A·B *Allen-Bradley*

PowerFlex Compact-class AC Drives on Modbus Building Block

Connected Components Accelerator Toolkit

A·B *Allen-Bradley* • *Rockwell Software*

Rockwell Automation
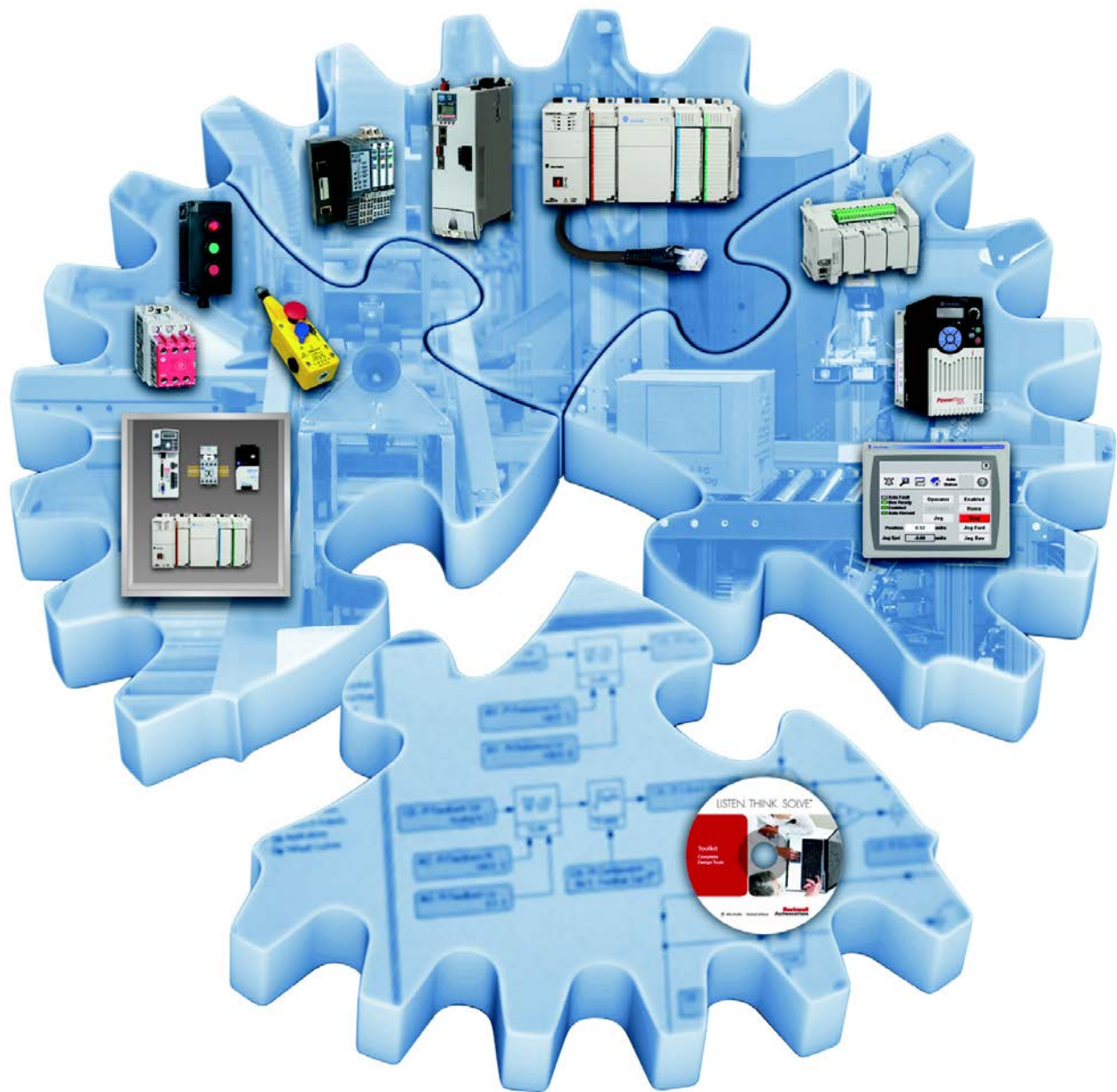
Important User Information

Read this document and the documents listed in the additional resources section about installation, configuration, and operation of this equipment before you install, configure, operate, or maintain this product. Users are required to familiarize themselves with installation and wiring instructions in addition to requirements of all applicable codes, laws, and standards.

Activities including installation, adjustments, putting into service, use, assembly, disassembly, and maintenance are required to be carried out by suitably trained personnel in accordance with applicable code of practice.

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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.
⚠️	**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.
IMPORTANT	Identifies information that is critical for successful application and understanding of the product.

Labels may also be on or inside the equipment to provide specific precautions.

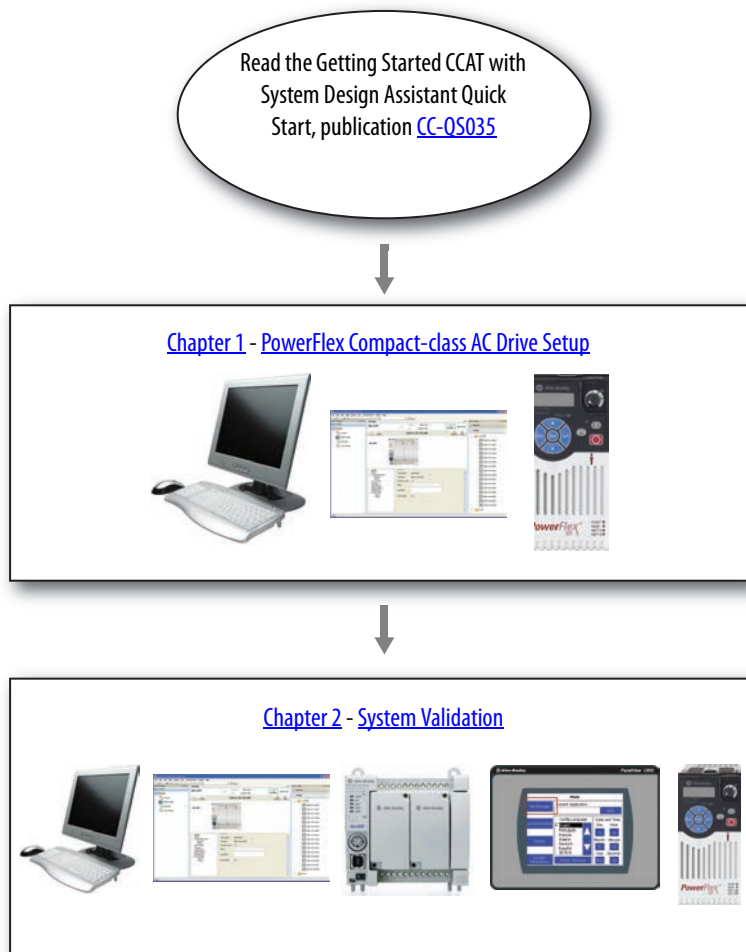|	
⚡	**SHOCK HAZARD:** Labels may be on or inside the equipment, for example, a drive or motor, to alert people that dangerous voltage may be present.
🔥	**BURN HAZARD:** Labels may be on or inside the equipment, for example, a drive or motor, to alert people that surfaces may reach dangerous temperatures.
💥	**ARC FLASH HAZARD:** Labels may be on or inside the equipment, for example, a motor control center, to alert people to potential Arc Flash. Arc Flash will cause severe injury or death. Wear proper Personal Protective Equipment (PPE). Follow ALL Regulatory requirements for safe work practices and for Personal Protective Equipment (PPE).

Follow this path to complete your building block project.

Read the Getting Started CCAT with System Design Assistant Quick Start, publication CC-QS035

Chapter 1 - PowerFlex Compact-class AC Drive Setup

Chapter 2 - System Validation

Notes:

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About This Publication

This quick start provides instructions for implementing a PowerFlex® Compact-class (523, 525, 4, 4M, 40, 40P, 400) AC drive speed-control application on Modbus by using the Connected Components Workbench™ software and a Micro800® programmable logic controller (PLC).

To help with the design and installation of your system, application files and other information are provided on the Connected Components Accelerator Toolkit (CCAT). The CCAT 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, you are free to focus on the design of your machine control and not on design overhead tasks.

The CCAT is available on the Connected Components Accelerator Toolkit DVD, publication CC-QR002, or through the Rockwell Automation Software Download and Registration System (SDRS) site at http://www.rockwellautomation.com/rockwellautomation/products-technologies/connected-components/tools/accelerator-toolkit.page

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

- **Before You Begin** - The chapters in this quick start do not have to be completed in the order in which they appear. However, this section defines the minimum amount of preparation that is 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, including, but not limited to, hardware and software.

- **Follow These Steps** - This section illustrates the steps in the current chapter and identifies the steps that are required to complete the examples.

Terminology

Term (abbreviation)	Definition
Application Sequence Programs	User-modified programs that work together with the standard-state machine logic to control what the machine does while in the abort, clear, reset, run, and stop states.
Auto/manual operation	When the PanelView™ 800 terminal is in Auto mode, the controller logic controls the machine and monitors machine status. When the PanelView 800 terminal switches to Manual mode, the terminal takes over control. Command buttons and numeric entry fields are available only when the machine is in Manual mode.
Bill of Materials (BOM)	A list of components that are needed for your system.
Building block (BB)	Tools for accelerating and simplifying the development of a Micro800 controller-based application. A typical building block includes a starting Bill of Material (BOM), Computer-Aided Design (CAD) drawings, Micro800 controller programs, PanelView 800 terminal applications, and a quick start document.
Computer-Aided Design (CAD)	A computer-based system that is developed to facilitate design of mechanical parts.
Connected Components Accelerator Toolkit (CCAT)	Software with application files and other information to speed the design and startup of component-based machines.
Connected Components Workbench	Software environment for configuring or programming Micro800 controllers, PanelView 800 terminals, PowerFlex drives, and other component-level products.
Connected Components Workbench project	A project consists of one or more of the following: • Micro800 controller configuration • Up to 256 Micro800 programs, each with program local variables • Micro800 global variables • PanelView 800 terminal application • PowerFlex drive parameter lists
Global variables	Project variables that any program can access, including all I/O and system variables.
State Machine control code	Machine logic for coordinating overall machine operation that is based on states. The state machine broadcasts commands and receives feedback information from each of the building blocks via user-modified application sequence programs.
Tags	A PanelView 800 term for variables.
User-defined Function Blocks (UDFBs)	Function block instructions that can be used like standard function block instructions within any Connected Components Workbench programming language. Anyone using Connected Components Workbench software can write these functions blocks. Many UDFBs are posted on the Rockwell Automation sample code website: http://samplecode.rockwellautomation.com/idc/groups/public/documents/webassets/sc_home_page.hcst.
User-defined Object (UDO)	A collection of PanelView 800 terminal screen objects that can be pasted into a new screen.

Available Connected Components Accelerator Toolkits

For the most up-to-date listing of available Connected Components Accelerator Toolkits and related quick starts, refer to these resources:

- Rockwell Automation Connected Components Accelerator Toolkit website at http://www.rockwellautomation.com/rockwellautomation/products-technologies/connected-components/tools/accelerator-toolkit.page
- Connected Components Accelerator Toolkit Building Block Project Descriptions Quick Reference, publication CC-QR003

For More Information

These resources contain information about related products from Rockwell Automation.

Resource	Description
Micro830® and Micro850® Programmable Controllers User Manual, publication 2080-UM002	Provides a reference guide for Micro830 and 850 controller systems. This publication also contains procedures on how to install, wire, and troubleshoot your controller.
Micro800® Digital and Analog Plug-in Modules and Accessories User Manual, publication 2080-UM004	Provides an overview and procedures for installing, wiring, and troubleshooting Micro800 plug-in modules and accessories.
Micro820® 20-point Programmable Controllers User Manual, publication 2080-UM005	Provides a reference guide for Micro820 controller systems. It also contains procedures on how to install, wire, and troubleshoot your controller.
PanelView 800 HMI Terminals User Manual, publication 2711R-UM001	Provides information for configuring the PanelView 800 terminal.
PowerFlex 520-Series Adjustable Frequency AC Drive User Manual, publication 520-UM001	Provides you with the basic information required to install, start up, and troubleshoot the PowerFlex 520-Series adjustable-frequency AC drives.
PowerFlex 4 Adjustable Frequency AC Drive, Firmware Version 6.*xx*, User Manual, publication 22A-UM001	Provides you with the basic information required to install, start-up, and troubleshoot the PowerFlex 4 adjustable-frequency AC drive.
PowerFlex 4M Adjustable Frequency AC Drive, Firmware Versions 1.*xx*…2.*xx*, User Manual, publication 22F-UM001	Provides you with the basic information required to install, start-up, and troubleshoot the PowerFlex 4M adjustable-frequency AC drive.
PowerFlex 40 Adjustable Frequency AC Drive, Firmware Versions 1.*xx*…6.*xx*, publication 22B-UM001	Provides you with the basic information required to install, start-up, and troubleshoot the PowerFlex 40 adjustable frequency AC drive.
PowerFlex 40P Adjustable Frequency AC Drive, Firmware Versions 1.*xx*…3.*xx*, publication 22D-UM001	Provides you with the basic information required to install, start-up, and troubleshoot the PowerFlex 40P adjustable frequency AC drive.
PowerFlex 400 Adjustable Frequency AC Drive, Firmware Versions 1.*xx*…7.*xx*, publication 22C-UM001	Provides you with the basic information required to install, start-up, and troubleshoot the PowerFlex 400P adjustable frequency AC drive.

You can view or download publications at http://www.rockwellautomation.com/literature. To order paper copies of technical documentation, contact your local Allen-Bradley distributor or Rockwell Automation sales representative.

