L14 - Drive Programming with the New PowerFlex® 520-Series AC Drive

For Classroom Use Only!

LISTEN. THINK. SOLVE.®

Allen-Bradley • Rockwell Software

Rockwell Automation

Important User Information

This documentation, whether, illustrative, printed, “online” or electronic (hereinafter “Documentation”) is intended for use only as a learning aid when using Rockwell Automation approved demonstration hardware, software and firmware. The Documentation should only be used as a learning tool by qualified professionals.

The variety of uses for the hardware, software and firmware (hereinafter “Products”) described in this Documentation, mandates that those responsible for the application and use of those Products must satisfy themselves that all necessary steps have been taken to ensure that each application and actual use meets all performance and safety requirements, including any applicable laws, regulations, codes and standards in addition to any applicable technical documents.

In no event will Rockwell Automation, Inc., or any of its affiliate or subsidiary companies (hereinafter “Rockwell Automation”) be responsible or liable for any indirect or consequential damages resulting from the use or application of the Products described in this Documentation. Rockwell Automation does not assume responsibility or liability for damages of any kind based on the alleged use of, or reliance on, this Documentation.

No patent liability is assumed by Rockwell Automation with respect to use of information, circuits, equipment, or software described in the Documentation.

Except as specifically agreed in writing as part of a maintenance or support contract, equipment users are responsible for:

- properly using, calibrating, operating, monitoring and maintaining all Products consistent with all Rockwell Automation or third-party provided instructions, warnings, recommendations and documentation;
- ensuring that only properly trained personnel use, operate and maintain the Products at all times;
- staying informed of all Product updates and alerts and implementing all updates and fixes; and
- All other factors affecting the Products that are outside of the direct control of Rockwell Automation.

Reproduction of the contents of the Documentation, in whole or in part, without written permission of Rockwell Automation is prohibited.

Throughout this manual we use the following notes to make you aware of safety considerations:

WARNING

Identifies information about practices or circumstances
that can cause an explosion in a hazardous environment,
which may lead to personal injury or death, property damage, or economic loss.

IMPORTANT

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

ATTENTION

Identifies information about practices or circumstances that can lead to personal injury or death, property damage, or economic loss. Attentions help you:

- identify a hazard
- avoid a hazard
- 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.

Drive Programming with the New PowerFlex 520-Series AC Drive

Contents

Before You Begin

Please review the following information before starting this lab.

About this lab

Learn the basics of drive programming using the new PowerFlex 525 compact 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 new feature that provides specific parameter groups for popular applications. 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 525 drives in Studio 5000.

Tools & Prerequisites

Software programs required

- Studio 5000 Logix Designer v23.00.00
- PowerFlex 525 Add-On Profile v1.04.33
- Connected Components Workbench v6.01.00
- RSLinx Classic v3.61.00
- FactoryTalk View Studio v7.00
- RSLinx Enterprise v5.60.08
- Wizards v3.12.11

Hardware devices required

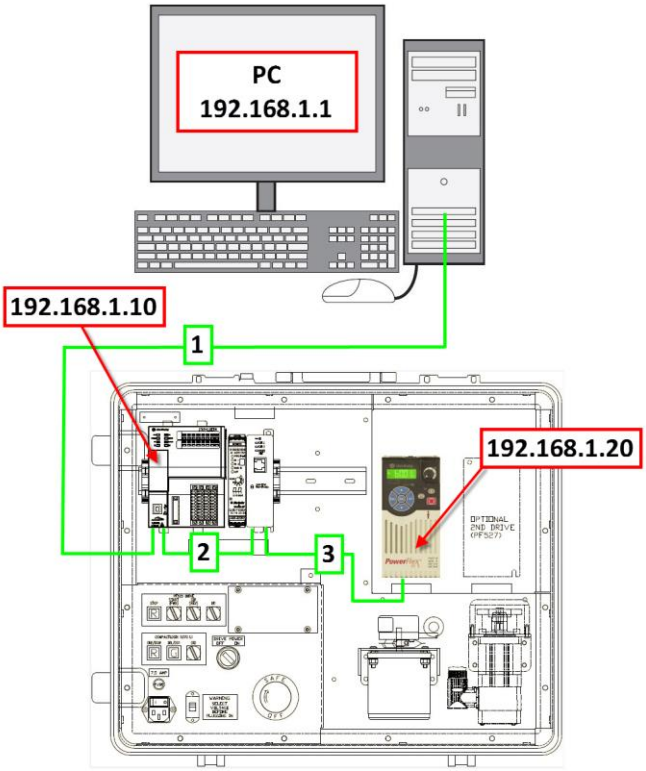
- PowerFlex 525 Demo Box (12P019A)
    - CompactLogix 5370 Controller (1769-L18ERM-BB1B) - v23.012
    - PowerFlex 525 AC Drive (25B-V2P5N104) – v2.003
- Ethernet patch cables

Files required

- PF525_Lab.ACD
- PF525_Lab_ADC.ACD
- PF525_Lab.mer

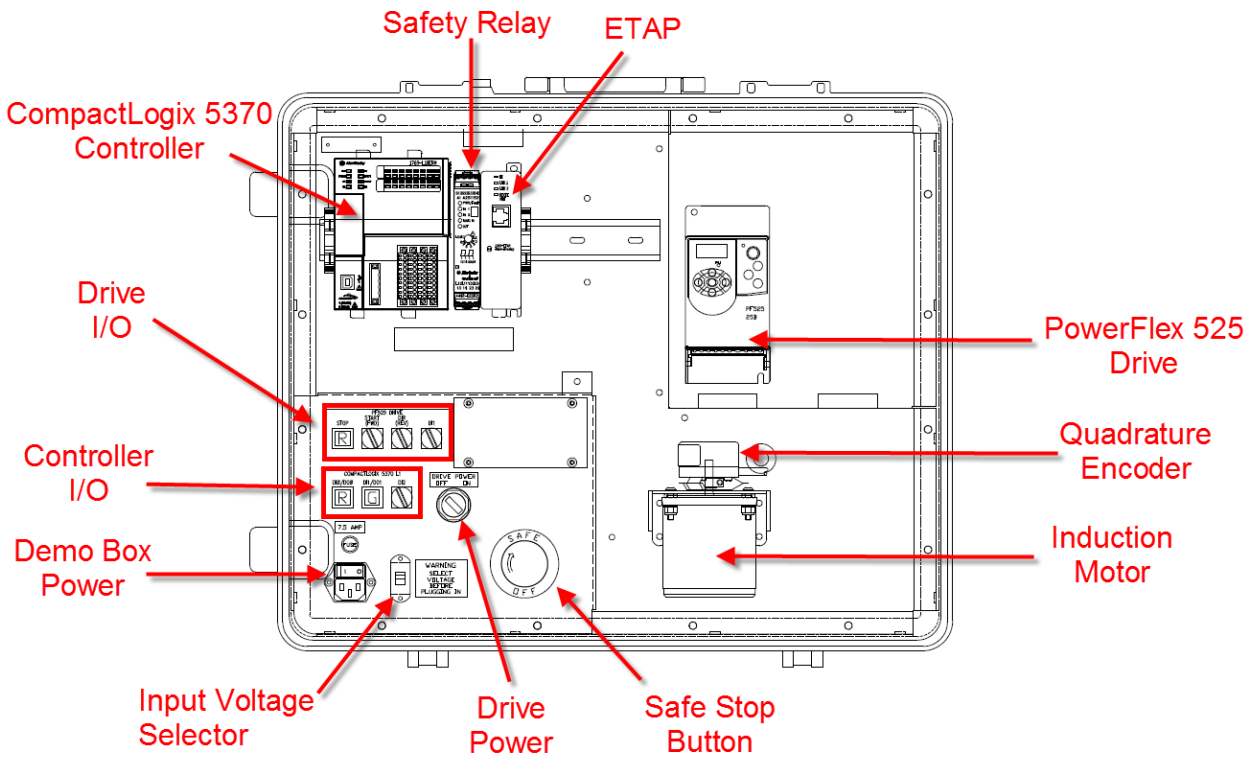
Lab files are located within the "C:\Lab Files\L14 – Basic Drive Programming" folder.

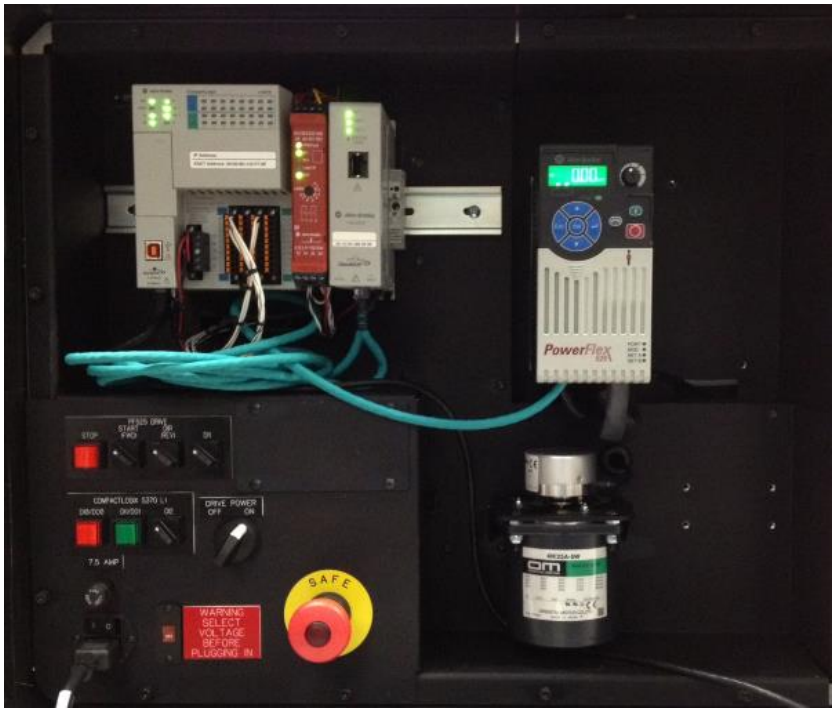
Network Setup



Ethernet Connections		
1	PC	L18ERM Port 1 (front)
2	L18ERM Port 2 (rear)	ETAP Port 1 (front)
3	ETAP Port 2 (rear)	PF525

About the Demo Box





Exercise 1: Using the HIM Keypad and Display

In this section you will perform the following:

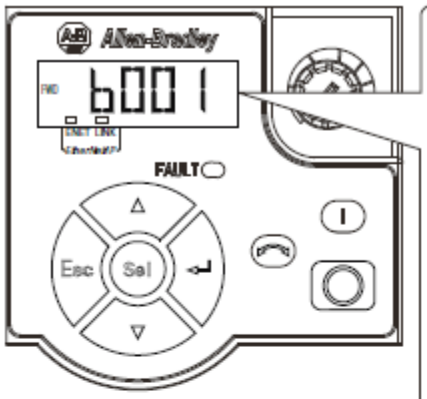
- Review key information about the HIM keypad and display of the PowerFlex 525 drive
- Reset the PowerFlex 525 drive to defaults
- Configure several parameters

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



Menu	Parameter Group and Description
b	**Basic Display** Commonly viewed drive operating conditions.
P	**Basic Program** Commonly used programmable functions.
t	**Terminal Blocks** Programmable terminal functions.
C	**Communications** Programmable communication functions.
L	**Logic** Programmable logic functions.
d	**Advanced Display** Advanced drive operating conditions.
A	**Advanced Program** Remaining programmable functions.
f	**Fault and Diagnostic** Consists of list of codes for specific fault conditions.
N	**Network** Network functions that are shown only when a comm card is used.
M	**Modified** Functions from the other groups with values changed from default.
G	**AppView and CustomView** Functions from the other groups organized for specific applications.

- **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	Display State	Description
ENET	Off	Adapter is not connected to the network.
	Steady	Adapter is connected to the network and drive is controlled through Ethernet.
	Flashing	Adapter is connected to the network but drive is not controlled through Ethernet.
LINK	Off	Adapter is not connected to the network.
	Steady	Adapter is connected to the network but not transmitting data.
	Flashing	Adapter is connected to the network and transmitting data.

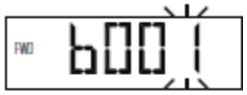
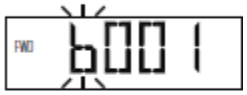
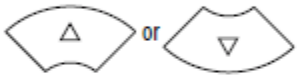
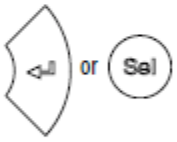
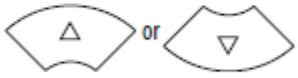
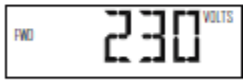
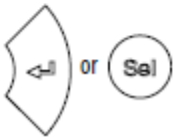
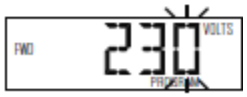
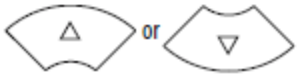
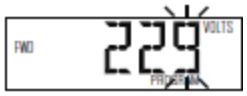
LED	LED State	Description
FAULT	Flashing Red	Indicates drive is faulted.

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

Key	Name	Description
	Reverse	Used to reverse direction of the drive. Default is active. Controlled by parameters P046, P048 and P050 [Start Source x] and A544 [Reverse Disable].
	Start	Used to start the drive. Default is active. Controlled by parameters P046, P048 and P050 [Start Source x].
	Stop	Used to stop the drive or clear a fault. This key is always active. Controlled by parameter P045 [Stop Mode].
	Potentiometer	Used to control speed of drive. Default is active. Controlled by parameters P047, P049 and P051 [Speed Referencex].

Viewing and Editing Parameters

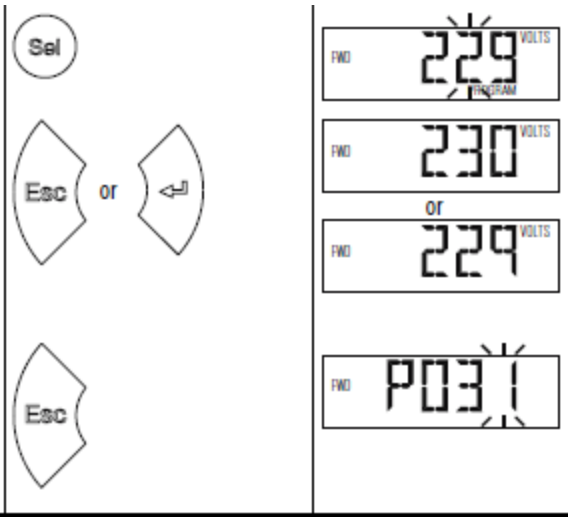
The following is an example of basic integral keypad and display functions. This example provides basic navigation instructions and illustrates how to program a parameter. Just read through the following.

Step	Key(s)	Example Display
1. 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.)		
2. Press Esc to display the Basic Display Group parameter number shown on power-up. The parameter number will flash.		
3. Press Esc to enter the parameter group list. The parameter group letter will flash.		
4. Press the Up Arrow or Down Arrow to scroll through the group list (b, P, t, C, L, d, A, f and Gx).		
5. Press Enter or Sel to enter a group. The right digit of the last viewed parameter in that group will flash.		
6. Press the Up Arrow or Down Arrow to scroll through the parameter list.		
7. Press Enter to view the value of the parameter. Or Press Esc to return to the parameter list.		
8. 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.		
9. Press the Up Arrow or Down Arrow to change the parameter value.		

10. If desired, press Sel to move from digit to digit or bit to bit. The digit or bit that you can change will flash.

11. Press Esc to cancel a change and exit Program Mode.
    Or
    Press Enter to save a change and exit Program Mode.
    The digit will stop flashing and the word Program on the LCD display will turn off.

12. Press Esc to return to the parameter list. Continue to press Esc to back out of the programming menu.
    If pressing Esc does not change the display, then b001 [Output Freq] is displayed. Press Enter or Sel to enter the group list again.

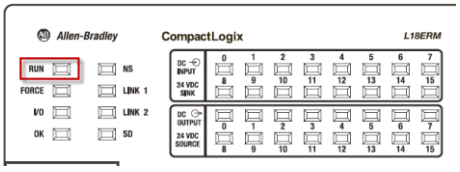


Reset Drive to Defaults

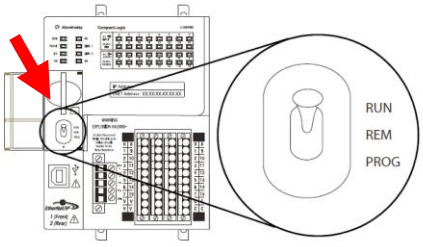
This is the beginning of the hands-on portion of the lab.

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 controllor 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.

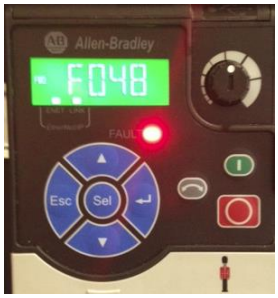
6. Press the **Enter** or **Sel** button to enter the Basic Program group. The right digit of the last viewed parameter in that group will flash.

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.

