PowerFlex® Drives Configuration & Programming
PowerFlex 525 & PowerFlex 755 AC Drives

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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
• recognize the consequence

**SHOCK HAZARD**
Labels may be located on or inside the drive to alert people that dangerous voltage may be present.

**BURN HAZARD**
Labels may be located on or inside the drive to alert people that surfaces may be dangerous temperatures.
PowerFlex Drives Configuration & Programming

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Before You Begin

Please review the following information before starting this lab.

About this lab

Learn the basics of drive configuration and programming using the PowerFlex 525 compact AC drive and the PowerFlex 755 AC Drive. Attendees will configure these drives using the Human Interface Module (HIM), Connected Components Workbench software and Studio 5000™ Logix Designer software. You will also try out AppView, a feature that provides specific parameter groups for popular applications for the PowerFlex 525 AC Drive. The third lab exercise shows how Premier Integration™ enhances the use of PowerFlex AC drives with ControlLogix® and CompactLogix™ controllers and other Allen-Bradley® products. In that exercise, you will see how to save time and money during system development, operation, and maintenance. If you have extra time, learn about the new Automatic Device Configuration (ADC) feature for PowerFlex 750-Series and PowerFlex 520-Series drives in Studio 5000.

Lab layout

This PowerFlex lab is broken into sections to allow user to “choose own adventure.” One can start with either Lab 1: PowerFlex 525 AC Drive Programming & Configuration or Lab 2: PowerFlex 755 AC Drive Programming & Configuration. Lab 3: Drive Add-On Profile with Drives and Motion Accelerator Toolkit is the premier integration of the drives using Studio 5000 Logix designer.
Tools & Prerequisites

Software programs required
- Studio 5000 Logix Designer v28.00
- PowerFlex 525 Add-On Profile v1.04.00
- PowerFlex 755 Add-On Profile v4.08.00
- Connected Components Workbench v8.01
- RSLinx Classic v3.74.00
- FactoryTalk View Studio v8.10
- RSLinx Enterprise v5.74.00
- Wizards v3.14.3

Hardware devices required
- PowerFlex 525/527 Demo Box (PF52X1)
  - CompactLogix 5370 Controller (1769-L18ERM-BB1B) – v28.011.20
  - 1738-ETAP
  - PowerFlex 525 AC Drive (25B-V2P5N104) – v4.001, with 25-COMM-E2P Option module
- PowerFlex 755 DHQ Demo Box (PN-39023)
  - PowerFlex 755 AC Drive (20G11-N-B-DM1AA6K32V8) – v12.001
- Ethernet patch cables

Files required
- PowerFlex_Lab.ACD
- PowerFlex_Lab_ADC.ACD
- PowerFlex.mer

Lab files are located within the “C:\Users\labuser\Desktop\Lab Files\PF525 and PF755 - Basic HIM, CCW, PI\Lab Files” folder.
Network Setup

Set IP Address of PowerFlex 755 to **192.168.1.30** by setting the IP address switches.

The PowerFlex 525 Network Option module IP address will be set using the Keypad in Lab 1.

<table>
<thead>
<tr>
<th>Ethernet Connections</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>PC</td>
<td>L18ERM Port 1 (front)</td>
</tr>
<tr>
<td>2</td>
<td>L18ERM Port 2 (rear)</td>
<td>ETAP Port 1 (front)</td>
</tr>
<tr>
<td>3</td>
<td>ETAP Port 2 (rear)</td>
<td>PF525, 25-COMM-E2P Ethernet Port 1</td>
</tr>
<tr>
<td>4</td>
<td>ETAP Device Port (front)</td>
<td>PF755, Embedded Ethernet Port</td>
</tr>
</tbody>
</table>
About the PowerFlex 525 Demo Box

- CompactLogix 5370 Controller
- ETAP
- Drive I/O
- PowerFlex 525 Drive
- Controller I/O
- Quadrature Encoder
- Demo Box Power
- Induction Motor
- Input Voltage Selector
- Drive Power
- Safe Stop Button
About the PowerFlex 755 DHQ Demo Box
Lab 1: Configuring the PowerFlex 525 AC Drive

Part 1: Using the HIM Keypad and Display

In this section you will perform the following:

- Review key information about the HIM keypad and display of the PowerFlex 525 drive
- Reset the PowerFlex 525 drive to defaults
- Configure several parameters

Information

The PowerFlex 525 drive is easy to configure with flexibility in programming options to meet your application. One of these options is the Liquid Crystal Display (LCD) Human Interface Module (HIM). Some of its key features are as follows:

- Improved visibility
- Increased resolution
- Descriptive scrolling text
  - Three adjustable speeds
- Full alphanumeric characters with 5 digits and 16 segments
- Supports multiple languages
  - English
  - French
  - Spanish
  - Italian
  - German
  - Portuguese
  - Polish
  - Turkish
  - Czech
Display and Control Keys

- **AppView**: Dedicated sets of parameters grouped together for the following applications
  - Conveyor
  - Mixer
  - Compressor
  - Centrifugal Pump
  - Blower
  - Extruder
  - Positioning
  - Textile / Fiber

- **CustomView**: Parameter Groups can be customized specifically for your application
  - Add up to 100 parameters
  - Save new “CustomView” groups for easy copy and paste
### Control and Navigation Keys

#### Display

<table>
<thead>
<tr>
<th>Display</th>
<th>Display State</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENET</td>
<td>Off</td>
<td>Adapter is not connected to the network.</td>
</tr>
<tr>
<td></td>
<td>Steady</td>
<td>Adapter is connected to the network and drive is controlled through Ethernet.</td>
</tr>
<tr>
<td></td>
<td>Flashing</td>
<td>Adapter is connected to the network but drive is not controlled through Ethernet.</td>
</tr>
<tr>
<td>LINK</td>
<td>Off</td>
<td>Adapter is not connected to the network.</td>
</tr>
<tr>
<td></td>
<td>Steady</td>
<td>Adapter is connected to the network but not transmitting data.</td>
</tr>
<tr>
<td></td>
<td>Flashing</td>
<td>Adapter is connected to the network and transmitting data.</td>
</tr>
</tbody>
</table>

#### LED

<table>
<thead>
<tr>
<th>LED</th>
<th>LED State</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>FAULT</td>
<td>Flashing Red</td>
<td>Indicates drive is faulted.</td>
</tr>
</tbody>
</table>

#### Key

<table>
<thead>
<tr>
<th>Key</th>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up Arrow Down Arrow</td>
<td>Scroll through user-selectable display parameters or groups. Increment values.</td>
<td></td>
</tr>
<tr>
<td>Escape</td>
<td>Back one step in programming menu. Cancel a change to a parameter value and exit Program Mode.</td>
<td></td>
</tr>
<tr>
<td>Select</td>
<td>Advance one step in programming menu. Select a digit when viewing parameter value.</td>
<td></td>
</tr>
<tr>
<td>Enter</td>
<td>Advance one step in programming menu. Save a change to a parameter value.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Key</th>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reverse</td>
<td>Used to reverse direction of the drive. Default is active. Controlled by parameters P046, F048 and P050 [Start Source x] and A544 [Reverse Disable].</td>
<td></td>
</tr>
<tr>
<td>Start</td>
<td>Used to start the drive. Default is active. Controlled by parameters P046, F048 and P050 [Start Source x].</td>
<td></td>
</tr>
<tr>
<td>Stop</td>
<td>Used to stop the drive or clear a fault. This key is always active. Controlled by parameter P045 [Stop Mode].</td>
<td></td>
</tr>
<tr>
<td>Potentiometer</td>
<td>Used to control speed of drive. Default is active. Controlled by parameters P047, F049 and P051 [Speed Reference].</td>
<td></td>
</tr>
</tbody>
</table>
### Viewing and Editing Parameters

The following is an example of basic integral keypad and display functions. This example provides basic navigation instructions and illustrates how to program a parameter. Just read through the following.

<table>
<thead>
<tr>
<th>Step</th>
<th>Key(s)</th>
<th>Example Display</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>When power is applied, the last user-selected Basic Display Group parameter number is briefly displayed with flashing characters. The display then defaults to that parameter's current value. (Example shows the value of b001 [Output Freq] with the drive stopped.)</td>
<td><img src="image" alt="Example Display" /></td>
</tr>
<tr>
<td>2.</td>
<td>Press Esc to display the Basic Display Group parameter number shown on power-up. The parameter number will flash.</td>
<td><img src="image" alt="Example Display" /></td>
</tr>
<tr>
<td>3.</td>
<td>Press Esc to enter the parameter group list. The parameter group letter will flash.</td>
<td><img src="image" alt="Example Display" /></td>
</tr>
<tr>
<td>4.</td>
<td>Press the Up Arrow or Down Arrow to scroll through the group list (b, P, t, C, I, d, A, f and G0).</td>
<td><img src="image" alt="Example Display" /></td>
</tr>
<tr>
<td>5.</td>
<td>Press Enter or Sel to enter a group. The right digit of the last viewed parameter in that group will flash.</td>
<td><img src="image" alt="Example Display" /></td>
</tr>
<tr>
<td>6.</td>
<td>Press the Up Arrow or Down Arrow to scroll through the parameter list.</td>
<td><img src="image" alt="Example Display" /></td>
</tr>
<tr>
<td>7.</td>
<td>Press Enter to view the value of the parameter. Or Press Esc to return to the parameter list.</td>
<td><img src="image" alt="Example Display" /></td>
</tr>
<tr>
<td>8.</td>
<td>Press Enter or Sel to enter Program Mode and edit the value. The right digit will flash and the word Program on the LCD display will light up.</td>
<td><img src="image" alt="Example Display" /></td>
</tr>
<tr>
<td>9.</td>
<td>Press the Up Arrow or Down Arrow to change the parameter value.</td>
<td><img src="image" alt="Example Display" /></td>
</tr>
</tbody>
</table>
Reset Drive to Defaults

This is the beginning of the hands-on portion of the lab.

1. Make sure DI1 is in the **Left** position

2. Make sure the CompactLogix controller is NOT in Run Mode. If the RUN LED on the controller is lit, move the switch to **PROG** (bottom/down) position then **REM** position (middle).

You may need to open the door on the controller to access the switch.
3. Press the Stop button to clear the fault from the drive.

4. Press the Esc button until you see zero speed on the keypad display.

5. Press the Select button and use the Up or Down arrows until you see the Basic Program group on the HIM display.

6. Press the Enter or Sel button to enter the Basic Program group. The right digit of the last viewed parameter in that group will flash.

7. Use the Up or Down arrows until you see P053. If you wait one (1) second, you will notice that the HIM display scrolls with “P053 – Reset to Defaults”.

Note: Rather than pressing the Up and Down arrows to scroll through many parameters in numerical order, you can also press Sel button to move from digit to digit or bit to bit. The digit or bit that you can change will flash.

8. Once P053 is displayed, Press the Enter button. You will see “0 - Ready/Idle” scroll across the display. Press the Up or Down arrows until you see “2 – Factory Reset”.

9. Press the Enter button to confirm. The drive will fault with a scrolling message of “F048 – Parameters Defaulted”. The picture below shows this.

10. Press the Stop button to clear the fault from the drive.

**Configuring the 25-COMM-E2P, Dual Port EtherNet option module, IP Address Parameters**

1. Take what you have learned about the keypad operation from the Reset Drive to Defaults section to make the following Network Option Communication group parameter changes. Navigate to the Network Option parameters starting at parameter N1004;
   - N1004 – Net Addr Sel = 1 - “Parameters”
   - N1006 – IP Addr Cfg 1 = 192
   - N1007 – IP Addr Cfg 2 = 168
   - N1008 – IP Addr Cfg 3 = 1
   - N1009 – IP Addr Cfg 4 = 20
   - N1010 – Subnet Cfg 1 = 255
   - N1011 – Subnet Cfg 2 = 255
   - N1012 – Subnet Cfg 3 = 255
   - N1013 – Subnet Cfg 4 = 0
   - N1014 – Gateway Cfg 1 = 192
   - N1015 – Gateway Cfg 2 = 168
   - N1016 – Gateway Cfg 3 = 1
   - N1017 – Gateway Cfg 4 = 1

2. In order for communication settings to take effect, cycle power to the drive by using the Drive Power selector switch located in the bottom left corner of the demo box. Turn the switch to the “OFF” position, and then after the display of the drive goes dark, back to the “ON” position.

   ![Drive Power Selector](image)

Continue on to the next exercise.
Part 2: Utilizing EtherNet/IP™ and Connected Components Workbench™ Software

Connected Components Workbench programming and configuration software supports the Micro800™ controllers, as well as the PowerFlex 4-class drives and PanelView™ Component graphic terminals for your small machine applications.

In this section you will perform the following:

- Connect to the PowerFlex 525 drive through the embedded EtherNet/IP via Connected Components Workbench software
- Explore the different parameter groupings as well as the AppView.
- Create a CustomView
- Explore the Startup Wizard

Connecting to the Drive

1. Go to the computer’s desktop and double click the shortcut for Connected Components Workbench software.

You will see the following splash screen while the software loads, which may take a few moments.
2. The main screen for the Connected Components Workbench software is shown below.