Notes:

PowerFlex Compact-class AC Drive Setup

This chapter provides instructions on how to configure your PowerFlex AC drive to communicate with a Micro800 PLC by using the Modbus RTU protocol. Later in this guide, the PLC is programmed to use the sample building-block code that is supplied in this Connected Components Accelerator Toolkit (CCAT). Micro850 controllers and PowerFlex 523 drives are referenced throughout this Quick Start. Wherever a Micro850 controller is referenced, a Micro830 or Micro820 controller can also be used. Wherever a PowerFlex 523 drive is referenced, a PowerFlex 525, 4, 4M, 40, 40P, or 400 drive can also be used.

Before You Begin

- Review the Getting Started CCAT with System Design Assistant Quick Start, publication CC-QS035.
- Apply power to your drive.

What You Need

- Personal computer with an available USB port
- Connected Components Workbench software, version 6.00 or later
- 1203-USB converter with 22-HIM-H10 cable
- PowerFlex 523, 525, 4, 4M, 40, 40P, or 400 drive

Follow These Steps

Complete these steps to configure your PowerFlex AC drive.

```
          ┌─────────────┐
          │    Start    │
          └─────────────┘
                 │
                 ▼
   ┌──────────────────────────────┐
   │ Configure Your Personal Computer │
   │ and PowerFlex Drive Connection on │
   │          page 13             │
   └──────────────────────────────┘
                 │
                 ▼
   ┌──────────────────────────────┐
   │ Connect to Your Drive on page 18 │
   └──────────────────────────────┘
                 │
                 ▼
   ┌──────────────────────────────┐
   │  Configure Your Drive by Using   │
   │     Connected Components      │
   │ Workbench Software on page 20 │
   └──────────────────────────────┘
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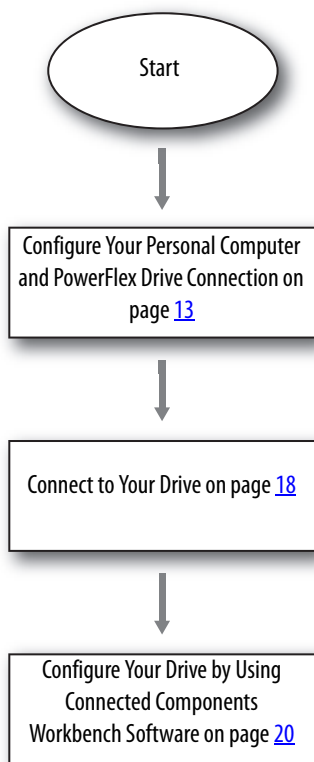
Configure Your Personal Computer and PowerFlex Drive Connection

Follow these steps to configure the connection between your personal computer and your drive.

1. Connect the RJ45 connector from the 1203-USB serial adapter to the DSI communication port on your drive.
2. Connect the USB connector from the 1203-USB serial adapter cable to an available USB port on your computer.

   If you are prompted to install drivers, use the recommended drivers.
3. To verify the COM port number of the 1203-USB serial adapter in Device Manager on your computer, choose Run from the Start menu.
4. In the Open box, type devmgmt.msc.
5. Click OK.
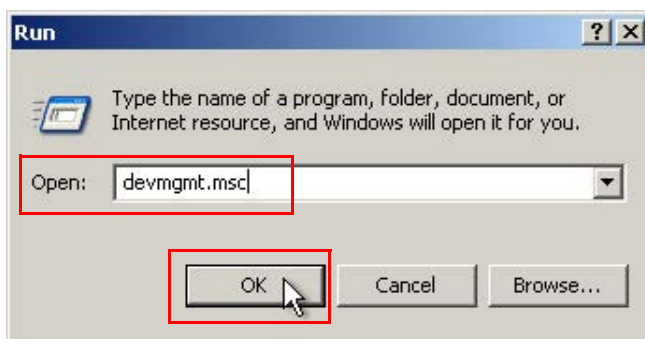
6. In the Device Manager dialog box, expand the Ports (COM & LPT) group, and locate the Allen-Bradley® 1203-USB device.

    The COM port is specified in parenthesis next to the device name (COM3 in this example). It can be different on your computer.
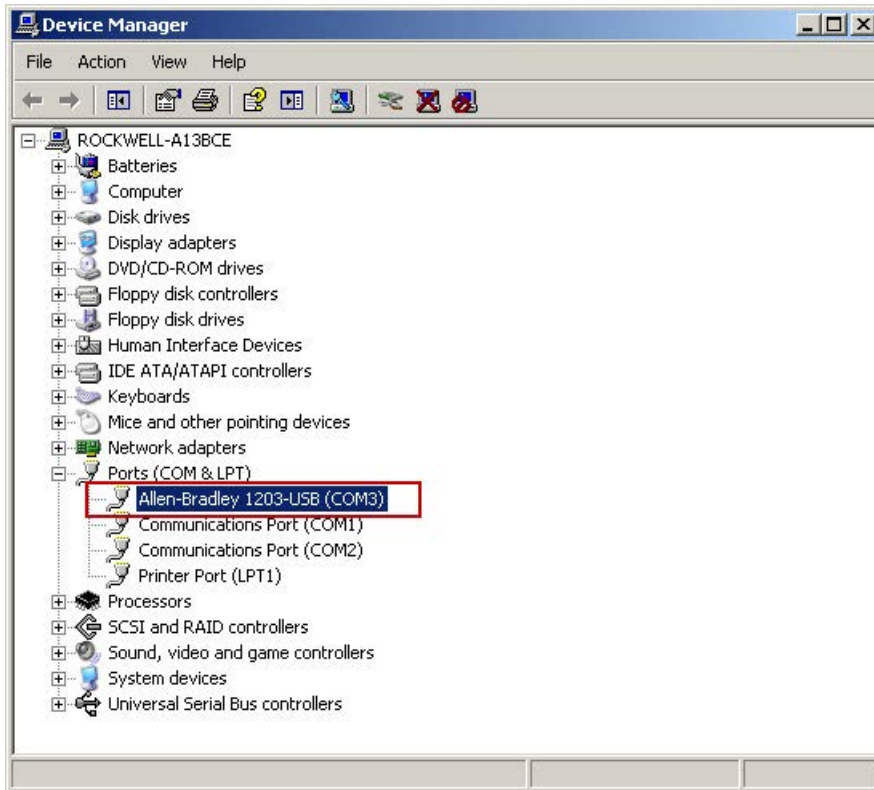
7. Note your port name and close the Device Manager window.

8. To configure an RS-232 DF1 driver, start RSLinx® Classic software.

9. From the Communications menu, choose Configure Drivers.
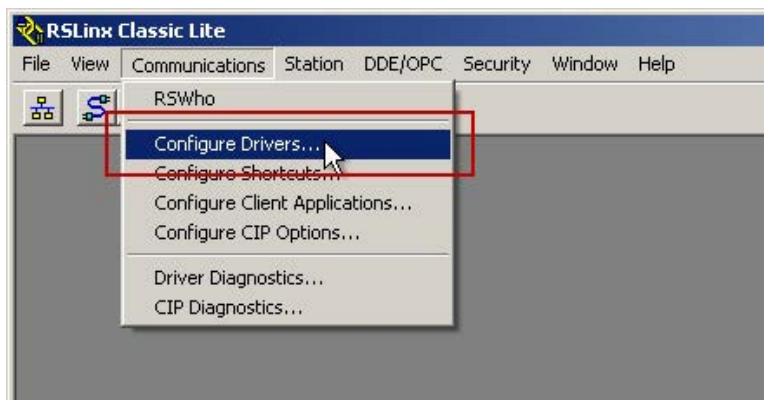
10. In the Configure Drivers dialog box, from the Available Driver Types pull-down menu, choose RS-232 DF1 devices.

11. Click Add New.
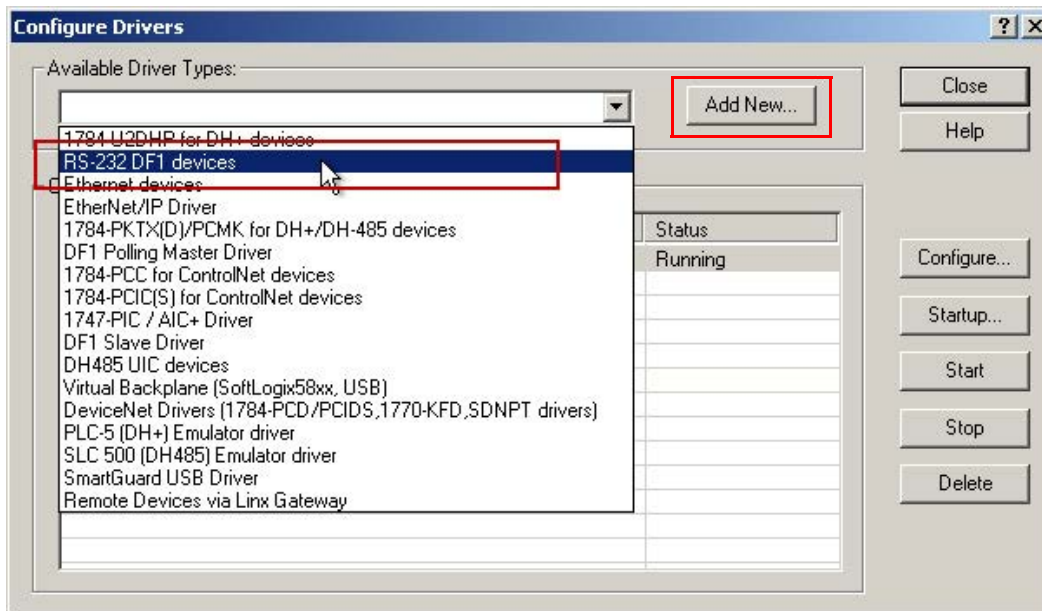
12. In the Add New RSLinx Classic Driver dialog box, type a name for your driver (you can use the default name, if desired).

