication is occurring between your devices.



Multiple Drive Considerations



Item	Description
1	Axis 1
2	Axis 2
3	Axis 3 (with terminating resistor)

The MicroLogix Position Control routine example supports Modbus communication with 1...6 PowerFlex 40P drives without any modifications. Since a Modbus network supports communication with only one device at a time, the more drives on the network, the longer it takes to communicate with all of the drives. With the default communication settings, the MicroLogix controller takes approximately 100 ms to get a status update from each enabled drive because 2 separate read requests are required. Therefore, you must first confirm that the slower response times for multiple drives is acceptable (6 PowerFlex 40P drives would have a maximum response time of 800 ms).

Once the additional drives are installed and wired, make sure that the RS-485 network cable is daisy-chained from drive to drive, and that the terminating resistor is installed on the connector of the last drive in the daisy-chain (only). Once all of the drives are powered up, configure the drive parameters as described in Chapter 1, making sure that each drive has a unique node address from 1...6.

Follow these steps to add a PowerFlex 40P drive to your Modbus network.

1. Verify that all power has been removed.
2. Add any additional drives to the network.
3. Configure each as in Chapter 1.

4. Daisy chain the RJ45 connector from the previous initial drive.

   The termination resistor will move to the end drive.

5. Follow the steps outlined in Chapter 1 for downloading the example parameter set from the file provided on the CD.

6. Change the node value to increment by 1 in parameter A104.

Configure and Validate MicroLogix Controller to PowerFlex 40P Drive Communication

By default, the MicroLogix Position Control routine example is configured for communicating with 1 drive, set to node address 1. In this section, we recommend that communication be verified with one drive at a time. Therefore, the step-by-step procedures are listed for the first drive. You should perform the same steps for each subsequent drive.

Data table bits B240/1...B240/16 (may also be represented as bits B240:0/1...B240:0/16 or B240:1/0) are the drive-communication enable bits for node addresses 1...16. If a bit is turned on, then the MicroLogix controller attempts to communicate with the drive at the node address represented by that bit during each communication scan.

IMPORTANT For every drive that does not respond at an enabled node address, a 2 second delay is added into the overall communication scan. Therefore, for best system communication performance, it is important to enable only node addresses for drives that can successfully respond.

By default, only bit B240/1 (drive #1 enabled) is set. Bits B240/2...16 are cleared. You can change and verify these settings by either using the programming software or by using the built-in Bit Monitoring function of the MicroLogix LCD display.

Follow these steps to verify or change the settings.

1. Press ESC multiple times on the MicroLogix front panel until the LCD screen displays the top-level menu selections.

   - I/O Status
   - Monitoring
   - Mode Switch

2. Press the down arrow corner of the diamond key so that the screen selector is pointing at Monitoring and then press OK.

   The LCD screen displays the following menu selections:

   - Bit
   - Integer

3. Press OK to select Bit.

   B240:0/0=OFF appears, where 0/0 is flashing.

4. Press the up arrow corner of the diamond key to display B240:0/1 (with 0/1 flashing) and verify that the value is '=ON'.

   If not, you can change it from OFF to ON by pressing OK so that 'OFF' starts flashing. Press the up arrow corner of the diamond key to change OFF to ON and then press OK key to accept the change (the 0/1 in B240:0/1 will begin flashing again and '=ON' is constantly displayed).

5. Verify that bits B240:0/2...B240:1/0 are all OFF by pressing the up arrow corner of the diamond key to display the state of each bit.

Now you are ready to verify that communication is working between the MicroLogix controller and the drive at node address 1.

1. Make sure that the MicroLogix controller is in RUN mode by verifying that the RUN status indicator next to the LCD screen is ON (solid green).

   If not, you can change the controller to RUN mode by using either the programming software or through the Mode Switch function of the MicroLogix LCD display.

   The Speed Control routine should now be constantly communicating with the drive via communication channel 0.

2. Inspect the COMM0 status indicator in the top left corner of the MicroLogix LCD display and verify that it is flashing rapidly.

If it is flashing rapidly, then you are ready to test any additional drives by repeating the previous steps and enabling one additional drive at a time. If the COMM0 status indicator is flashing only once every couple of seconds, then the drive is not responding to the MicroLogix communication attempts. Go back and verify the wiring connections and the drive-communication parameter settings. If the COMM0 status indicator is always off, then either the MicroLogix controller is not in RUN mode or the Position Control routine was not properly downloaded to the controller.

Configure and Validate PanelView Component Terminal to MicroLogix Controller Communication

The 6-inch color touchscreen PanelView Component (PVc) terminal communicates with the MicroLogix controller over the Ethernet network. The PVc application reads from and writes to the data table of the MicroLogix controller. When the PVc application writes to the MicroLogix controller, the controller program detects the value change and writes that new value to the appropriate drive via the Modbus network. Since the controller program is continually updating status data from all of the enabled drives into its data table via Modbus reads, the PVc application is monitoring the latest drive status data.

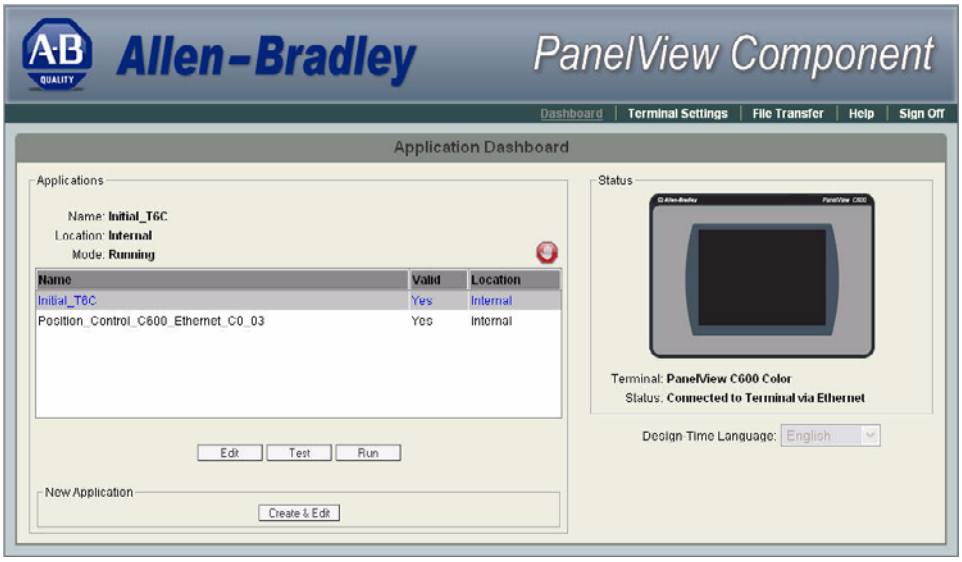
The sample CCBB Position Control programs for the controller and PVc terminal assumes the static IP address for the MicroLogix controller is 192.168.1.2.