You may need to maximize the software to make viewing easier.

3. There are many features in the Connected Components Workbench software. Mainly, we will be using the software to go online with the PowerFlex 525 drive. Click the [+] next to Discover within the Device Toolbox.

4. Click the “Browse Connections” button to launch the RSWho connection browser.
5. The lab's preconfigured RSLinx driver will appear. Click on the [+] to expand the topic **AB_ETH-1, Ethernet**. Click to highlight the “192.168.1.20, PowerFlex 525 1P 110V .50HP” device.

![Connection Browser](image1)

6. Press the “OK” button to initiate the connection process. For a quick moment, you might see a connection status window.

![Connecting](image2)

Otherwise, once the connection process is complete, you will see the following main screen with a green highlighted “Connected” for the PowerFlex 525 drive within the Connected Components Workbench software.

![Connected Screen](image3)
Exploring Drive Parameters through Standard Parameter Groupings

1. Some useful tools for the PowerFlex 525 drive are included in the Connected Components Workbench software, as shown below. Take some time to explore them.

2. Select the '0 - PowerFlex 525' tab, then click on the “Parameters” icon to view the PowerFlex 525 drive parameters as seen below.

The PowerFlex 525 drive Add-On Profile has a time saving feature with Connected Components Workbench software that will show the non-default parameters. This makes it easy for users to view which parameters were changed from their default setting.

This button only updates the set of parameters shown based on the upload. When a parameter changes from defaults after clicking the button, it won't be added to the list until the view is refreshed.
3. Make sure “All Parameters” is selected within the Group dropdown selection box and then click the “Show Non-Defaults” button as shown below.

A progress window showing the upload will appear.

4. Once the upload has completed you will see the parameters window update to just show only the non-default parameters.

5. Close the Port 0 Parameters dialog box by clicking 

6. You can do the same with the option modules. Select the select the ‘25-COMM-E2P’ tab, then click ‘Parameters’. When the Port 2 Parameters dialog box opens, click ‘Show Non-Default’ button. Take a look, you will notice that the parameters you changed in Part 1 appear in this list.

7. Click the “Show All” button to return to viewing all of the 25-COMM-E2P parameters.

8. Close the Port 2 Parameters dialog box by clicking the
9. **Select the ‘0 - PowerFlex 525’ tab, then click ‘Parameters’.** To make viewing and editing parameters even simpler, you can enter a word or abbreviation into the filter value entry box. For example, type “Motor” into the **Filter Value** entry box. Notice that it filters and only shows the parameters that have the word motor in their parameter names.

![Parameters screenshot]

Try some other examples such as “Dig”, “Speed”, or “10” and see the results.

Remember to clear/delete the entry field when finished.
10. Under the Group dropdown selection box, you can scroll through the different drive parameter groups, AppView groups and the CustomView group.

11. Select “Basic Program” from the Group dropdown menu and explore the parameters shown below.

These are the most simplistic parameters that are needed to start up/commission a PowerFlex 525 drive. Take some time to explore some of the other parameter groupings such as “Terminals”, “Communications” and “Advanced Program” for more startup and commissioning parameters.
Exploring Drive Parameters with AppView™ and CustomView™ Groupings

The PowerFlex 525 drive has several AppView groupings that are tailored for a specific application to make the drive startup and commissioning simpler. This reduces guesswork about which parameters you need to change, and all of the drive parameters for that application are all in one convenient location.

1. Within the Group dropdown selection box, select the AppView parameter group for “Conveyor”. Scroll through these application specific parameters.

2. The PowerFlex 525 drive has a CustomView parameter group which is an application set that can be customized specifically for your application. You can add up to 100 parameters and save the new CustomView group. Select “Custom Group” from the Group dropdown selection box and click on the “Edit Group” button.

3. The Edit Custom Group window will appear. Here you will be able to select and add parameters into a nameable custom group. In this example, type in “ABC’s Group” in the Group Name box highlighted below.
4. Find the following parameters in the list and add them to “ABC’s Group”:

- Parameter 30 - Language
- Parameter 31 - Motor NP Volts
- Parameter 32 - Motor NP Hertz
- Parameter 33 - Motor OL Current
- Parameter 34 - Motor NP FLA
- Parameter 35 - Motor NP Poles
- Parameter 36 - Motor NP RPM
- Parameter 37 - Motor NP Power
- Parameter 39 - Torque Perf Mode
- Parameter 40 - Autotune
- Parameter 41 - Accel Time 1
- Parameter 42 - Decel Time 1
- Parameter 43 - Minimum Freq
- Parameter 44 - Maximum Freq
- Parameter 45 - Stop Mode
- Parameter 46 - Start Source 1
- Parameter 47 - Speed Reference 1
- Parameter 62 - DigIn TermBlk 02
- Parameter 63 - DigIn TermBlk 03
- Parameter 64 - 2-Wire Mode
- Parameter 65 - DigIn TermBlk 05
- Parameter 76 - Relay Out1 Sel
- Parameter 81 - Relay Out2 Sel

Once the parameters have been added, click the “OK” button to download this CustomView group to the drive.

You can also select/highlight multiple parameters then click the “Add ->” button. This makes adding parameters go a lot faster.
5. Notice how the parameter entries from above are all now in the ABC’s Group CustomView for easy viewing and editing of the parameters.

![Parameters dialog box]

Close the ‘Parameters’ dialog box by clicking the in the top right corner of the window.

**PowerFlex 525 Drive Start-Up Wizard**

1. Click on the “Wizards” button. The Available Wizards selection box will appear.

2. Select the “PowerFlex 525 Startup Wizard” from the list and click the “Select” button to launch the PowerFlex 525 Startup Wizard.

![Available Wizards dialog box]

After a moment, the Welcome screen for the PowerFlex 525 Startup Wizard will appear.
3. Click the “Next >” button to proceed with exploring the startup wizard.

4. Below is the Reset Parameters page. Here you have a few different options.
   - Reset all settings to factory defaults but retain the custom parameter group.
   - Reset all settings to factory defaults (including the custom parameter group).
   - Reset only the “Power Parameters”.

Click the “Reset” button for the first option, “Reset all settings to factory defaults but retain the custom parameter group”.
5. When the Confirmation window appears, verify that you made the correct choice and click the “Yes” button.

The drive may make a noise as it resets to defaults, and then will display the “F048 – Params Defaulted” fault on the HIM. After you see the following indicator on the Startup Wizard, continue by clicking the “Next >” button.

6. Make sure “English” is selected in the Language dropdown selection box and Click the “Next >” button to proceed to the next page…
7. On the next three pages, verify and if needed, modify the parameters according to the following screenshots. At the end of each page, remember to click the “Next >” button to proceed to the next page.

- Motor Control Page

- Motor Data Page (changes required)

- Feedback Page

- Stop / Brake Mode Page
8. The next page is for the Direction Test. If desired, you may skip the Direction Test by clicking the “Next >” button and move onto the next numbered step in this manual. To continue with the Direction Test, follow the steps below.

Press the Stop button to Clear Faults if the drive is faulted. The button is shown below.

Press and hold the Jog button to run the Direction Test. The button is shown below.

Note: If the following window appears, click the “Yes” button.

If the motor rotation is in the correct direction, click on the “Yes” radio button.

Proceed to the next test by clicking the “Next >” button.
9. The next page is for the AutoTune. If desired, you may skip the AutoTune by clicking the "Next >" button and move onto the next numbered step in this manual. To continue with the AutoTune, follow the steps below.

Click on the "Rotate Tune" button highlighted below to initiate the AutoTune Test. It may take up to a minute to complete after pressing the button.

Once finished, you will see the "Test Completed: Yes" result.

Proceed onto the next page by clicking the "Next >" button.
10. On the next several pages, verify and if needed, modify the parameters according to the following screenshots. At the end of each page, remember to click the “Next >” button to proceed to the next page.

- Ramp Rates / Speed Limits

- Speed Control

- EtherNet/IP
- Digital Inputs (changes required)
- We want to demonstrate control of the drive using the Keypad or from switches in the demo box wired to the PowerFlex 525 terminal block. The demo box switches will be assigned to Start Source 2 and enabled using switch DI1.

- Use the ‘Start Source 2’ pulldown menu to select ‘Digin TrmBlk’.
- The demo box STOP, START(FWD), DIR(REV) and DI1 switches are wired to terminal blocks 1, 2, 3 and 5 respectively.
- Use the ‘Digin TermBlk 02, 03, 05’ pulldown menus to assign these devices as shown below.
- Relay Outputs (changes required)

Relay Outputs

Relay 1 N.O.
- Function: MotorRunning
- Level: 0
- On Time: 0.0
- Off Time: 0.0

Relay 2 N.C.
- Function: At Frequency
- Level: 0
- On Time: 0.0
- Off Time: 0.0

- Opto Outputs

Opto Output
- Logic: 1-N.O./2-N.O.

Opto Out 1
- Function: MotorRunning
- Level: 0

Opto Out 2
- Function: At Frequency
- Level: 0

- Analog Outputs

Analog Outputs
- Select: OutFreq 0-10
- High: 100 VmA
- Setpt: 0.0
11. After stepping through the previous pages to the Pending Changes page, you can review a summary of the planned programming changes you have made to the PowerFlex 525 drive.

Make sure all the pages have the check mark (✓) to the left of the page name/icon.

Click the “Finish >>” button to accept pending changes.
12. The main PowerFlex 525 drive window will be present. Click the “Reset” button for all of the new parameter settings to take effect. Some settings require a drive reset to be implemented.

A window will appear confirming that you would like to reset the device.

![Reset](image)

Click the “OK” button. You will hear the PowerFlex 525 drive cycle power and the HIM Keypad display will turn off and on before scrolling the drive information.

13. The reset happens quickly. You may see the following screen appear If it does, click the “OK” button.

![Reset Pending](image)

While the computer is reconnecting to the drive, your screen may show the following graphic for a moment.

![Reconnecting](image)

After the connection has been established with the drive again, the window will return to its normal state.

14. Disconnect connection to the drive. You may be prompted to upload parameters from the drive or to save the project when exiting the Connected Components Workbench software. Select the “No” button for each.

15. The configuration of the PowerFlex 525 is complete. At this point, we will be using the startup settings to run the motor.

16. Keeping in mind that you now control the drive from two sources: the push buttons and potentiometer of the drive, and the selector switches; attempt to run the drive.
17. You should start with the selector switches in the following position: DI1 in this position will select the drive Keypad to control the drive.

![Selector Switches Diagram]

18. With the buttons on the PF525: use \( \text{\textcircled{1}} \) to start the drive, \( \text{\textcircled{2}} \) varies the speed, and \( \text{\textcircled{3}} \) stops the drive.

19. Move selector switch DI1 to the right position to enable Start Source 2, previously configured to use the PF525 DRIVE demo box switches.

![Selector Switches Diagram]

20. With the PF525 DRIVE switches; toggle \( \text{\textcircled{4}} \) to start the drive, \( \text{\textcircled{5}} \) reverses the direction and \( \text{\textcircled{6}} \) stop the drive. The Keypad Speed Pot still controls the speed.

![Drive Control Diagram]

21. Use the \( \text{\textcircled{7}} \) push button or Keypad \( \text{\textcircled{8}} \) to stop the drive.

Continue on to the next exercise
Lab 2: Configuring the PowerFlex 755 AC Drive

Part 1: Using the HIM Keypad and Display

In this section you will perform the following:

- Review key information about the HIM keypad and display of the PowerFlex 755 drive
- Reset the PowerFlex 755 drive to factory defaults
- Set the motor control mode and enter motor nameplate data
- Set the speed feedback device and speed limits
- Perform a direction test
- Configure speed references, ramp rates, inputs, and outputs
- Configure several parameters

Information

This hands-on lab will provide you with an opportunity to explore the PowerFlex 755 AC drive. The image below shows some of the essential keys which you will be using in this session. Please familiarize yourself with these keys (buttons):

One of the ways to perform an Assisted Startup on the PowerFlex 755 is using the Startup routine in the H.I.M. The following steps will lead you through that:
1. Access the Status screen which is displayed on HIM PowerUp. Press STOP button to clear fault

![Status Screen](image1)

2. Press the ‘Folders’ button on the HIM keypad. The button is located on the bottom row of the HIM Keypad (shown circled in the left image below). Pressing the ‘Folders’ button changes the HIM screen display to the Folders screen, shown below to the right. Depending on your drive configuration, the text next to each number may vary.

![Folders Screen](image2)

Resetting Factory Defaults and Starting Wizard

3. Highlight Port 0 and use the left or right arrow keys to scroll through the different folders, to locate the folder called ‘MEMORY’.

![Folder Search](image3)
4. Use the down arrow key to highlight ‘Set Defaults’ if necessary and press the Enter key located in the center of the HIM keypad to make this your selection.

5. The screen which follows after completion of the previous step is shown. Use the down arrow key to highlight ‘This Port Only’. Press the Enter key located in the center of the HIM keypad to make this your selection.