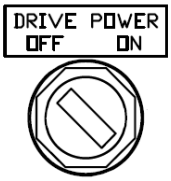


10. Press the **Stop**  button to clear the fault from the drive.

Configuring Drive Parameters

1. Take what you have learned about the keypad operation from the **Reset Drive to Defaults** section to make the following Communication group parameter changes:
   - C128 – EN Addr Sel = ***1 - "Parameters"***
   - C129 – EN IP Addr Cfg 1 = ***192***
   - C130 – EN IP Addr Cfg 2 = ***168***
   - C131 – EN IP Addr Cfg 3 = ***1***
   - C132 – EN IP Addr Cfg 4 = ***20***
   - C133 – EN Subnet Cfg 1 = ***255***
   - C134 – EN Subnet Cfg 2 = ***255***
   - C135 – EN Subnet Cfg 3 = ***255***

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.



Continue on to the next exercise.

Exercise 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.

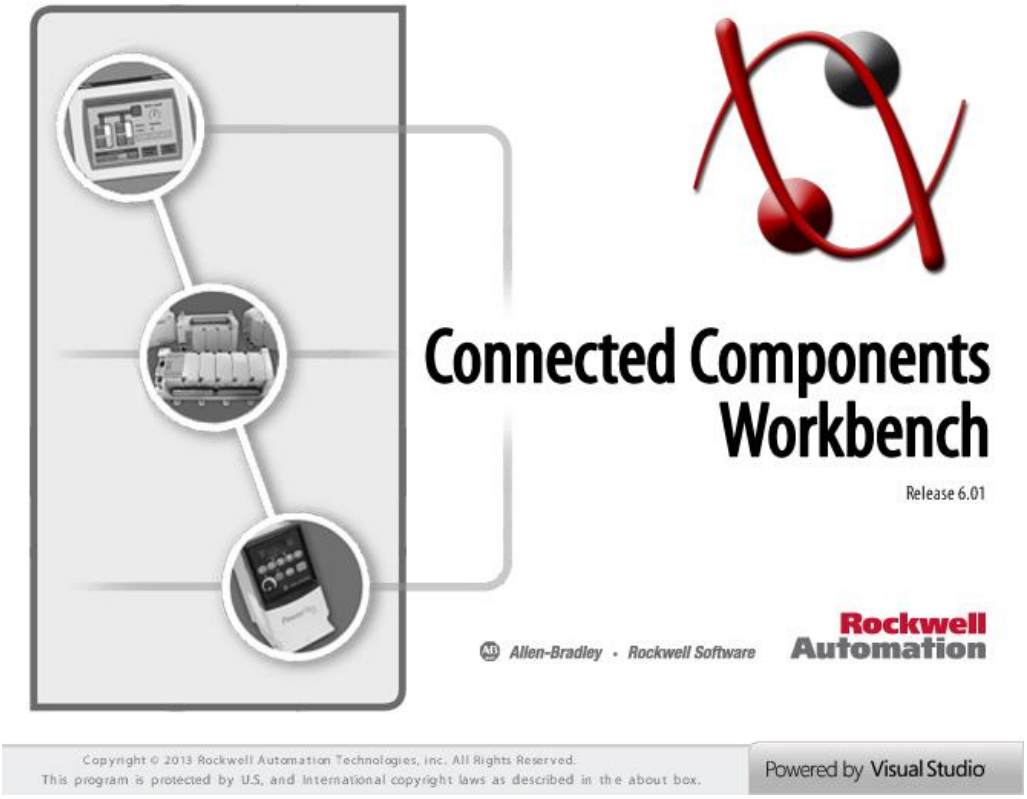
In this section you will perform the following:

- 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

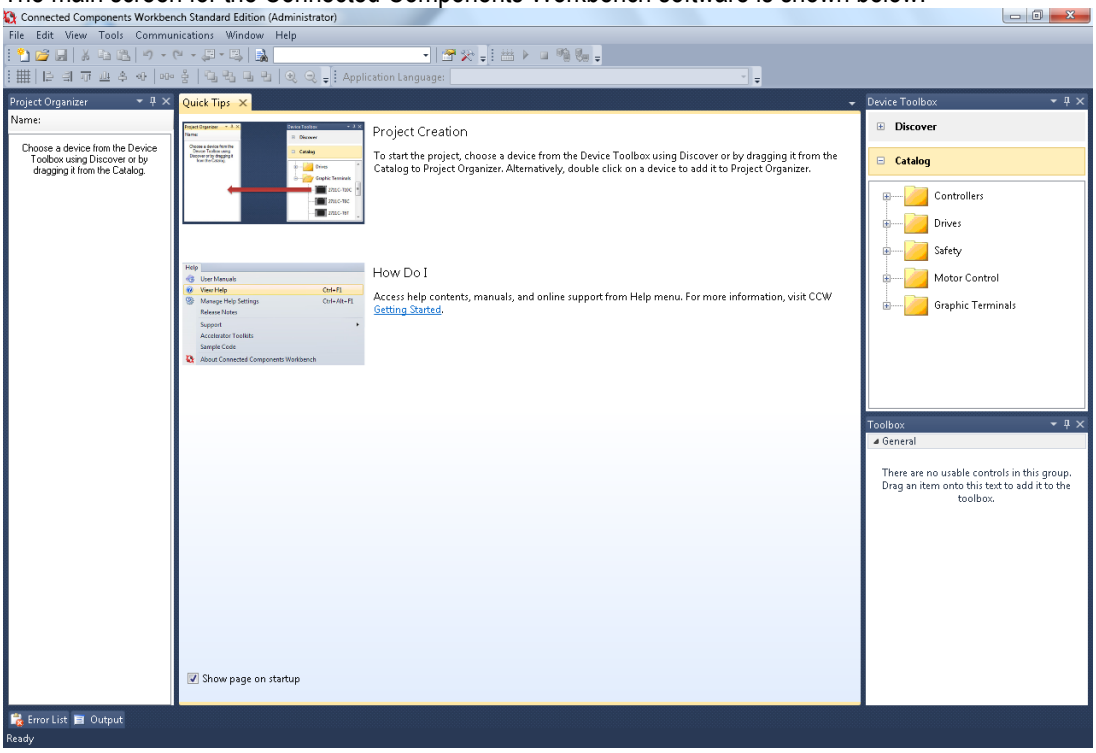
Connecting to the Drive

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.

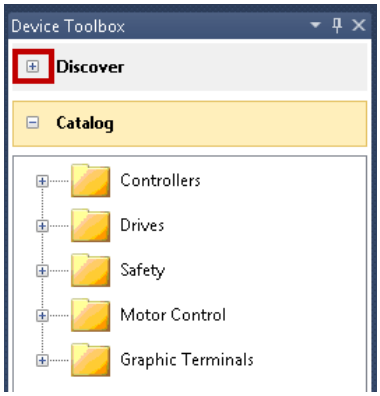


2. The main screen for the Connected Components Workbench software is shown below.

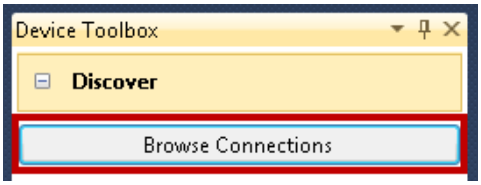


You may need to maximize the software to make viewing easier.

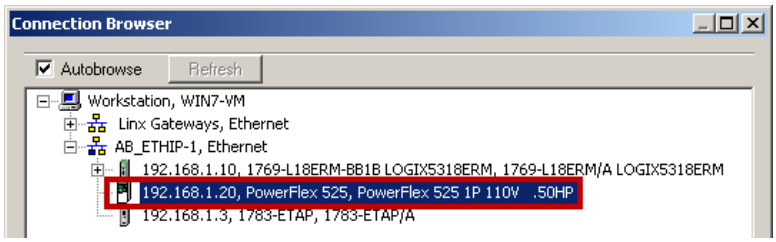
3. There are many features in the Connected Components Workbench software. Mainly, we will be using the software to go online with the PowerFlex 525 drive. Click the [+] next to Discover within the Device Toolbox.



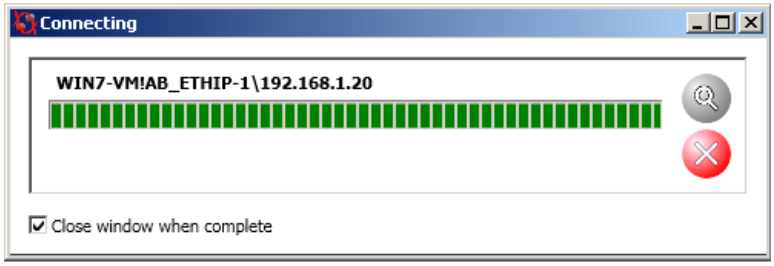
4. Click the **"Browse Connections"** button to launch the RSWho connection browser.



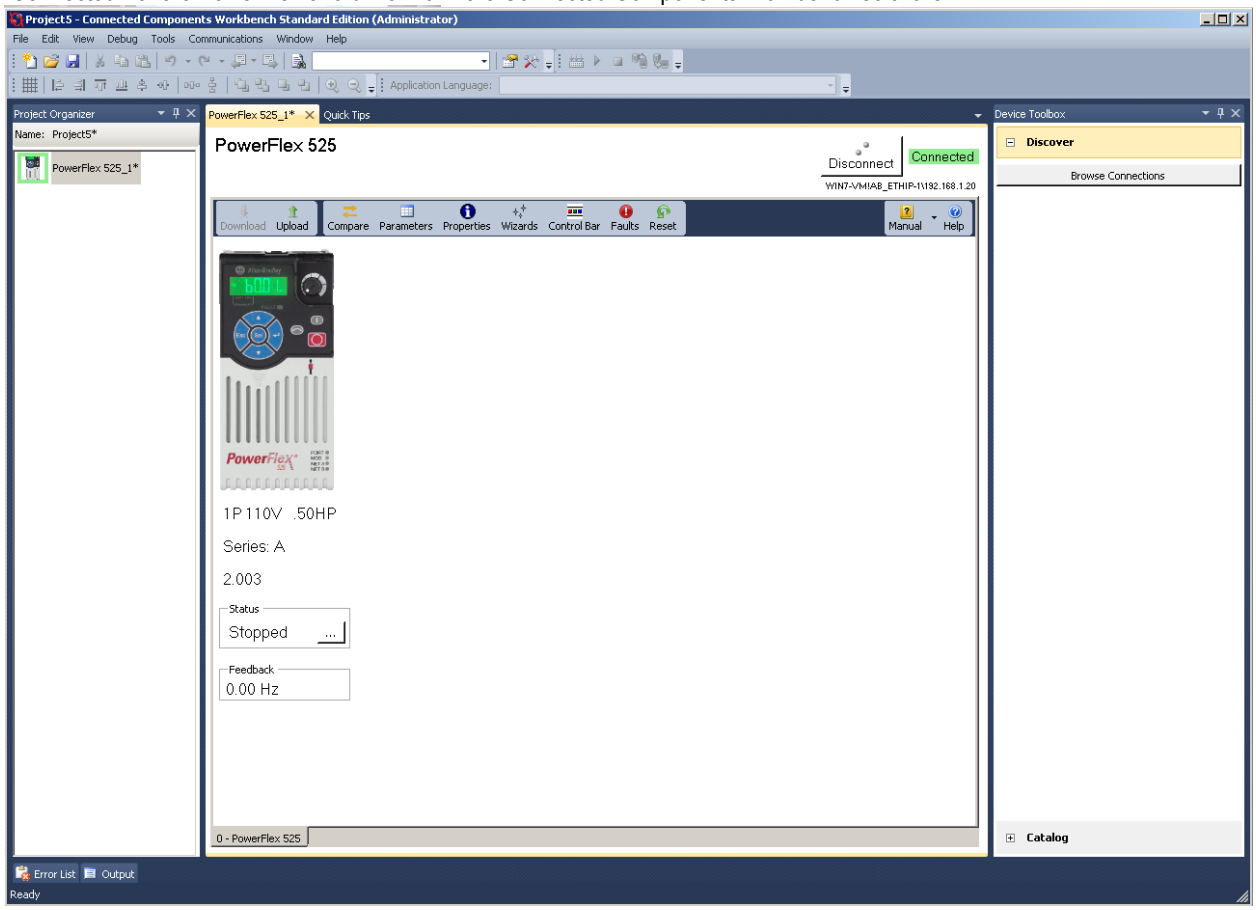
5. The lab's preconfigured RSLinx driver will appear. Click on the **[+]** to expand the topic **AB_ETH-1, Ethernet**. Click to highlight the "192.168.1.20, PowerFlex 525 1P 110V .50HP" device.



6. 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 525 drive within the Connected Components Workbench software.

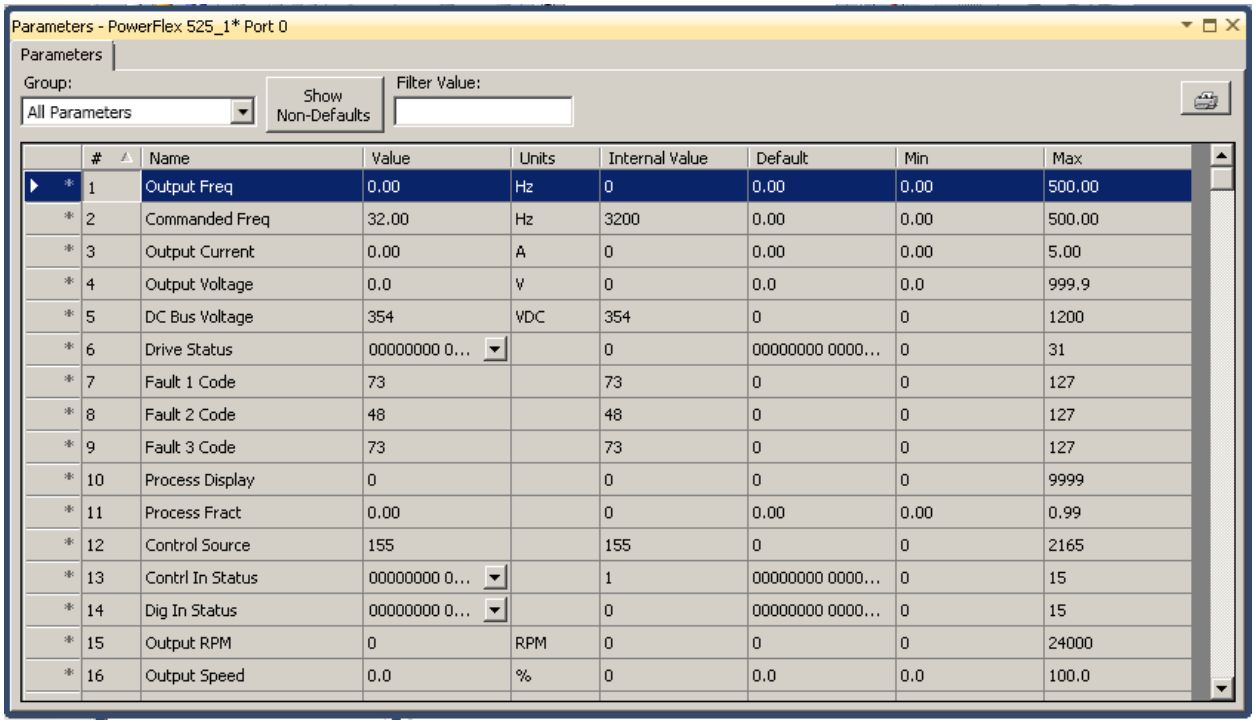


Exploring Drive Parameters through Standard Parameter Groupings

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. Click on the **"Parameters"**  icon to view the PowerFlex 525 drive parameters as seen below.

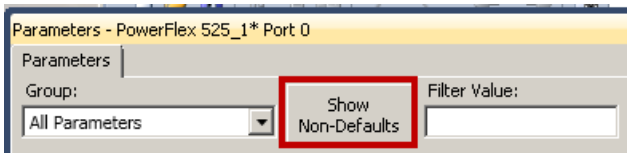


#	Name	Value	Units	Internal Value	Default	Min	Max
1	Output Freq	0.00	Hz	0	0.00	0.00	500.00
2	Commanded Freq	32.00	Hz	3200	0.00	0.00	500.00
3	Output Current	0.00	A	0	0.00	0.00	5.00
4	Output Voltage	0.0	V	0	0.0	0.0	999.9
5	DC Bus Voltage	354	VDC	354	0	0	1200
6	Drive Status	00000000 0...		0	00000000 0000...	0	31
7	Fault 1 Code	73		73	0	0	127
8	Fault 2 Code	48		48	0	0	127
9	Fault 3 Code	73		73	0	0	127
10	Process Display	0		0	0	0	9999
11	Process Fract	0.00		0	0.00	0.00	0.99
12	Control Source	155		155	0	0	2165
13	Contrl In Status	00000000 0...		1	00000000 0000...	0	15
14	Dig In Status	00000000 0...		0	00000000 0000...	0	15
15	Output RPM	0	RPM	0	0	0	24000
16	Output Speed	0.0	%	0	0.0	0.0	100.0

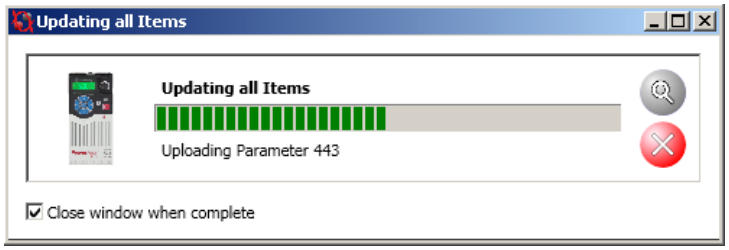
The PowerFlex 525 drive Add-On Profile has a time saving feature with Connected Components Workbench software that will show the non-default parameters. This makes it easy for users to view which parameters were changed from their default setting.