If you are using a different IP address for the controller, then the first thing that you must do is modify the MicroLogix 1100 IP address in the PVc application.

Follow this procedure to modify the MicroLogix IP address in the PVc application.

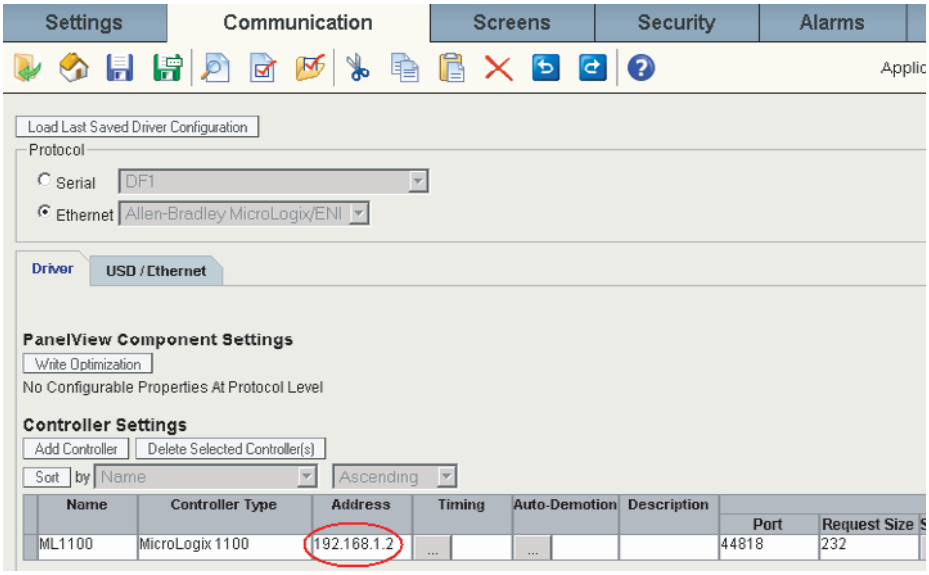
1. Connect to the PVc terminal with your Internet Explorer or Firefox web browser by entering the terminal IP address in the web browser location bar.

2. Select the application name in the PVc dashboard dialog box and then click Edit.



3. From the Edit dialog box, click the Communication tab.

The following dialog box appears.

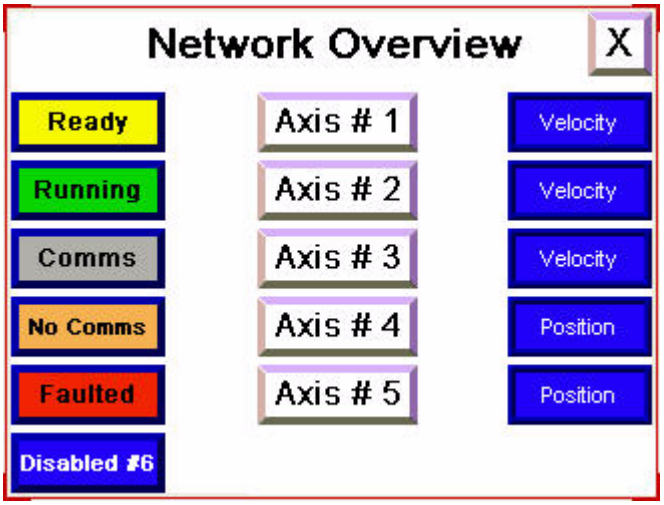


4. Once the MicroLogix IP address is correct and the PVc application is validated and saved, from the Application Dashboard dialog box, click Run to run the PVc Position Control application.

Network Overview

Since you have already verified that communication between the MicroLogix controller and the PowerFlex 40P drive is working, once the PVc application is running, any drives that are enabled should display as being 'Ready' on the Network Overview screen.

Drives Enabled

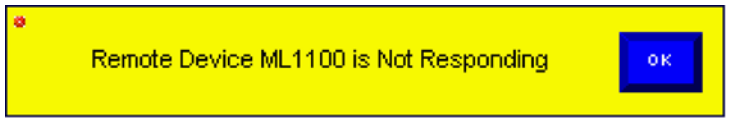


Ready - indicates that the drive is responding when the MicroLogix controller attempts to communicate with it and that the drive is ready to be started.

When the application is running, if an axis node address is disabled, its 'Axis # x' push button is invisible. The Network Overview screen has been preconfigured to support up to 6 drives (node addresses 1...6).

If, instead, you get a yellow banner message like the following, then the PVc application is still not able to communicate with the MicroLogix controller over the Ethernet network at the configured IP address.

Banner Message



Use RSLogix programming software and your web browser to verify that the MicroLogix controller's IP address configured for channel 1 matches the one in the PVc application. If your personal computer can communicate with both devices over the Ethernet network, then the PVc terminal should be able to communicate with the MicroLogix controller over the Ethernet network.

Once the PVc terminal is successfully communicating with the MicroLogix controller, you may observe a drive status other than Disabled or Ready. These are the other possibilities:

- Running - indicates that the drive has been started and is currently running.
- Comms - indicates that the drive is responding to communication and is only seen for a second before being ready.
- No comms - indicates that the drive is not responding to communication attempts from the MicroLogix controller.
- Faulted - indicates that the drive is currently faulted.

You can now enable or disable a drive node address from the Network Overview screen. Pressing Disabled next to a drive description enables that drive node address – the button description changes to one of the states listed above. Once a drive node address is enabled, pressing the button again disables that node address, so it once again displays Disabled.