6. Use the soft key labeled ‘ALL’ to reset default all parameter settings in the Drive.

7. Use the ‘CLR’ soft key to acknowledge and clear the ‘Module Defaulted’ fault. Press the ‘Enter’ soft key.

8. Press the ‘Folders’ button on the HIM keypad again to access the Folders Menu.
9. Now use the left or right arrow keys to scroll through the different folders, to locate the folder called ‘START UP’.

![Image of HIM keypad with START UP folder selected]

10. The first item listed in the ‘START UP’ folder is ‘Begin Start Up’ and this is highlighted by default. Press the Enter key located in the center of the HIM keypad to make this your selection.

11. The startup routine starts with an Introduction screen. Press the ‘ENTER’ soft key to continue. The ‘ENTER’ soft key is located on the top row of the HIM keypad.

![Image of HIM keypad with PowerFlex 755 Startup]

- Note: You can always use the ESC soft key to return to a previous step.
12. Pressing the ‘ENTER’ soft key in the previous step has led you to a new screen, which allows you to select the type of startup you wish to perform. For this lab session, we will choose ‘General Startup’. This is highlighted by default. Press the ‘ENTER’ soft key located on the top row of the HIM keypad to make this your selection.

Setting the Motor Control Mode

13. Pressing the ‘ENTER’ soft key in the previous step has led you to the ‘General Startup Main Menu’. You will go through steps listed in this menu to configure your drive. Press ‘ENTER’ soft key to enter the first section ‘Motor Control’.

14. The introduction screen provides information about the ‘Motor Control section. Press the ‘ENTER’ soft key to continue.
15. Pressing the ‘ENTER’ soft key in the previous step leads you to a screen which lists the available motor control modes in the PowerFlex 755. For this lab session, we will choose the Sensorless Vect mode. Use the scroll down ▼ or scroll up ▲ arrow soft keys to select ‘Sensorless Vect’. Press the ‘ENTER’ soft key to make this your selection.

![Screen with available motor control modes]

16. After selecting the motor control mode in the previous step, you are directed back to the General Startup Main Menu. ‘Motor Data’ should be highlighted now. Press the ‘ENTER’ soft key to make this your selection. The next few steps will require you to input the nameplate information of the motor you are doing a Startup on.

![General Startup Main Menu]

17. Pressing the ‘ENTER’ soft key in the previous step has led you to the ‘Startup Motor Data Entry’ screen. The first information you will provide is the Motor Nameplate (NP) Volts. The Motor in the demo is rated for 230 V. This should be the default value for this parameter. Press the ‘ENTER’ soft key to confirm your input and move to the next screen.
18. The next information you need to provide is the Power Units. By default the value of the parameter should be set to ‘HP’. Press the ‘ENTER’ soft key to confirm your selection and move to the next screen.

19. You will now be required to input the Motor Nameplate (NP) Power. The motor internal to the demo is rated 25 Watts (0.025 kW) or 0.033 HP. Notice that there are no designated buttons on the HIM keypad for entering a decimal point. The PowerFlex 755 HIM keypad uses a soft key to provide a ‘decimal point’ button. This ‘decimal point’ soft key is activated when the first digit in the numeric value is entered. In this case, start by entering ‘0’. Notice how one of the soft keys (top row of the HIM keypad) is now a ‘decimal point’ button. Use the ‘decimal point’ soft key button and the appropriate number keys to input a value of 0.033. Press the ‘ENTER’ soft key to confirm your input and move to the next screen.
20. You will now be required to input the Motor Nameplate (NP) Amperes. The Motor in the demo is rated for 0.22 amps. Use the ‘decimal point’ soft key button and the appropriate number keys to input a value of ‘0.22’. Press the ‘ENTER’ soft key to confirm your input and move to the next screen.

21. You should be in the ‘Edit Motor NP Hertz’ screen. The Motor in the demo is rated for 60 Hz. The Default value should be ‘60’ Hz. Press the ‘ENTER’ soft key to confirm your input and move to the next screen.

22. You will now be required to input the Motor Nameplate (NP) RPM. The Motor in the demo is rated for 1600 RPM. Use the appropriate number keys to input a value of ‘1600’. Press the ‘ENTER’ soft key to confirm your input and move to the next screen.

23. You should now be in the ‘Edit Mtr OL Factor’ screen. This screen allows you to enter the Motor Overload factor. By default this parameter value is set to a value of ‘1.00’. We will use this as our selection for this lab session. Press the ‘ENTER’ soft key to confirm this and move to the next screen.

24. You should be in the ‘Edit Motor Poles’ screen. The Motor in the demo is a 4 Pole motor. By default, this parameter value is set to a value of ‘4’. Press the ‘ENTER’ soft key to confirm this as your selection and move to the next screen.

25. You will now be required to input the Speed Units. For this lab we will use ‘RPM’ for our Speed Units. Use the scroll down ▼ or scroll up ▲ arrow soft keys to select ‘RPM’. After this setting has been selected, press the ‘ENTER’ soft key to confirm this and move to the next screen.
26. With the completion of the previous step, you have finished inputting the Motor Nameplate data and other information required in the ‘Motor Data’ section. Pressing the ‘ENTER’ soft key in the previous step has directed you to the Main Menu and the item ‘Feedback’ should be highlighted. Press the ‘ENTER’ soft key to make this your selection.

27. Select ‘Open Loop’ as we do not have an encoder on board the Drive.
Setting the Speed Limits

28. The previous step was the last step in configuring your feedback device. You should now have been directed back to the General Startup Main Menu. Configuring the limits is the next step in the Startup routine. Press the ‘ENTER’ soft key to access ‘Limits’ section.

29. For this lab session, we will be making the following changes in the ‘Limits’ section. Use the number keys to input the values listed for each item and press the ‘ENTER’ soft key to move forward to the next screen. After the four values have been entered, you will be exited out of this section.

- Max Fwd Speed = 1600 RPM
- Max Rev Speed = -1600.00 RPM (you can directly enter a value of ‘1600’; the negative sign is defaulted)
- Min Fwd Speed = 0.00 RPM
- Min Rev Speed = 0.00 RPM

Direction Auto Tune and Inertia Tests

30. You should now have been directed back to the General Startup Main Menu. The ‘Tests’ section is next and should be highlighted by default at this stage. Press the ‘ENTER’ soft key to access ‘Tests’ section.

31. There are two tests which are part of the Startup Routine. You will perform these tests in the next few steps. You will run the Direction test first. The ‘Direction Test’ list item should be highlighted by default. Press the ‘ENTER’ soft key to make this your selection. Press the Start key to start the motor.
32. The next screen asks the question ‘Is the direction of rotation forward?’ To demonstrate the ability of the PowerFlex 755 to electronically swap motor leads to change motor direction, let us choose ‘No’ as the answer to this question. Use the down arrow key to select and highlight ‘No’ and press the ‘ENTER’ soft key.

![Start-up direction test screen](image)

33. The next screen asks the question ‘How would you like to fix motor polarity?’. Select the default highlighted option ‘Automatic change’ by using the ‘ENTER’ soft key.

![Start-up direction test screen](image)

34. The screen that follows asks you to stop the drive so this change in direction, initiated in the previous step, can take place. Press the ‘STOP’ key to stop the drive.

![Start-up direction test screen](image)
35. Follow the direction on the next screen which asks you to ‘START’ the drive. You can start the drive and by using the START key.

36. The next screen asks the question ‘Is the direction of rotation forward?’ and requires confirmation that the changes to direction are acceptable. If the motor is running forward, select ‘Yes’ by pressing the ‘ENTER’ soft key. If motor is running reverse, repeat

37. As required by the following screen, press the STOP key to stop the drive.

38. Press the ‘START’ button to begin the test and review changed motor direction.

39. Select ‘Yes’ as your answer when asked the question again ‘Is the direction of rotation forward?’

40. Press the Stop key. This should successfully complete the Direction test.

41. You should now be back in the ‘Motor Test Menu’ screen. Now use the ‘ENTER’ soft key to select the ‘Auto tune’ Test. Read the important information on the screen and press the ‘ENTER’ soft key.

42. Pressing the ‘ENTER’ soft key in the previous step has directed you to the ‘Select the tuning mode’ screen. For this lab session, we will perform a rotate tune on the demo motor. Select the default highlighted option ‘Rotate Tune’ by pressing the ‘ENTER’ soft key.
43. As directed by the HIM screen information, press the START key to start the ‘Auto tune’ Test. Notice the changing information on the HIM (as the different parts of the Auto tune tests are completed). Wait till the test is completed.

44. The completion of the test is indicated by the ‘Test Completed Successfully’ screen. Press the ‘ENTER’ soft key.

45. Pressing the ‘ENTER’ key in the previous step has directed you back to the ‘Motor Test Menu’. Use the ‘ENTER’ soft key to select ‘Done’ in the ‘Motor Test Menu’ screen.

Configuring the Speed Reference and Ramp rates

46. At this time you should be in the ‘General Startup Main Menu’. The next item on the Startup menu list ‘Ref Ramp Stop’ should be highlighted by default. Press the ‘ENTER’ soft key to make this your selection.

47. The ‘Edit Direction Mode’ box should be on the screen now. We will use the default parameter value of ‘Unipolar’ for this lab session. Press the ‘ENTER’ soft key to confirm and save your selection.

48. You should be on the ‘speed reference source’ selection screen. Use the down arrow or up arrow keys to highlight ‘Analog Input’ as your Speed Reference source. Use the ‘ENTER’ soft key to make this your selection.

49. In the window ‘Select Port to Use’ that appears following the previous step, use the down arrow or up arrow keys to highlight ‘Port 07 I/O module 24V’. Use the Enter key to make this your selection.
50. Use the down arrow \( \downarrow \) and up arrow \( \uparrow \) keys, if necessary, to highlight 'Par 0050 Anlg In0 Value'. Use the Enter key \( \Rightarrow \) to make this your selection. Press the 'ENTER' soft key to confirm and save your selection.

51. The next few steps will configure the Analog Input you chose as Speed Reference. For this lab session we will use the 0-10V potentiometer (labeled 0-10VDC IN 0) on the demo as our Analog Input speed reference. Pressing the 'ENTER' soft key in the previous step has led you to the first item required to configure the Analog Input. You should be in 'Edit Anlg In0 Hi' screen. Press the 'ENTER' soft key to accept the default value of 10.000 Volt.

52. In the 'Edit Anlg In0 Lo' screen that follows, press the 'ENTER' soft key to accept the default value of 0.000 Volt.

53. In the next few screens input these values:
   - 'Speed Ref A Anlg Hi' = 1600 RPM
   - 'Speed Ref A Anlg Lo' = 0 RPM
   Press the ‘ENTER’ soft key.

54. You should be in the 'Startup / Stop Config' screen now, press the 'ENTER' soft key to accept the default selection of 'Ramp 1' to be used as 'Stop Mode A'.

55. Pressing the ‘ENTER’ key in the previous step has directed you to the screen to configure the 'Bus Reg Mode A'. Select the default of 'Adjust Freq 1' using the 'ENTER' soft key.

56. Following the step to set bus regulation you will now set Ramp (Accel and Decel) times. In the ‘Edit Accel Time 1’ screen, use the appropriate number key to enter a value of ‘3’ seconds. Press the ‘ENTER’ soft key.

57. Similarly enter a value of 3 seconds for the deceleration time in the ‘Edit Decel Time 1’ screen. Press the ‘ENTER’ soft key.

58. The next screen continues the ramp speed configuration and asks the question ‘Do you want to perform S-curve for Accel/Decel?’. We will select ‘No’ as the answer for this lab session. You can select ‘No’ by highlighting it using the down and up arrow keys and then using the ‘ENTER’ soft key to confirm and save your selection.

**Configuring the Inputs and Outputs**

59. Completing the previous step successfully has led you to the 'General Startup Main Menu' with the item 'I/O' highlighted. Press the ‘ENTER’ soft key to enter the 'I/O' section.

60. You should be in the 'Start Stop I/O' screen now. The first item to configure on this list is ‘Start Stop & Dir’. Press the ‘ENTER’ soft key to enter this section. Read the Introductory screen to this section and press the 'ENTER' soft key to continue.

61. The next screen requires you to answer the question 'Will a Digital Input be used as a START Source? Select 'Yes' using the \( \downarrow \) down and \( \uparrow \) up arrow keys and then using 'ENTER' soft key to confirm and save your selection. We will use the green push button labeled 'IN 1' in the demo as our Start Source in a later step.

62. The next screen will ask the question 'Is Reverse required from a digital input?' Select 'Yes' using the \( \downarrow \) down and \( \uparrow \) up arrow keys and then using ‘ENTER’ soft key to confirm and save your selection. We will use the switch labeled 'IN 2' in the demo as forward/reverse in a later step.
63. Select ‘3 wire’ as your choice for the question ‘Enter Choice for the control method’.

64. In the ‘Select Port To Use’ window use the up and down arrow keys to highlight ‘Port 07 I/O Module 24V’ Press the ‘ENTER’ soft key to make this your selection.