> 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.

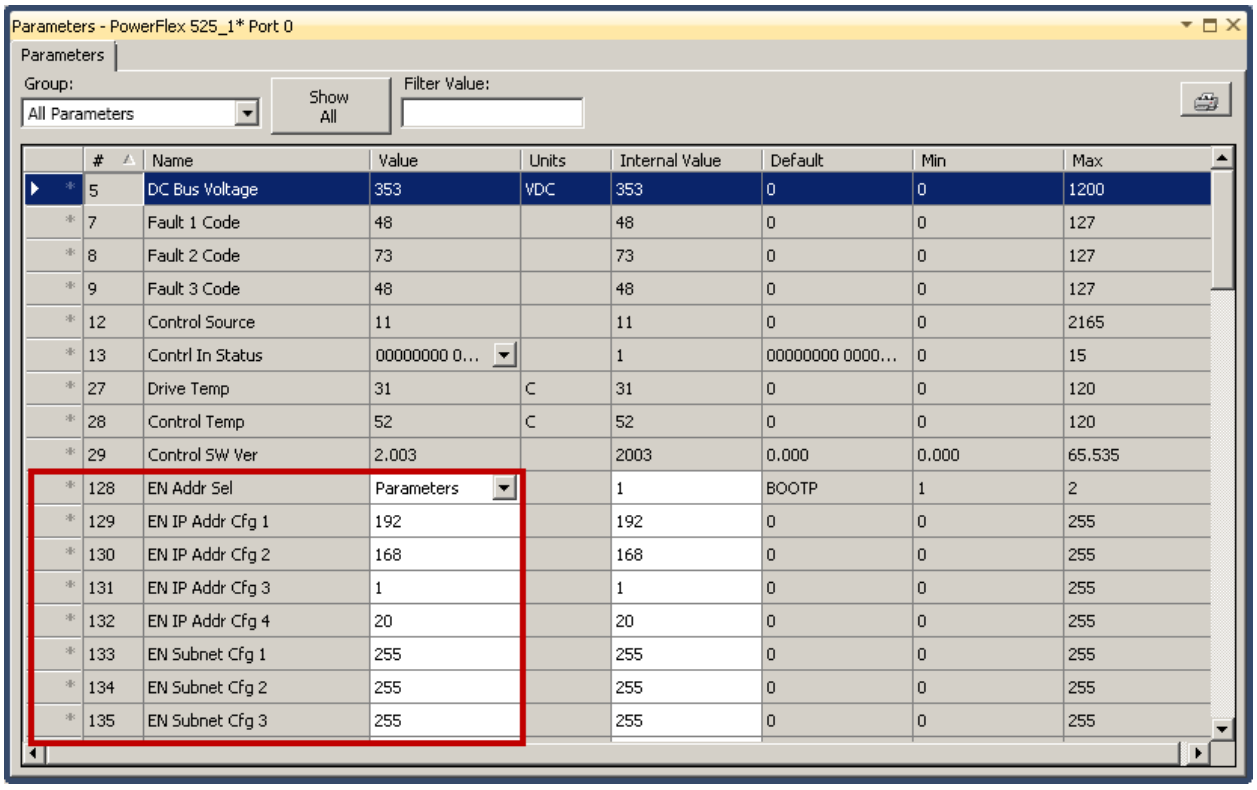
3. Make sure **"All Parameters"** is selected within the Group dropdown selection box and then click the **"Show Non-Defaults"** button as shown below.



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. Take a look, you will notice that the parameters you changed in Lab 1 appear in this list.

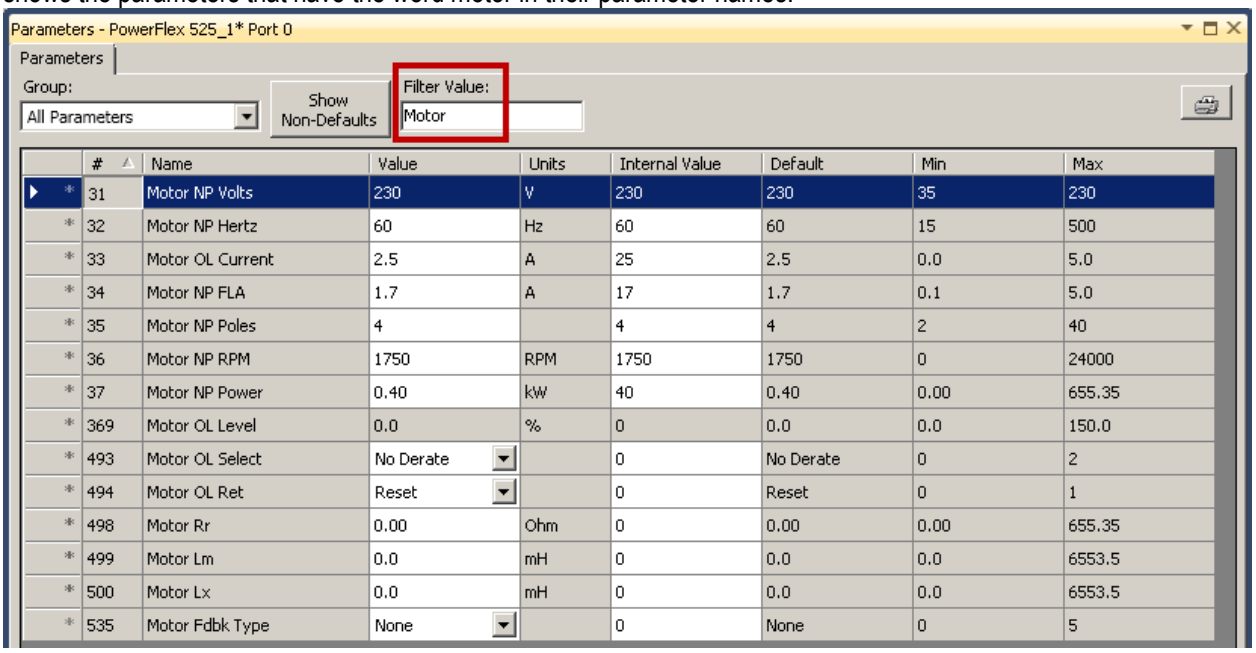


#	Name	Value	Units	Internal Value	Default	Min	Max
5	DC Bus Voltage	353	VDC	353	0	0	1200
7	Fault 1 Code	48		48	0	0	127
8	Fault 2 Code	73		73	0	0	127
9	Fault 3 Code	48		48	0	0	127
12	Control Source	11		11	0	0	2165
13	Contrl In Status	00000000 0...		1	00000000 0000...	0	15
27	Drive Temp	31	C	31	0	0	120
28	Control Temp	52	C	52	0	0	120
29	Control SW Ver	2.003		2003	0.000	0.000	65.535
128	EN Addr Sel	Parameters		1	BOOTP	1	2
129	EN IP Addr Cfg 1	192		192	0	0	255
130	EN IP Addr Cfg 2	168		168	0	0	255
131	EN IP Addr Cfg 3	1		1	0	0	255
132	EN IP Addr Cfg 4	20		20	0	0	255
133	EN Subnet Cfg 1	255		255	0	0	255
134	EN Subnet Cfg 2	255		255	0	0	255
135	EN Subnet Cfg 3	255		255	0	0	255

5. Click the **"Show All"** 

button to return to viewing all of the PowerFlex 525 drive parameters.

6. 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.

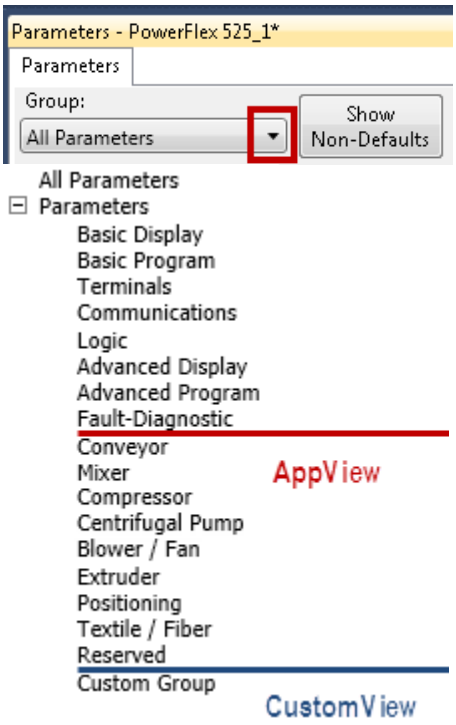


#	Name	Value	Units	Internal Value	Default	Min	Max
31	Motor NP Volts	230	V	230	230	35	230
32	Motor NP Hertz	60	Hz	60	60	15	500
33	Motor OL Current	2.5	A	25	2.5	0.0	5.0
34	Motor NP FLA	1.7	A	17	1.7	0.1	5.0
35	Motor NP Poles	4		4	4	2	40
36	Motor NP RPM	1750	RPM	1750	1750	0	24000
37	Motor NP Power	0.40	kW	40	0.40	0.00	655.35
369	Motor OL Level	0.0	%	0	0.0	0.0	150.0
493	Motor OL Select	No Derate		0	No Derate	0	2
494	Motor OL Ret	Reset		0	Reset	0	1
498	Motor Rr	0.00	Ohm	0	0.00	0.00	655.35
499	Motor Lm	0.0	mH	0	0.0	0.0	6553.5
500	Motor Lx	0.0	mH	0	0.0	0.0	6553.5
535	Motor Fdbk Type	None		0	None	0	5

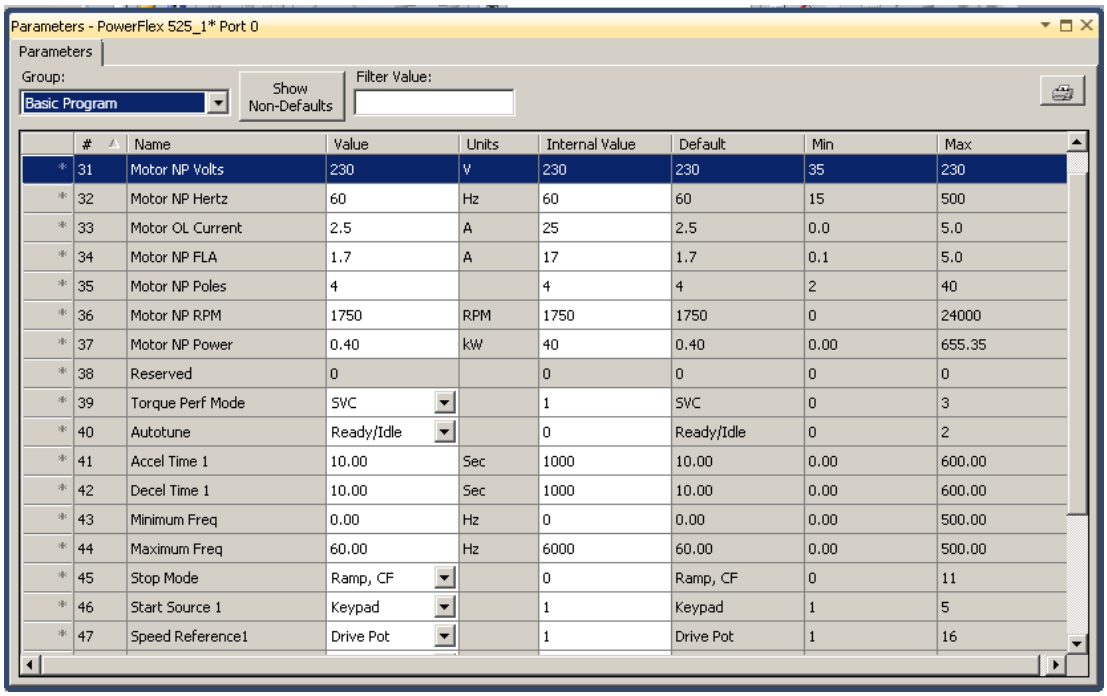
Try some other examples such as ***"Dig"***, ***"Speed"***, or ***"10"*** and see the results.

Remember to clear/delete the entry field when finished.

7. Under the Group dropdown selection box, you can scroll through the different drive parameter groups, AppView groups and the CustomView group.



8. Select **"Basic Program"** from the Group dropdown menu and explore the parameters shown below.



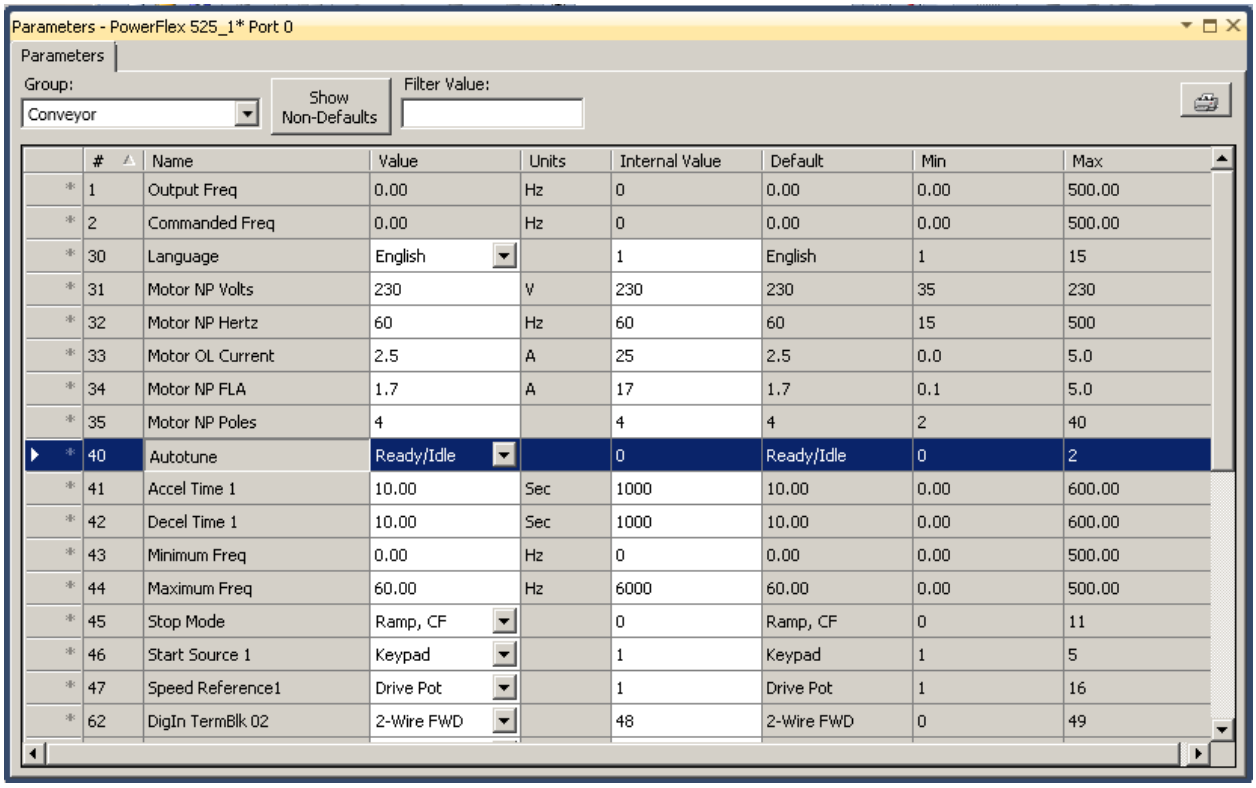
#	Name	Value	Units	Internal Value	Default	Min	Max
31	Motor NP Volts	230	V	230	230	35	230
32	Motor NP Hertz	60	Hz	60	60	15	500
33	Motor OL Current	2.5	A	25	2.5	0.0	5.0
34	Motor NP FLA	1.7	A	17	1.7	0.1	5.0
35	Motor NP Poles	4		4	4	2	40
36	Motor NP RPM	1750	RPM	1750	1750	0	24000
37	Motor NP Power	0.40	kW	40	0.40	0.00	655.35
38	Reserved	0		0	0	0	0
39	Torque Perf Mode	SVC		1	SVC	0	3
40	Autotune	Ready/Idle		0	Ready/Idle	0	2
41	Accel Time 1	10.00	Sec	1000	10.00	0.00	600.00
42	Decel Time 1	10.00	Sec	1000	10.00	0.00	600.00
43	Minimum Freq	0.00	Hz	0	0.00	0.00	500.00
44	Maximum Freq	60.00	Hz	6000	60.00	0.00	500.00
45	Stop Mode	Ramp, CF		0	Ramp, CF	0	11
46	Start Source 1	Keypad		1	Keypad	1	5
47	Speed Reference1	Drive Pot		1	Drive Pot	1	16

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

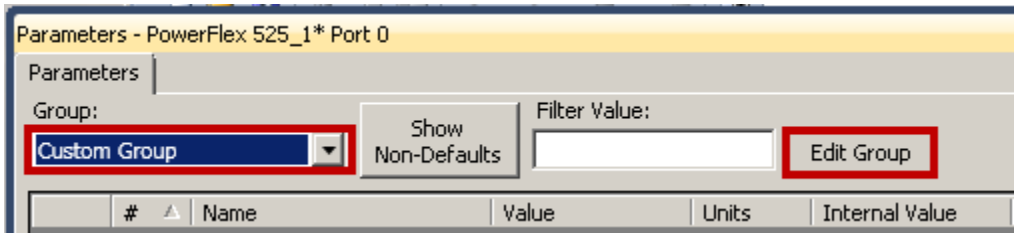
The PowerFlex 525 drive has several AppView groupings that are tailored for a specific application to make the drive startup and commissioning simpler. This reduces guesswork about which parameters you need to change, and all of the drive parameters for that application are all in one convenient location.