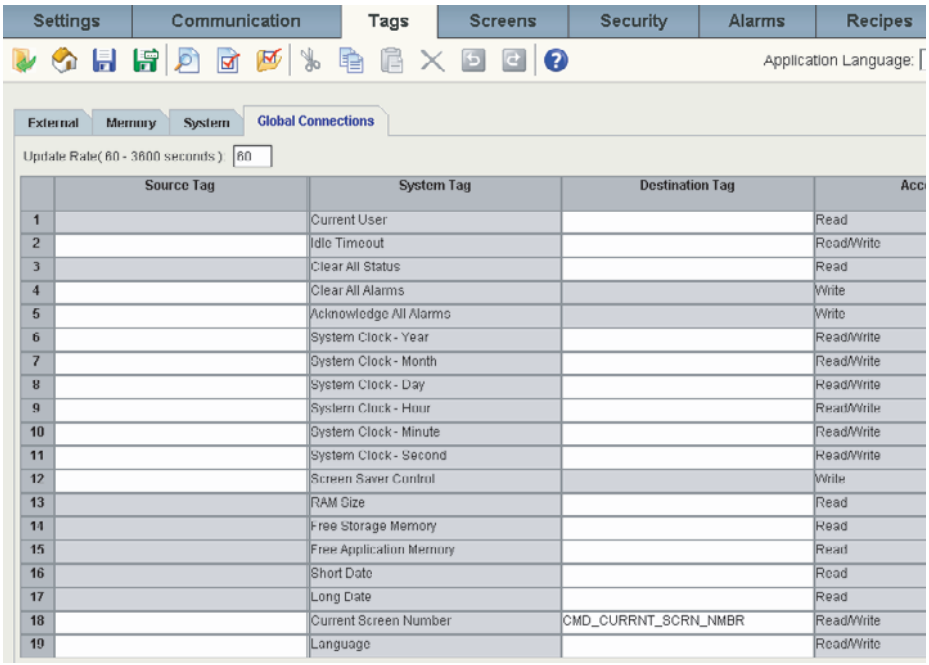
The  button in the top-right corner lets you to exit the application to the PVc Terminal Configuration dialog box.

IMPORTANT Before proceeding, make sure that all of the configured drives are enabled and communicating successfully and that all of the non-existing drives are disabled within the Network Overview screen.

TIP At this point, you can edit the Network Overview screen and delete the buttons and status displays that are associated with non-existing drives. You can also edit the drive descriptions (like Axis #1) to something more meaningful in the application (like Transfer Conveyor).

IMPORTANT Note that the screen numbering is very important. The drive-status screen numbers match the drive node address. With every screen change, the PVc terminal writes the screen number to the MicroLogix controller by entering a destination tag for the Current Screen Number under the Tags>Global Connections. CMD_CURRNT_SCRN_NMBR is a write-only tag defined for the MicroLogix controller.

Tag Definitions



	Source Tag	System Tag	Destination Tag	Acc
1		Current User		Read
2		Idle Timeout		Read/Write
3		Clear All Status		Read
4		Clear All Alarms		Write
5		Acknowledge All Alarms		Write
6		System Clock - Year		Read/Write
7		System Clock - Month		Read/Write
8		System Clock - Day		Read/Write
9		System Clock - Hour		Read/Write
10		System Clock - Minute		Read/Write
11		System Clock - Second		Read/Write
12		Screen Saver Control		Write
13		RAM Size		Read
14		Free Storage Memory		Read
15		Free Application Memory		Read
16		Short Date		Read
17		Long Date		Read
18		Current Screen Number	CMD_CURRNT_SCRN_NMBR	Read/Write
19		Language		Read/Write

Because all of the drive status screens use the same tag definitions, the MicroLogix controller copies the data for the appropriate drive based on the current screen number.

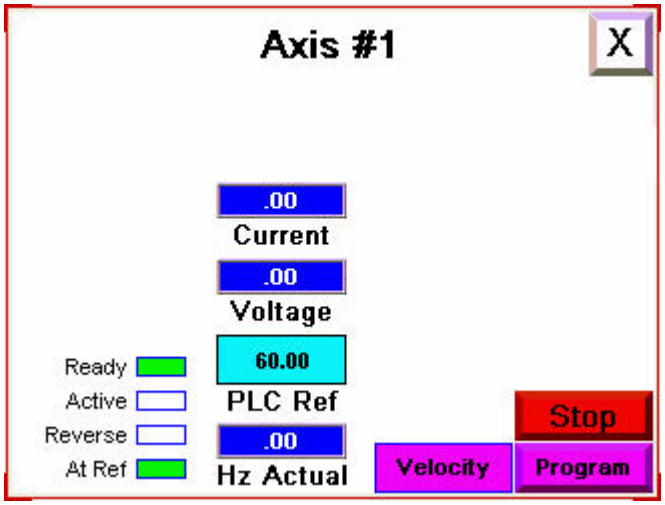
Entering the Speed Program Screen

Now that the PVc terminal is successfully communicating with the MicroLogix controller, you are ready to test the Control functionality.

Begin by pressing the Axis #1 button on the Network Overview screen for a drive that is enabled.

The Axis # x button is invisible for a drive until it is enabled by pressing Disabled #x. The screen that appears will be similar to this screen if in Velocity mode.

Axis #x Button Visible



On this screen, Axis #1 is a text object that you can change to reflect the name and description of Axis #1. When selecting Velocity or Position, upon entering the screen, you notice that the Program button is displayed in the lower right-hand corner. To access the write functions in this program, press Program to display Operator mode.

Notice that the button in the lower right-hand corner displays Program mode. This indicates that the screen is currently for monitoring only – the MicroLogix program is still in control of the drive. The only action that you can initiate from the screen while in Program mode is to stop the drive by pressing and holding Stop. If you want to take control of the drive away from the MicroLogix controller, press Program to change the screen to Operator mode. When you do, notice that the Start, Jog, Forward, and Reverse buttons become visible.

The 

button in the top-right corner takes you back to the Network Overview screen. It is only visible in Program mode.