65. In the ‘Param to Use’ window Press the Enter soft key to select.

66. First, you will select the bit/Digital Input you want to use as your START. We are going to use the green push button labeled ‘IN 1’ as our start input. To do this scroll to Bit 01 Input 1 and press the Enter soft key.

67. Repeat steps 66 and 68 to select the red push button labeled ‘IN 0’ as your Stop switch (Bit 00 Input 0) and the selector switch labeled ‘IN 2’ as your Forward/Reverse switch (Bit 02 Input 2) in that order.

68. Back in the ‘Start Stop I/O’ menu screen. Scroll down to ‘Analog Outputs’ and select ‘ENTER’.

69. In the ‘Select Port To Use’ window use the up and down arrow keys to highlight ‘Port 07 I/O Module 24V’ Press the ‘ENTER’ soft key to make this your selection.

70. Select the ‘Anlg In0 Value’.

71. In the next page that comes up, select ‘Voltage’ for Analog Out 0 type.

72. Set the ‘Anlg Out0 DataHi’ to 10.0 volts and set the ‘Anlg Out0 DataLo’ to 0.0 volts.

73. Repeat for ‘Anlg Out0 Hi’ and ‘Anlg Out0 Lo’.

74. Press the ‘ENTER’ soft key to select ‘Disabled’ for the ‘Anlg Out1 Sel’.

75. You should now be back in the ‘Start Stop I/O’ menu screen. This is all we will configure in this section so use the down arrow keys to scroll down to the last item on the list ‘Done’. After ‘Done’ is highlighted, use the ‘ENTER’ soft key to make this your selection.

76. You should now be back in the General Startup Main Menu screen. you have finished with the Startup routine steps required for this lab session. Select ‘Done’ using the ‘ENTER’ soft key to exit out this screen.

77. Select ‘Exit Startup’ using the ‘ENTER’ soft key to exit out of the Startup routine.

78. You can now test your drive to perform the functions you configured during the startup routine namely, Start using the green push button IN 1, Stop using the red push button IN 0, change direction using IN 2 and provide speed reference using the ‘0-10VDC IN 0’ pot.
Part 2: Utilizing EtherNet/IP™ and Connected Components Workbench™ Software

Connected Components Workbench includes user-interface configuration tools for Micro800™ controllers, PowerFlex® drives, a Safety Relay device, PanelView™ Component graphic terminals, and serial and network connectivity options.

In this section you will perform the following:
- Connect to the PowerFlex 755 drive through the embedded EtherNet/IP via Connected Components Workbench software
- Explore the different parameter groupings
- Explore the Startup Wizard

Connecting to the Drive

7. Go to the computer’s desktop and double click the shortcut for Connected Components Workbench software.

You will see the following splash screen while the software loads, which may take a few moments.
8. The main screen for the Connected Components Workbench software is shown below. 

You may need to maximize the software to make viewing easier.

9. There are many features in the Connected Components Workbench software. Mainly, we will be using the software to go online with the PowerFlex 755 drive. Click the [+] next to Discover within the Device Toolbox.

10. Click the “Browse Connections” button to launch the RSWho connection browser.
11. The lab’s preconfigured RSLinx driver will appear. Click on the [+] to expand the topic **AB_ETH-1, Ethernet**. Click to highlight the “192.168.1.30, PowerFlex 755, PowerFlex 755” device.

12. Press the “OK” button to initiate the connection process. For a quick moment, you might see a connection status window.

Otherwise, once the connection process is complete, you will see the following main screen with a green highlighted “Connected” for the PowerFlex 755 drive within the Connected Components Workbench software.
Exploring Drive Parameters through Standard Parameter Groupings

13. Some useful tools for the PowerFlex 755 drive are included in the Connected Components Workbench software, as shown below. Take some time to explore them.

14. Select the Process Display

The Process Display allows you to view parameter values in an easy to read graphical display.

15. Navigate back to the Process Display, and click on the Pencil icon for the middle display item. In this window, you can select, scale, and assign text to Display Item 1

In this lab we will leave the parameter as is. Close the Process Display window.
16. Observe the multiple tabs available for each optional module (card) in the drive. These tabs indicate the function of the module (card) and display important information, such as voltage and amp ratings, series, revision, and operational status. Your Demo has only peripherals 0, 1, and 7.

Take some time to explore them.

17. You can display the status view for any peripheral (e.g. the DeviceLogix adaptor or 20-HIM-x6) by selecting the peripheral’s tab. If your demo box does not include the stated cards, use the available tabs and explore the peripherals on your demo.

18. After checking peripherals 0, 1, and 7; return to peripheral ‘0-PowerFlex 755’.
19. Click on the “Parameters” icon to view the PowerFlex 755 drive parameters as seen below.

The PowerFlex 755 drive’s parameters window displays both read-only and writeable parameters. You can double click on any of these parameters to view Value and Attributes. You can scroll down to Parameter 11 [DC Bus Volts]. Double-click on this parameter to view it.
This is a read-only parameter that displays the value of the DC Bus Volts. This value changes as the DC Bus Volts varies, and you can see that here. Click **Cancel**.

Scroll down even further to **Parameter 535** [Accel Time 1], and then double-click on this parameter to view and edit it.

This is a writeable parameter that determines the acceleration rate it takes to go from 0 Hz to Parameter 27 [Motor NP Hertz] or Parameter 28 [Motor NP RPM], according to the setting in Parameter 300 [Speed Units]. To edit this parameter, a new value would be entered, followed by clicking **OK**. In this case though, click **Cancel**.

Similar to PowerFlex 525, the PowerFlex 755's Add-On Profile has a time saving feature with Connected Components Workbench software that will show the non-default parameters. This makes it easy for users to view which parameters were changed from their default setting.

This button only updates the set of parameters shown based on the upload. When a parameter changes from defaults after clicking the button, it won't be added to the list until the view is refreshed.
20. Make sure “All Parameters” is selected within the Group dropdown selection box and then click the “Show Non-Defaults” button as shown below.

A progress window showing the upload will appear.

21. Once the upload has completed you will see the parameters window update to just show only the non-default parameters. Take a look, you will notice that the parameters you changed in Part 1 appear in this list.

22. Click the “Show All” button to return to viewing all of the PowerFlex 755 drive parameters.
23. To make viewing and editing parameters even simpler, you can enter a word or abbreviation into the filter value entry box. For example, type “motor” into the Filter Value entry box. Notice that it filters and only shows the parameters that have the word motor in their parameter names.

![Parameters - PowerFlex 755.1 Port 0](image)

Try some other examples such as “inp”, “torque”, or “535” and see the results.

Remember to clear/delete the entry field when finished.
24. Under the Group dropdown selection box, you can scroll through the different drive parameter groups.

25. Select “Speed Ramp Rates” from the “Speed Control” Group dropdown menu and explore the parameters shown below.

You've just seen some of the parameters needed to start up/commission a PowerFlex 755 drive. Take some time to explore some of the other parameter groupings such as “Feedback & I/O”, “Applications”, “Communication” and “Diagnostics.”

26. Close the parameters.
PowerFlex 755 Drive Start-Up Wizard

27. Click on the Wizard Browser icon [Image] to launch the Wizard Browser and display the available wizards.

The PowerFlex 755 Startup Wizard is similar to performing the HIM Assisted Startup. Configuration parameters that are common to most applications are displayed in text/graphic forms and presented in a sequential step-by-step process.

The DPI/DSI Tech Support Wizard is used to collect information for a remote support person to help troubleshoot a problem. Drive and peripheral information such as series and revision is collected along with changed parameters, fault & event queues, diagnostic items, etc. This information is saved to a text file which can be emailed to RA Tech Support, the OEM that supplied the machine, or the Corporate Engineer responsible for the remote plant, etc.

Some additional wizards are already loaded on the drive, and even more additional wizards will be available in the future and can be added to Connected Components Workbench at any time. New wizards will be posted on the AB Drives Web Updates page for free download:

http://www.ab.com/support/abdrives/webupdate/index.html

- Note: The same wizards also work with DriveTools SP v6.02 (or higher), Logix Designer, and RSLogix 5000 v16 (or higher) with Drive AOP 3.01 (or higher)
28. Select the PowerFlex 755 Startup Wizard and click Select.

The wizard will first upload the parameters for each of the wizard pages.

![Uploading Parameters For Wizard](image)

29. The first step in the wizard is the Welcome page. It explains the wizard and gives hints and tips for using the wizard. Click Next >.

![Welcome Page](image)

30. The Reset Parameters page is next. It allows you to reset the parameters back to factory defaults. Verify that both High Voltage and Normal Duty are selected from the pull down menus. Make sure the radio button for Host and Ports to Defaults (Preferred) is selected. Then click Reset Parameters.
In the confirmation window, click **Yes**.

Observe the on screen confirmation of the parameters being reset.

Click **Next >** to continue viewing the **System Time** and **Ethernet Port** settings. Continuing to click **Next >** until you read the **Motor Control** step of the wizard.

31. Perform the **Motor Control** step of the PowerFlex 755 Startup Wizard. Make the selections shown.

   - Motor Control Mode: Induction Sensorless Vector
   - Speed Units: Hz
   - Primary Speed Feedback: Port 0, Param Open Loop Fdbk
   - Position Feedback: Port 0, Param Simulator Fdbk
Click **Next** to get to the *Motor Data* step of the wizard.

32. The *Motor Data* step is next. This step assists in entering the data from your motor’s nameplate into the drive.

   Change the parameters to the following:

   - **Power Units**: HP
   - **Motor NP Power**: 0.03 HP
   - **Motor NP FLA**: 0.22 Amps
   - **Motor NP Volts**: 230 VAC
   - **Motor NP Hertz**: 60 Hz
   - **Motor NP RPM**: 1600 RPM
   - **Motor OL Factor**: 1.00
   - **Motor Poles**: 4 Pole
Click **Next >** to the *Stop Mode* step of the wizard.

33. The *Stop Mode* step is next. This step assists in selecting the drive's stop mode and dynamic brake (DB) resistor type. No selections need to be changed in this step; keep the default selections.

Click **Next >** to the *Direction Test* step of the wizard.
34. The Direction Test step is next. It helps you determine if the motor is rotating in the proper direction for your application. No selections need to be change on this screen.

- Note: If the drive is faulted, click on to clear the fault.

Direction tests are not needed for this example; however they can be ran if you desire. If you do perform the test, note the following:

Click the Jog button and hold it for a few seconds to run the drive. As long as you hold the jog button, the drive will run. Once you let go of the button, the drive will stop. After the motors stops, click the Yes radio button. Observe how clicking the Yes radio button updated the screen with a Test Passed status as well as adding the Change Direction option.
Click Next > to the AutoTune step of the wizard.

35. The AutoTune step is next. This step is where you can use the automatic tuning algorithms (AutoTune). When running these algorithms, the drive energizes the motor and makes measurements, which are used to make parameter settings.

AutoTune tests are not needed for this example; however they can be ran if you desire. If you do perform the AutoTune, please note the test status:

Leaving the AutoTune page while the test is in process will abort the test, faulting the drive. Do not leave AutoTune page until the test is complete:

- Note: In some cases, an Over Speed Fault may occur during a Rotate Tune. Just acknowledge it and move on with the lab.

Click Next > until you reach the Ramp Rates / Speed Limits step of the wizard.

- Note: Clicking < Back, Next >, or leaving step by any means will abort the test.
36. The Ramp Rates / Speed Limits step is next. Set the following values:

- Max Forward Speed: 60 Hz
- Min Forward Speed: 0 Hz
- Min Reverse Speed: 0 Hz
- Max Reverse Speed: -60 Hz

Adjust the S-Curve values and see how that changes the shape of the ramps. Set it back to zero before moving on.

Click **Next >** to the Speed Reference step of the wizard.

37. The Speed Reference step is next. It helps you select where the drive gets its speed reference. Observe the screen with the default value of Port 0: Parameter 871 [Port 1 Reference].
38. Now select the reference to be from **Port 7: Parameter 50 [Anlg In0 Value]**, observe how the wizard shows the pertinent parameters for this analog input.
39. The Start / Stop step of the drive is next. Make the selections below:

- **Di Start**: Port 7 [I/O Module 24 V] Parameter 1 [Dig In Sts] Bit 1 [Input 1]
- **Di Stop**: Port 7 [I/O Module 24 V] Parameter 1 [Dig In Sts] Bit 0 [Input 0]
- **Di Forward / Reverse**: Port 7 [I/O Module 24 V] Parameter 1 [Dig In Sts] Bit 2 [Input 2]
Click **Next >** to the Other Digital Inputs step of the wizard.

40. The Other Digital Inputs step is next. No changes need to be made here.

![Other Digital Inputs](image)

Click **Next >** to continue to ‘Analog Output Port 7’ → ‘Analog Out 0’

- Note: There are other digital inputs available to the user; however the wizard shows the commonly programmed inputs. All the available digital inputs can be accessed via the HIM or software tool. See the user manual for those parameter numbers.