13. Click OK.

14. In the Configure RS-232 DF1 Devices dialog box, configure the driver settings as follows:

   a. From the Comm Port pull-down menu, choose the port number of your 1203-USB serial adapter.

   b. From the Device pull-down menu, choose 1770-KF2/1785-KE/SCANport.

   c. From the Baud Rate pull-down menu, choose 115200 baud.

   IMPORTANT   **Do not** click Auto-Configure.

15. Click OK.
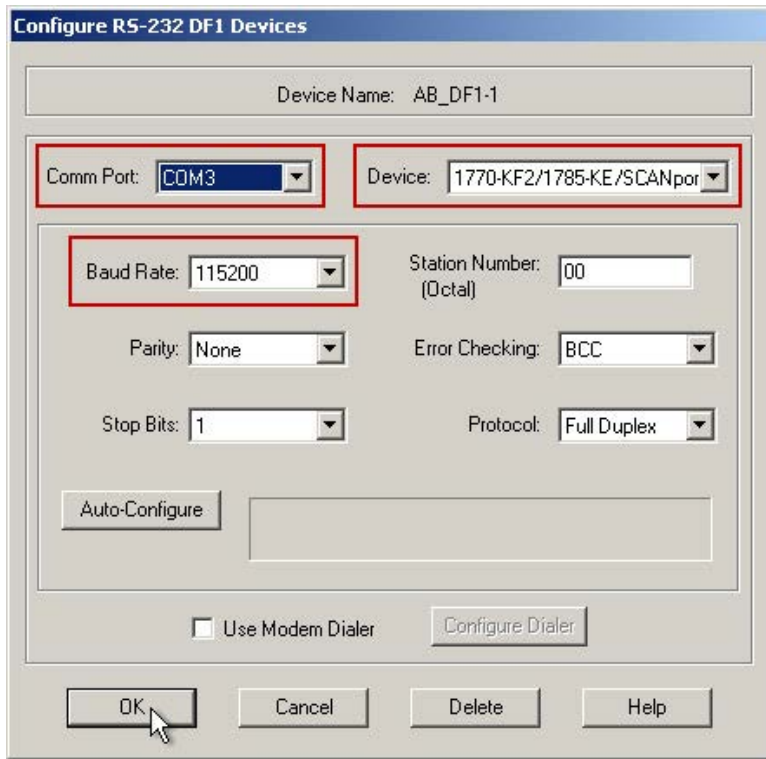
16. In the RSLinx toolbar, click the RSWho icon to verify that your drive is properly communicating with RSLinx Classic software.
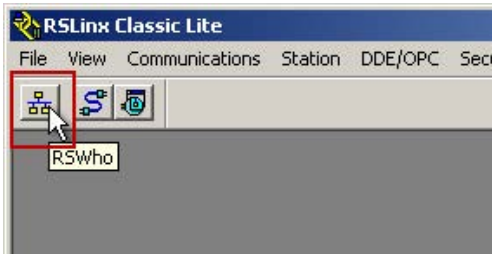
17. Expand your RS-232 DF1 driver, and verify that your drive is displayed.

    It is listed as 01, AB DSI. If the drive does not display below the driver, check your COM port and driver settings.
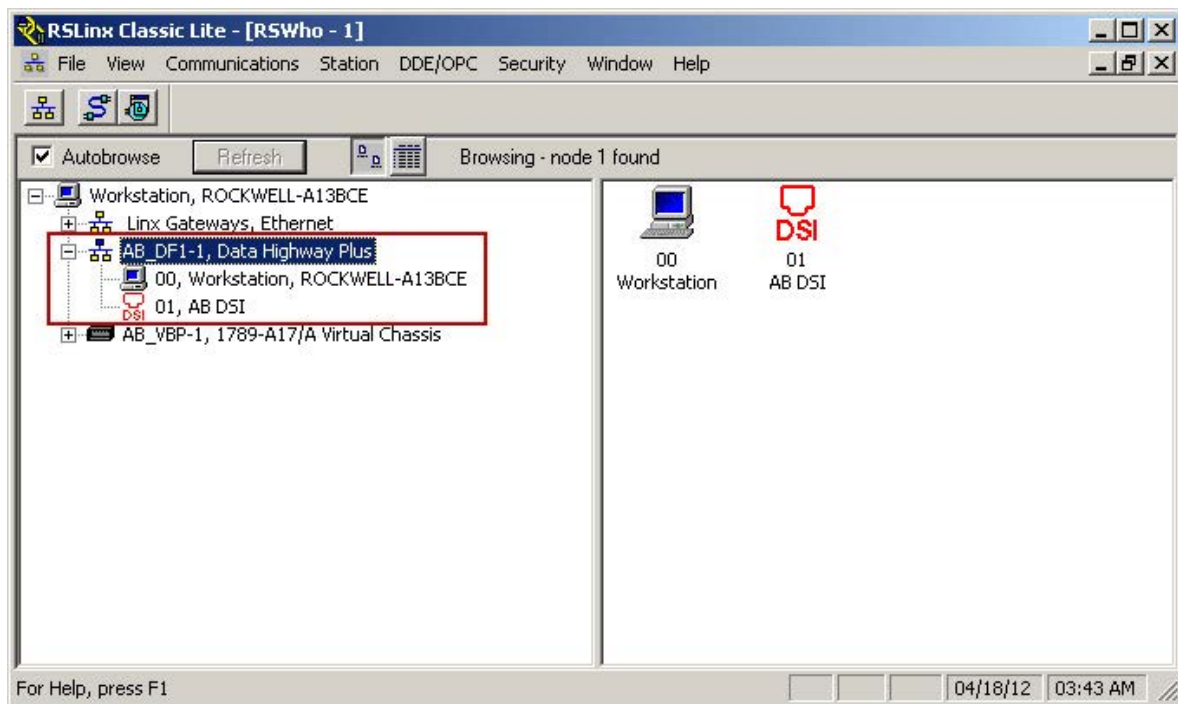
18. Close RSLinx Classic software.

    Do not shut down; the RSLinx Classic icon still appears in your icon tray.

Connect to Your Drive

Follow these steps to connect to your drive by using Connected Components Workbench software.

1. Open the starting PowerFlex AC Drive Device Building Block Connected Components Workbench project or the Connected Components Accelerator Toolkit (CCAT) version 2.0 generated project. Use the 'change controller' feature, if necessary, to match your Micro800 controller catalog number. Refer to the software help for instructions on using change controller feature.

2. In the Connected Components Workbench Device Toolbox, expand Discover, and click Browse Connections.
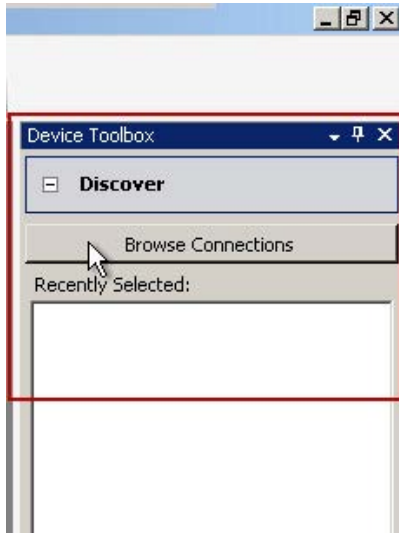
3. From the Connection Browser dialog box, select your drive (01, AB DSI) and click OK.
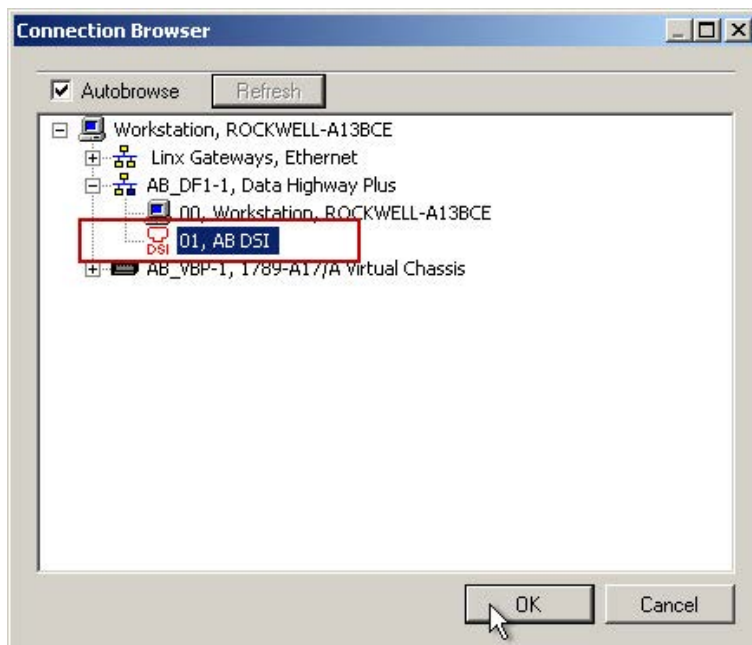
A drive is added to the Project Organizer and the drive appears in the Device Details window in the main project workspace. This example shows a PowerFlex 525 drive.

Configure Your Drive by Using Connected Components Workbench Software

The following steps show you how to configure your drive's communication, start source, and speed reference source, so it works properly with the PowerFlex AC Drive on Modbus Device Building Block. You must enter the correct motor and application-specific data into the wizard to properly commission your drive. Depending on your drive type, there can be more steps in your wizard. Follow these steps to configure your drive.

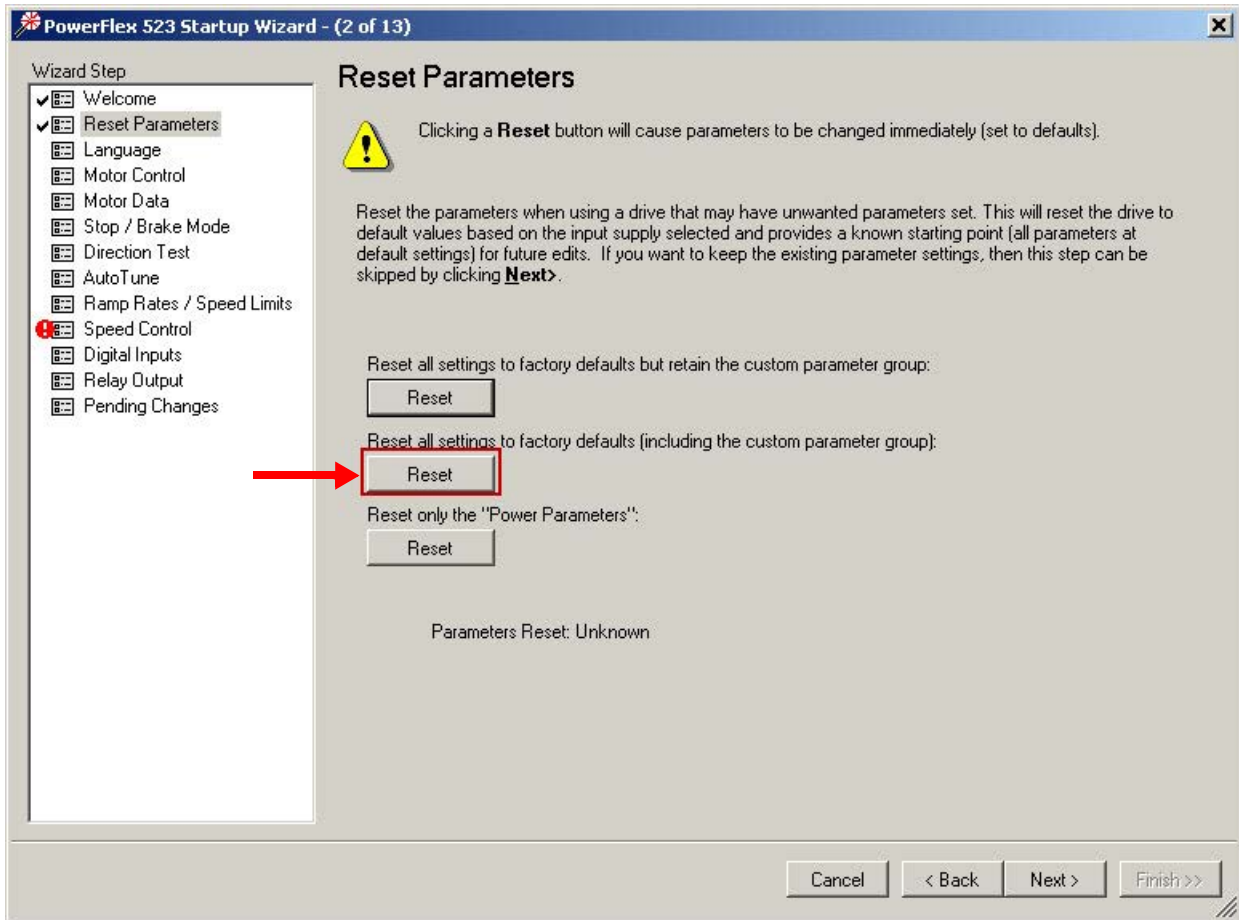1. In the toolbar, click the Wizards icon.
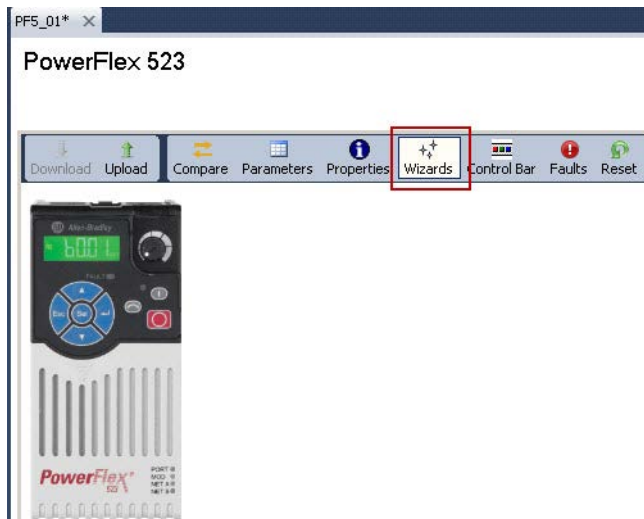
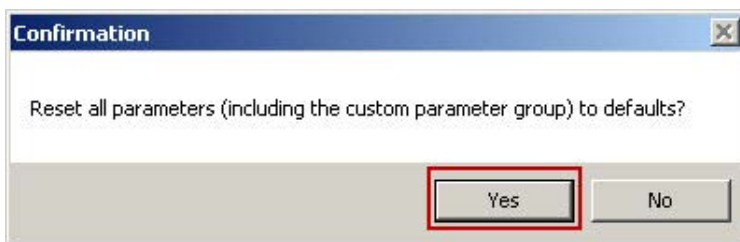2. From the list of Available Wizards, select the applicable Startup Wizard and click Select.

3. Complete each step of the Startup Wizard sequentially.

4. When the Reset Parameters step appears in the Wizard, click Reset below Reset all settings to factory defaults (including the custom parameter group).



5. To confirm the reset, click Yes.

A confirmation message with a green check mark appears in the window to indicate that the reset was completed successfully. It is acceptable if your drive faults after resetting the parameters.
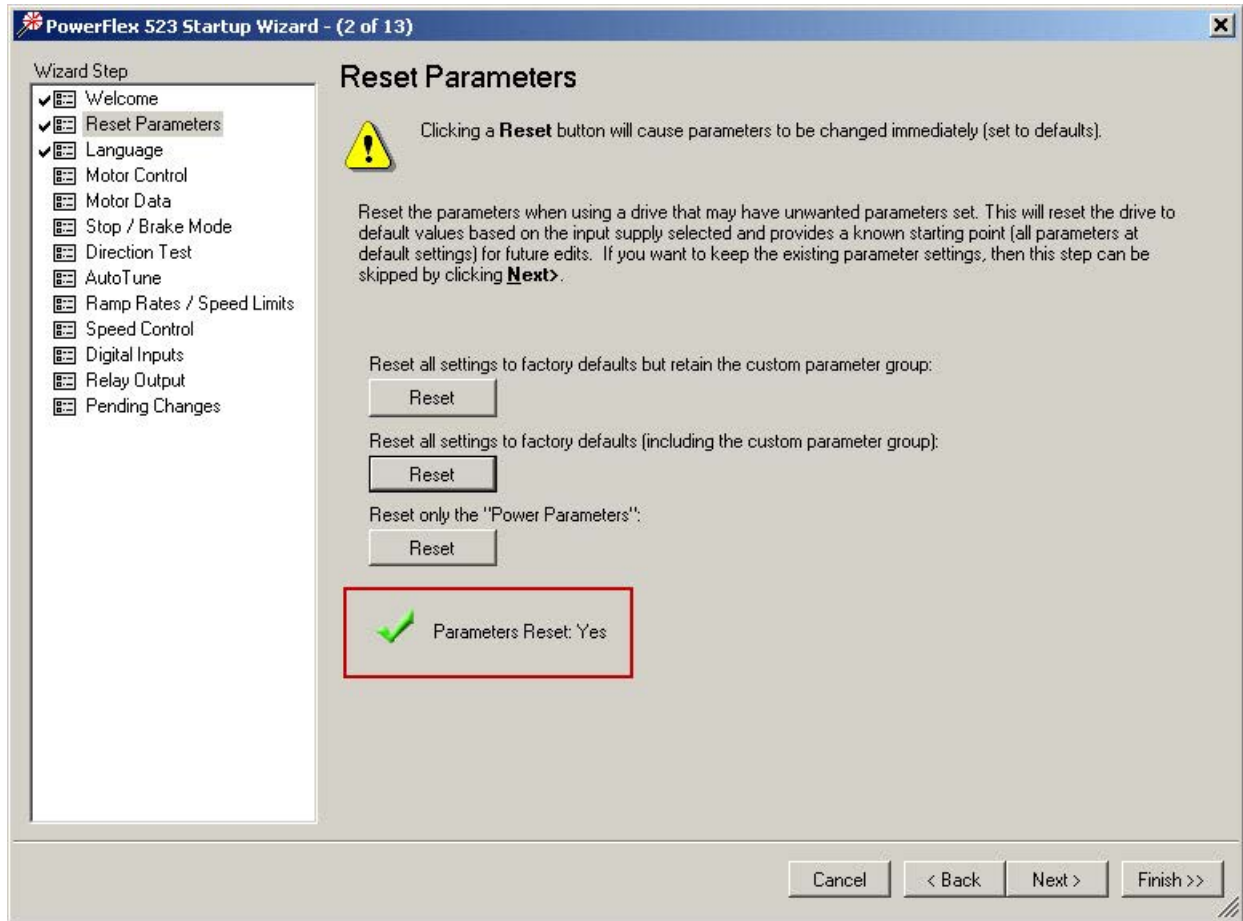
6. Continue the Startup Wizard steps and enter the proper data to commission your drive.

7. When the Speed Control step appears, from the Speed Reference pull-down menu, choose Serial/DSI as the Speed Reference source.