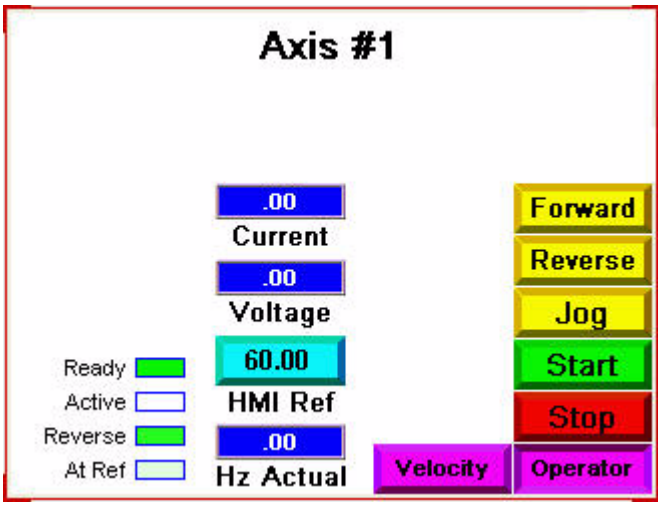
In this mode, all user functions are removed except Stop. Also, PLC Ref is status only when the screen is changed to Operator mode. PLC Ref changes to a programmable HMI Ref interface.

Testing Out the Speed Control Functionality

The box in the second column from the right indicates the present state of the drive. Entering the Velocity or Position dialog boxes does not put the drive into that mode.

Instead press Velocity or Position.

Present State of the Device



When you do this, a Stop is executed.

The indicators on the left-hand side show whether the drive is Ready to run (not faulted), Active (running), whether the direction is Forward or Reverse, and whether the drive is running at the reference frequency (At Ref).

The numeric displays in the middle show the Output Current in Amps, the Output Voltage in Volts, the reference frequency in Hertz, and the actual frequency in Hertz. Although the drive provides these values to the MicroLogix controller as integer values, the PLC program performs the appropriate division and stores the values as floating point/real values, so that the PanelView terminal can read and display them just as they are displayed on the built-in drive displays.

The HMI Ref reference frequency display is also a numeric entry button. Refer to Adjust the Speed, page 28. When you press this button, a numeric entry keypad is displayed that lets you enter a new reference frequency. Again, this value is accepted only by the MicroLogix controller if the screen is in Operator mode and the drive is set to velocity.

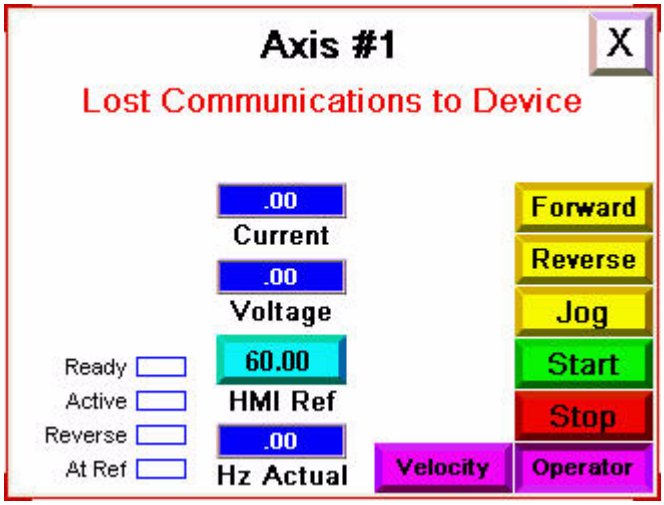
Your first control action to test while the drive stopped is Forward and Reverse. As you press one button and then the other, verify via the built-in display that the drive is switching between forward and reverse as indicated by a status indicator. If the drive is not switching between forward and reverse, go back to the beginning of this chapter and verify the MicroLogix communication to this drive.

Once you have verified Forward and Reverse, and with the motor disconnected from the load (open shaft), test the Jog function by pressing and holding Jog. As long as you continue pressing Jog, the drive should accelerate up to the configured Jog frequency. As soon as you release Jog, the drive should decelerate back to stop.

When you press Start, the drive should accelerate up to the reference frequency displayed as Hz Ref. Now if you press Hz Ref and enter a new reference frequency, the MicroLogix controller accepts and forwards the new reference frequency to the drive. The Hz Ref display updates to the new value entered.

Unplug the RJ45 network connection to the drive and verify that the Lost Communications to Device message is displayed.

Lost Communication to Device



Plug the RJ45 connector back in and the Lost Communications to Device message disappears.

Notice that two new buttons appear. The white button displays the flashing fault code 81 and a brief description. For diagnostic information on this fault, press this white button and you go to the Fault Type, Description, and Action dialog box. See the Fault Look-up Display section for more information.

Push the CLR Fault button.

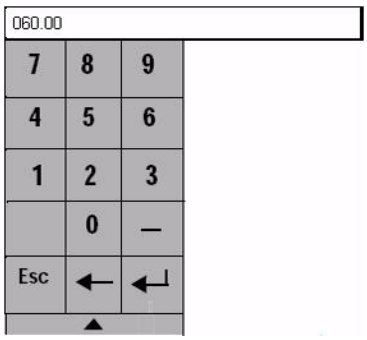
Adjust the Speed

Follow this procedure to adjust the relative speed of your positioning system while in Velocity mode.

1. Press HMI Ref.

   The following keypad appears.

2. Enter the new speed value and press Enter.



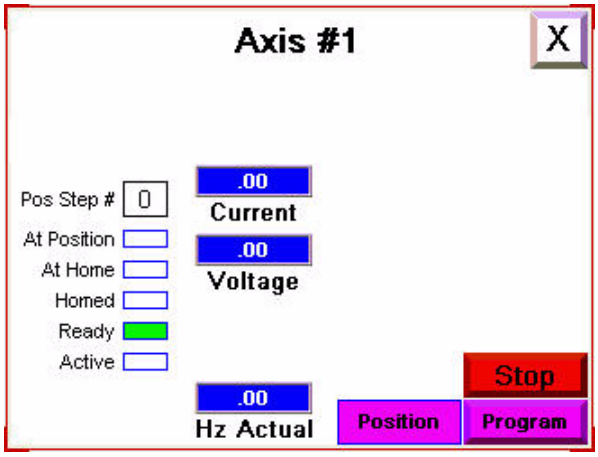
The keypad closes and the motor speed is updated with the new value.