41. Set your analog output to read the voltage from the drive by following the capture

![Analog Out 0](image)

Note: Port: 7 – I/O Module 24V. Parameter 50 – Anlg In0 Value

42. Continue to click **Next >** until you reach the Pending Changes step of the wizard.
43. The *Pending Changes* step is next, and last. The purpose of this step is to verify all of the changes you made in the wizard, and then apply the changes to the drive. The below screen is for your reference, and there may be some differences between your actual screen and the one shown.

Click *Finish >>*. The wizard will write your changes to the drive.

- **Note:** The Pending Changes step can be used a reference tool. You can print the summary with the print button at the bottom of the window. You can refer to the printed summary when commissioning duplicate drives or replacing a faulted drive.

44. Use your configured inputs to spin the motor.
Using the Control Bar Tool

45. Change Parameter 301 [Access Level] to Expert to allow all of the parameters to be visible.

![Control Bar Tool](image1)

46. Click on the button in the tool bar at the top of the window.

![Tool Bar Button](image2)

47. Read the Caution Advisory window and click OK.

![Caution Advisory](image3)

48. Use the buttons on the left-hand side of the control bar to start, stop, jog, and control the direction of the drive.

![Control Bar Buttons](image4)
The speed reference was selected earlier to be Port 7 [I/O Module 24V] Parameter 50 [Anlg In0]. To allow the control bar to have control of the speed reference, change Port 0 Parameter 545 [Sped Ref A Sel] while the drive is not running. Stop the drive, and change it to Port 0 Parameter 877 [Port 13 Reference].

Start the drive again and use the slider on the right-hand side to control the speed reference.

49. Stop the drive and turn off the control bar by clicking the button again. Observe the Caution Advisory window and click Yes.
Using Off-line Files

This feature allows you to save your drive configuration to a computer. It is useful for several reasons:

- You can use the configuration if you replace the drive or install an identical one
- You can use the configuration to troubleshoot the drive if it begins to malfunction because the settings have changed

**Uploading and Saving the Drive’s Configuration to a PC**

50. From the **Toolbar** menu, select the **Properties** tab. In the **Save As...** window, define the filename and location of the file. Take note of the name and remember where you save this file, it will be needed later.

51. In the Properties window, select **Export** to upload all the parameters from the PowerFlex 755 drive

52. Select the ‘**Upload Entire Device**’ to save data from the drive

53. The following window should come up showing each port’s parameter is uploading.

54. Give a name to your file and save on the desktop.
55. Disconnect from the drive and select **No** when asked to upload values from online to project.

56. You should notice that your saved file has an .iuux extension.

**Downloading a saved Configuration CCW file to a Drive**

57. After your file is saved and you have disconnected from the drive, using what you learned previously, set the drive to defaults using the HIM.

58. While your CCW project is still opened, go to the **Toolbar** menu and select the **Properties** tab.

59. Select the **Import** button, and select your .iuux file to import parameters.

60. Your steps should follow as such:

61. The upload will happen fast. Once done, click the **Download** button.
62. Wait as CCW gathers port information.

63. Select the Error Check Download check box to get detailed information on any download errors and click the Advanced button to specify which ports to download.

64. If you have all peripherals on your demo box, uncheck Port 6 Safe Speed Montr.

65. Select Download button to download to the drive.
66. During the Download process you may receive warning messages. If you see this “Data Out of Range” message, Click the Blue Magnifying Glass button...

![Screenshot of the Data Out of Range message]

...A dialog box similar to this one (it may contain more detailed error information) will appear. Click Ignore to continue the Download.

![Screenshot of the DPI Error Detected dialog box]

You may have to perform this operation several times to fully complete the Download.

67. Close the download status bar upon successful completion.

![Screenshot of the Success message]

68. Close the Connected Component Workbench software.

Note: This concludes the guided portion of the lab.
Lab 3: PowerFlex Drives Add-On Profile with Drives and Motion Accelerator Toolkit.

This section will provide a preview of the PowerFlex Drives Add-On Profiles as well as the Drives and Motion Accelerator Toolkit Add-On Instructions and Faceplates for the PowerFlex 525 and PowerFlex 755 drives.

About Integrated Drive Profiles and Premier Integration

Integrated Drive Profiles are designed to save system development time and to make systems easier to maintain. Testing of skilled engineers configuring drives in a timed, side-by-side comparison, Integrated Drive Profiles in RSLogix 5000 and Studio 5000 Logix Designer software can reduce drive system development time by as much as 70% compared to traditional configuration. This is achieved by:

- Providing one software tool to configure the entire controller and drive system.
- Configuring both controller and drive network connections from a single location – eliminating I/O mismatch errors.
- Allowing the dynamic selection of drive parameters transmitted as network I/O – communicating only what is needed for the application.
- Auto-generating descriptive tag names – eliminating the need to enter individual tag descriptions.
- Auto-generating respective tag data types – eliminating the need to convert from one data type to another.
- Saving all drive configurations in the project file and in the controller – providing a single source of drive configuration data.
- Providing Copy & Paste capability when creating additional duplicate drives – reduces errors in configuration with systems containing multiple identical drives.
- Using the same easy-to-use drive configuration Wizards in the Connected Components Workbench, DriveTools SP, and DriveExplorer software packages.

Systems using the Integrated Drive Profiles in RSLogix 5000 and Studio 5000 Logix Designer software are also easier to maintain:

- Drive diagnostics, faults, alarms and event information is integral to RSLogix 5000 and Studio 5000 Logix Designer software.
- Drive Tech Support Wizard can be run from RSLogix 5000 and Studio 5000 Logix Designer software to collect all pertinent information about a drive, its peripherals, various software components, and PC operating system.
- Drives can be flash updated from RSLogix 5000 and Studio 5000 Logix Designer software.
- Having a single repository of drive configuration data in the controller project file reduces downtime by speeding drive replacement.

Integrated Drive Profiles are "Add-On Profiles", independent of particular releases of RSLogix 5000 and Studio 5000 Logix Designer software. Many are backward compatible to work with previous versions of the programming software as well, helping to prevent obsolescence of the controller when newer drives are available.
Exploring the Add-On Profile for the PowerFlex 525 Drive

1. Start the program. Double-click the Studio 5000 software icon on the desktop.

You will see the following splash screen.

2. A pre-configured Studio 5000 Logix Designer software project has already been created for your convenience. From the splash screen, click “Existing Project” under the “Open” column and select “Project File”.

3. Select the “PowerFlex_Lab” file and click the “Open” button.
Lab files are located within the “C:\Users\labuser\Desktop\Lab Files\PF525 and PF755 - Basic HIM, CCW, PI\Lab Files” folder.

The file will be opened in the Logix Designer software after a few moments.

4. In the Controller Organizer, scroll down to the I/O Configuration section shown in the graphic below. Open the Module Properties window for the drive by double-clicking on the “PowerFlex 525-E2P PF525_Drive”.

   ![Diagram of Controller Organizer and Module Properties window]

The Module Properties window will appear.

5. Click on the tab labeled “Drive”.

   ![Module Properties window with Drive tab selected]
The Add-On Profile for the PowerFlex 525 drive in the Logix Designer software provides a common look-and-feel to the Connected Components Workbench software. This provides the same ability to upload, download, view, and compare drive parameters, as well as access the Wizards. One additional feature in Logix Designer is for setting up Automatic Device Configuration (ADC) the drive.

6. Click on the “Properties” button.

This opens the Properties window to the Setup tab, which shows some basic drive information including Configuration, Revision, Device Language and Electronic Keying.

The buttons in the top right corner of the window have very useful functions, as listed below.

= Creates device database from online drive to add new revisions and configurations
7. Click on the “Communications” tab.

The following screenshot is for the PowerFlex 525 Embedded Ethernet communication. For this lab we are using the 25-COMM-E2P module in Port 2 for communication. You can view a similar Properties dialog box for the 25-COMM-E2P by selecting the '2 - 25-COMM-E2P' tab, then clicking 'Properties' and selecting the 'Communications' tab.

On this tab, you can configure the Ethernet communication settings for the drive. This includes setting a static IP address or configuring the drive for BOOTP or DHCP.

8. Click on the “Import/Export” tab.

From this tab, you can import or export the drive configuration file as either a *.PF5 (PowerFlex 520 Series USB) or *.IUUX (CCW Device) file type. Using the USB port on the removable control module of the PowerFlex 525 drive lets you download the configuration to a drive that does not have main power applied. This can save time and reduce the personal protective equipment requirements for programming many similar drives.

The *.PF5 and *.IUUX file format is compatible with Connected Components Workbench, but the PowerFlex 525 is not compatible with *.DNO or *.CSF files.
9. Click on the [X] in the upper right hand corner to close the Properties window.

10. Now let's look at the PowerFlex 755. In the Controller Organizer, double-click on the "PowerFlex 755-EENET PF755_Drive".

11. From the Module Properties window, click on the "Drive" tab.

The Add-On Profile for the PowerFlex 755 drive in the Logix Designer software provides a common look-and-feel to the DriveExplorer software (not covered in this class). This provides the same ability to upload, download, view, and compare drive parameters, as well as access the Wizards. One additional feature in Logix Designer is for setting up Automatic Device Configuration (ADC) the drive.

12. The tool bar for the PowerFlex 755 can be described as follows:
13. Observe the multiple tabs available for each optional peripheral in the drive. These tabs indicate the function of each module and display important information such as: port, voltage and amp ratings, series, and revision. Click on each port peripheral to review.

![Image of multiple tabs]

NOTE: Your window may be different from pictured image as demo boxes vary.

14. Leave the Drive tab and proceed to the General tab. Within the Module Definition section of the General tab, click the “Change...” button to open the Module Definition window.

![Module Definition window]

Within the Module Definition window, you can perform the following actions:
- Set the Revision of the drive firmware, and set the Electronic Keying
- Select the Drive Rating, Rating Options, and Drive Type
- Create database files from the online drive or download database files from the web
- Perform a full or Partial Drive Match
- Configure the input and outputdatalinks
15. Close the PowerFlex 755 Module Properties window and reopen the PowerFlex 525 Module Properties window. Navigate to the Drive tab.

16. Click on the **Parameters** button. This should look familiar—just like the Connected Components Workbench software! Just as you did earlier in the lab, you can go online with the drive, view and modify parameters with the Parameter, AppView and CustomView groups.

   ![Parameters Window]

   Click on the [X] in the upper right hand corner to close the Parameters window.

17. Back in the Module Properties screen, click on the **General** tab.

   The General tab is used to set the drive Name, Ethernet Address and configure the Module Definition.
18. Within the Module Definition section of the General tab, click the “Change...” button to open the Module Definition window.

Within the Module Definition window, you can perform the following actions:

- Select the Drive Rating, set the Revision of the drive firmware, and set the Electronic Keying
- Create database files from the online drive or download database files from the web
- Configure the input and output datalinks

The Module Definition window provides the ability to configure up to four words of Input Data and four words of Output Data to be passed through the embedded Ethernet connection. By default, drive status and control information will be communicated.

**Status Information**
The “DriveStatus” word contains the drive status bit information, such as Ready, Fault, and At Reference.
The “OutputFreq” word contains the speed feedback information, which shows the actual operating frequency (Hz) of the drive.

**Control Information**
The “LogicCommand” word contains the drive command bit information, such as Stop, Start, Forward, Reverse, and Clear Faults.
The “FreqCommand” word contains the commanded reference value for the drive to run.

**Datalinks**
Datalinks are pointers to drive parameters. Instead of offering fixed I/O assemblies where what-you-see-is-what-you-get, our drive I/O assembly is dynamic and gives the programmer the ability to pick and choose the desired parameters to communicate as network I/O.
19. To configure the datalinks, you would select the parameters from the dropdown selection list. No parameters need to be added for this lab, but take some time to scroll through the available parameters that can be assigned as Input and Output Datalinks.

Click on the [X] in the upper right hand corner to close the Module Definition window and then close the Module Properties window.
Taking Advantage of Having the Drive in the Controller Organizer

When your application requires more than one drive, you can save time with Studio 5000 for configuration. Within the Controller Organizer, you can duplicate the PowerFlex 525 drive or the PowerFlex 755 drive on the Ethernet network as many times as needed by using the Copy and Paste features. All of the node information is copied, including the drive parameter settings. All you need to do is change the IP address, and give the device a unique name. Integrated Drive Profiles are not only easy to use; they also allow larger systems to be designed faster.

1. Create the contextual menu by right-clicking on the device and select “Copy”.

2. Select the Ethernet network and right-click to show the network menu. Select “Paste” from the list.

3. The new drive will appear. It will not have a valid IP address, but the name will be an incremented value of the original drive.

Where do you think the drive configuration data gets stored? The drive configuration data for each node is actually stored in your Logix Designer project! It also resides in the controller after the project is downloaded. This provides a convenient local resource for a node’s configuration settings if the drive needs replacing. Just connect to the controller, open the drive’s AOP, and download the configuration!
4. In addition to storing the configuration data in the controller, the controller manages the communications to the drive with convenient tag-based addressing. Double-click on the “Controller Tags” icon under the “Controller PowerFlex_Lab” folder.

![Controller Organizer](image)

The Monitor Tags window will appear.