   If a conflict appears, then choose Keypad on the Speed Reference 3 tab.
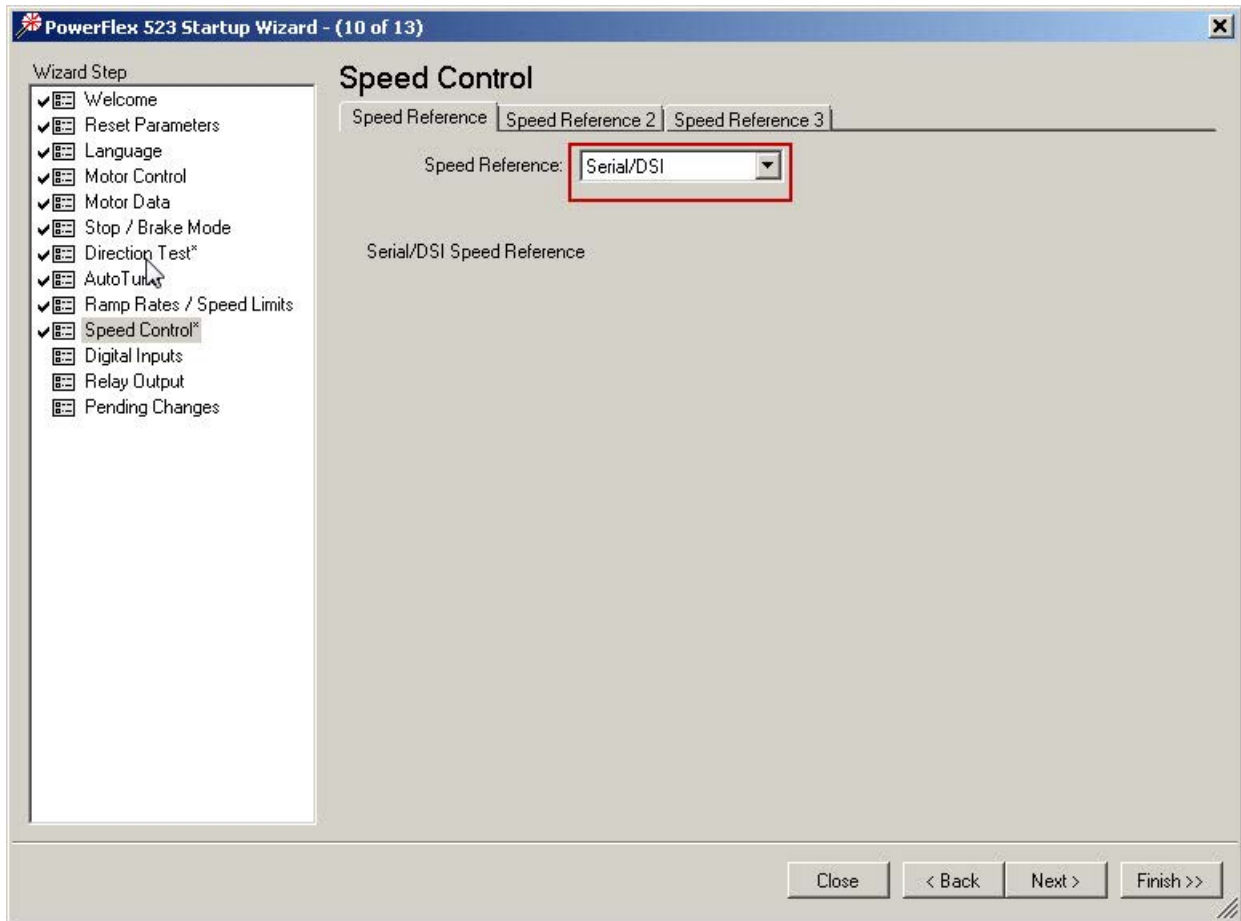
8. Continue the Startup Wizard steps.

9. When the Digital Inputs step appears, from the Start Source pull-down menu, choose Serial/DSI as the Start Source.

10. To avoid a conflict with the Start Source choice, from the Start Source 3 pull-down menu, choose Keypad.

11. From the DigIn TermBlk *xx* pull-down menus, choose Not Used.
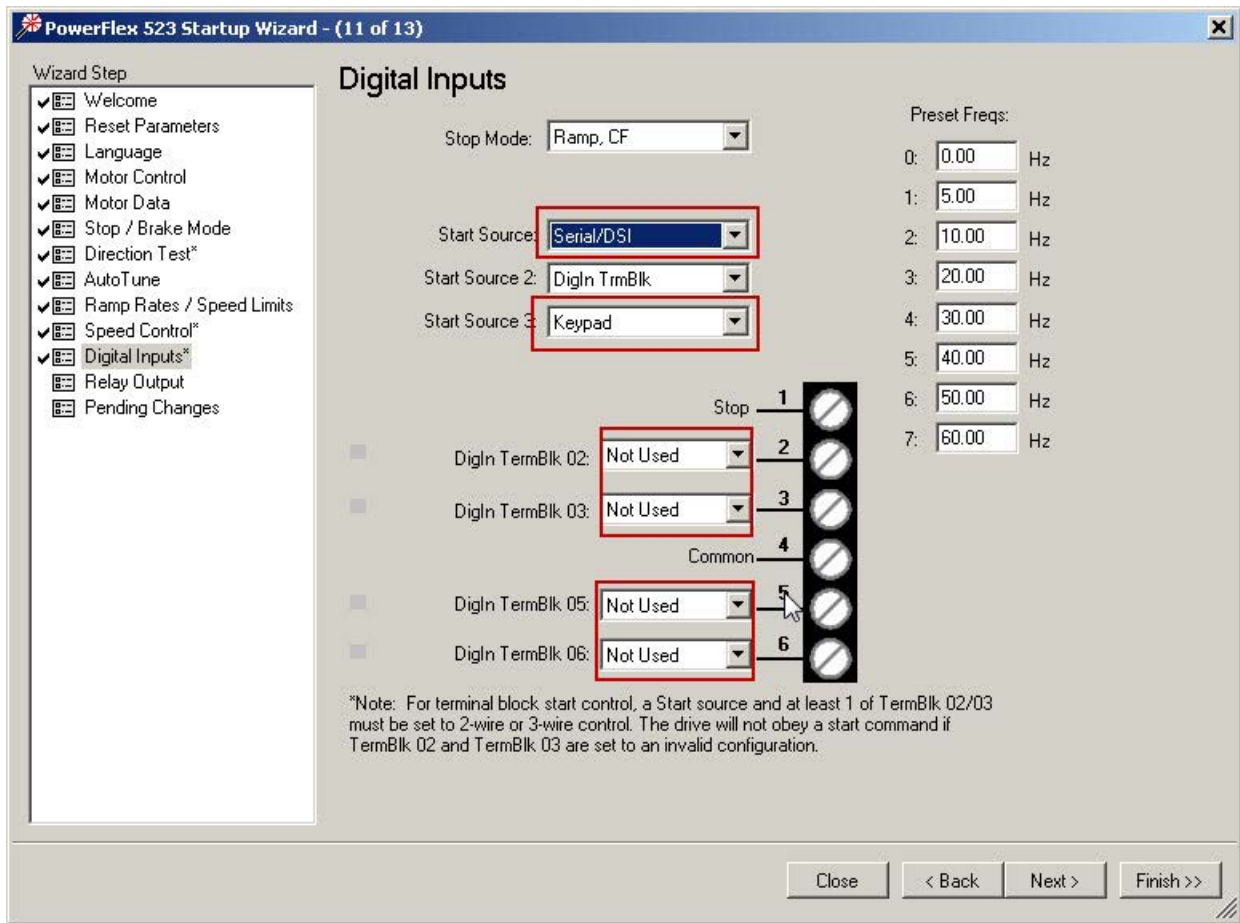
12. Continue the Startup Wizard steps to complete your drive commissioning.

13. When the Applied and Pending Changes step appears, click Finish to complete and exit the wizard.
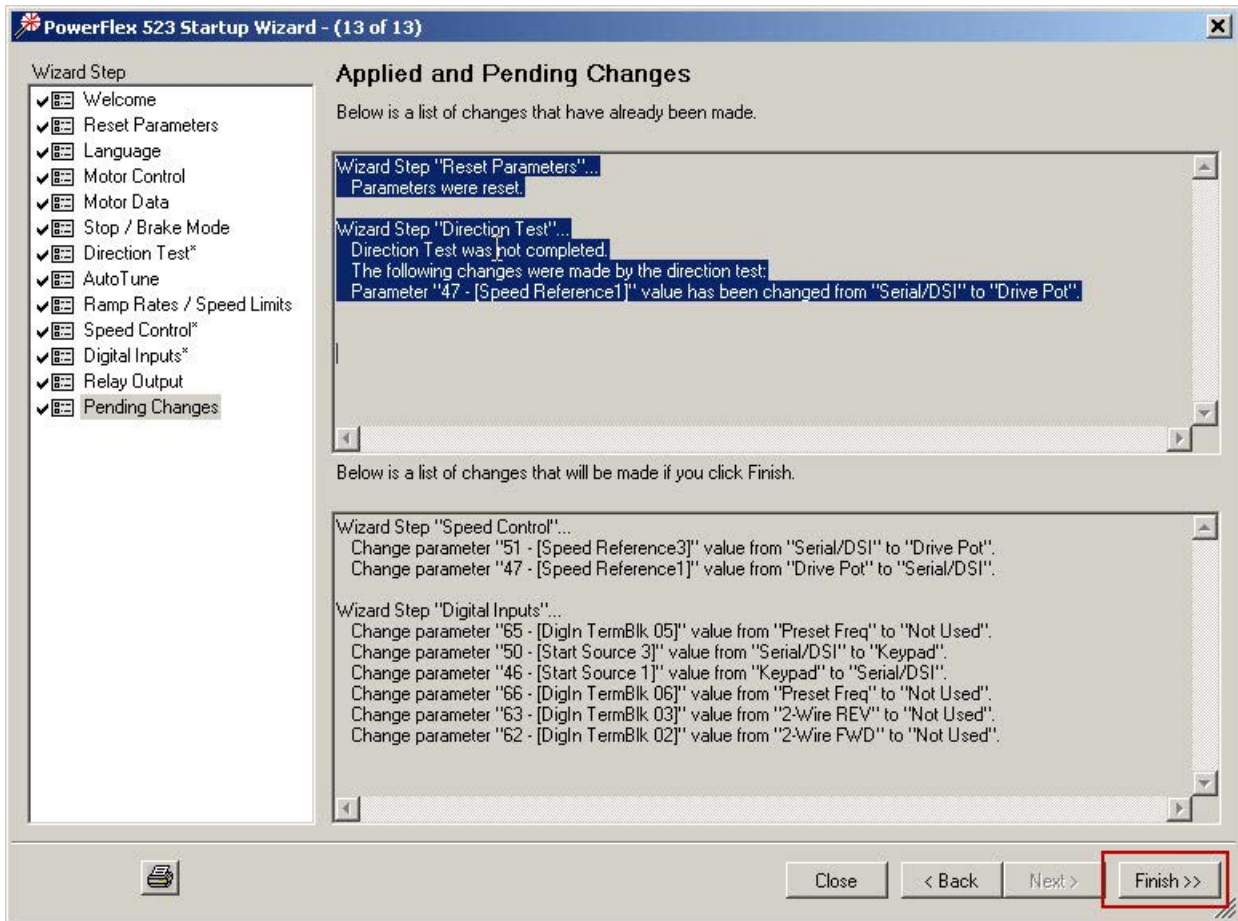
To configure the drive's communication properties by using the Parameter List editor, follow these steps.

1. In the toolbar, click the Parameters icon.

2. In the Parameter List editor, enter the following parameters values.

Parameter Name	Value
Comm Data Rate	19.2K
Comm Node Addr	100
Comm Format	RTU 8-N-1

The RS-485 Data Rate must be the same for all drives that are connected on the serial/Modbus connection, with 19200 baud being the fastest rate possible. Each drive on the serial/Modbus connection must have a unique RS-485 node address from 1…247.

Changes are made and saved immediately because you are connected to the drive.

3. Click the X in the upper right corner to close the Parameter List editor.
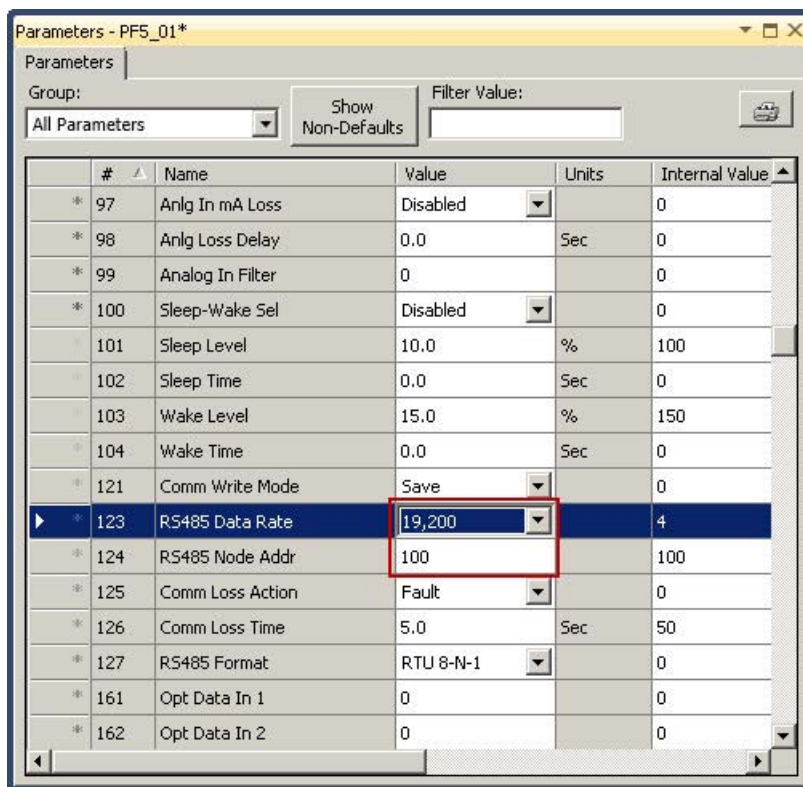
4. You must cycle power to the drive to change the RS485 Data Rate and the RS485 Node Address; remove power from the drive and wait 10 seconds before restoring it.

5. Disconnect the 1203-USB cable from your personal computer and from the drive.

You have completed configuring your drive.

System Validation

This chapter provides instructions on how to configure, connect, and validate communication between the devices in your PowerFlex Compact-class AC drive device building-block system.

Before You Begin
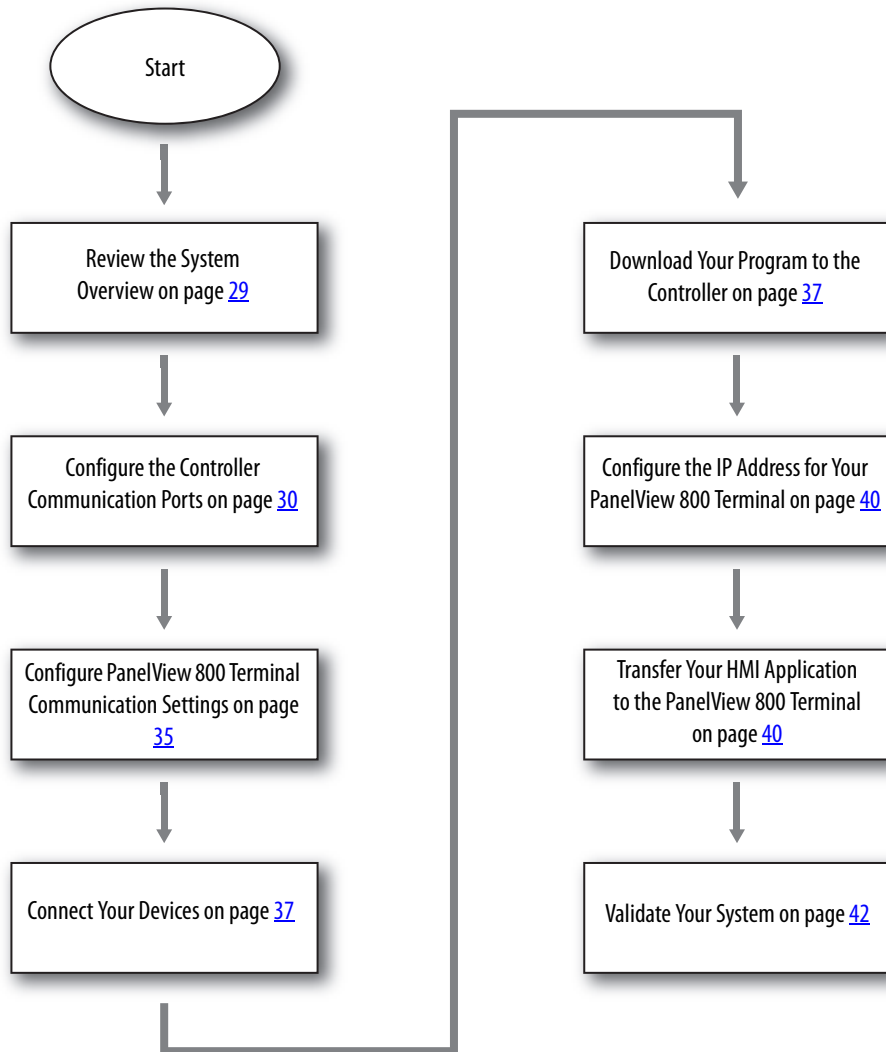
- Complete the steps in Chapter 1.
- Verify that the devices are connected as shown in the assembled wiring diagrams.
- Verify that your Micro800 controller, the PowerFlex AC drive, and the PanelView 800 terminal have power applied to them.

What You Need

- Micro820, Micro830, or Micro850 controller with Isolated Serial Port plug-in module (catalog number 2080-SERIALISOL)
- PowerFlex 523, 525, 4, 4M, 40, 40P, or 400 drive
- 4 in. (or larger) PanelView 800 terminal
- 1761-CBL-PM02, 9-pin to 8-pin MINI-DIN RS-232 communication cable, if a CIP serial connection for the PanelView 800 terminal is used
- Two 1585J-M8*xxxx*-2 RJ45 Ethernet patch cords, if a CIP on Ethernet connection for the PanelView 800 terminal is used
- 1783- US*xxx* Stratix 2000™ unmanaged Ethernet switch
- Two-wire, twisted-pair shielded RS-485 communication cable (Belden 3105A recommended)
- AK-U0-RJ45-TB2P, RJ45 two position terminal block with a 120 Ω terminating resistor
- USB programming cable (A to B) or Ethernet cable for personal computer to Micro800 controller communication
- Personal computer with available USB port and Ethernet connection with Connected Components Workbench software, version 6.00 or later, installed

Follow These Steps

Complete these steps to validate your system.