Entering the Position Program Screen

Begin by pressing the 'Axis #' button on the Network Overview screen for a drive that is enabled and in Position mode. Recall that the 'Axis #' button is invisible for a drive until it is enabled by pressing the 'Disabled #' button. The screen that appears is similar to the following.

The Axis # x button is invisible for a drive until it is enabled by pressing Disabled #x. The screen that appears will be similar to this screen. If not, Axis is in Position mode. Press program to enter Operator mode. Press Velocity to enter Position mode. Press Operator again to be in Program mode.

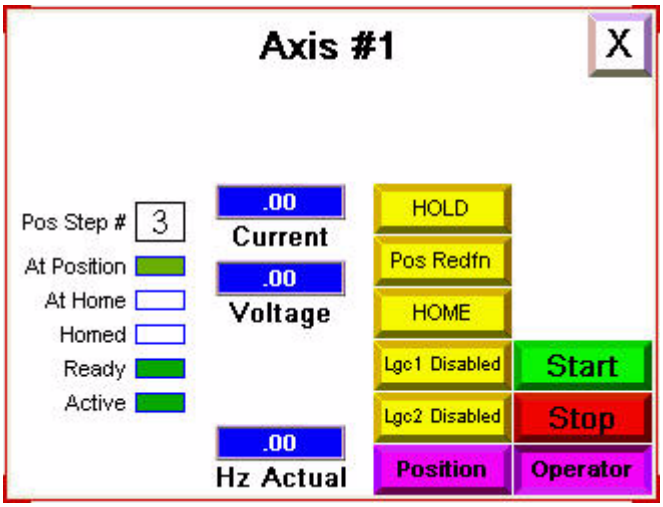
Axis #x Button Visible



This screen displays the current status of your PLC program. If it is running, you see current, voltage, and drive speed. You also see Position Step number and an indication of drive and position state.

Testing Out the Position Control Functionality

This screen lets you Start, Stop, Hold, Home, Position, Redefine, and enable Logic 1 and Logic 2. Pos Step provides the status of the current position step.



Start Your Position Control Example

Follow these steps to start your Position Control example using SimplePosition.csf downloaded to the drive.

1. From the Position Operator screen, the drive must be set to Position mode via the HMI screen.
2. Press Pos Redfn.

   This marks the new starting point.
3. Press Start.

   The drive will step through states 0...5 and repeat.

4. Press Lgc1.

   The Pos Step jumps to step 6.

5. Press Lgc2 within 5 seconds of pressing Lgc1, the drive stops, otherwise it goes to step 0 and repeats.

The Lgc1 and Lgc2 buttons are maintained functions. You must return them to a logic 0 state by pressing them a second time.

Hold and Restart Phase-state Actions

Follow these steps to hold (pause) your position system and then restart the system.

1. Press Start.
2. Press Hold.

   The button displays HOLDING while flashing. This is a maintain function button.

3. Press HOLDING.

   The drive releases the hold bit and continues to the next step.

4. Press Stop.

   The motor stops.

Home Action

Follow these steps to Home your position system by using a sensor wired into the drive digital input.

1. Press Home with the drive stopped.

   The Home button displays Homing while flashing. This is a maintain function button.

2. Press Start.

   The motor rotates at 10 Hz looking for the HOME location. Once the object has reached the sensor, the At Home indicator turns green.

   The Homed indicator changes state to green unless the system has been previously Homed.

   The Active indicator turns on only while the motor is running.

3. Press Homing to release the Home function.

4. Press Start.

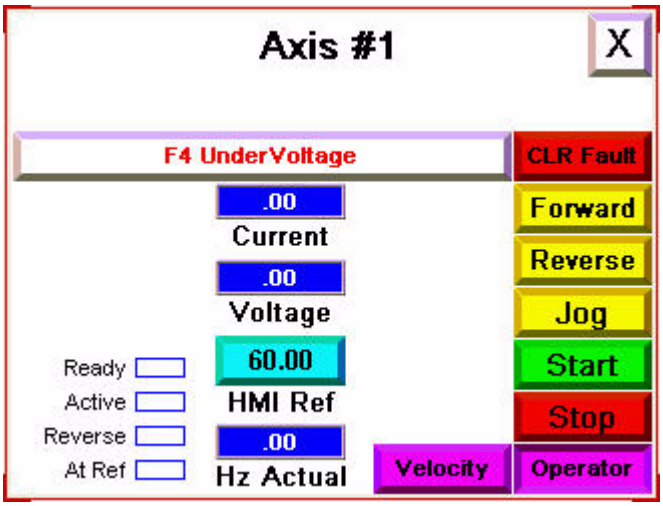
   The Active indicator now turns on.

   The Step Position # now displays 0 and the system begins stepping through the sequence.

5. Verify that Current, Voltage, and Hz Actual are displayed while running.

Fault Look-up Display

The final feature of the Operator screen to verify is the Fault Code display. The Fault Look-up display lets you cross reference a drive fault.



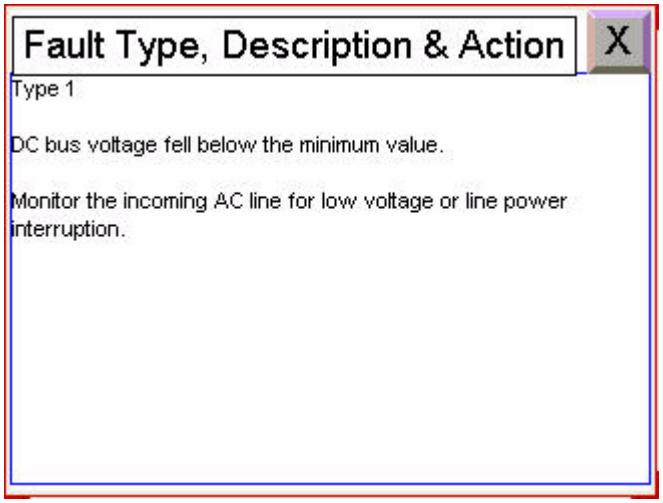
To generate a fault condition, unplug the incoming power to the drive until the F4 fault appears on the built-in drive display, and then quickly restore the incoming power.