5. Find the tag for “PF525_Drive:1” and expand it by clicking on the [+] next to the name. It may help to change the width of the “Name” and “Value” columns to view the tag names and values more easily.

![Monitor Tags](image)

Descriptive tag names have been created for the configured drive, based on the module definition. The Drive Status bits (BOOLs) are clearly defined as well as the “OutputFreq” and “OutputCurrent” (defined as one of the Input Datalinks). Note that the proper data types are automatically used for every tag.
6. Now expand the "PF525_Drive:O" tag to view the output tag names.

Descriptive tag names have been created for the drive again. The Logic Command bits (BOOLEs) are clearly defined as well as the "FreqCommand" value for applying a reference to the drive. The proper data types are automatically used for every tag.

7. Close the Studio 5000 Logix Designer project.

Click "No" when prompted to save changes to the project.
Downloading the Project

1. Open the PowerFlex_Lab project. Click the “Open” icon illustrated below.

2. Select the “PowerFlex_Lab.ACD” file and click the “Open” button.

3. Open the drive Module Properties window by double-clicking on the “PowerFlex 525-E2P PF525_Drive” node in the I/O Configuration folder.

The Module Properties window will appear.
4. Click on the “Drive” tab.

   ![Connection Browser window](image)

   ![Module Definition](image)

5. Click the “Download” button.

   ![Download button](image)

   The Connection Browser window will appear.

6. Expand the “AB_ETH-1” Ethernet driver and select the “192.168.1.20, PowerFlex 525” node.

   ![Connection Browser window expanded](image)

   ![Click the “OK” button](image)

7. You will be asked to confirm with the window shown below. Click the button to “Download Entire Device”.

   ![Download Entire Device](image)
8. For a brief moment, you will see a downloading progress bar while the parameter settings are being sent to the drive.

9. If you see this “Data Out of Range” message, Click the Blue button…

   ...and Click Ignore

10. If you see this “Data Out of Range” message, Click the Blue button…

   ...and Click Ignore

You may hear the drive reset, which is normal. After the download is complete, the Module Properties page will be back in focus on the Drive tab.
11. Click the “OK” button to close the Module Properties window.


13. Click on the “Drive” tab.

14. Click the “Download” button.

15. From the “Connect To Drive” window, select the “192.168.1.30, PowerFlex 755” node.
16. Click “OK”.

17. You will be asked to select a device to download. Please select ALL devices.

If you get this error screen:

![Download Error]

Failed during write of data block. Download will be terminated.
Possible reason: the device may have data locks, may be actively controlling a motor (running), or DeviceLogix may be enabled.

Just click OK and continue. That is due to the Safety Card which is not used in this lab.

18. Click “Download”, which will occur very fast

19. Click “OK” on the module properties window.

20. Click on “Communications” in the menu bar and select “Who Active”.

![Who Active Window]

The Who Active window will appear.
21. Verify that the node labeled “192.168.1.10, 1769-L18ERM LOGIX5318ERM” via the AB_ETHIP-1 Ethernet driver is selected and click the "Download" button.

The Download window will appear.

22. When the confirmation window appears, click the "Download" button again.

You will see a progress bar.
23. Put the controller in “Run” mode. One way to do this is by clicking on the mode drop-down arrow and select “Run Mode”.

24. When prompted to confirm switching the controller mode to “Remote Run”, click the “Yes” button.

25. To clear the faults after downloading the program, switch the selector switch DI2 to the right-hand position then back to its left-hand position.

26. Verify that the “DI1” selector switch is in the left-hand position.

27. Use the green button to start both drives, and red button to stop both.

Continue to the next section of the lab.
About Drives and Motion Accelerator Toolkit (DMAT)

Publication IASIMP-QS019 is a quick start guide that provides step by step instructions for using the Drives and Motion Accelerator Toolkit to help you design, install, operate, and maintain a drive system. Included are selection tools, layout and wiring drawings, and pre-configured logic and HMI files to assist you in creating an Integrated Architecture solution for your application requirements.

All the supporting files are included on the Drives and Motion Accelerator Toolkit (DMAT) DVD, publication IASIMP-SP017. The DVD provides drive selection tools; CAD drawings for panel layout and wiring; basic status, control, and diagnostic logic files; FactoryTalk View ME and SE faceplates, 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. You can also download these same supporting files from the Rockwell Automation Integrated Architecture Tools website, http://www.ab.com/go/iatools on the Beyond Getting Started tab.

In this section, the FactoryTalk View project has already been made. You will explore the runtime application.

NOTE: If the FactoryTalk Runtime application is not currently open, you may reference the Lab Configuration Guide to re-open the file.
Switch to the HMI Application

1. Minimize Studio 5000 Logix Designer so that the HMI screen on the desktop can be seen. If the HMI Application is not running in the background, contact your instructor.

2. If the warning screen is displayed, click the blue “OK” button to load the Startup screen.

3. The Startup screen should now be displayed, though some of the indicators will be in a different state.

The Startup screen provides machine status and control, plus it allows navigation to all other screens. Take a moment to familiarize yourself with the Startup screen before moving on to the next section.

Faceplate Operation

The Startup screen display provides machine control as well as the main navigation screen to launch all other faceplates or screens that provide additional equipment control, status, and alarm history. This display can be configured to suit your machine or system needs.

Machine Control

Program (AUTOMATIC) mode refers to the automatic function or automatic sequencing for the machine. Operator (MANUAL) mode allows for some manual operations, like start, stop, forward, reverse, jog, etc. The machine status indicators provide a summation view of all the devices for the entire machine. The “Program/Operator” selector button lets you toggle between the two modes.

The “Clear Faults” button attempts to clear faults on all devices. The condition that caused the fault must be corrected before the clear is successful.
The State Diagram faceplate can be accessed by pressing the “State Diagram” button. While in Program mode, the state diagram illustrates the machine operational model:

The states with a dashed outline indicate a transitional state; while the solid line indicates an end state.

Depending on your current machine state, use the following commands to transition between states:

- **ABORTED** – Press Clear Faults
- **STOPPED** – Press Start
- **RUNNING** – Press Stop

The machine is placed into the **ABORTED** state whenever a drive fault condition and/or a state transition error has been detected. The machine is also placed into the **ABORTED** state on Power Up or during “first scan” (i.e. Program to Run Mode) of the controller. Refer to the Alarm History faceplate to determine the cause for the **ABORTED** condition.

If you opened the State Diagram faceplate, close it by pressing the [X] in the top-right corner.
Run the Machine

Follow these steps to start and stop the system while in Program mode.

1. If the machine is currently in the ABORTED state, press the "Clear Faults" button.

After a few moments the state machine should transition to the STOPPED state.

2. Press the "Program/Operator" button until "Program" is displayed. Program mode (AUTO) is now the active control mode.

3. Press the "Start" button. The system begins operating according to the Studio 5000 Logix Designer program.

The description from the ladder logic program is shown here.

```plaintext
PROMIFLEX 525 & PowerFlex 755
RUN FORWARD / REVERSE

The following application example demonstrates how to control a PowerFlex drive using sequencers. While the Machine is STARTING / RUNNING, the drive will be operated as follows:

1) Set Direction FWD, Speed Reference 50 Hz
2) Start drive, run at speed 10 sec
3) Stop drive, remain stopped 3 sec
4) Set Direction REV, Speed Reference 32 Hz
5) Start drive, run at speed 10 sec
6) Stop drive, remain stopped 5 sec
7) Repeat

The Run Sequence is continuously repeated until the Stop Sequence is initiated by a Machine ABORT or STOP command.
```

4. Let the system run for about one minute to see the full cycle of the ladder logic. Once satisfied, press the "Stop" button.
5. After the system stops, press the “Program/Operator” button until it displays “Operator”.

The machine must be stopped before you can switch control modes. When in Operator (MANUAL) mode, you can individually control each axis from its corresponding faceplate.

Continue to the next section.

**Using the PowerFlex 525 Drive & PowerFlex 755 Drive Faceplates**

The steps below also apply to both the PowerFlex 755. The faceplate screen is consistent between “PF525” and the “PF755”.

1. Press the “PF525” button from the Startup screen.

   The faceplate will appear.

   ![](image)

   The PowerFlex 525 faceplate provides status information, fault information, and trending data. The faceplate also includes the ability to manually control the drive.
2. Click on the outlined numeric entry to display keypad to change the speed reference of the drive.

The numeric box performs a dual purpose. It displays the drive feedback, but can also be used to enter information. After you click the “Enter” button the value is stored but not displayed. Once the motor is spinning, the value will be updated.

3. Type a value between 0 Hz and 60 Hz and press the “Enter” button on the keypad to confirm.

The faceplate will technically allow a higher value to be entered, but the drive will limit to 60 Hz in any case.

4. Click the “Start” button in the PF525 faceplate.

The drive will start turning the motor at the commanded speed. You can see the speed feedback changing in the numeric box on the faceplate.

5. After making the motor come to reference speed, click the “Stop” button in the PF525 faceplate.
6. Press the “Faults” button.

The Faults faceplate will come up. It may look different than the screenshot below, since it will display the last fault.

If a fault condition exists, the Faults icon flashes red. This faceplate determines the fault information from the drive and displays the fault type, code and description. When there is no active fault, the display shows the last fault condition recorded.

7. On the demo box, push in the red “Safe Off” button to generate a fault on the drive. This will generate a F059 – Safety Open fault.

8. Press the “Help” button for more information about the fault.

The Help screen displays the fault descriptions and actions.
9. Press the arrows to switch between screens.

You can clear faults from the Startup screen or, if in Operator mode, from the Fault display. The Alarm History screen logs fault information from all of the devices.

10. When you are finished, pull out the red “Safe Off” button and press the “Clear Faults” button on the Startup screen to clear the fault in the drive and the state machine.

11. Press the “Configuration” button.

From the Configuration screen you can enter display names and units as required for your application.

Some of the labels are used on the Equipment Status faceplate.
12. Press the “Trend” button.

The Trend screen lets you view Speed Feedback and any other pens are setup up.

13. Press the “Trend Configuration” button.

The Trend Configuration button is only visible from the Trend screen.

14. When you have finished exploring the PowerFlex 525 drive faceplate, close it by pressing the [X] in the top right corner of the faceplate.
The Alarm History Faceplate

The Alarm History faceplate provides a summary of current and past alarms for all of the configured devices or drives configured in the application. The faceplate receives fault information directly from each of the device modules and applies a timestamp based on the order in which it was received.

1. Press the “Alarm History” button on the Startup screen to open the faceplate.

The Alarm History faceplate can be an effective diagnostic tool for troubleshooting, helping machine operators pinpoint root cause for problems quickly.

2. When you are done with the Alarm History faceplate, close it by pressing the Close button on the bottom of the screen.
The Equipment Status Faceplate

The Equipment Status faceplate lets you quickly load and configure a summary display of preconfigured status and diagnostic displays (faceplates). The Equipment Status faceplate works in conjunction with individual device faceplates and provides a single summary display of all the devices that may be configured for an application.

1. Press the “Equipment Status” button on the Startup screen to open the faceplate.

You can configure up to nine device faceplates to run with the Equipment Status screen and each device faceplate can be launched directly from it by clicking on the device name.

2. When you are done with the Equipment Status faceplate, close it by pressing the [X] in the top-right corner.

3. Switch back to Studio 5000 software. From the “File” menu, select “Close” to exit the current project.

4. If you are prompted to save the changes to the program, click the “No” button.

If time permits, continue to the next lab section.
Bonus Lab Exercise: Automatic Device Configuration (ADC) with the PowerFlex AC drives

About Automatic Device Configuration (ADC)

Automatic Device Configuration (ADC) is a feature (in Version 20 of RSLogix 5000 software and Version 21 or higher in Logix Designer software) that supports the automatic download of configuration data. This occurs, if necessary, as the Logix controller establishes an EtherNet/IP network connection to a PowerFlex drive, firmware revision 4.001 or later, and its associated peripherals.

ADC will occur the first time the Logix controller connects to the drive after ADC is enabled. This is necessary to ensure a configuration match, and to generate and write configuration signatures for each port. Future connections made by the Logix controller, such as after a reset or power loss, will first check the configuration signatures to determine if an ADC download is necessary.

The project file and controller contain the configuration settings for any PowerFlex drives in the project. When the project is downloaded to the controller, these settings are also transferred and reside in the controller's memory. ADC automates the process of downloading the configuration to the drive and saves you time. It is particularly beneficial in a drive replacement situation where maintenance personal may not have access to laptops or workstations.

This feature is currently available for the following PowerFlex drives:

- PowerFlex 525 via Embedded Ethernet (EENET) and Dual Port Ethernet (E2P)
- PowerFlex 523 via Dual Port Ethernet (E2P)
- PowerFlex 755 (Version 4.001 and up) via Embedded Ethernet (EENET) and Dual Port Ethernet (ENETR)
- PowerFlex 753 (version 7.001 and up) via Dual Port Ethernet (ENETR)

ADC can also work in tandem with Firmware Supervisor. When Firmware Supervisor is set up and enabled in the project, and if the respective ControlFLASH firmware kit is installed on the computer when the project is downloaded, the drive and peripherals will be automatically brought to appropriate firmware revision if needed. This further reduces the need for maintenance personal to access laptops and workstations while replacing drives.