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

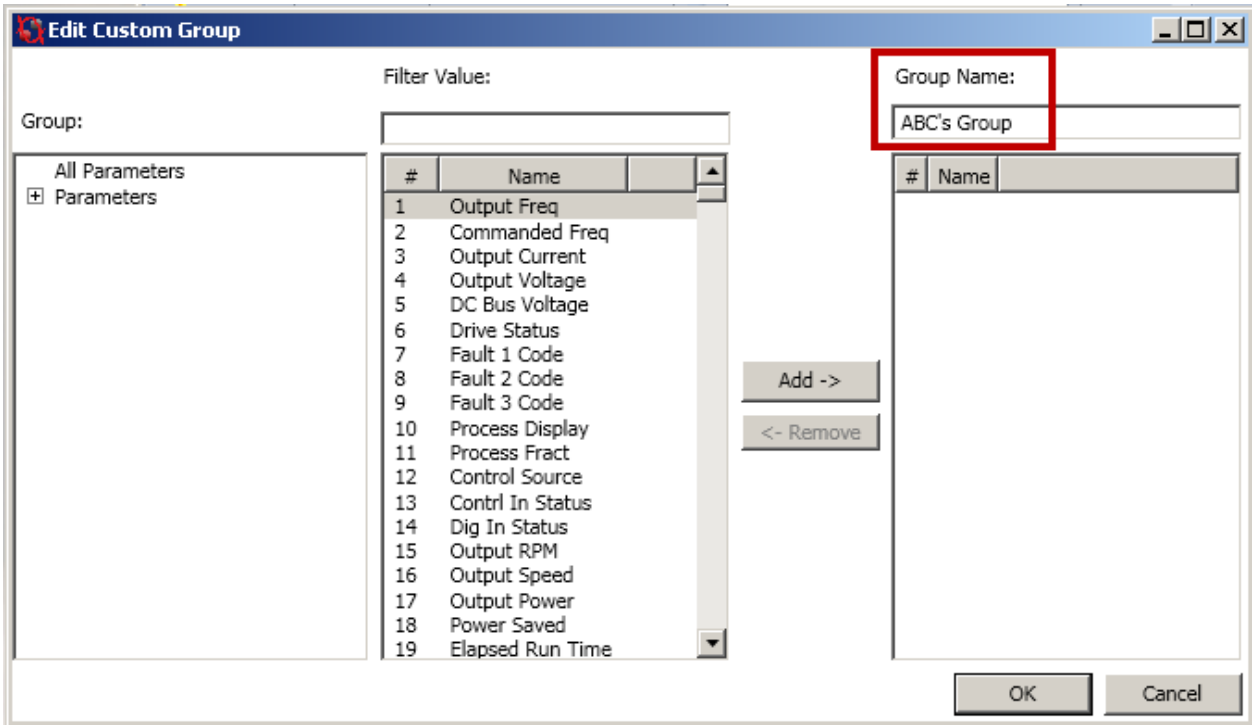


#	Name	Value	Units	Internal Value	Default	Min	Max
1	Output Freq	0.00	Hz	0	0.00	0.00	500.00
2	Commanded Freq	0.00	Hz	0	0.00	0.00	500.00
30	Language	English		1	English	1	15
31	Motor NP Volts	230	V	230	230	35	230
32	Motor NP Hertz	60	Hz	60	60	15	500
33	Motor OL Current	2.5	A	25	2.5	0.0	5.0
34	Motor NP FLA	1.7	A	17	1.7	0.1	5.0
35	Motor NP Poles	4		4	4	2	40
40	Autotune	Ready/Idle		0	Ready/Idle	0	2
41	Accel Time 1	10.00	Sec	1000	10.00	0.00	600.00
42	Decel Time 1	10.00	Sec	1000	10.00	0.00	600.00
43	Minimum Freq	0.00	Hz	0	0.00	0.00	500.00
44	Maximum Freq	60.00	Hz	6000	60.00	0.00	500.00
45	Stop Mode	Ramp, CF		0	Ramp, CF	0	11
46	Start Source 1	Keypad		1	Keypad	1	5
47	Speed Reference1	Drive Pot		1	Drive Pot	1	16
62	DigIn TermBlk 02	2-Wire FWD		48	2-Wire FWD	0	49

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.



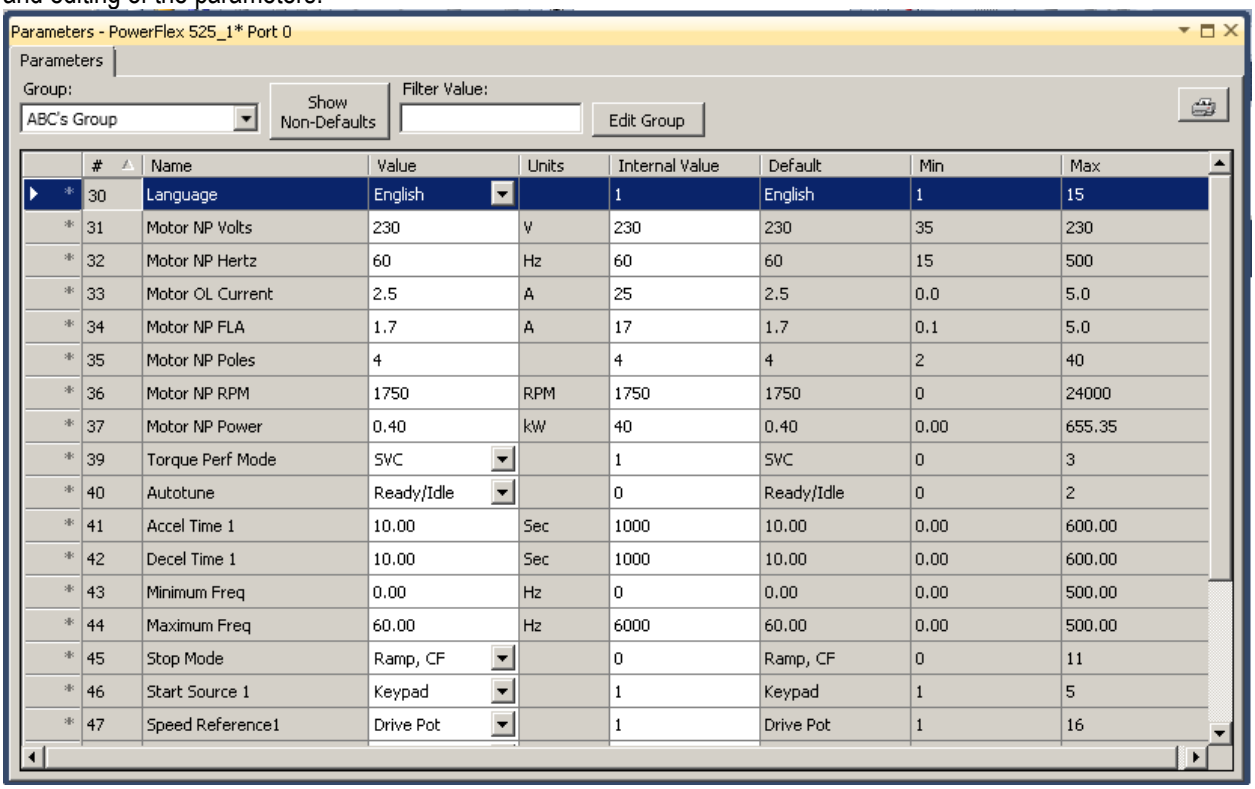
4. Find the following parameters in the list and add them to "ABC's Group":

Parameter 30 - Language	Parameter 43 - Minimum Freq
Parameter 31 - Motor NP Volts	Parameter 44 - Maximum Freq
Parameter 32 - Motor NP Hertz	Parameter 45 - Stop Mode
Parameter 33 - Motor OL Current	Parameter 46 - Start Source 1
Parameter 34 - Motor NP FLA	Parameter 47 - Speed Reference1
Parameter 35 - Motor NP Poles	Parameter 62 - DigIn TermBlk 02
Parameter 36 - Motor NP RPM	Parameter 63 - DigIn TermBlk 03
Parameter 37 - Motor NP Power	Parameter 64 - 2-Wire Mode
Parameter 39 - Torque Perf Mode	Parameter 65 - DigIn TermBlk 05
Parameter 40 - Autotune	Parameter 76 - Relay Out1 Sel
Parameter 41 - Accel Time 1	Parameter 81 - Relay Out2 Sel
Parameter 42 - Decel Time 1	

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.



#	Name	Value	Units	Internal Value	Default	Min	Max
30	Language	English		1	English	1	15
31	Motor NP Volts	230	V	230	230	35	230
32	Motor NP Hertz	60	Hz	60	60	15	500
33	Motor OL Current	2.5	A	25	2.5	0.0	5.0
34	Motor NP FLA	1.7	A	17	1.7	0.1	5.0
35	Motor NP Poles	4		4	4	2	40
36	Motor NP RPM	1750	RPM	1750	1750	0	24000
37	Motor NP Power	0.40	kW	40	0.40	0.00	655.35
39	Torque Perf Mode	SVC		1	SVC	0	3
40	Autotune	Ready/Idle		0	Ready/Idle	0	2
41	Accel Time 1	10.00	Sec	1000	10.00	0.00	600.00
42	Decel Time 1	10.00	Sec	1000	10.00	0.00	600.00
43	Minimum Freq	0.00	Hz	0	0.00	0.00	500.00
44	Maximum Freq	60.00	Hz	6000	60.00	0.00	500.00
45	Stop Mode	Ramp, CF		0	Ramp, CF	0	11
46	Start Source 1	Keypad		1	Keypad	1	5
47	Speed Reference1	Drive Pot		1	Drive Pot	1	16

Close the Parameters – PowerFlex 525_1* window by clicking the **[X]** in the top right corner of the window.

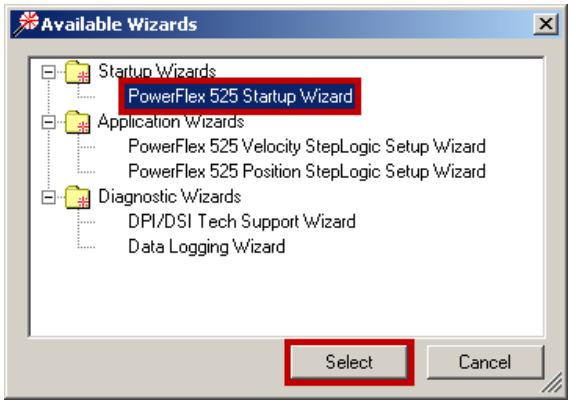
PowerFlex 525 Drive Start-Up Wizard

1. Click on the "Wizards" 

button.

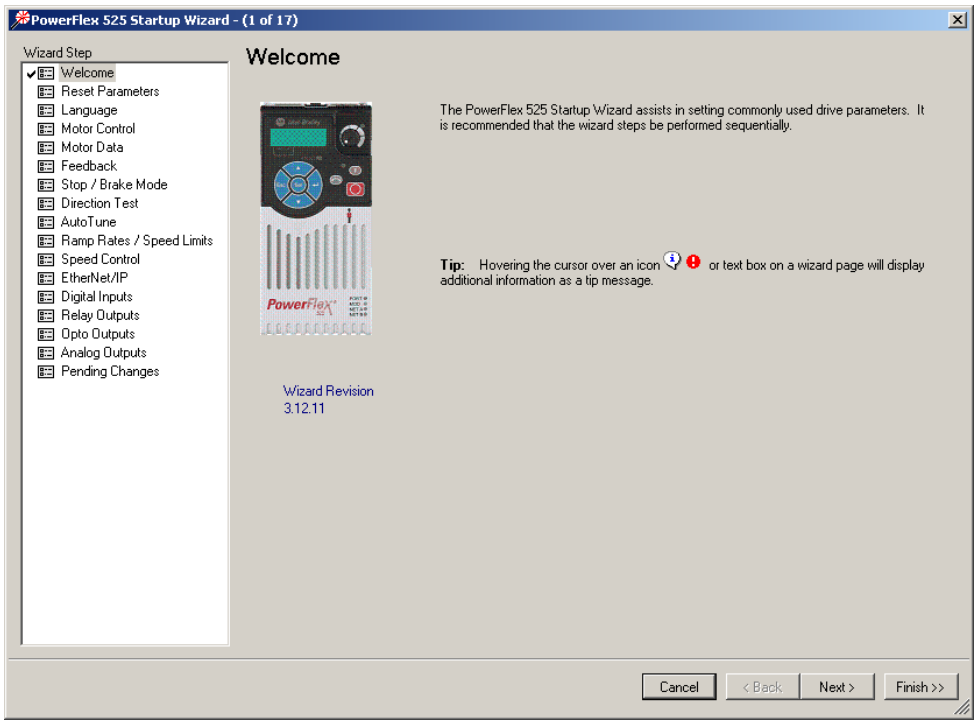
The Available Wizards selection box will appear.

2. Select the "PowerFlex 525 Startup Wizard" from the list and click the **"Select"** button to launch the PowerFlex 525 Startup Wizard.



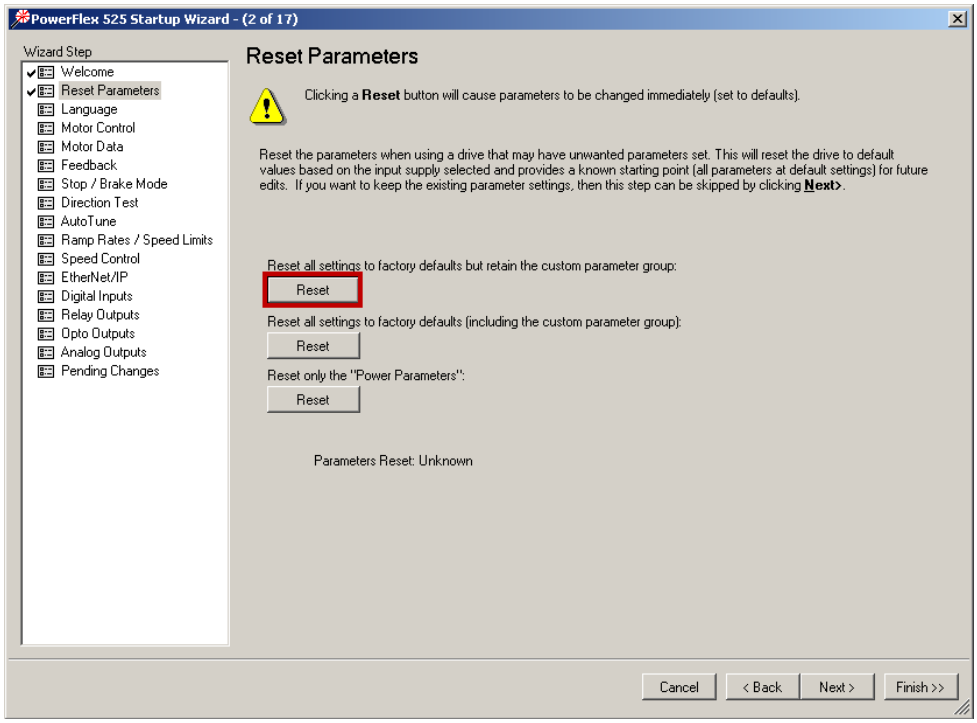
After a moment, the Welcome screeen for the PowerFlex 525 Startup Wizard will appear.

3. Click the **"Next >"** button to proceed with exploring the startup wizard.



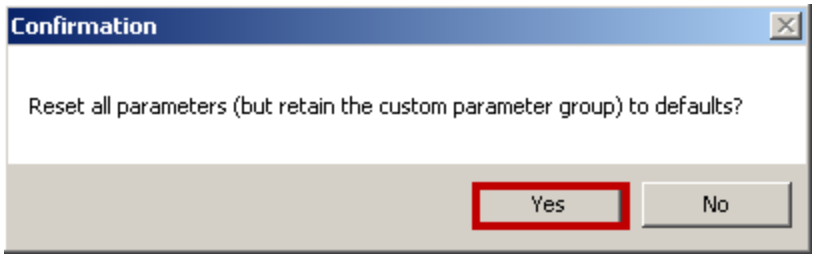
4. Below is the Reset Parameters page. Here you have a few different options.