Press 

on the current display. It will be blinking with the indicated fault and code.

The Fault Type, Description, & Action display appears. The screen provides the same information and troubleshooting tips for that particular drive as found in the drive user documentation.

Fault Type, Description, and Action Display



As with the other screens, pressing  in the upper right-hand corner takes you back to the previous screen.

Upon return to the Position or Velocity Control Screen, notice that it is back in Program mode - anytime you leave either control screen, it automatically reverts to Program mode. In order to clear the fault, press 

. After doing so, the fault clears, as indicated by the fault display button disappearing, along with the CLR Fault button. This is the same action that was used for communication loss earlier in the chapter.

For detailed steps and various configurations, refer to CCBB Simple Positioning Examples PF40P StepLogic document setup by using DriveExplorer software on the Connected Components Building Blocks Overview CD, publication CC-QR001 (English only).

Integrating Drive Control into the Machine Control Ladder Logic

The previous section demonstrated how the HMI used the Position Control routine to start, stop, jog, set direction, clear faults, and adjust the speed of a drive while the HMI is in Operator mode. When the HMI is in Program mode, it is your machine's control ladder logic that uses the Position Control routine to control one or more of the drives by adjusting specific bits and words in the data table.

An example of how to use the drive control routines to reset the faults on all of the drives, and to start and stop one or more of the drives, is included in ladder file 100 of the CCBB drive control program.

MicroLogix 1100 Sample Code for PowerFlex 4-Class Drive Parameter Backup & Restore

PowerFlex 4-Class Drive Parameter Backup & Restore (PB&R) provides the capability of backing up all of the configured drive parameters for up to 16 PowerFlex 4-class (PF4-class) drives, connected together on a Modbus serial RS-485 network. The parameter sets are stored as recipes within a MicroLogix controller, which is the Modbus master on the network. Recipe memory is used to store the parameter settings for each drive, without consuming any MicroLogix user program or data table memory (except for that memory used by the subroutines themselves). As recipes, the parameter settings are saved as part of the MicroLogix RSLogix program, as well as part of the optional memory-module back-up image.

Once a PF4-class drive's parameters have been backed up to the MicroLogix 1100 controller, if that drive fails and is replaced with a new drive, those parameters can be quickly restored to the new drive, without requiring any programming device and/or software.

This MicroLogix sample code consists of an SLC library routine that can be imported into a new or existing MicroLogix 1100 or 1400 (or MicroLogix 1500 LRP) RSLogix project. If the LCD user-display is not being controlled by any existing routines in the MicroLogix controller, this PB&R functionality can be initiated through the MicroLogix 1100 keypad and LCD user-display. Alternatively, PB&R can be initiated via the MicroLogix 1100 web server by using Internet Explorer web browser, or directly from RSLogix 500 software while online with the MicroLogix controller.

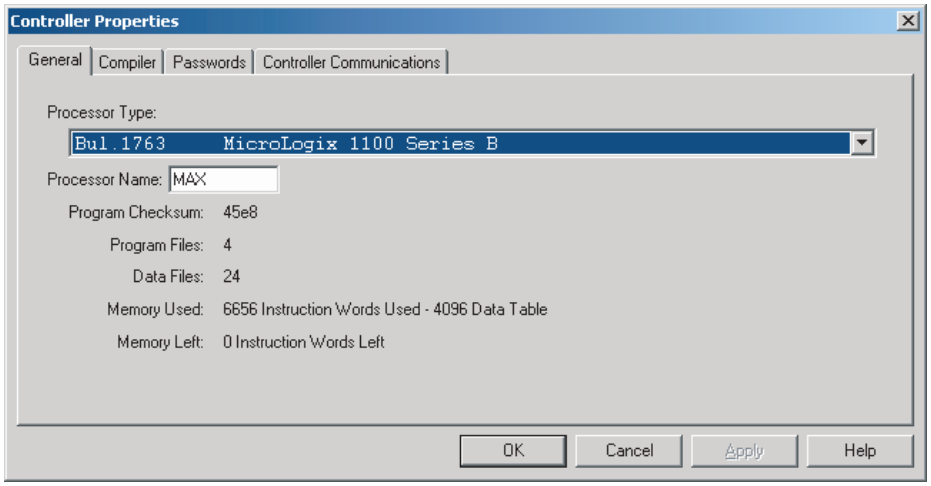
Before importing the PB&R routine, be sure to confirm all of the following:

- All drives are PowerFlex 4-class drives (PowerFlex 4M, 4, 40, 40P and/or 400).
- All drives are networked together with the MicroLogix 1100 controller by using RS-485 serial Modbus network.
- Channel 0 of the MicroLogix controller is configured for Modbus RTU Master. The MicroLogix controller must be the only master on the Modbus network.
- The Modbus communication parameters for all devices are set to 9600 baud, 8 data bits, no parity bit, and 1 stop bit, which is the factory default settings for PF4-class drives.
- All drive node addresses fall within the range of 1...16.
- No node address 100 exists on the network. This is reserved for the device restore functionality, since this is the factory-default node address for PF4-class drives.
- Recipe files 0...6 and recipe numbers 0...16 are available for use.
- Program files 242...255 and data table files 248...255 are available for use.
- Enough unused data table and program memory is available.

Although the drive parameters are stored in recipe memory, the various subroutines that make up the PB&R routine require program and data table memory, as well as specific program-file numbers and data-table file numbers. In order to minimize the amount of files and memory used, it is possible to delete some files, depending on which PF4-class drives are used. For instance, if you only need to support PowerFlex 4M drives, then you can delete the files that are specific to PowerFlex 4, 40, 40P, and 400 drives, to minimize the amount of memory used by the PB&R routine. The number of drives being supported does not matter, whether you have 1 or 16 drives; the same amount of program and data table memory is used for PB&R. Also, if you are not going to use the LCD user-display to initiate the back-up and restore functions, you can also delete the files specific to this functionality.

The MicroLogix 1100 memory supports a maximum of 4096 Data Table words and a maximum of 6656 Instruction words.

Controller Properties Dialog Box



The 4096 Data Table words use up 1024 Instruction Words, so the maximum number of Instruction Words available for ladder logic is 5632.