This exercise will help teach you how to set up ADC for a drive. For more information in regards to the PowerFlex 525 drive and Automatic Device Configuration (ADC), refer to the PowerFlex 525 Embedded EtherNet/IP Adapter User Manual. There is also information about Automatic Device Configuration (ADC) in the PowerFlex 25-COMM-E2P Dual-Port EtherNet/IP Adapter User Manual.
Exploring the Setup of Automatic Device Configuration (ADC)

1. From the “File” menu, select “Open...” to select an existing project.

2. Select the “PowerFlex_Lab_ADC.ACD” file and click the “Open” button.

Lab files are located within the “C:\Users\labuser\Desktop\Lab Files\PF525 and PF755 - Basic HIM, CCW, PII Lab Files” folder.
3. In the Controller Organizer, scroll down to the I/O Configuration section shown in the graphic below. Open the Module Properties window for the drive by double-clicking on the “PowerFlex 525-E2P PF525_Drive”. The Module Properties window will appear.

4. Click on the tab labeled “Drive”.

The Drive tab will appear. The drive AOP requires deliberate action to enable ADC. This helps ensure that ADC is fully understood prior to turning it on.

The drive AOP also has an ADC icon on the Drive tab that shows if ADC is enabled (green arrow) or disabled (gray arrow) for that drive.

5. Click on the “ADC” button.

This will open the Automatic Device Configuration setup window.
6. The picture below shows how to enable or disable ADC for the PowerFlex 525 drive and its peripherals (if applicable). Click the check box that is highlighted below to enable ADC.

![Automatic Device Configuration - Port 0](image)

7. Click the “Apply” button in the Automatic Device Configuration window and close the window. In order for setting changes to take effect, you must click the “Apply” button before closing the window with the [X] at the top corner.

8. Click the “OK” button to close the Module Properties window.

9. Repeat steps 3-8 for the “PowerFlex 755-EENET PF755_Drive”.

![Automatic Device Configuration Settings](image)

Note: When enabling ADC for the PowerFlex 755 drive and its peripherals, uncheck the checkbox for Port 6: 20-750-S1 Safe Speed Monitoring to disable ADC for the Safety peripheral card.

10. Click on “Communications” in the menu bar and select “Who Active”. The Who Active window will appear.
11. Verify that the node labeled “192.168.1.10, 1769-L18ERM LOGIX5318ERM” via the AB_ETH-1 Ethernet driver is selected and click the “Download” button.

The Download window will appear.

12. When the confirmation window appears, click the “Download” button again.

If you reach this step in the lab but do not end up completing the entire ADC exercise, please notify an instructor as you leave so that the controller may be reset for the next session.
13. When prompted to confirm switching the controller back to “Remove Run”, click the “Yes” button.

14. Automatic Device Configuration (ADC) may cause the transition to run to be longer. If the following window appears, click the “OK” button to acknowledge the delay.

Continue to the next section to see ADC in action.
Demonstrating Automatic Device Configuration

In this section, you will generate a configuration mismatch by changing a parameter on the drive and then reconnecting it. This will cause the ADC feature to activate and restore the drive to its programmed configuration.

1. Wait for the drive to be configured from the previous download. That will be indicated in Logix Designer by the following transition:

2. **Unplug** one of the Ethernet cables between the controller and the drive. This will generate a fault on the drive.

3. Press the **Stop** button to clear the fault from the drive.

4. Using the lessons from the first exercise, change parameter “P033 – Motor OL Current” to **5.0** (or another value if you desire).

5. Reconnect the Ethernet cable to the drive. This will reinitiate communication between the drive and the controller, which starts with verifying the configuration signature.

Notice that the PowerFlex 525 drive will get a **F048 – Parameters Defaulted** fault on the LCD Keypad display after a few seconds. This is normal and the first step of the Automatic Device Configuration process. The drive is now being configured.

6. Go back to the I/O Configuration tree in Logix Designer; you will notice a Yellow triangle next to the PowerFlex 525 drive (PF525_Drive). Click once on the drive to highlight/select it. You will notice that the drive’s connection status is in a “**Configuring**” state.
7. Minimize Logix Designer so that the HMI is visible. On the Startup screen of the HMI, there is a multistate indicator which shows the connection status of the PowerFlex 525 drive. It will take about a minute for the PowerFlex 525 drive to be configured.

8. Wait until the ADC process has completed. This will be indicated by the drive’s connection status switching from “Configuring” to “Running”. Once this occurs, continue to the next step. ADC will automatically reset (power cycle) the drive as part of the configuration process. This is done because some parameters require a reset before they take effect. If a drive is being replaced with an out-of-the-box drive, you will typically see one or more resets during the ADC process.
9. If the machine is currently in the ABORTED state, press the “Clear Faults” button.

After a few moments the state machine should transition to the STOPPED state.

10. Press the “Program/Operator” button until “Program” is displayed. Program mode (AUTO) is now the active control mode.

11. Press the “Start” button. The system begins operating according to the Studio 5000 Logix Designer program.

The same logic from the previous section will be executed.

12. Let the system run for about one minute to see the full cycle of the ladder logic. Once satisfied, press the “Stop” button.

You can verify that the drive has the correct parameter now loaded for “P033 – Motor OL Current” through the HIM or the Add-On Profile using techniques you learned earlier this lab.

**Reset the System**

To disable Automatic Device Configuration, you can either reverse the steps of the previous section, or more easily, download a new program to the controller that does not have ADC enabled.

1. Close the PowerFlex_Lab_ADC project file. You don’t need to save changes.

2. Open the PowerFlex_Lab project file from the previous lab exercise.

3. Download the PowerFlex_Lab project to the controller, and put it back into “Remote Run” mode when prompted.

This concludes the lab exercises. Additional information about the Drives and Motion Accelerator Toolkit has been included for your reading as the next appendix if you are interested in it.
Appendix: Overview of the DMAT

The Drives and Motion Accelerator Toolkit DVD, publication IASIMP-SP017, was developed around a modular concept. Modularity lets you decide which components to incorporate into your machine, providing greater flexibility and a custom fit. The preconfigured logic is specifically designed around this modular concept and consists of three main logic module types.

Logic Module Overview

- **Machine**
  - The machine module contains the high level control for the entire machine. The machine module was built around a simple state machine that you can customize to fit most applications. The machine module broadcasts out commands and receives feedback information from each of the application and device modules. Based on the feedback information, the machine will react accordingly.
  - In addition, the machine module provides a high level interface with the HMI, accepting commands like Start, Stop, and Clear Faults. It provides status info to the HMI terminal like current state of the machine (for example, RUNNING versus STOPPED).

- **Application**
  - The application modules contain all of the application specific code. This is where a majority of the customizing is expected to occur and is essentially a programming space where you spend a significant portion of your efforts to develop proprietary logic specific to your application.

- **Device**
  - Device modules contain all of the logic to control the essential functions required by the device. This logic reduces the programming effort required by most applications providing more time for the proprietary logic needed for the application.
  - Typically, the device module consists of a physical drive, but could also consist of a virtual or feedback-only axis. Device modules can also consist of multiple devices (for example, a drive) and perhaps a feedback device (for example, a sensor).
Machine/Application/Device Module Relationship

The machine module monitors the current state of the overall machine and based on the state and/or requests from the HMI terminal, broadcasts out commands to both the application and device modules. The individual modules perform a predefined task based on the command. Some of the commands may be ignored depending on the module type.

Each of the modules are defined as individual programs in the Logix Project.

Each program contains all of the necessary logic to interact with the other configured modules. This interface between each of the modules is accomplished via the Monitor and Control routines located in each of the programs. The machine commands and corresponding module status is routed through the Monitor and Control routines. This lets the modules operate independently in a modular structure.
Module Routine Overview

Each module is broken down into routines that contain logic for a specific function. Each module contains a monitor and control routine that provides a common interface between the machine and the application / device modules. Each of the routines main functions are listed below:

<table>
<thead>
<tr>
<th>Logic Module Type</th>
<th>Routine</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Machine</td>
<td>R00_Main</td>
<td>Dispatch routine, calls all of the other routines in the program.</td>
</tr>
<tr>
<td></td>
<td>R01_PowerUp</td>
<td>Initializes parameters following power up or controller first scan.</td>
</tr>
</tbody>
</table>
|                   | R02_Monitor            | * Summarizes the status from all of the dependent modules (for example, application and device modules).  
* Detects Abort and/or Stop conditions.  
* Provides machine status information to HMI terminal. |
|                   | R03_Control            | * Provides main interface with HMI terminal requests (for example, Start/Stop/Clear Faults pushbuttons).  
* Contains the state machine logic. |
| Application       | R00_Main               | Dispatch routine, calls all of the other routines in the program.         |
|                   | R01_PowerUp            | Initializes parameters following power up or controller first scan.       |
|                   | R02_Monitor            | * Summarizes the status for the application module (for example, OK, Ready, Running, Stepped).  
* Detects module faults (for example, Failed to RESET, Failed to RUN). |
|                   | R03_Control            | Receives machine commands and initiates the corresponding sequences (for example, RESET, RUN and STOP sequences). |
|                   | R04_Reset              | Contains the RESET sequence logic, used to prepare the application to run. |
|                   | R10_ApplicationCode    | * Typical location for the application specific logic.  
* Contains the RUN and STOP sequences. |
| PowerFlex         | R00_Main               | Dispatch routine, calls all of the other routines in the program.         |
|                   | R01_PowerUp            | Initializes parameters following power up or controller first scan.       |
|                   | R02_Monitor            | * Summarizes the status for the device module (for example, OK, Ready, Reset).  
* Detects module faults (for example, Failed to RESET, Failed to CLEAR, Module Not Ready).  
* Contains the faceplate add-on instruction (AOI) for the HMI terminal faceplate. |
|                   | R03_Control            | Receives machine commands and initiates the corresponding sequences (for example, RESET and ABORT sequences) |
|                   | R04_Reset_Abt          | * Contains place holder for application specific reset logic if required.  
* Contains the ABORT sequence which makes sure that the drives contained within the module are stopped and disabled. The ABORT sequence also makes sure that other devices are placed into a desired state. |
Machine Module

The machine module contains the high level control for the entire machine. The machine module was built around a simple state machine that you can customize to fit most applications. The machine module broadcasts out commands and receives feedback information from each of the application and device modules. Based on the feedback information, the machine will react accordingly.

In addition, the machine module provides a high level interface with the HMI, accepting commands like Start, Stop, and Clear Faults. It provides status info to the HMI terminal like current state of the machine (for example, RUNNING versus STOPPED).

Machine States

By default, the machine program module operate based on the below overall state diagram.
The machine module uses the Transitional States to move between Permanent States. Typically, the machine only remains on a Transitional State for brief period of time. If the machine module detects an error during a Transitional State or if the application or device modules fail to transition within an allotted time (10 seconds by default), the machine module issues an ABORT command. The fail safe transition timer makes sure the overall machine does not become stuck in a Transitional State. It also helps to provide diagnostic information to determine which module is not transitioning properly.