- 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".

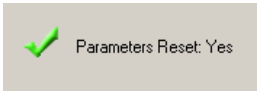


Click the **"Reset"** button for the first option, "Reset all settings to factory defaults but retain the custom parameter group".

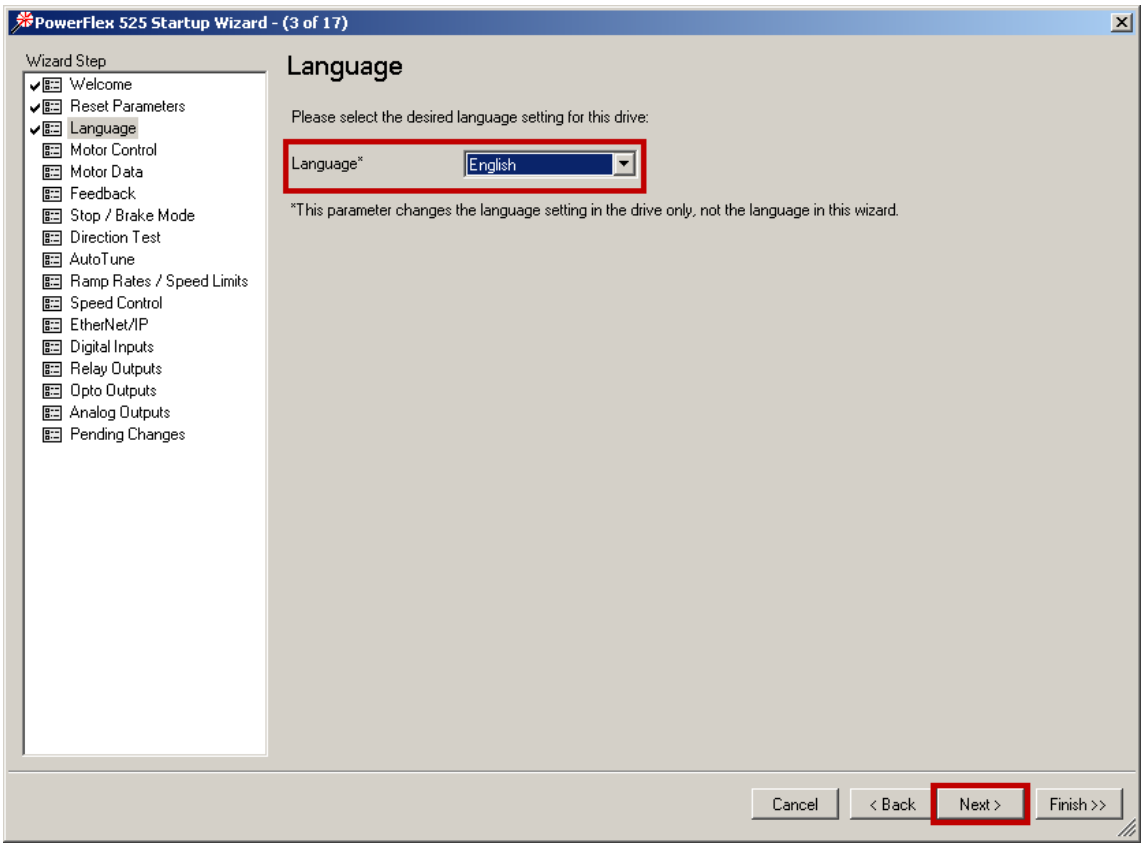
5. When the Confirmation window appears, verify that you made the correct choice and click the **"Yes"** button.



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.

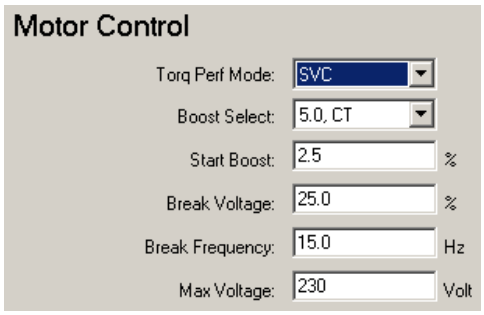


6. Make sure ***"English"*** is selected in the Language dropdown selection box and Click the **"Next >"** button to proceed to the next page…

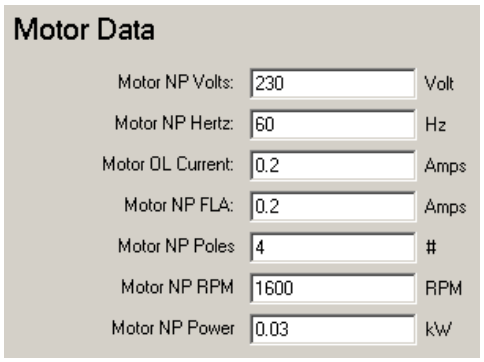


7. On the next three pages, verify and if needed, modify the parameters according to the following screenshots. At the end of each page, remember to click the **"Next >"** Next > button to proceed to the next page.

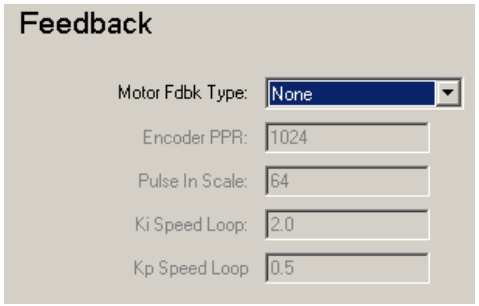
- Motor Control Page



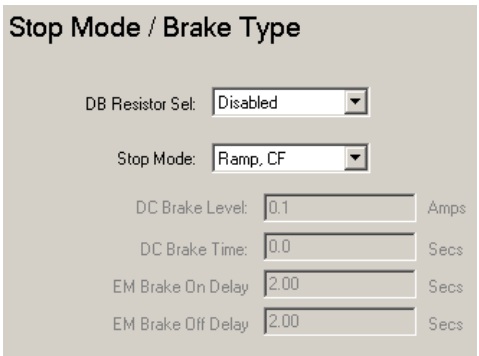
- Motor Data Page (changes required)



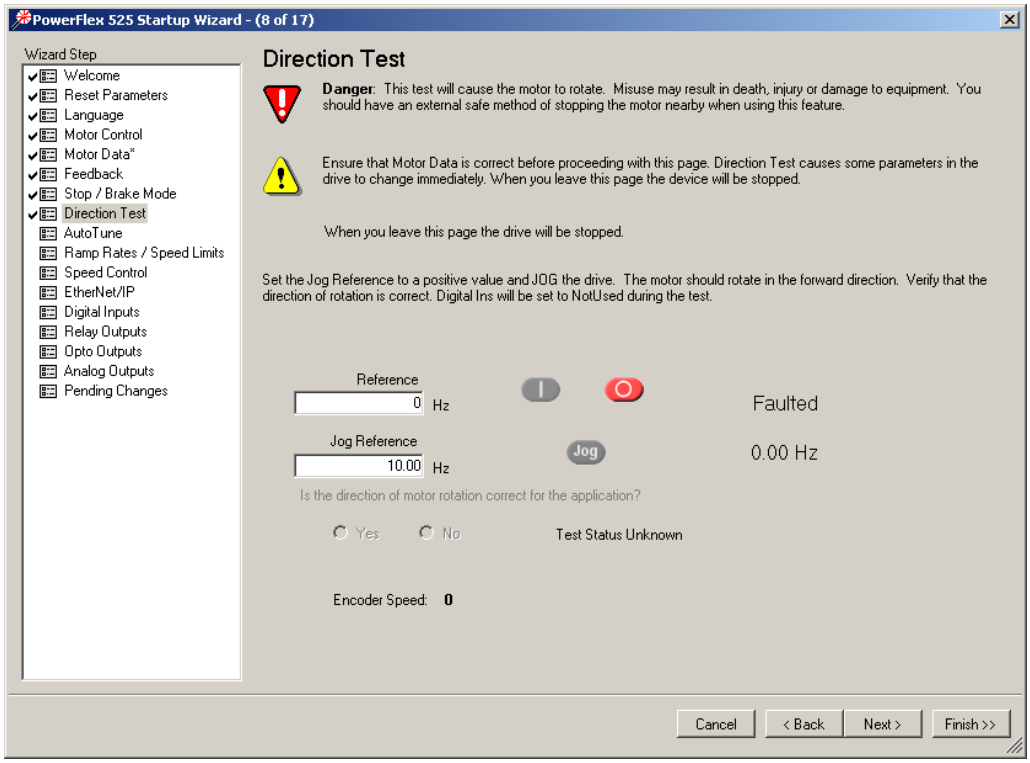
- Feedback Page



- Stop / Brake Mode Page



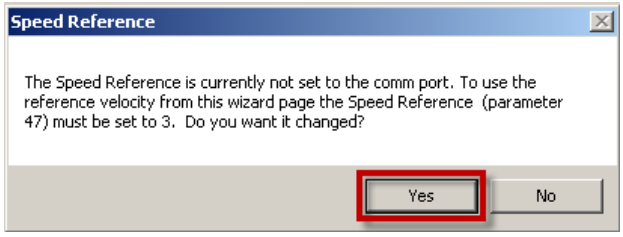
8. The next page is for the Direction Test. If desired, you may skip the Direction Test by clicking the **"Next >"** button and move onto the next numbered step in this manual. To continue with the Direction Test, follow the steps below.



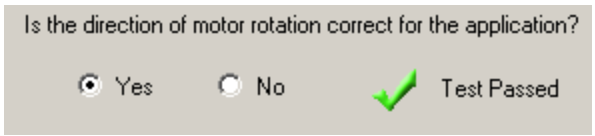
Press the **Stop** button to Clear Faults if the drive is faulted. The button is shown below.

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.



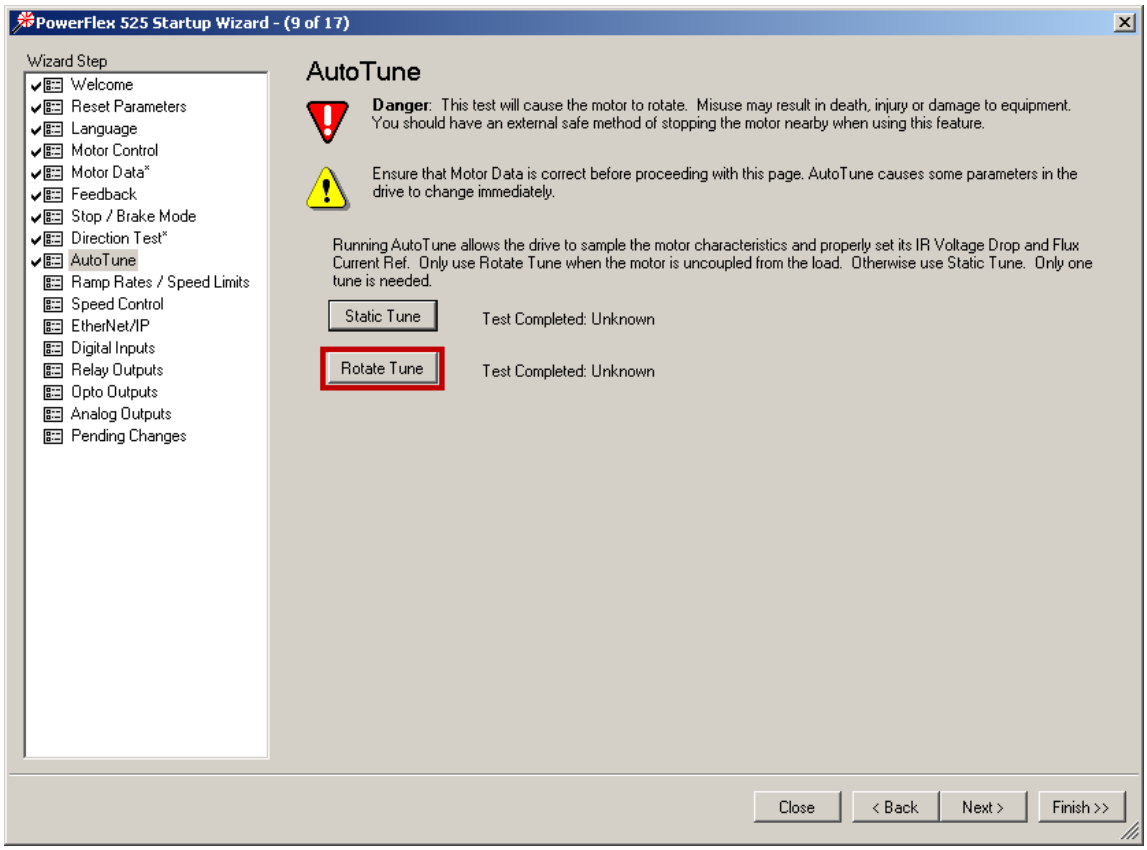
If the motor rotation is in the correct direction, click on the **"Yes"** radio button.



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.

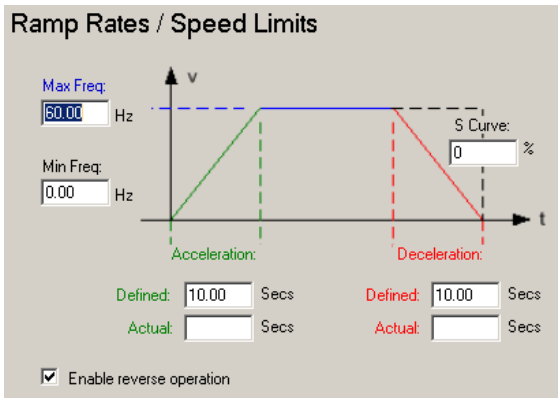


Once finished, you will see the "Test Completed: Yes" result.

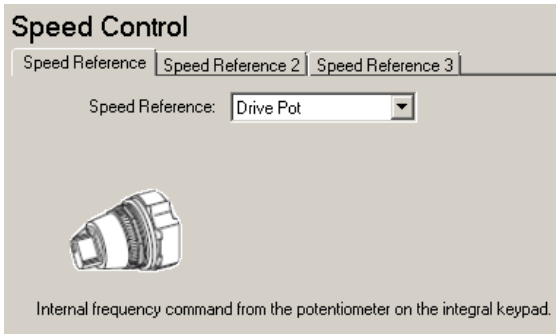
Proceed onto the next page by clicking the **"Next >"** button.

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.