These tables list the program files, data table files used, and memory usage.

Ladder File Table

Ladder File Name	File No.	Required by	No. of Instruction Words
DRIVE PB&R	255	All	20
DRIVE BKUP	254	All	62
DRIVE RSTR	253	All	68
PB&R LCD	252	Optional	600
PF4M BKUP	251	PF4M only	84
PF4M RSTR	250	PF4M only	252
PF4 BCKUP	249	PF4 only	56
PF4 RESTR	248	PF4 only	90
PF40 BCKUP	247	PF40 only	83
PF40 RESTR	246	PF40 only	121
PF40P BKUP	245	PF40P only	117
PF40P RSTR	244	PF40P only	157
PF400 BKUP	243	PF400 only	114
PF400 RSTR	242	PF400 only	103

Data File Table

Data File Name	File No.	Required by	No. of Data Table Words
PB&R PARAM	255	All	256
PB&R MSG	254	All	50
PB&R LCD	253	Optional	756
PF4M MSG	252	PF4M only	550
PF4 MSG	251	PF4 only	275
PF40 MSG	250	PF40 only	350
PF40P MSG	249	PF40P only	450
PF400 MSG	248	PF400 only	400

Therefore, the maximum amount of memory used by the PB&R routine, supporting all PF4-class drive types and including the LCD user-display capability, is 3087 Data Table words and 1927 Instruction words. The minimum amount of memory used by the PB&R routine, supporting only PowerFlex 4 drives with no LCD user-display capability, is 581 Data Table words and 296 Instruction words.

Merge the PB&R Routine into a New or Existing Program

The PB&R routine library file names all start with:

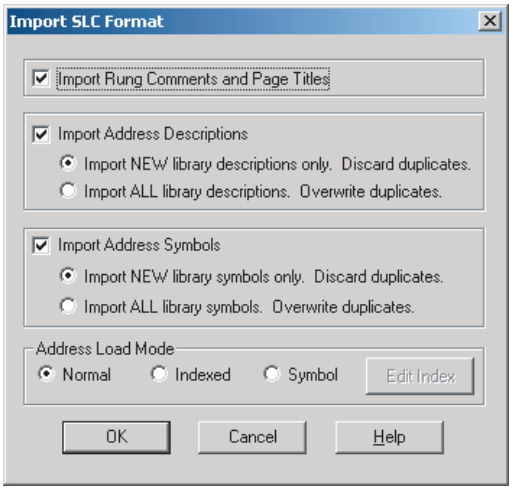
'ML1100 TO PF4-CLASS DRIVE PARAMETER BACKUP & RESTORE WITH USER DISPLAY'

Use RSLogix 500 software, version 7.20 or later, to open the MicroLogix 1100 series B file (new or existing) offline that you intend to copy the PB&R subroutines into. If you are merging into an existing file, make sure you have a back-up copy before proceeding.

1. Verify that Channel 0 in the existing file is configured for Modbus RTU Master.
2. Copy the PB&R routine files onto your computer, within RSLogix 500 software.
3. From the File menu, choose Open.
4. Browse to and select the following file:

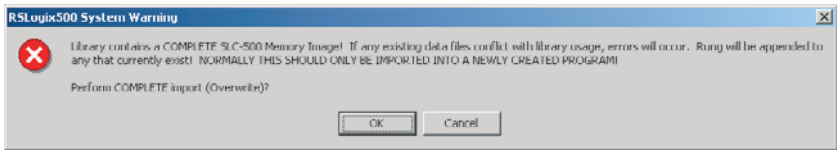
   'ML1100 TO PF4-CLASS DRIVE PARAMETER BACKUP & RESTORE WITH USER DISPLAY.SLC'

   The following screen appears.



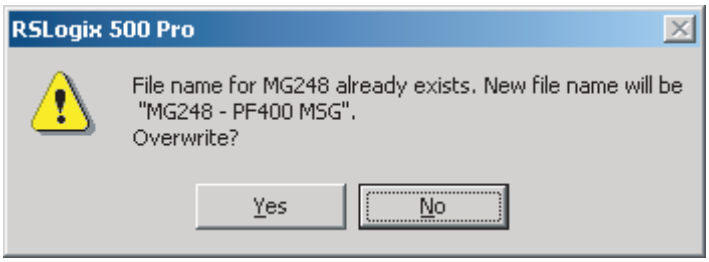
5. Match the default settings and click OK.

The following warning message appears.



6. Click OK.

Next you see a series of screens that are similar to this one.



7. Click Yes to all of these screens.

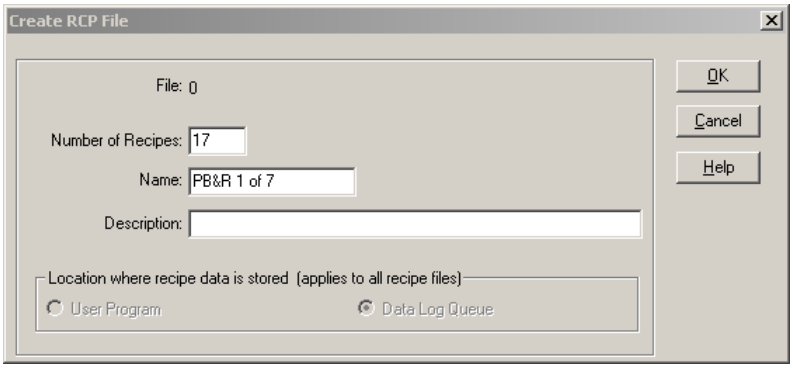
Next, if the Recipe (RCP) Configuration Files don't already exist in the ladder project, you must create the Recipe (RCP) Configuration Files for the project. Go to step 1 below to create the files.

If the files do exist, verify the project. See step 8 on page 39.