You can fully customize the state machine, letting you change the relationship between states and the state names, and add or remove states if needed. Refer to the Drives and Motion Accelerator Toolkit (DMAT) Quick Start publication (iasimp-qs019_en-p.pdf) Appendix B, for information on how to customize the state machine.
### Default Machine States

<table>
<thead>
<tr>
<th>Machine State</th>
<th>State Type</th>
<th>Description</th>
</tr>
</thead>
</table>
| ABORTING      | transitional| Broadcasts the ABORT command until confirmation that all of the application and device modules are aborted. The ABORTING state is triggered based on feedback from the modules. Default ABORT conditions that place the machine in the ABORTING state include:  
  - Power-up detected (for example, controller first scan)  
  - Modules not ready while the machine is in STARTING and/or RUNNING states  
  - Modules detected a fault condition  
  - Modules failed to RESET  
  - Modules failed to START  
  - Modules failed to STOP  
  - Modules failed to CLEAR |
| ABORTED       | permanent   | All application and device modules are aborted (for example, stopped and disabled). Typically, this state indicates a fault condition. |
| CLEARING      | transitional| Broadcasts the CLEAR command until confirmation that all of the application and device modules are ok (for example, all active drive and/or modules have been cleared) within the allotted time. Otherwise, an ABORT condition is generated.  
  Once all of the modules are ok, the machine is placed into the STOPPED state. |
| RESETTING     | transitional| Broadcasts the RESET command until confirmation that all of the application and device modules are reset within the allotted time. Otherwise, an ABORT condition is generated. |
| IDLE          | permanent   | All application and device modules are reset or ready to run (for example, enabled or horned). Typically, this state that the machine is ready to run and awaits a START command. |
| STARTING      | transitional| Broadcasts the RESET command until confirmation that all of the application modules are running within the allotted time. Otherwise, an ABORT condition is generated. |
| RUNNING       | permanent   | All application modules are running. |
| STOPPING      | transitional| Broadcasts the STOP command until confirmation that all of the application modules are stopped within the allotted time. Otherwise, an ABORT condition is generated. |
| STOPPED       | permanent   | All application modules are stopped and all modules (application and/or device) are ready. |

### Default Machine Commands

<table>
<thead>
<tr>
<th>Machine Command</th>
<th>Application Module Response</th>
<th>Device Module Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>ABORT</td>
<td>Halts the application RUN sequence (if active) and initiates the STOP sequence. The STOP sequence attempts to stop and disable all active drives.</td>
<td>Halts the device module RESET sequence (if active) and initiates the device module ABORT sequence. The ABORT sequence makes sure the drives contained within the module are stopped and disabled. The ABORT sequence can also be used to make sure other devices are placed into a desired state.</td>
</tr>
<tr>
<td>CLEAR</td>
<td>Attempts to clear any active faults that exist in the modules.</td>
<td>Attempts to clear any active faults that exist in either the module and/or drive.</td>
</tr>
<tr>
<td>RESET</td>
<td>Initiates the application RESET sequence, which prepares the application and/or devices to run. Use this for the coordinated reset of multiple modules.</td>
<td>Initiates the device module RESET sequence, which prepares the device module to run.</td>
</tr>
<tr>
<td>START</td>
<td>Initiates the application RUN sequence. Customize the RUN sequence to fit the needs of your application.</td>
<td>Ignored (1)</td>
</tr>
<tr>
<td>STOP</td>
<td>Halts the application RUN sequence (if active) and initiates the STOP sequence. The STOP sequence attempts to stop and disable all active drives.</td>
<td>Halts the device module RESET sequence.</td>
</tr>
</tbody>
</table>

(1) By default, these commands are ignored by the module. However, you can change the relationship of each module to best fit the needs of the application.
Machine Control Module Tags

The machine control data type, UDT_MachCtrl, comprises the overall machine control and status, including the state machine. The user-defined data type consists of these components.

<table>
<thead>
<tr>
<th>Name</th>
<th>Alias For</th>
<th>Base Tag</th>
<th>Data Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Machine</td>
<td>UDT_MachCtrl</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Machine Mode</td>
<td></td>
<td></td>
<td>BOOL</td>
<td>Machine Mode</td>
</tr>
<tr>
<td>Machine Mode OPERATOR</td>
<td></td>
<td></td>
<td>BOOL</td>
<td>Operator (MANUAL) Mode</td>
</tr>
<tr>
<td>Machine Mode PROGRAM</td>
<td></td>
<td></td>
<td>BOOL</td>
<td>Program (AUTO) Mode</td>
</tr>
<tr>
<td>Machine Cmd</td>
<td></td>
<td></td>
<td>BOOL</td>
<td>Machine Commands</td>
</tr>
<tr>
<td>Machine Cmd ABORT</td>
<td></td>
<td></td>
<td>BOOL</td>
<td>Machine Commands</td>
</tr>
<tr>
<td>Machine Cmd CLEAR</td>
<td></td>
<td></td>
<td>BOOL</td>
<td>Machine Commands</td>
</tr>
<tr>
<td>Machine Cmd RESET</td>
<td></td>
<td></td>
<td>BOOL</td>
<td>Machine Commands</td>
</tr>
<tr>
<td>Machine Cmd START</td>
<td></td>
<td></td>
<td>BOOL</td>
<td>Machine Commands</td>
</tr>
<tr>
<td>Machine Cmd STOP</td>
<td></td>
<td></td>
<td>BOOL</td>
<td>Machine Commands</td>
</tr>
<tr>
<td>Machine State</td>
<td>UDT_MachState</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Machine State ABORTED</td>
<td></td>
<td></td>
<td>BOOL</td>
<td>Indicates current machine state</td>
</tr>
<tr>
<td>Machine State ABORTING</td>
<td></td>
<td></td>
<td>BOOL</td>
<td>Indicates current machine state</td>
</tr>
<tr>
<td>Machine State CLEARING</td>
<td></td>
<td></td>
<td>BOOL</td>
<td>Indicates current machine state</td>
</tr>
<tr>
<td>Machine State IDLE</td>
<td></td>
<td></td>
<td>BOOL</td>
<td>Indicates current machine state</td>
</tr>
<tr>
<td>Machine State RESETING</td>
<td></td>
<td></td>
<td>BOOL</td>
<td>Indicates current machine state</td>
</tr>
<tr>
<td>Machine State RUNNING</td>
<td></td>
<td></td>
<td>BOOL</td>
<td>Indicates current machine state</td>
</tr>
<tr>
<td>Machine State STARTING</td>
<td></td>
<td></td>
<td>BOOL</td>
<td>Indicates current machine state</td>
</tr>
<tr>
<td>Machine State STOPPED</td>
<td></td>
<td></td>
<td>BOOL</td>
<td>Indicates current machine state</td>
</tr>
<tr>
<td>Machine State STOPPING</td>
<td></td>
<td></td>
<td>BOOL</td>
<td>Indicates current machine state</td>
</tr>
<tr>
<td>Machine State Display</td>
<td></td>
<td></td>
<td>STRING</td>
<td>Indicates previous or last machine state</td>
</tr>
<tr>
<td>Machine Abort Status</td>
<td></td>
<td></td>
<td>INT</td>
<td>Displays abort status</td>
</tr>
<tr>
<td>Machine OK</td>
<td></td>
<td></td>
<td>BOOL</td>
<td>Machine OK (not faulted)</td>
</tr>
<tr>
<td>Machine Ready</td>
<td></td>
<td></td>
<td>BOOL</td>
<td>Machine ready for use</td>
</tr>
<tr>
<td>Machine SL Status</td>
<td></td>
<td></td>
<td>BOOL</td>
<td>Machine in safe limited speed</td>
</tr>
</tbody>
</table>

Machine Tags

<table>
<thead>
<tr>
<th>Tag Group</th>
<th>Function</th>
</tr>
</thead>
</table>
| Machine mode         | Additional modes can be added to the machine. By default, the modes included are:  
|                      | • OPERATOR or manual mode                                                |
|                      | • PROGRAM or auto mode                                                  |
| Machine commands     | Broadcast machine commands that direct all of the dependent modules (for example, application and device modules). |
| Current machine state| Indicates the current state of the overall machine. Only one state can be set at even given time. |
| Previous machine state| Indicates the previous machine state. Used primarily by the application and device modules to determine Transitional State faults. |
| Machine state display| String tag that can be used to indicate the current machine state.       |
| Machine status       | Indicates miscellaneous machine status information.                    |

Device and Application Status Rungs and Logix

The device and application status rungs provide feedback information to the machine module and consist of these components.
The status bits are set in the Monitor routine of the corresponding modules. These status bits are vital to the machine module, as they are used to determine the overall status of the machine. They help the machine transition between states or detect a fault and respond accordingly. All of the module status information is summarized in the Monitor routine of the machine module.

For this Drives and Motion Accelerator Toolkit (DMAT) application example, the rungs are found in the R02_Monitor routine of the P01_Machine program.
DMAT Device Status Rungs

---

**MODULE STATUS**

---

**ALL MODULES ABORTED**

13

- Module Aborted
- PF525_Module Aborted
- PF755_Module Aborted

**ALL MODULES READY**

14

- Module Ready for Use
- PF525_Module Ready
- PF755_Module Ready

**ALL MODULES RESET**

15

- Module Reset
- PF525_Module Reset
- PF755_Module Reset

**ALL MODULES OK**

16

- Module OK (NOT Faulted)
- PF525_Module OK
- PF755_Module OK

**ANY MODULE SAFE LIMITED SPEED REQUEST**

17

- Module Safe Limited Speed Request
- PF525_Module SLSReq
- PF755_Module SLSReq

---
DMAT Application Status Rungs

**APPLICATION STATUS**

**OK**
- Application OK (NOT Faulted)
  - Source A
  - Source B

**READY**
- Application Ready for Use
  - Application Ready

**RUNNING**
- By default, the Application is **RUNNING** when RunSEQ[0] is non-zero.
  - Refer to the Application Code routine to modify the Run sequence.

**STOPPED**
- By default, the Application is **STOPPED** when StopSEQ[0] reaches 999.
  - Refer to the Run/ApplicationCode routine in the Application module to modify the Stop sequence.

**RESET**
- By default, the Application is **RESET** when ResetSEQ[0] reaches 999.
  - Refer to the Run/Reset routine in the Application module to modify the Reset sequence.

**Rung 6**
- **Equi**
  - Application_OK
  - Application_OK

**Rung 7**
- **Equi**
  - Application_FaultStatus
    - Source A
  - Source B

**Rung 8**
- **Equi**
  - Application_OK

**Rung 9**
- **Equi**
  - RunSEQ[0]
  - Source A
  - Source B

**Rung 10**
- **Equi**
  - StopSEQ[0]
  - Source A
  - Source B

**Rung 11**
- **Equi**
  - ResetSEQ[0]
  - Source A
  - Source B
Application Modules

The application modules contain all of the application specific code. This is where a majority of the customizing is expected to occur and is essentially a programming space where you spend a significant portion of your efforts to develop proprietary logic specific to your application. In this example, application code is shown within the R10_ApplicationCode routine of the P02_Application program.

In this example below, only a part of the application code is shown for the DMAT assembly application.
Device Modules

Device modules contain all of the logic to control the essential functions required by the device. For this DMAT example, we are using the PowerFlex 753 / 755 HMI faceplate and AOI instruction which has preprogrammed start, stop, speed reference, Accel and Decel times. This logic reduces the programming effort required by most applications providing more time for the proprietary logic needed for the application.

Typically, the device module consists of a physical drive, but could also consist of a virtual or feedback-only axis. Device modules can also consist of multiple devices, for example, a drive and perhaps a feedback device, for example, a sensor.

Device Module Tags

The application and individual device modules interact with each other via device specific control tags that include both command and status information. The control tags consist of these data types.

<table>
<thead>
<tr>
<th>Device Classifications</th>
<th>Covered Products</th>
<th>Data Type</th>
</tr>
</thead>
</table>
| PowerFlex drives       | PowerFlex 4-class drives, for example 4, 40, 40P  
                        | PowerFlex 7-class drives, for example 70EC, 700VC  
                        | PowerFlex 750-Series drives for example 753, 755   | Product specific add-on defined (AOI) data type:  
                        |                                                        | PFlex_XXX_AOI                                       
                        |                                                        | Where XXX refers to the specific PowerFlex drive.   |
| Kinetix 300 drives     | Kinetix 300                             | User-defined type: UDT_K300_Ctrl                    |
| SERCOS Physical axis  | Kinetix 2000                           | User-defined type: UDT_ServoCtrl                    |
|                        | Kinetix 6000                           |                                                    |
|                        | Kinetix 6200                           |                                                    |
|                        | Kinetix 7000                           |                                                    |
| SERCOS Feedback-only axis | Applicable SERCOS drives               | User-defined type: UDT_ServoCtrl                    |
| CIP Motion physical axis | Kinetix 6500                           | User-defined type: UDT_ServoCtrl                    |
|                        | PowerFlex 755                           |                                                    |
| CIP Motion feedback-only axis | Applicable CIP Motion drives       | User-defined type: UDT_ServoCtrl                    |
| Virtual axis           | N/A                                     | User-defined type: UDT_ServoCtrl                    |

All of the data types listed above can be modified to fit specific needs of your application. However, modifications to the data types could have an impact on the device module and/or other preprogrammed logic, especially during import of additional device modules.

For example, the UDT_ServoCtrl data type that is used by the integrated motion drives (CIP Motion and sercos interface based drives) consists of these tags.
CIP Motion UDT_ServoCtrl Tag Listing

UDT_ServoCtrl Tag

<table>
<thead>
<tr>
<th>Tag Group</th>
<th>Function</th>
</tr>
</thead>
</table>
| Commands           | The command tags initiate preprogrammed logic in the device module. The command tags can be set (latch - OTL) in either the device and/or application module, and the device module will perform the requested action. The device module also clears the command bit (unlatch – OTU).
|                    | For example, if the Enable bit is latched, the corresponding device module executes a Motion Servo On (MSO) instruction and unlatches the Enable bit. |
| Status             | The Status tags are updated by the device module and contain commonly used information that can be referenced by both the device and application modules. |
|                    | For example, if the ON status bit is set, the application or device module knows that the drive is fully enabled. |
| Motion instructions| Placeholders for Motion Instructions. This provides a central group of Motion Instructions that can be used by both the application and device module. |
| Miscellaneous data placeholders | Placeholders for commonly used data for the application and device modules. The data placeholder tags are set by default in the PowerUP routine located in the device module. |

The user-defined type for the Kinetix 300 drives and the add-on defined data type for the PowerFlex drives serve similar function as the UDT_ServoCtrl data type, however their layouts differ. Refer to the specific data types for more information.
Device Module Control Logic

In this example, the R03_Control routine for the P04_PF755_Drive device module initiates and/or clears the Reset and Abort sequences. It is the same for the R03_Control routine for the P03_PF525_Drive device module.