```
        ┌──────────┐
        │  Start   │
        └──────────┘
             │
             ▼
```

Start

Review the System Overview on page 29

Configure the Controller Communication Ports on page 30

Configure PanelView 800 Terminal Communication Settings on page 35

Connect Your Devices on page 37

Download Your Program to the Controller on page 37

Configure the IP Address for Your PanelView 800 Terminal on page 40

Transfer Your HMI Application to the PanelView 800 Terminal on page 40

Validate Your System on page 42

Review the System Overview

The PanelView 800 Graphic Terminal can be connected to the Micro800 controller with a CIP serial or CIP on Ethernet connection:

- When a CIP serial connection is used, connect the PanelView 800 terminal to the Micro800 controller's embedded serial port by using a 1761-CBL-PM02 cable.

- When a CIP on Ethernet connection is used, connect the PanelView 800 terminal to the Ethernet switch and connect the Ethernet switch to the Micro800 controller's embedded Ethernet port by using Ethernet patchcords.

Both methods of connection are explained in this manual, but choose only one method for your project.

The PowerFlex AC drive is connected to the Micro800 controller's Isolated Serial Port plug-in module (catalog number 2080-SERIALISOL) with two-wire, twisted-pair shielded cable (Belden 3105A recommended) and one AK-U0-RJ45-TB2P terminal block connection per drive. These devices communicate with the Modbus RTU protocol (RS-485). The Micro800 controller is the Modbus master, and the PowerFlex drive is the Modbus slave. Additional Modbus RTU slave devices can be daisy-chained on this RS-485 network.

Figure 1 - Device and Network Layout Diagram
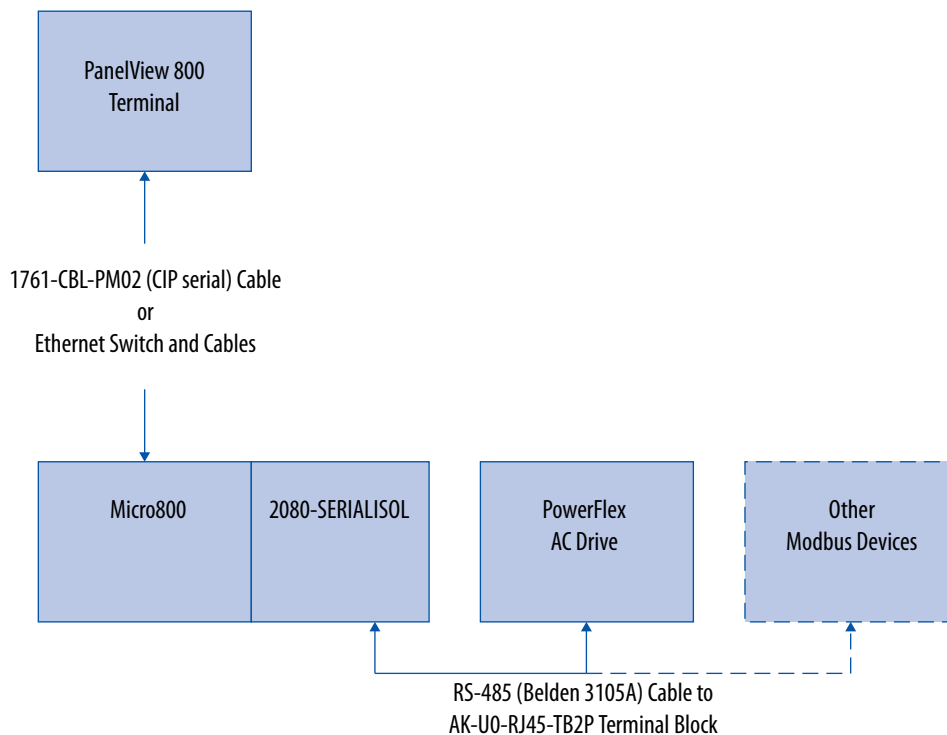
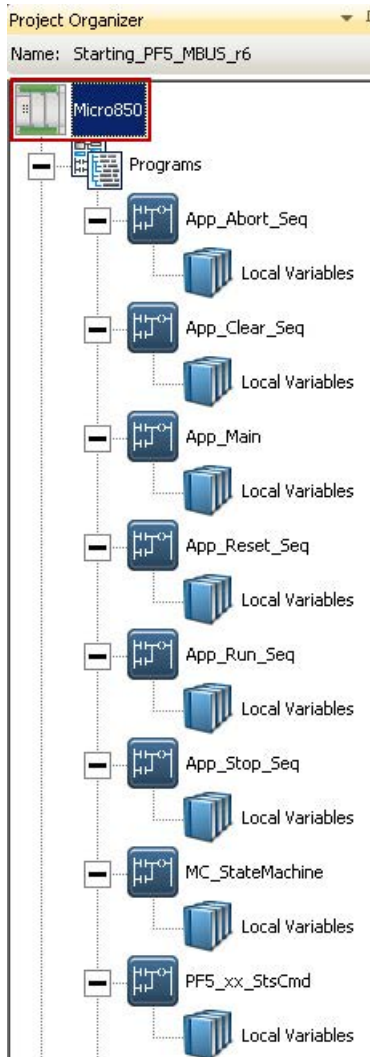# Configure the Controller Communication Ports

In the default project, the serial ports are already configured. The following settings are used for each serial port.

Table 1 - Default Serial Port Settings

| Embedded Serial Port (to PanelView 800 Terminal)	
Setting	**Value**
Driver	CIP Serial
Baud Rate	38400
Parity	None
Unit Address	1
Advanced Settings	
Error Detection	CRC
Embedded Responses	After One Received
Duplicate Packet Detection	Yes
Ack Timeout (x 20 ms)	50
NAK Retries	3
ENQ Retries	3
Transmit Retries	3
RTS Off Delay	0
RTS Send Delay	0
2080-SERIALISOL Plug-in Module (to PowerFlex AC Drive)	
Setting	**Value**
Driver	Modbus RTU
Baud Rate	19200
Parity	None
Modbus Role	Modbus RTU Master
Advanced Settings	
Media	RS-485
Data Bits	8
Stop Bits	1
Response Timer	200
Broadcast Pause	200
Inter-Char Timeout	0
RTS-Pre Delay	0
RTS-Post Delay	0

Follow these steps to modify these settings in the default Connected Components Workbench project.

1. From the Connected Components Workbench software, from the File menu, choose Open.

2. From the Connected Components Accelerator Toolkit (CCAT), choose the default 'Starting_PFx_Modbus_r8.ccwsln' project or the CCAT version 2.0 generated project. Use controller type change, if necessary, to match your Micro800 controller catalog number. Refer to software help for instructions on controller type change.

3. In the Project Organizer, double-click the controller icon. This example shows a Micro850 controller.

The Controller Detail view appears in the main project window.

4. Configure the settings for your PanelView 800 terminal communication port:

    - If a CIP serial connection is used, select the embedded serial port in the controller configuration list and edit the required settings.
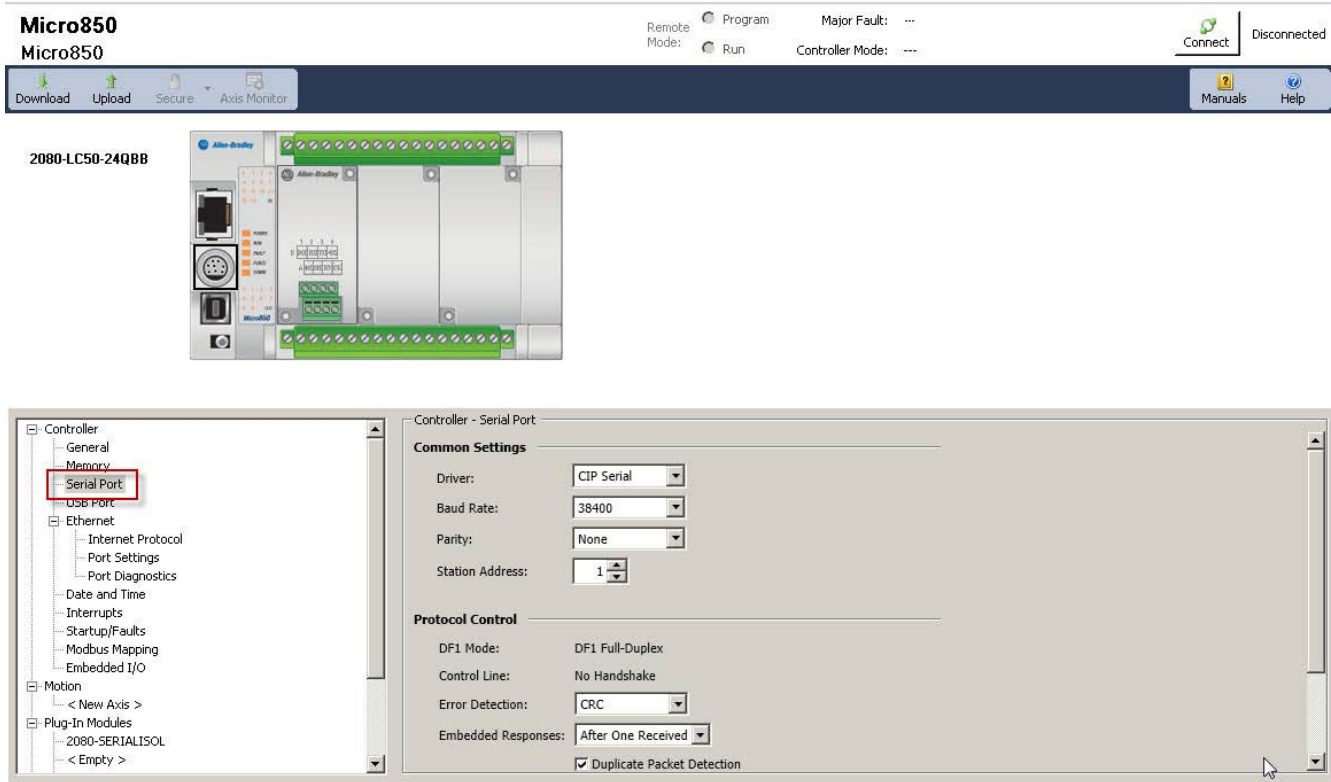
- If a CIP on Ethernet connection is used, complete the following steps.
    a. Select the Ethernet port in the controller configuration list.
    b. Click Configure IP address and settings.
    c. Edit the IP Address, Subnet Mask, and Gateway Address settings.

5. Expand Plug-in Modules in the controller configuration list, add (if not already present) and configure the 2080-SERIALISOL port for your controller in slot 1 as shown here.
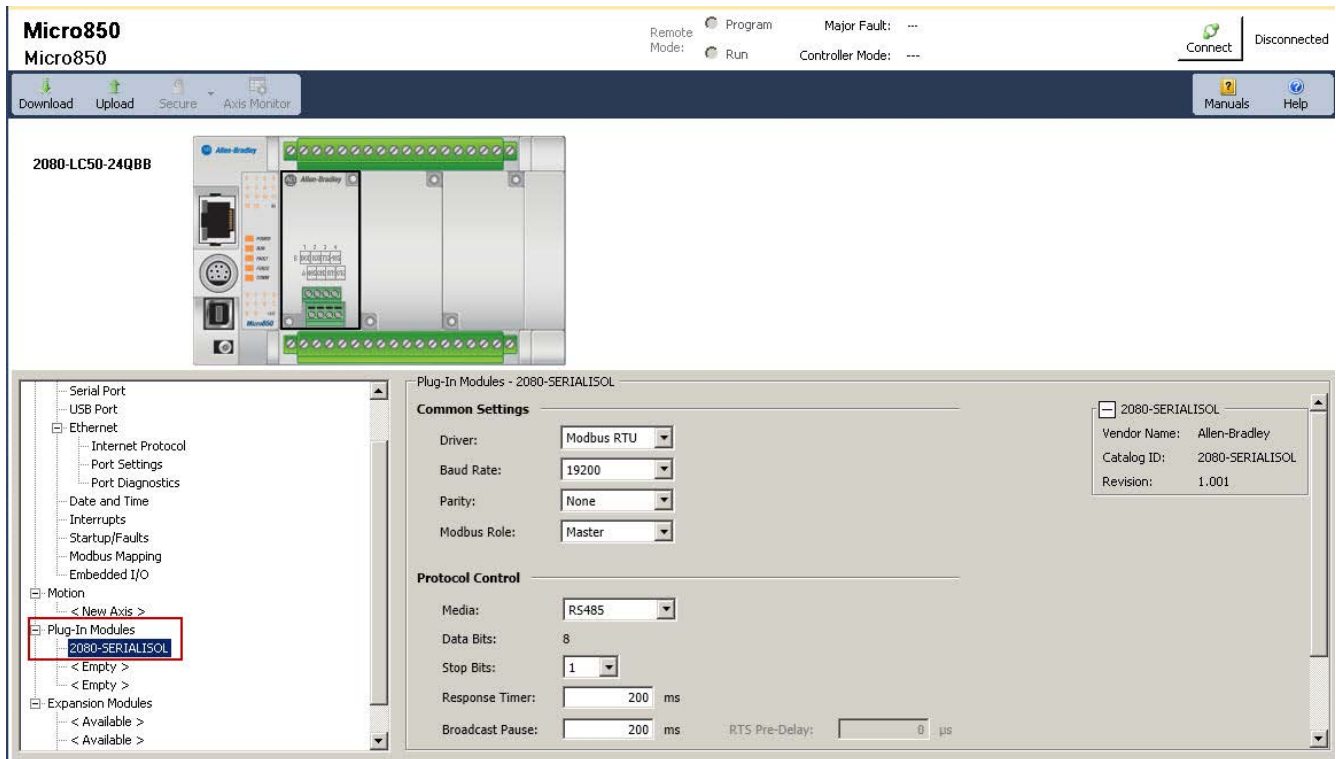
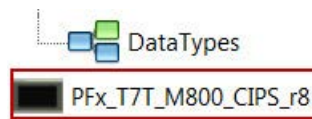# Configure PanelView 800 Terminal Communication Settings

In the default project, the CIP serial communication and controller settings have already been configured. The following settings are used.

Table 2 - Default CIP Serial Communication and Controller Settings

| Driver Configuration	
Protocol	CIP Serial
Port	RS-232
Baud Rate	38400
Data Format: 8-N-1	8-N-1
Flow Control	None
Controller Settings	
Name	PLC-1
Controller Type	Micro800
Address	1

Follow these steps to modify these settings in the default Connected Components Workbench project.

1. To open the PanelView 800 application editor, in the Project Organizer double-click the PanelView 800 device icon.
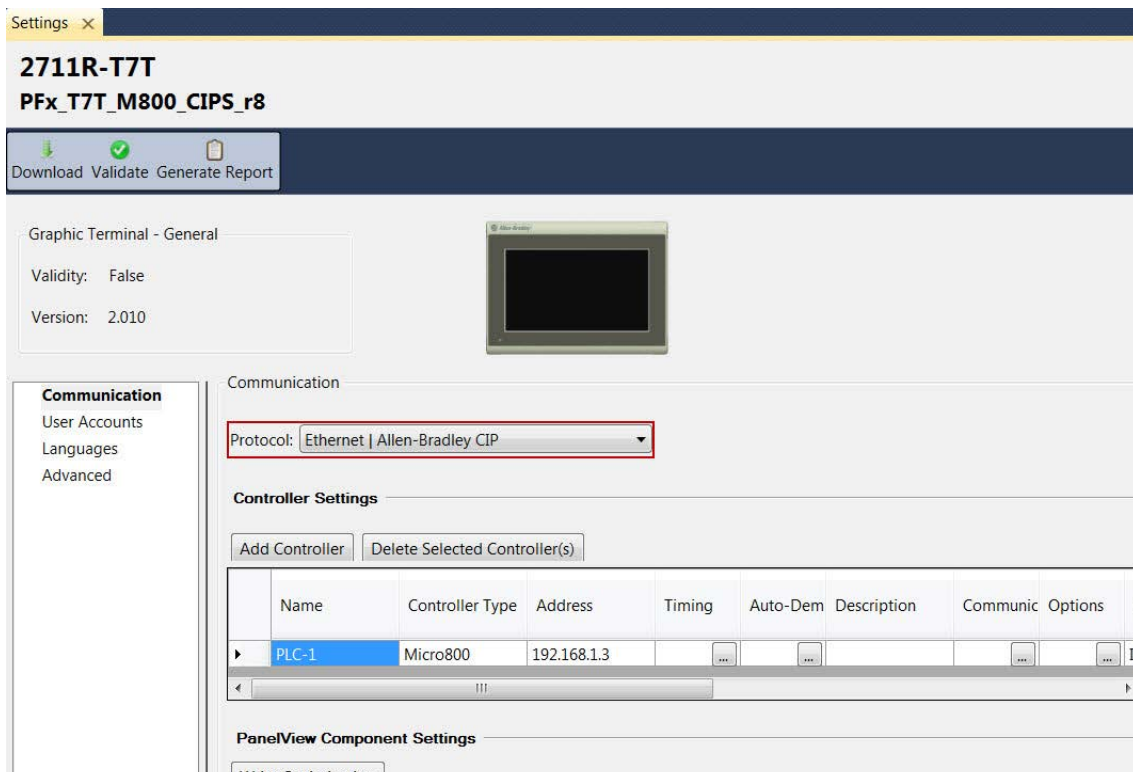
The PanelView 800 Communication Settings pane appears in the main project window.

2. Configure the appropriate communication settings:

- For CIP Serial communication, configure the settings that are shown here.
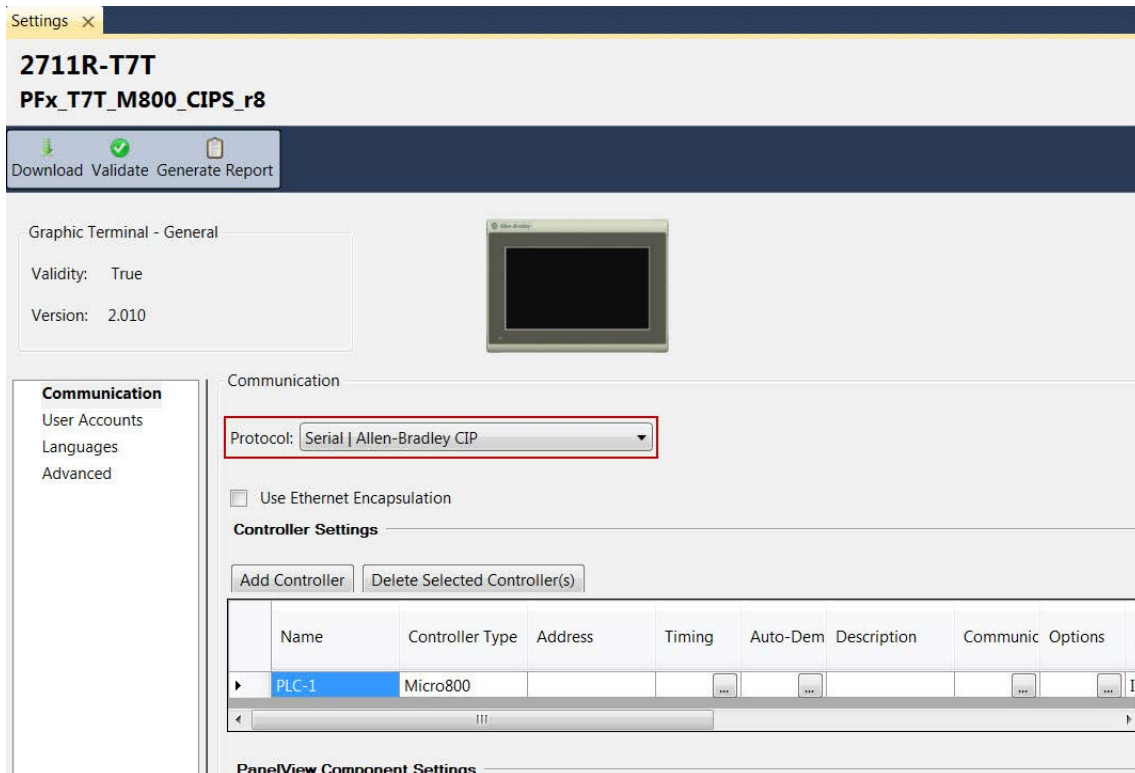
- For CIP on Ethernet communication, configure the settings that are shown here.

Connect Your Devices