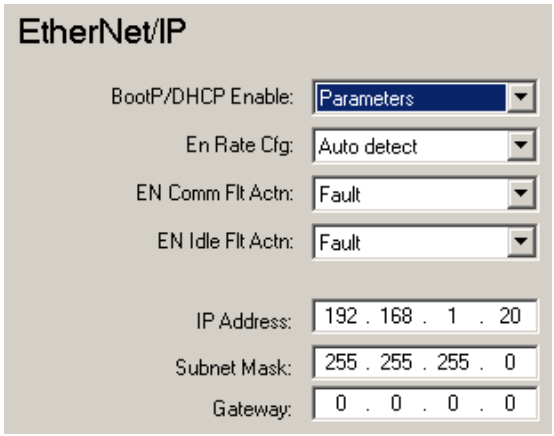
- Ramp Rates / Speed Limits



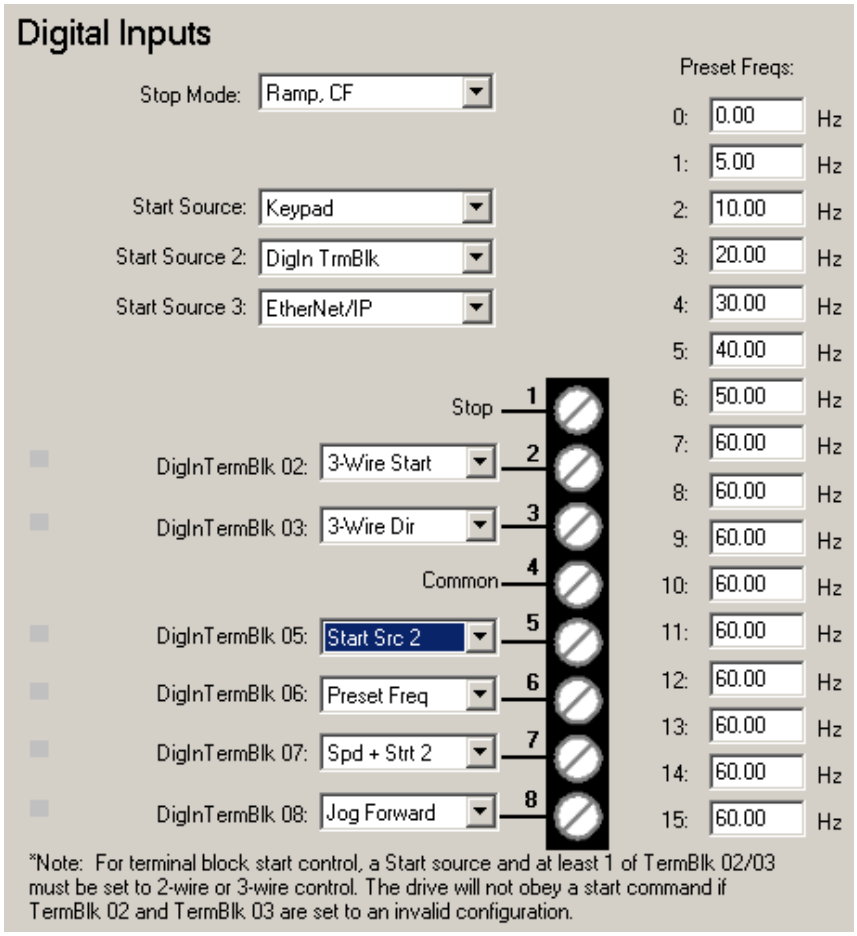
- Speed Control



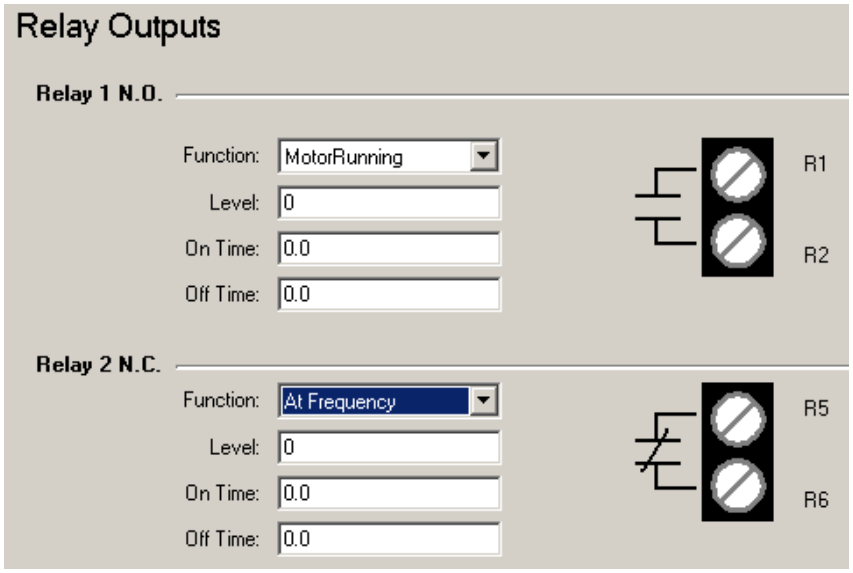
- EtherNet/IP



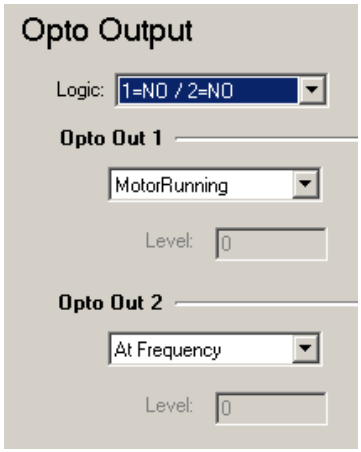
- Digital Inputs (changes required)



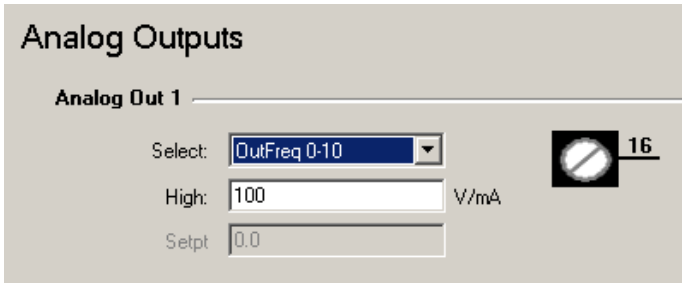
- Relay Outputs (changes required)



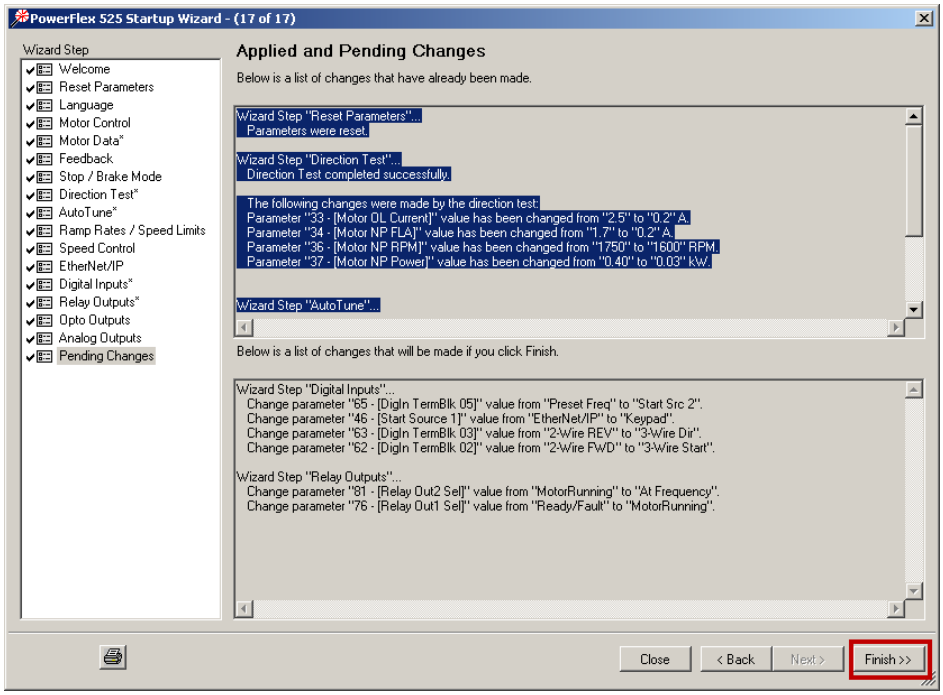
- Opto Outputs



- Analog Outputs



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.

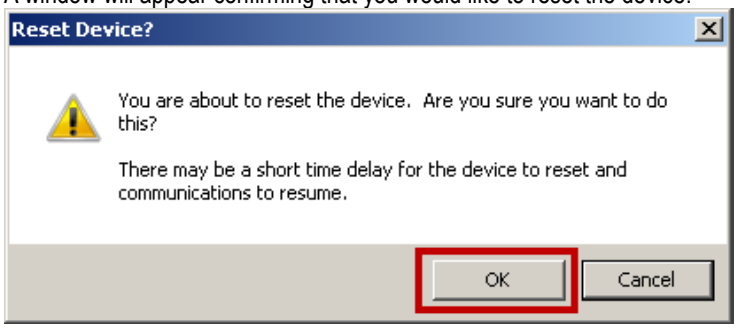


Make sure all the pages have the check mark (✓) to the left of the page name / icon.

Click the **"Finish >>"** button to accept pending changes.

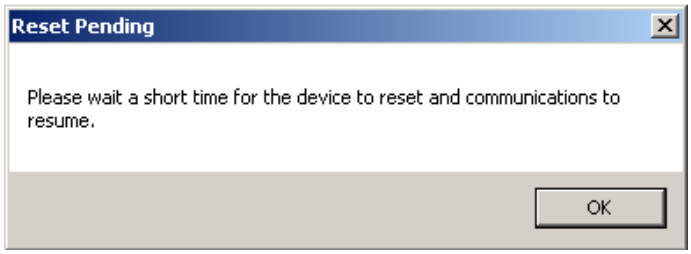
12. The main PowerFlex 525 drive window will be present. Click the **"Reset"** button for all of the new parameter settings to take effect. Some settings require a drive reset to be implemented.

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

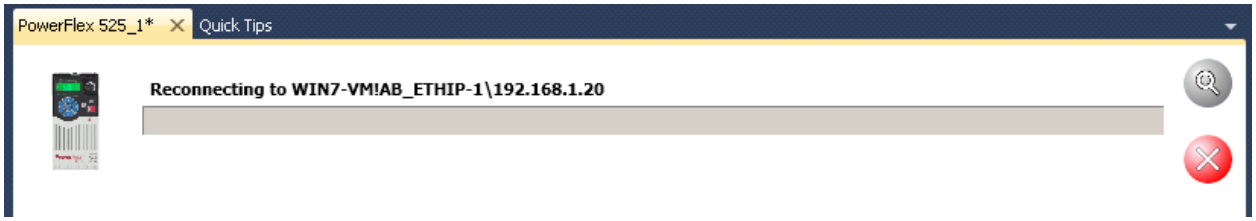


Click the **"OK"** button. You will hear the PowerFlex 525 drive cycle power and the HIM Keypad display will turn off and on before scrolling the drive information.

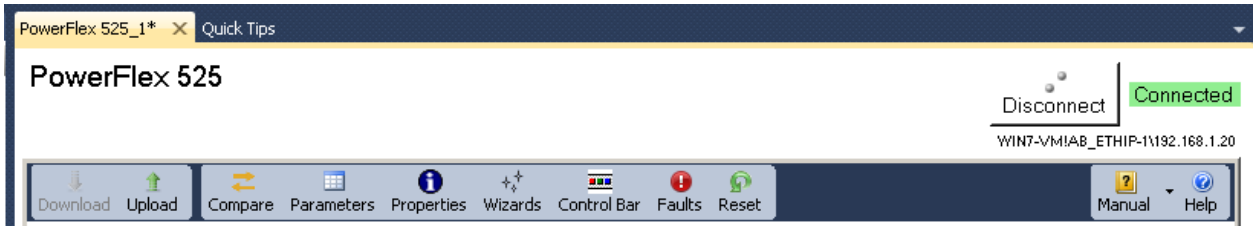
13. The reset happens quickly. You may see the following screen appear If it does, click the **"OK"** button.



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



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



14. Exit the Connected Components Workbench software. You may be prompted to upload parameters from the drive or to save the project. Select the **"No"** button for each.

Continue on to the next exercise.

Exercise 3: PowerFlex 525 Drive Add-On Profile with Drives and Motion Accelerator Toolkit.

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

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.

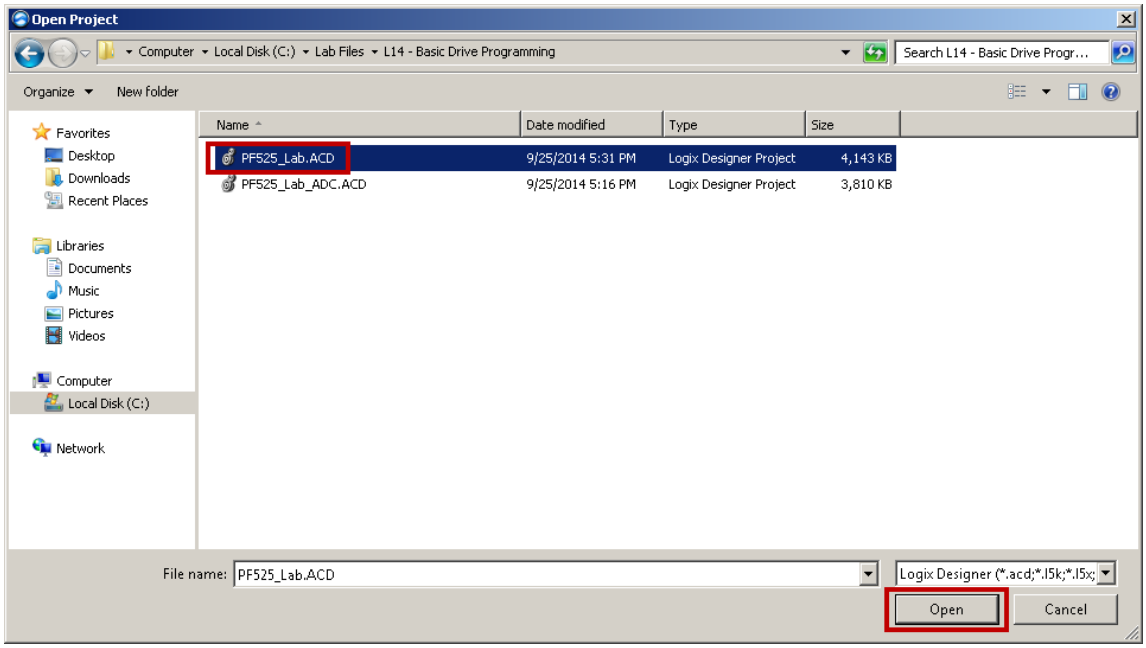
Exploring the Add-On Profile for the PowerFlex 525 Drive

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.

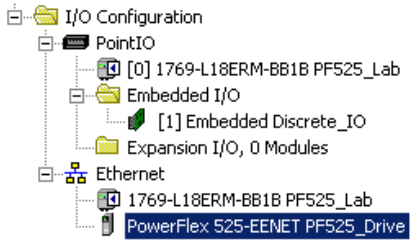
3. Select the **"PF525_Lab.ACD"** file and click the **"Open"** button.



Lab files are located within the "C:\Lab Files\L14 – Drive Basic Programming" folder.

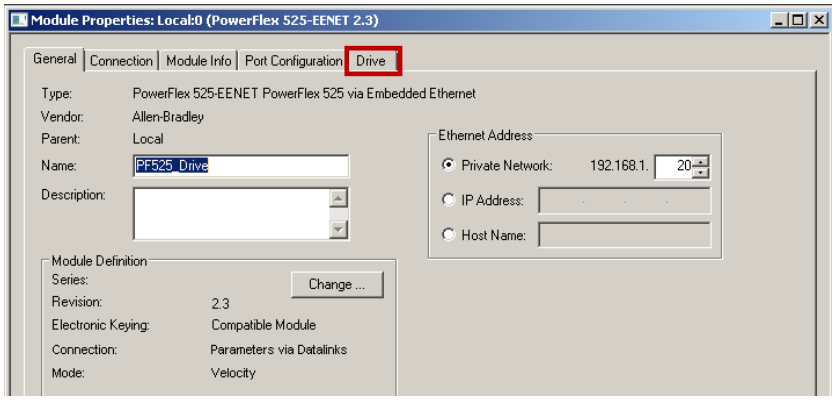
The file will be opened in the Logix Designer software after a few moments.

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-EENET PF525_Drive"**.

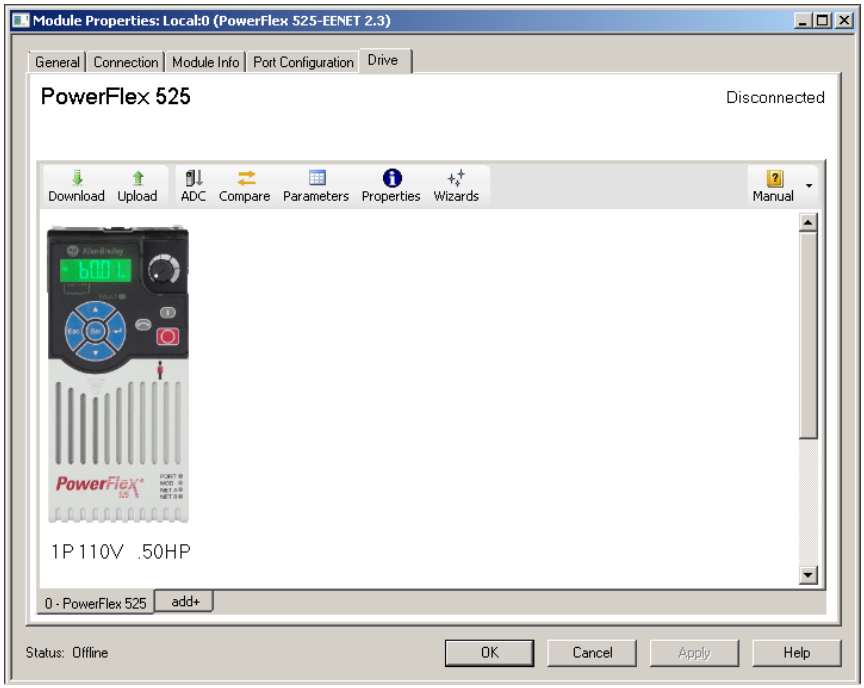


The Module Properties window will appear.

5. Click on the tab labeled **"Drive".**

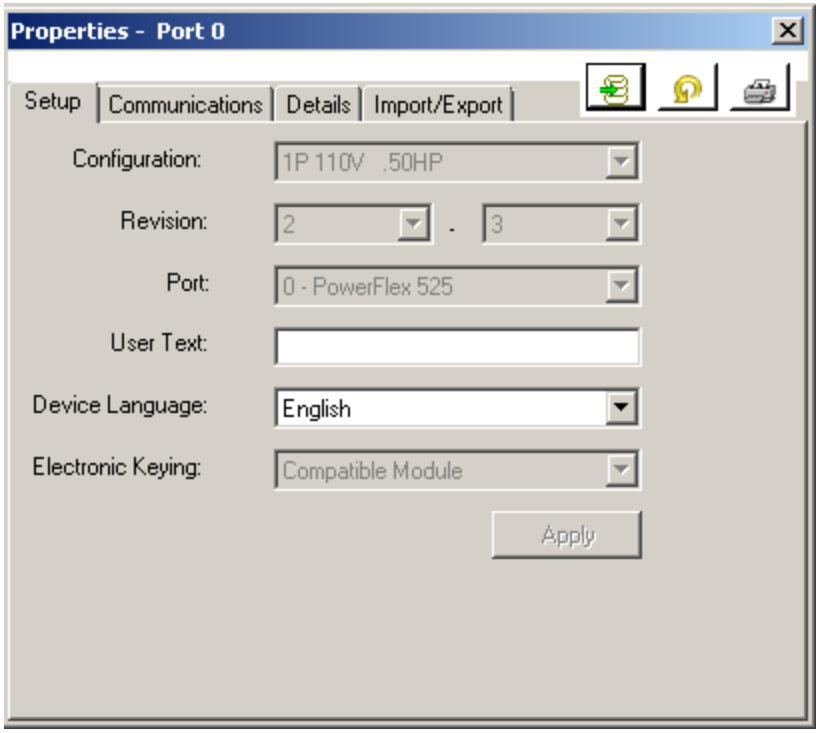


The Add-On Profile for the PowerFlex 525 drive in the Logix Designer software provides a common look-and-feel to the Connected Components Workbench software. This provides the same ability to upload, download, view, and compare drive parameters, as well as access the Wizards. One additional feature in 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.