1. Right-click RCP Configuration Files and choose New.

2. In the Number of Recipes box, enter 17.

3. In the Name box, enter 'PB&R 1 of 7' for RCP File 0.

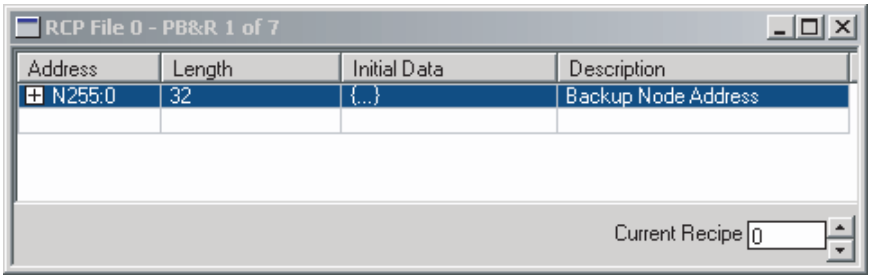


4. Click OK.

5. Click the Address box and enter N255:0.

6. Click the Length box and enter 32.

   The description displays automatically.



7. Close this screen and similarly create RCP Files 1...6 by using the following data.

RCP File No.	No. of Recipes	Name	Address	Length
0	17	PB&R 1 of 7	N255:0	32
1	17	PB&R 2 of 7	N255:32	32
2	17	PB&R 3 of 7	N255:64	32
3	17	PB&R 4 of 7	N255:96	32
4	17	PB&R 5 of 7	N255:128	32
5	17	PB&R 6 of 7	N255:160	32
6	17	PB&R 7 of 7	N255:192	32

8. Click Verify Project.

If you get verification errors, either attempt to fix them individually, or try merging from your original file again. If the project verified without any errors, then the merge was successful and you are ready to test the project or delete the files that you do not need.

Refer to the Ladder File Table and Data File Table to determine which files you can delete, based on the types of PF4-class drives you are using, in order to free up MicroLogix 1100 program and data table memory. If you delete a program file (subroutine), you also need to delete the rung that calls that subroutine for the project to successfully verify.

Initiating the PB&R functionality

Every PF4-class drive on the Modbus network has a node address between 1...16. The Parameter Backup function is initiated by writing the node number to be backed up into data table word N255:0. Therefore, the backup can be initiated from any device that can write to N255:0, including the MicroLogix 1100 LCD user-display, the MicroLogix 1100 web server, and RSLogix 500 software. Similarly, the Parameter Restore function is initiated by writing the node number of the drive that was replaced into data table word N255:255. (The drive to be restored must be using its factory-default communication settings of node 100, 9600 baud, 8 data bits, no parity, and 1 stop bit.)

From the MicroLogix 1100 LCD User-display

Follow this procedure to use the LCD user-display on the front of the MicroLogix 1100 controller to initiate the PB&R function.

1. Make sure that the MicroLogix 1100 controller is in Run or Remote Run mode.
2. Use the arrow to move the cursor down from the LCD top menu to the 'User Disp' selection and press OK.
3. Use the arrow to increase the displayed value from +00000 to +00001 for 'Backup' and to +00002 for 'Restore' and press OK.
4. On the second screen, use the arrow to increase the displayed value up to the node number of the drive (1...16) to be backed up or restored and press OK.

   Within several seconds, a status screen indicates whether the operation was successful.
5. Press ESC to return to the main PB&R screen.

   Note that immediately after the Restore function, you must cycle power to the drive for the restored node address to take effect.
6. To exit out of the PB&R main screen, press and hold ESC for several seconds.

From the MicroLogix 1100 Web Server

Follow this procedure to use the MicroLogix 1100 web server to initiate the PB&R function.

1. Go online with the MicroLogix 1100 controller by using a standard web browser.
2. Select Data Views, and enter your User Name and Password that has write privileges (default is administrator/Ml1100).
3. Click File Name N255.
4. Decide if you want to back up or restore, referring to the appropriate procedure.

Follow this procedure for backup.

1. Double-click N255:0.
2. Enter the node number of the drive to be backed up.
3. Click OK to confirm the value that was entered.
4. Close the Data Change Success dialog box and then click Update.

   Upon completion of the backup, the value of N255:0 returns back to 0.

Follow this procedure for Restore.

1. Double-click N255:255.
2. Enter the node number of the drive to be restored.
3. Click OK to confirm the value that was entered.
4. Close the Data Change Success dialog box and then click Update.

   Upon completion of the restore, the value of N255:255 returns to 0.

   Note that immediately after the Restore function, you must cycle power to the drive for the restored node address to take effect.

From RSLogix 500 Software

Follow this procedure to initiate the PB&R function via RSLogix 500 software.

1. Go online with the MicroLogix 1100 controller and verify that the MicroLogix 1100 controller is in Run or Remote Run mode.
2. Double-click Data File N255.
3. Decide if you want to back up or restore, referring to the appropriate procedure.

Follow this procedure for Backup.

1. Double-click N255:0.
2. Enter the node number of the drive to be backed up.

   Upon completion of the backup, the value of N255:0 returns back to 0.

Follow this procedure for Restore.

1. Double-click N255:255.
2. Enter the node number of the drive to be restored.

   Upon completion of the restore, the value of N255:255 returns back to 0.

   Note that immediately after the Restore function, you must cycle power to the drive for the restored node address to take effect.

Additional Resources

Refer to page 9 for a listing of product and information resources.

Rockwell Automation Support

Rockwell Automation provides technical information on the Web to assist you in using its products. At http://support.rockwellautomation.com, you can find technical manuals, a knowledge base of FAQs, technical and application notes, sample code and links to software service packs, and a MySupport feature that you can customize to make the best use of these tools.

For an additional level of technical phone support for installation, configuration, and troubleshooting, we offer TechConnect Support programs. For more information, contact your local distributor or Rockwell Automation representative, or visit http://support.rockwellautomation.com.

Installation Assistance

If you experience a problem with a hardware module within the first 24 hours of installation, please review the information that's contained in this manual. You can also contact a special Customer Support number for initial help in getting your module up and running.

United States	1.440.646.3434 Monday – Friday, 8 a.m. – 5 p.m. EST
Outside United States	Please contact your local Rockwell Automation representative for any technical support issues.

New Product Satisfaction Return

Rockwell tests all of its products to ensure that they are fully operational when shipped from the manufacturing facility. However, if your product is not functioning, it may need to be returned.

United States	Contact your distributor. You must provide a Customer Support case number (see phone number above to obtain one) to your distributor in order to complete the return process.
Outside United States	Please contact your local Rockwell Automation representative for return procedure.

www.rockwellautomation.com

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