Follow these steps to connect your devices.

1. Connect the PanelView 800 terminal to the Micro800 controller:
   - If a CIP serial connection is used, connect the PanelView 800 terminal serial RS-232 port to your Micro800 controller's embedded serial port by using a 1761-CBL-PM02 cable.
   - If a CIP on Ethernet connection is used, connect the PanelView 800 terminal Ethernet port to the Stratix switch and connect another Ethernet cable from the Stratix switch port to the Micro800 controller's embedded Ethernet port.

2. Connect the RJ45 plug on your drive to your Micro800 controller's Isolated Serial Port (catalog number 2080-SERIALISOL) by using a two-wire, twisted-pair shielded cable (Belden 3105A, recommended).
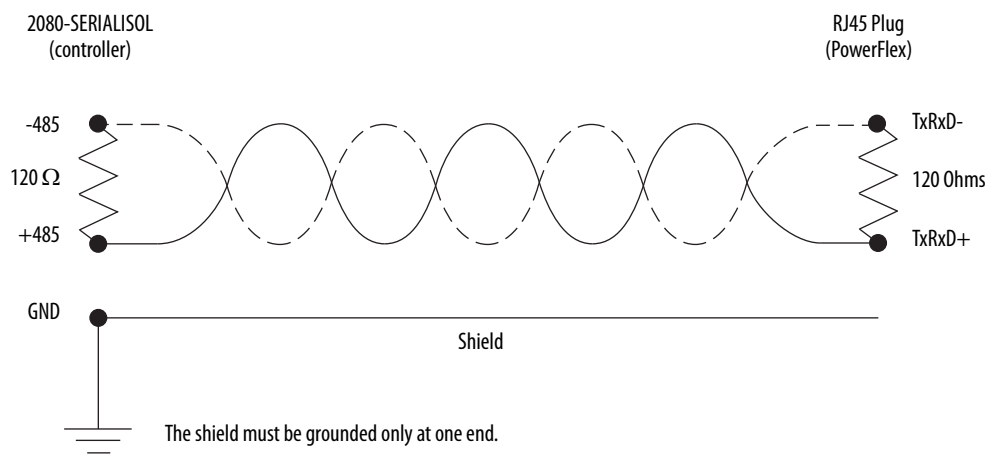
# Download Your Program to the Controller

Follow these steps to download your program to the controller.

1. Connect the computer to the controller using either an Ethernet or USB connection.
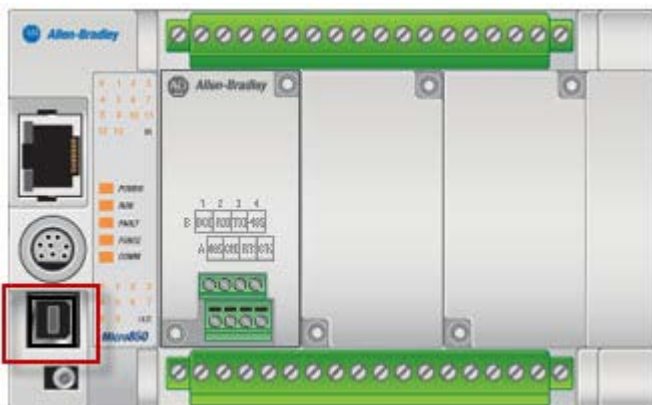
If you are prompted to install any drivers, use the recommended drivers.

2. In your Connected Components Workbench project, in the Project Organizer, right-click your controller icon and choose Build.
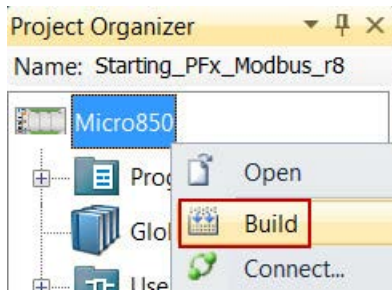
3. If the build was successful, the Output pane at the bottom of your project window displays a success message. Or, if the build was unsuccessful, an error list appears.

Example Output pane: build successful
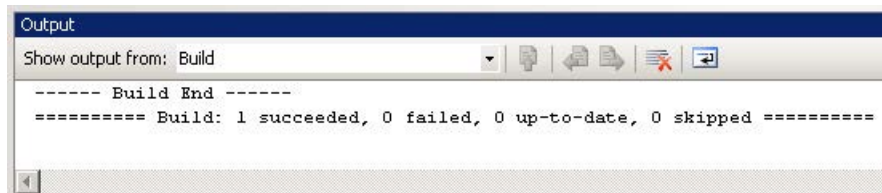
Example Output pane: error list
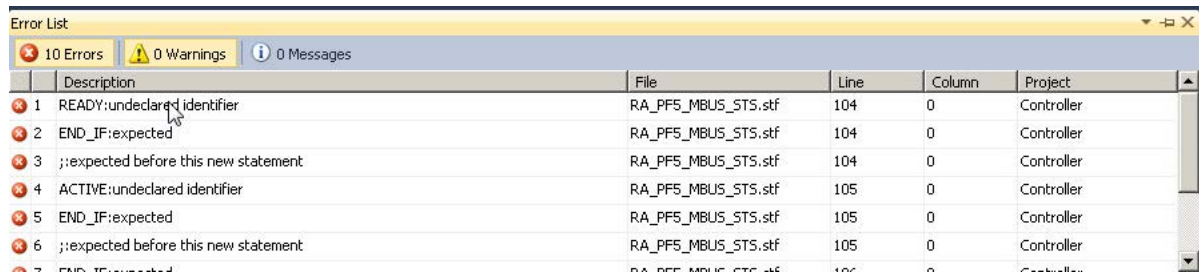
   a. If the build is successful, continue to step 4.
   b. Double-click an error description to go to that error.
   c. Correct each error.
   d. Repeat step 2 and step 3 until the build is successful and continue to step 4.

4. From the Project Organizer, right-click your controller icon and choose Download.
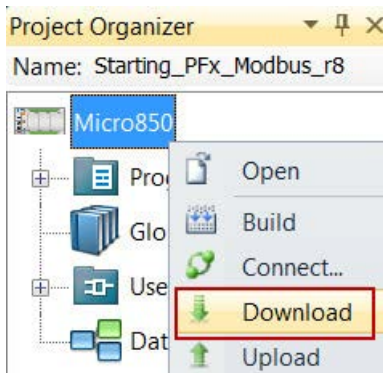
5. From the Connection Browser, select your controller and click OK.
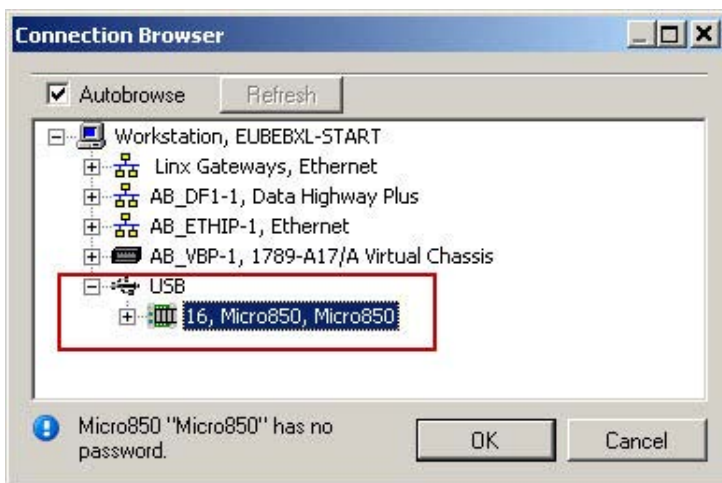
6. If prompted to change the controller mode to Remote Program mode, click Yes.

Configure the IP Address for Your PanelView 800 Terminal

Follow these steps to configure a static IP address on the PanelView 800 terminal.

1. From the Main menu, press Communication to open the Communication screen.

2. Press Set Static IP Address.

3. Configure the IP Address and Mask values so they are in the same range as your Micro800 controller.

4. To return to the Main menu, press Main.

Transfer Your HMI Application to the PanelView 800 Terminal

Follow these steps to transfer your HMI application to the PanelView 800 terminal by using Connected Components Workbench software.

1. In the Project Organizer, right-click the PanelView 800 device icon and choose Download.
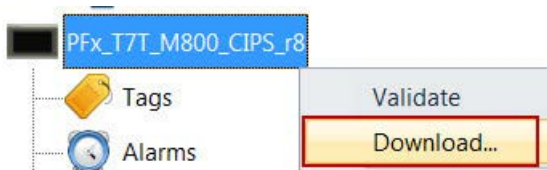
2. In the Connection Browser window, select the PanelView 800 terminal.

3. Click OK.
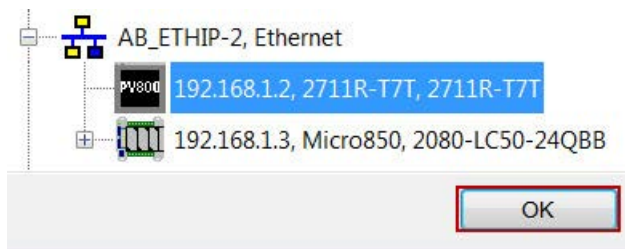
4. Verify that the download completed successfully.

5. From the Main menu of your PanelView 800 terminal, press File Manager.

6. On the File Manager screen, select Internal as your Source.

7. Select your application.

8. Press Run.
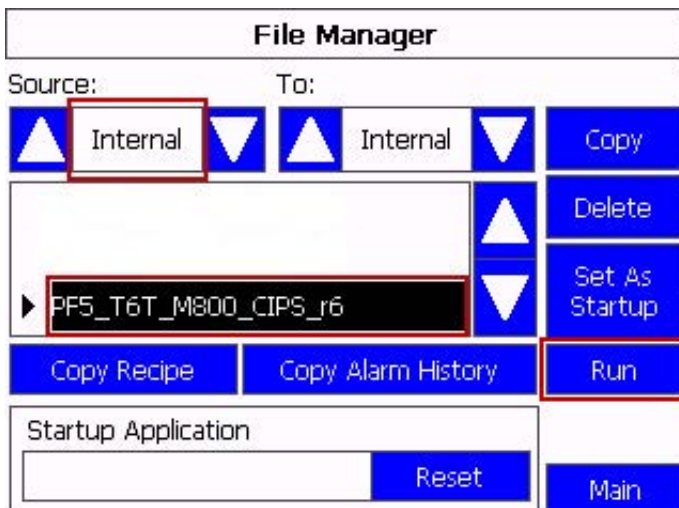
Validate Your System

In this section, you review the Machine Functions screen and explore the Status and Command screens to test the manual control of the building block.

Understand the Machine Functions Screen

The Machine Functions screen is the screen that links to the installed building blocks. When this screen is first loaded, you can complete the following tasks:

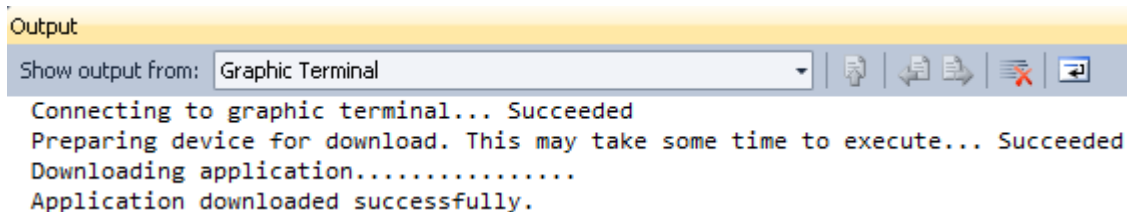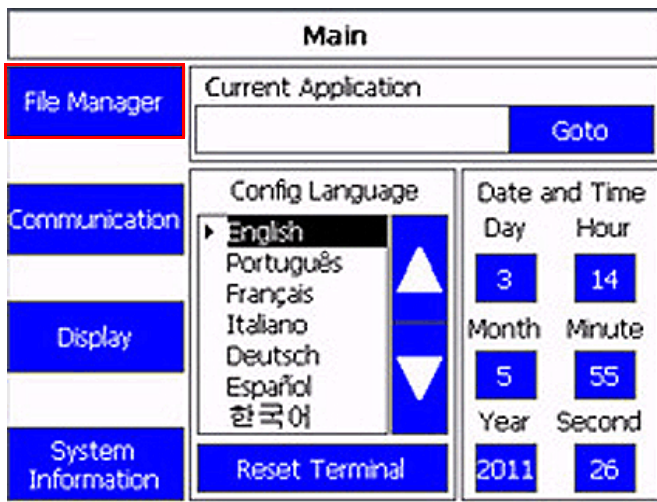- Return to the Machine Overview screen by pressing the 'X' in the upper right-hand corner of the screen.
- View a device in detail by pressing its button.
- View the current machine Auto/Manual state.
- Change the current machine Auto/Manual state.
- Clear machine faults, start/stop the machine (while in Auto mode) and go to the machine state diagram overview screen.
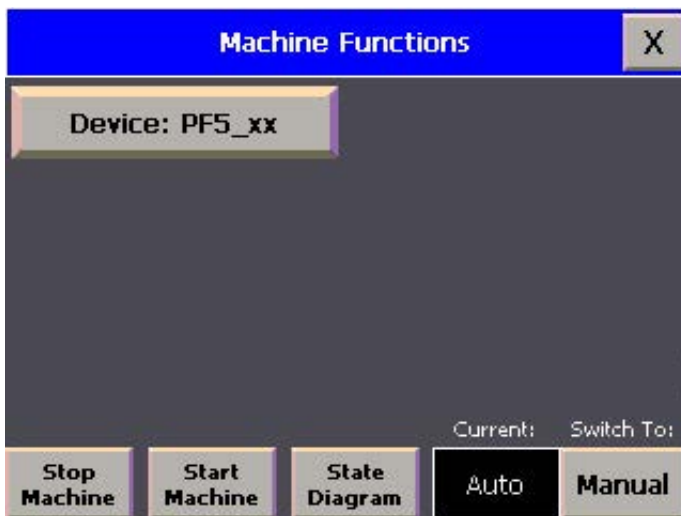
The border of the device button changes color to indicate a specific status. For PowerFlex AC drives, the button border colors indicate the following status:

- A green border indicates that the drive is active and running.
- A gray border indicates that the drive is inactive and stopped.
- A red border indicates that there is a fault or an alarm is present.

Understand the Status and Command Screen

Follow this procedure to understand the drive status and command features.

1. From the Device Overview screen, switch the Operation mode to Manual.

2. Press the device.

   The Status and Command screen for the device appears in Manual mode.
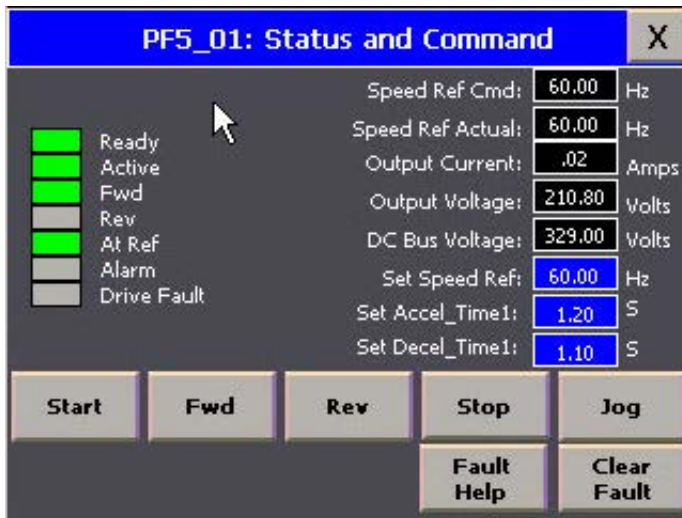
3. At any time, press X in the top-right corner to return to the previous screen.

   If this screen is opened while the program is in Auto mode, some of the commands are inactive and some of the input selectors are unavailable.

The following status and command indicators and fields appear on this screen.

Table 3 - Drive Status Indicators

Status	Gray	Green	Red
Ready	The drive is not ready.	The drive is ready.	–