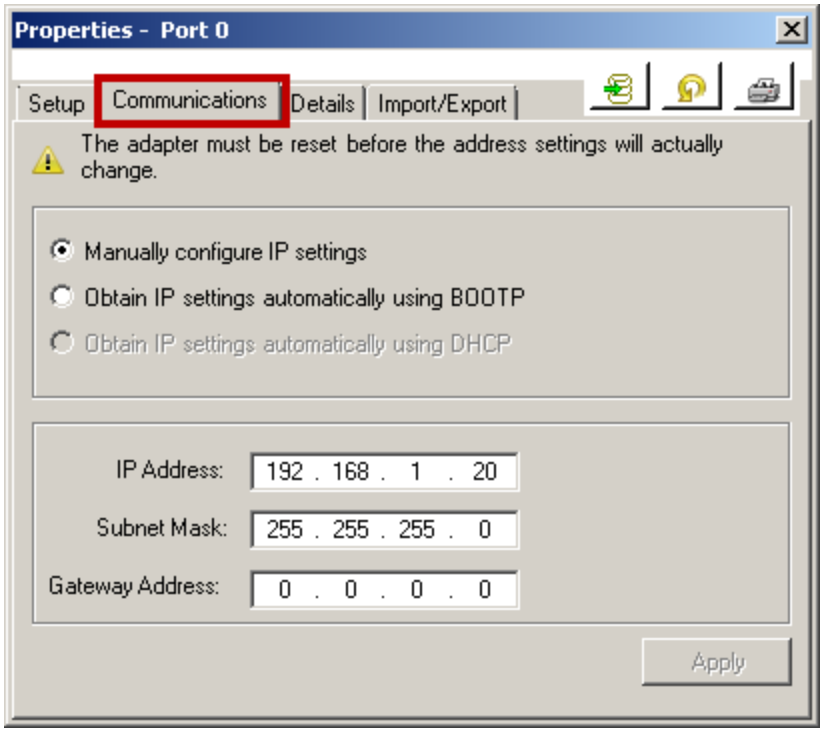
 = Creates device database from online drive to add new revisions and configurations

 = Reset device data to factory defaults

 = Print

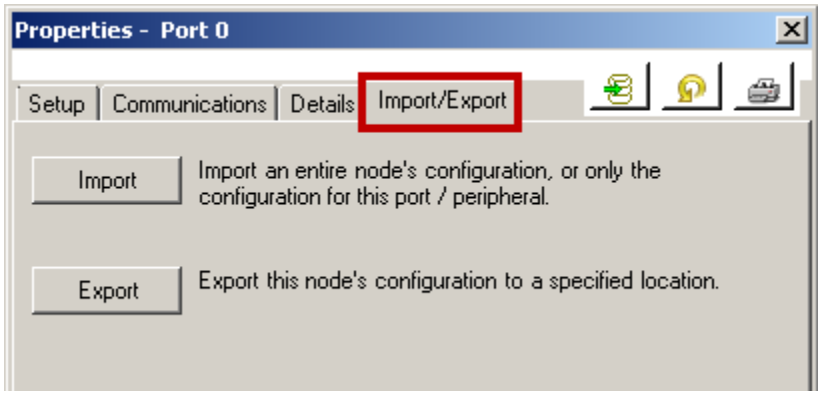
> If you forget each button's purpose, hold your cursor over them and they will display a tooltip with their function.

7. Click on 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.

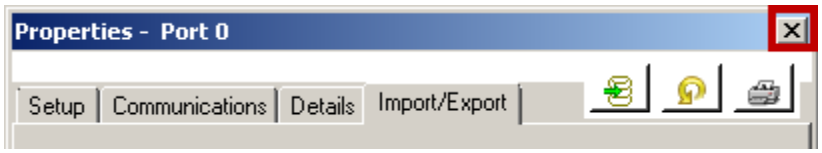
8. Click on the **"Import/Export"** tab.



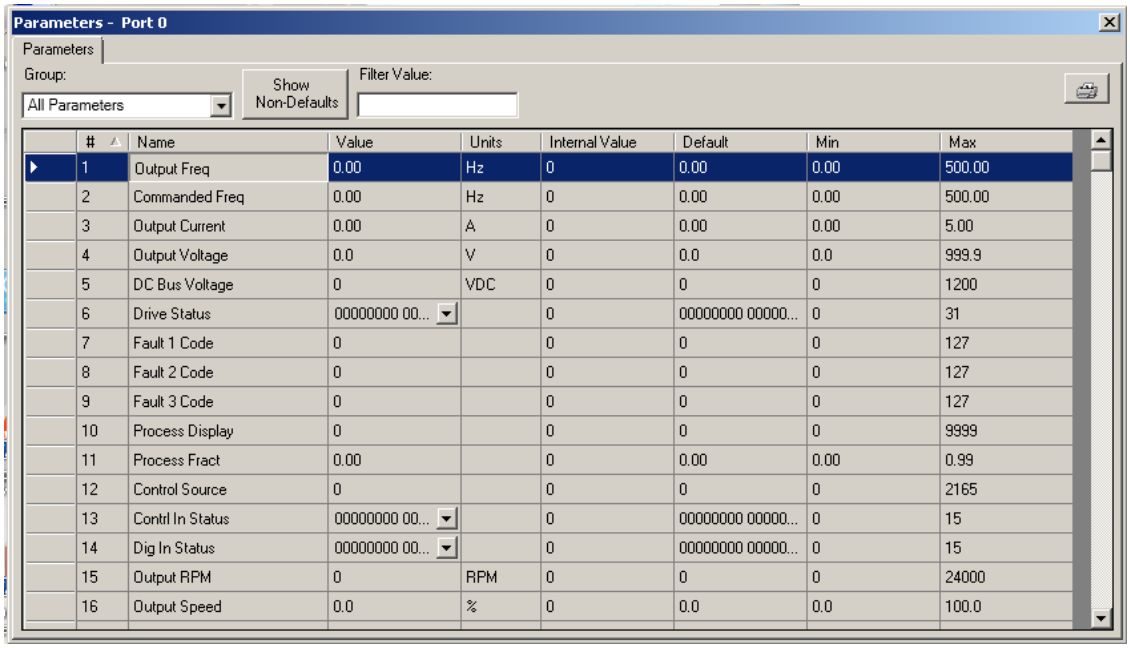
From this tab, you can import or export the drive configuration file. Using the USB port on the removable control module of the PowerFlex 525 drive lets you download the configuration to a drive that does not have main power applied. This can save time and reduce the personal protective equipment requirements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

> The *.PF5 file format is not compatible with DriveExplorer or DriveExecutive, and 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. 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.

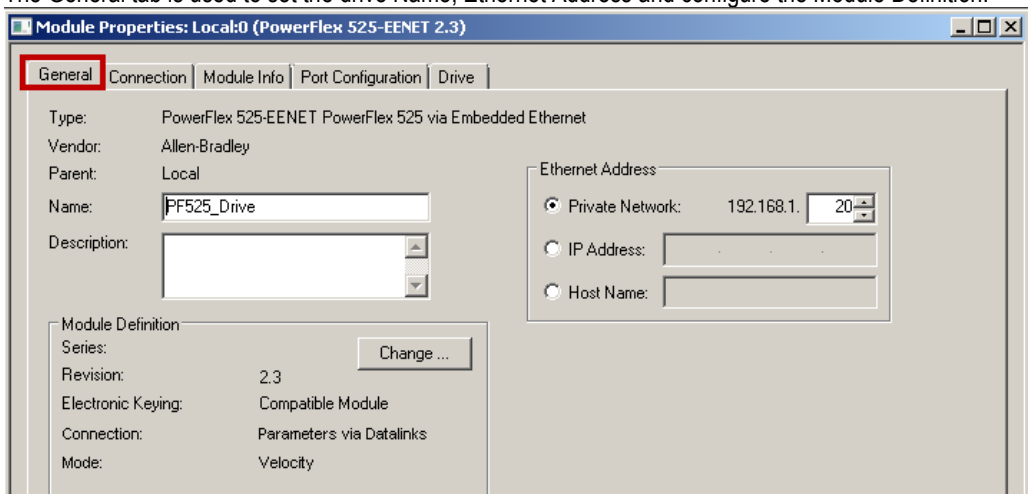


#	Name	Value	Units	Internal Value	Default	Min	Max
1	Output Freq	0.00	Hz	0	0.00	0.00	500.00
2	Commanded Freq	0.00	Hz	0	0.00	0.00	500.00
3	Output Current	0.00	A	0	0.00	0.00	5.00
4	Output Voltage	0.0	V	0	0.0	0.0	999.9
5	DC Bus Voltage	0	VDC	0	0	0	1200
6	Drive Status	00000000 00...		0	00000000 00000...	0	31
7	Fault 1 Code	0		0	0	0	127
8	Fault 2 Code	0		0	0	0	127
9	Fault 3 Code	0		0	0	0	127
10	Process Display	0		0	0	0	9999
11	Process Fract	0.00		0	0.00	0.00	0.99
12	Control Source	0		0	0	0	2165
13	Contrl In Status	00000000 00...		0	00000000 00000...	0	15
14	Dig In Status	00000000 00...		0	00000000 00000...	0	15
15	Output RPM	0	RPM	0	0	0	24000
16	Output Speed	0.0	%	0	0.0	0.0	100.0

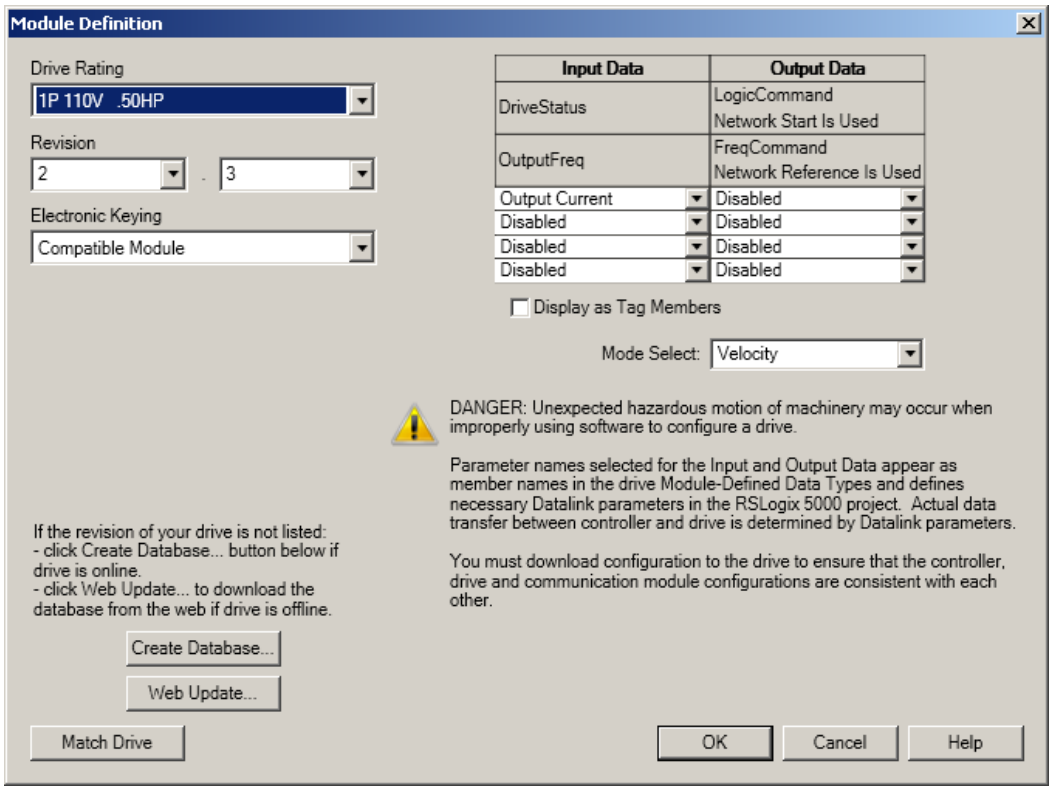
Click on the **[X]** in the upper right hand corner to close the Parameters window

11. 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.



12. 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

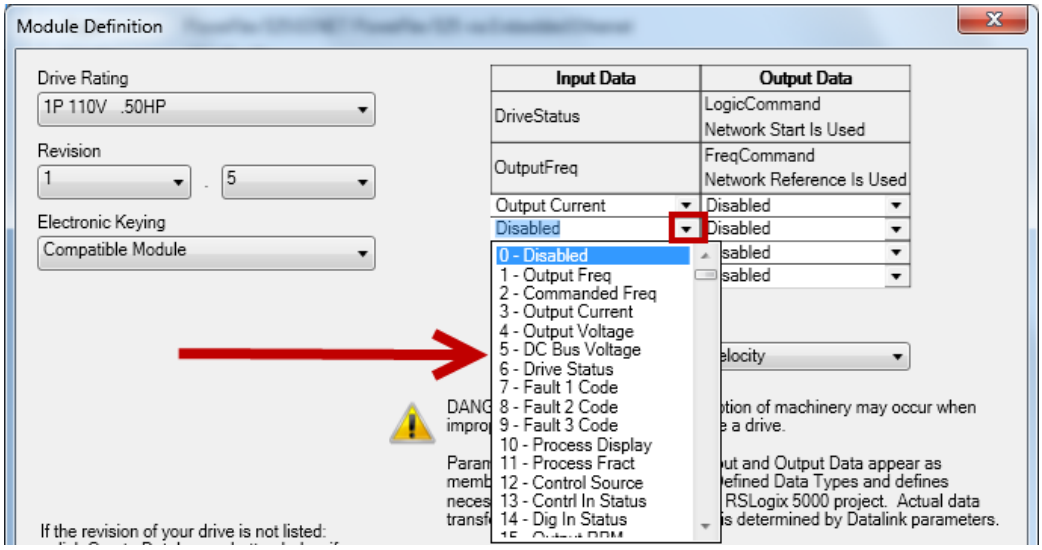
The "LogicCommand" word contains the drive command bit information, such as Stop, Start, Forward, Reverse, and Clear Faults.

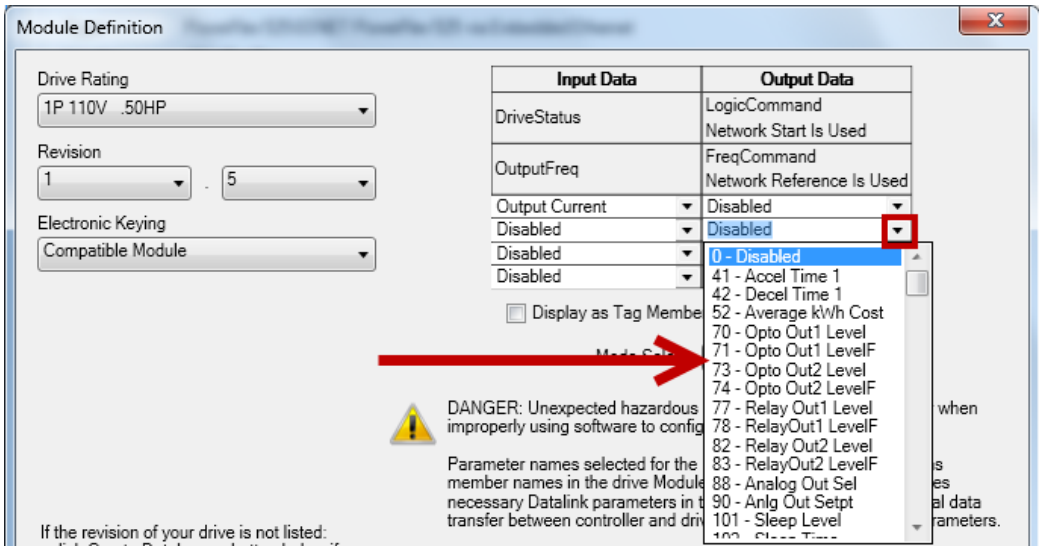
The "FreqCommand" word contains the commanded reference value for the drive to run.

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.

13. 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.