Active	The drive is not active (running).	The drive is active (running).	–
Fwd	The drive is not commanded forward.	The drive is commanded forward.	–
Rev	The drive is not commanded reverse.	The drive is commanded reverse.	–
At Ref	The drive is not at reference speed.	The drive is at reference speed.	–
Alarm	The drive alarm is not present.	–	The drive alarm is present.
Drive Fault	The drive fault is not present.	–	The drive fault is present.

Table 4 - Drive Status

Speed Ref Cmd	Value of the active frequency command in Hertz. Shows the commanded frequency even if the drive is not running.
Speed Ref Actual	Value of the drive frequency present at T1, T2, T3 (U, V, W), in Hertz.
Output Current	Value of the current present at T1, T2, T3 (U, V, W), in amperes.
Output Voltage	Value of the voltage present at T1, T2, T3 (U, V, W), in volts.
DC Bus Voltage	Value of the present DC bus voltage level, in volts.

Table 5 - Drive Command and Configuration

Set Speed Ref	Set the speed reference of the drive by entering a value from 0 to 60.00.
Set Accel_Time1	Set the acceleration time of the drive from 00.01…600.0 seconds.
Set Decel_Time1	Set the deceleration time of the drive from 00.01…600.0 seconds.
Start button	Press to start the drive.
Fwd button	Press to set the drive direction to forward.
Rev button	Press to set the drive direction to reverse.
Stop button	Press to stop the drive.
Jog button	Press to jog the drive (this button is active only when the drive is stopped).
Clear Fault button	Press to clear any drive fault.
Fault Help	Press to go to the Fault Help screen, to find more troubleshooting information on an active fault error.

If the controller loses communication with a drive, then a Drive Communication Loss banner appears.

IMPORTANT	Any drive status values that are shown on this screen during this condition are invalid because the controller cannot communicate with the drive to update the values.
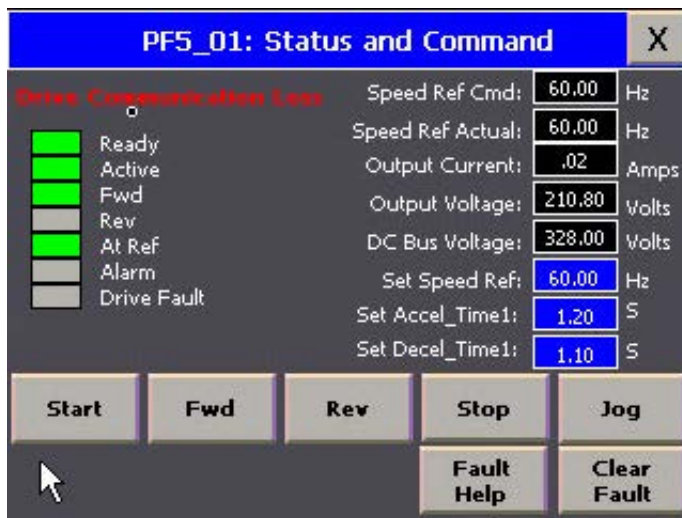
Verify the Manual Operation of the Drive

Verify manual operation of the drive by checking that the Start, Stop, Fwd, Rev, and Jog buttons are working properly.

1. Confirm that any motor connected to the drive is in a safe state to operate manually.

2. Set a speed reference that is safe for your application.

3. Set an acceleration and deceleration time that is safe for your application.

4. Press Fwd to set the drive direction to forward.

5. Press Start, and verify that the drive starts and ramps up to the speed reference in the time specified.

    You can verify the actual speed reference in the Speed Ref Actual numeric display.

6. Verify that the Ready, Active, Fwd, and At Ref indicators are green once the drive is at speed.

7. Press Stop, and verify the drive stops in the time that is specified and ramps to a speed reference of 0.00 Hz.

    The Active indicator turns gray once the drive has stopped.

8. Repeat steps 1…7 with the drive set in the reverse (Rev) direction.

9. Test the Jog functionality by pressing and holding the Jog button.

    The drive jogs at the preset jog speed of 10.00 Hz.

You have completed verifying the manual operation of your drive.

Verify Operation of the Fault Help Screen

1. Connect a switch to a digital input on the drive.

    See 'I/O Wiring' in the PowerFlex 520-Series AC Drive User Manual, publication 520-UM001, for details.

2. Set the appropriate parameter (t062, t063, t065, or t066 [DigIn TermBlk *xx*]) to option 12 'Aux Fault'.

3. Activate the switch so that the digital input is set.

The color of the Drive Fault label (on the Status and Command screen) changes from green to red and shows the fault code 'F02', as shown here.
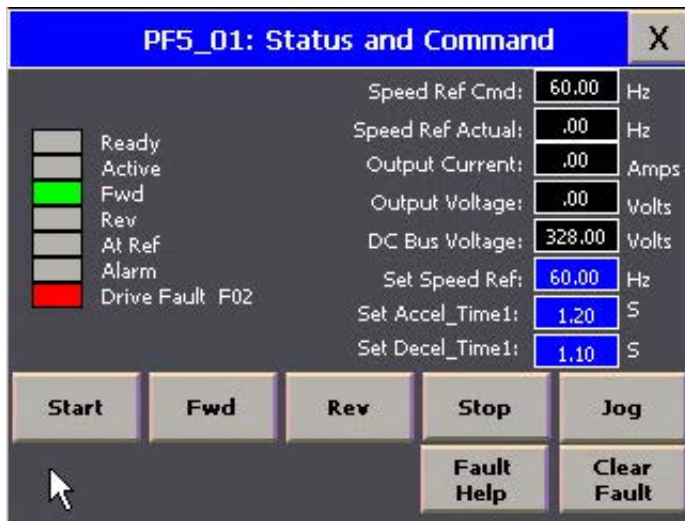
4. To view the fault message screen, press Fault Help at the bottom of the screen.
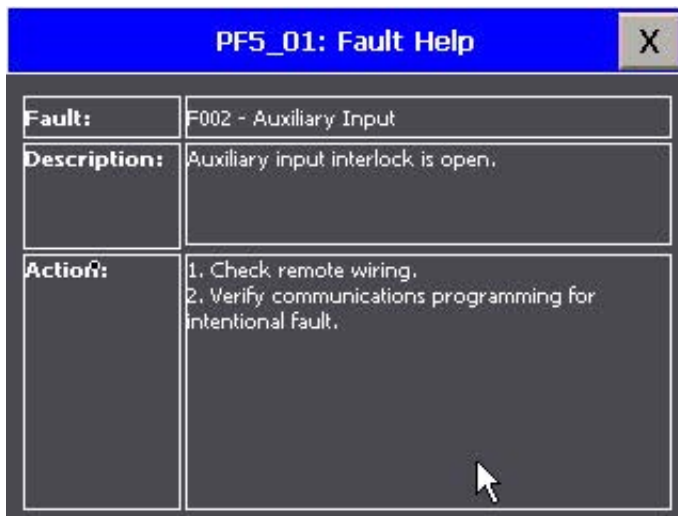
Over 100 fault message codes are preloaded and can be annunciated by the application.

You have completed verifying the Fault Help screen.

PowerFlex Compact-class User-defined Function Block

This appendix describes the available user-defined function block and the associated inputs and outputs.

RA_PFx_MODBUS_STS_CMD User-defined Function Block

This user-defined function block (UDFB) sends commands to and provides status from a PowerFlex Compact-class AC drive using Modbus RTU messaging over RS-485. This UDFB has been tested with up to eight drives within one project. The measured drive start/stop response times for eight drives (at 19,200 baud) in a 100 sample test varied from 40...440 milliseconds.

Table 6 - RA_PFx_MODBUS_STS_CMD Inputs

Variable	Data Type	Input Data Range	Description
FBEN	BOOL	TRUE/FALSE	When the preceding rung conditions are TRUE, the function block is enabled.
Channel	UINT	5…9	Set this value to the channel of the serial port to which the drive is communicating (slots 1…5).
NodeAddress	USINT	1…247	Set this value to the Modbus RTU slave node address of the drive.
UpdateRate_ms	UDINT	1000…65535	Set this value to the read interval in milliseconds (writes are made on an exception basis).
Stop	BOOL	TRUE/FALSE	Set this bit to TRUE to command the drive to stop.
Start	BOOL	TRUE/FALSE	Set this bit to TRUE to command the drive to start.
Jog	BOOL	TRUE/FALSE	Set this bit to TRUE to command the drive to jog.
ClrFault	BOOL	TRUE/FALSE	Set this bit to TRUE to command the drive to clear all faults.
SetFwd	BOOL	TRUE/FALSE	Set this bit to TRUE to command the drive to rotate in the forward direction.
SetRev	BOOL	TRUE/FALSE	Set this bit to TRUE to command the drive to rotate in the forward direction.
SpeedRef	REAL	0.00…500.00	Set this value to the speed at which you want the drive to operate, in Hertz.
AccelTime1	REAL	0.00…600.00	Set the time for the drive to accelerate to the maximum frequency.
DecelTime1	REAL	0.00…600.00	Set the time for the drive to decelerate to the minimum frequency.

Table 7 - RA_PFx_MODBUS_STS_CMD Outputs

Variable	Data Type	Description
FBENO	BOOL	This bit is TRUE when the function block is enabled.
FB_Err	BOOL	This bit is TRUE when an error in the function block occur (see CommLoss or DriveType).
CommLoss	BOOL	This bit is TRUE when communication is lost between the controller and drive.
DriveType	STRING	Model of the supported drive, once identified, or 'Unknown Drive'.
DriveFault	BOOL	This bit is TRUE when the drive is faulted.
FaultCode	UINT	This value provides the drive fault code. Please reference your drive's user manual for fault code definitions.
Ready	BOOL	This bit is TRUE when the drive is in the Ready state.
Active	BOOL	This bit is TRUE when the drive is Active (running).
CmdFwd	BOOL	This bit is TRUE when the drive is rotating in the Forward direction.
CmdRev	BOOL	This bit is TRUE when the drive is rotating in the Reverse direction.
AtRef	BOOL	This bit is TRUE when the drive's speed feedback is equal to its commanded speed.
CmdSpeed	REAL	This value is the drive's commanded speed, in Hertz.
SpeedFeedback	REAL	This value is the drive's speed feedback, in Hertz.
OutputCurrent	REAL	This value is the output current of the drive, in amperes.
DCBusVoltage	REAL	This value is the DC bus voltage of the drive, in volts.
OutputVoltage	REAL	This value is the output voltage of the drive, in volts.

Global Variables

This appendix contains the global variables that are used for user program interfacing.

Table 8 - Global Variables

Variable Name	Variable Description
(user-defined prefix)_Cmd_Accel_Time1	First acceleration time
(user-defined prefix)_Cmd_ClrFlt_Auto	Clear drive faults
(user-defined prefix)_Cmd_Decel_Time1	First deceleration time
(user-defined prefix)_Cmd_Jog_Auto	Jog drive
(user-defined prefix)_Cmd_SetFwd_Auto	Set drive direction to forward rotation
(user-defined prefix)_Cmd_SetRev_Auto	Set drive direction to reverse rotation
(user-defined prefix)_Cmd_SpeedRef_Auto	Set drive speed reference
(user-defined prefix)_Cmd_Start_Auto	Start drive
(user-defined prefix)_Cmd_Stop_Auto	Stop drive
(user-defined prefix)_Sts_Active	Drive is active
(user-defined prefix)_Sts_Alarm	Drive is in alarm
(user-defined prefix)_Sts_AtRef	Drive is at reference speed
(user-defined prefix)_Sts_CmdFwd	Drive has been commanded to forward rotation
(user-defined prefix)_Sts_CmdRev	Drive has been commanded to reverse rotation
(user-defined prefix)_Sts_CmdSpeed	Commanded speed
(user-defined prefix)_Sts_DCBusVoltage	DC bus voltage
(user-defined prefix)_Sts_DriveCommLoss	Drive communications has been lost
(user-defined prefix)_Sts_DriveFault	Drive is faulted
(user-defined prefix)_Sts_DriveFaultCode	Drive numeric fault code
(user-defined prefix)_Sts_OutputCurrent	Output current of the drive
(user-defined prefix)_Sts_OutputVoltage	Output voltage of the drive
(user-defined prefix)_Sts_Ready	Drive is ready
(user-defined prefix)_Sts_SpeedFeedback	Speed feedback

Notes:

Rockwell Automation Support

Rockwell Automation provides technical information on the Web to assist you in using its products. At http://www.rockwellautomation.com/support you can find technical and application notes, sample code, and links to software service packs. You can also visit our Support Center at https://rockwellautomation.custhelp.com/ for software updates, support chats and forums, technical information, FAQs, and to sign up for product notification updates.

In addition, we offer multiple support programs for installation, configuration, and troubleshooting. For more information, contact your local distributor or Rockwell Automation representative, or visit http://www.rockwellautomation.com/services/online-phone.

Installation Assistance

If you experience a problem within the first 24 hours of installation, review the information that is contained in this manual. You can contact Customer Support for initial help in getting your product up and running.

United States or Canada	1.440.646.3434
Outside United States or Canada	Use the Worldwide Locator at http://www.rockwellautomation.com/rockwellautomation/support/overview.page, or contact your local Rockwell Automation representative.

New Product Satisfaction Return

Rockwell Automation tests all of its products to help ensure that they are fully operational when shipped from the manufacturing facility. However, if your product is not functioning and needs to be returned, follow these procedures.

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

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