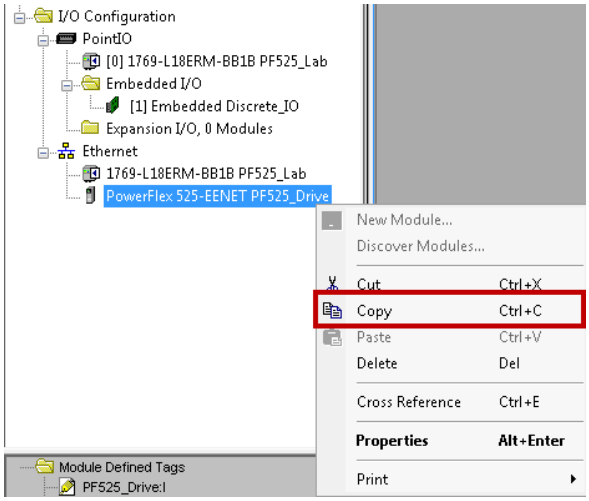


Click on the **[X]** in the upper right hand corner to close the Module Definition window and then close the Module Properties window.

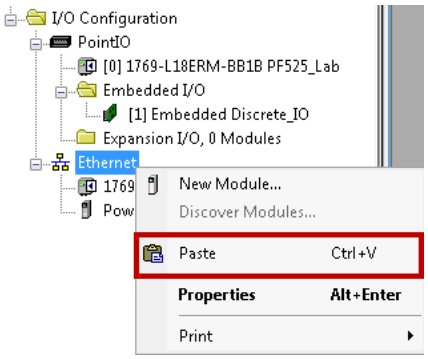
Taking Advantage of Having the Drive in the Controller Organizer

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 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.

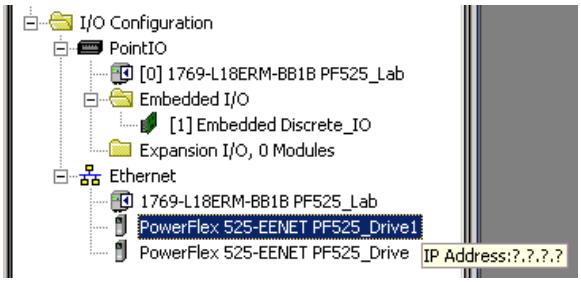
1. Create the contextual menu by right-clicking on the device and select **"Copy".**



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

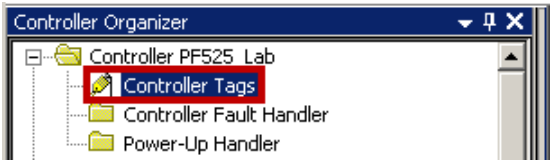


3. The new drive will appear. It will not have a valid IP address, but the name will be an incremented value of the original drive.



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 PF525_Lab" folder.



The Monitor Tags window will appear.

5. Find the tag for "PF525_Drive:I" 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.

Scope: PF525_Lab Show: All Tags Enter Name

Name	Value	Force Mask	Style	Data Type
PF525_Drive:I	{...}	{...}		AB:PowerFlex525V_E_3DC2426F:I:0
PF525_Drive:I.DriveStatus	2#0000_0110_0000_1101		Binary	INT
PF525_Drive:I.Ready	1		Decimal	BOOL
PF525_Drive:I.Active	0		Decimal	BOOL
PF525_Drive:I.CommandDir	1		Decimal	BOOL
PF525_Drive:I.ActualDir	1		Decimal	BOOL
PF525_Drive:I.Accelerating	0		Decimal	BOOL
PF525_Drive:I.Decelerating	0		Decimal	BOOL
PF525_Drive:I.Faulted	0		Decimal	BOOL
PF525_Drive:I.AtReference	0		Decimal	BOOL
PF525_Drive:I.CommFreqCnt	1		Decimal	BOOL
PF525_Drive:I.CommLogicCnt	1		Decimal	BOOL
PF525_Drive:I.ParmsLocked	0		Decimal	BOOL
PF525_Drive:I.DigIn1Active	0		Decimal	BOOL
PF525_Drive:I.DigIn2Active	0		Decimal	BOOL
PF525_Drive:I.DigIn3Active	0		Decimal	BOOL
PF525_Drive:I.DigIn4Active	0		Decimal	BOOL
PF525_Drive:I.OutputFreq	0		Decimal	INT
PF525_Drive:I.OutputCurrent	0		Decimal	INT

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.

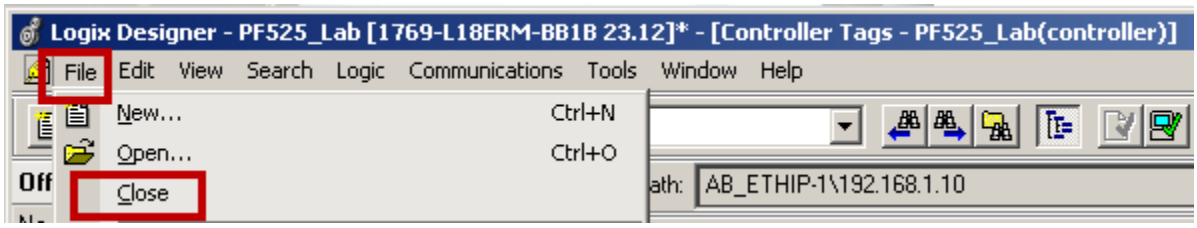
6. Now expand the “PF525_Drive:O” tag to view the output tag names.

Scope: PF525_Lab Show: All Tags Enter Name

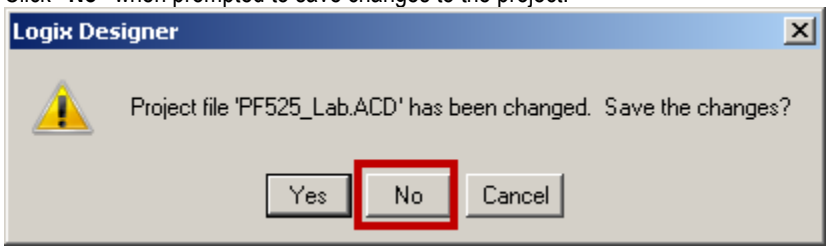
Name	Value	Force Mask	Style	Data Type
PF525_Drive:O	{...}	{...}		AB:PowerFlex525V_EENET_Drive:O:0
PF525_Drive:O.LogicCommand	2#0000_0000_0000_0000		Binary	INT
PF525_Drive:O.Stop	0		Decimal	BOOL
PF525_Drive:O.Start	0		Decimal	BOOL
PF525_Drive:O.Jog	0		Decimal	BOOL
PF525_Drive:O.ClearFaults	0		Decimal	BOOL
PF525_Drive:O.Forward	0		Decimal	BOOL
PF525_Drive:O.Reverse	0		Decimal	BOOL
PF525_Drive:O.ForceKeypadCtrl	0		Decimal	BOOL
PF525_Drive:O.MOPIncrement	0		Decimal	BOOL
PF525_Drive:O.AccelRate1	0		Decimal	BOOL
PF525_Drive:O.AccelRate2	0		Decimal	BOOL
PF525_Drive:O.DecelRate1	0		Decimal	BOOL
PF525_Drive:O.DecelRate2	0		Decimal	BOOL
PF525_Drive:O.FreqSel01	0		Decimal	BOOL
PF525_Drive:O.FreqSel02	0		Decimal	BOOL
PF525_Drive:O.FreqSel03	0		Decimal	BOOL
PF525_Drive:O.MOPDecrement	0		Decimal	BOOL
PF525_Drive:O.FreqCommand	0		Decimal	INT

Descriptive tag names have been created for the drive again. The Logic Command bits (BOOLs) 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.

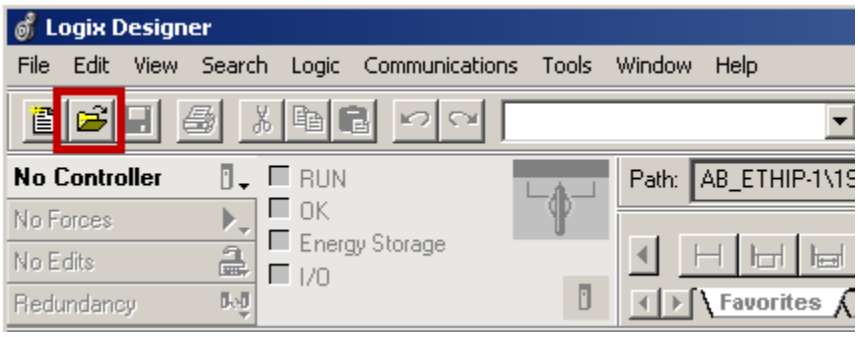


Click **“No”** when prompted to save changes to the project.

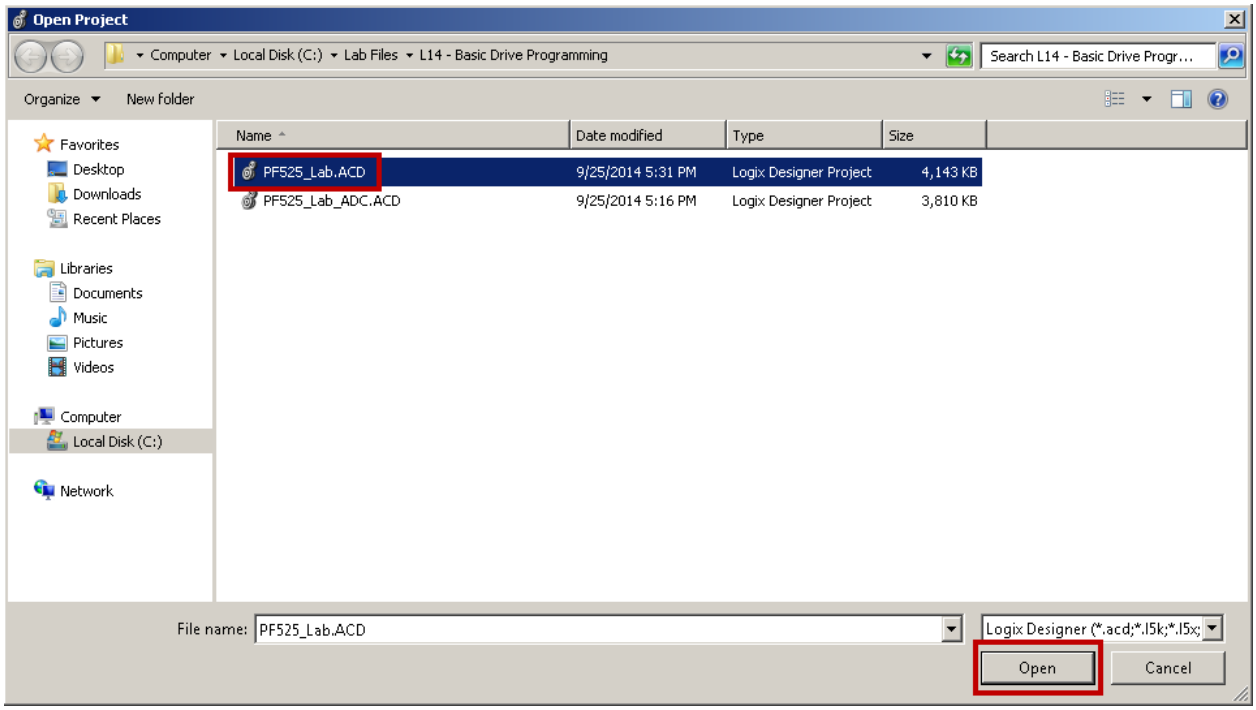


Downloading the Project

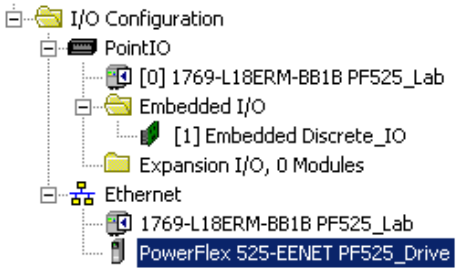
1. Open the PF525_Lab project. Click the **"Open"** icon illustrated below.



2. Select the **"PF525_Lab.ACD"** file and click the **"Open"** button.

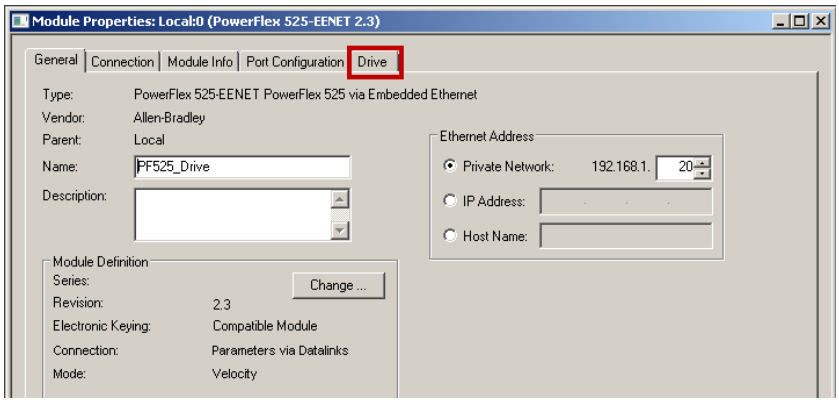


3. Open the drive Module Properties window by double-clicking on the **"PowerFlex 525-EENET PF525_Drive"** node in the I/O Configuration folder.



The Module Properties window will appear.

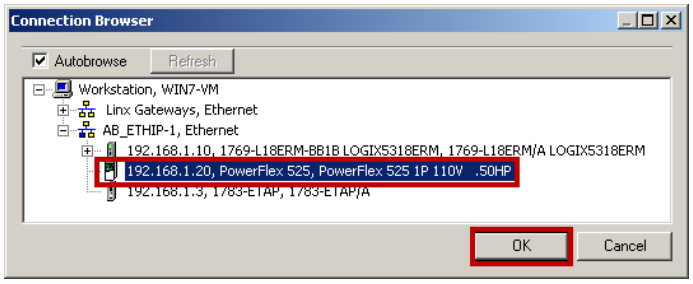
4. Click on the "**Drive**" tab.



5. Click the **"Download"** button.

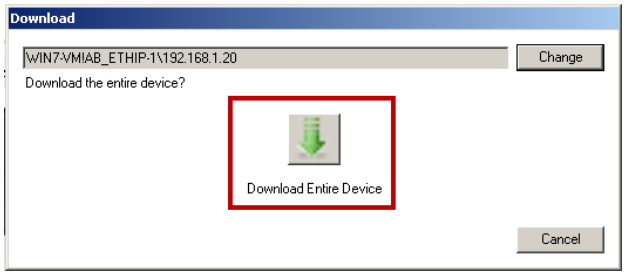
The Connection Browser window will appear.

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

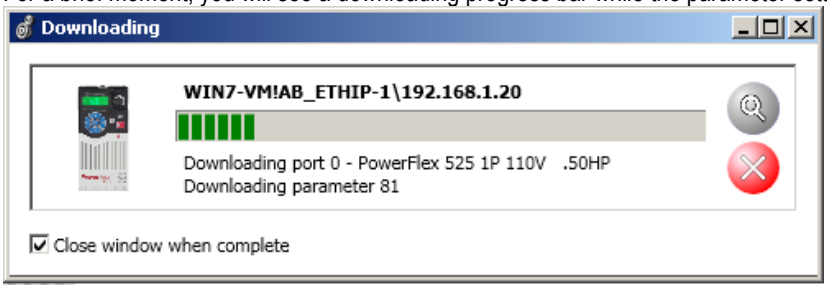


Click the **"OK"** button

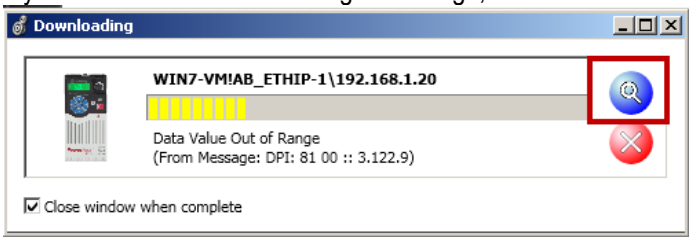
7. You will be asked to confirm with the window shown below. Click the button to **"Download Entire Device".**



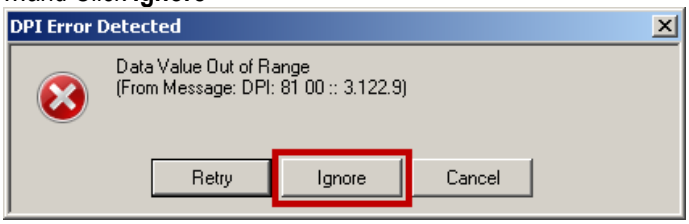
8. For a brief moment, you will see a downloading progress bar while the parameter settings are being sent to the drive.



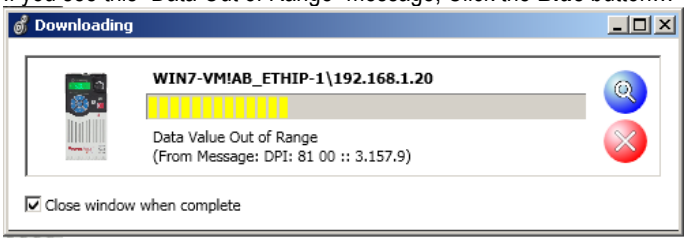
9. If you see this “Data Out of Range” message, Click the **Blue** button…



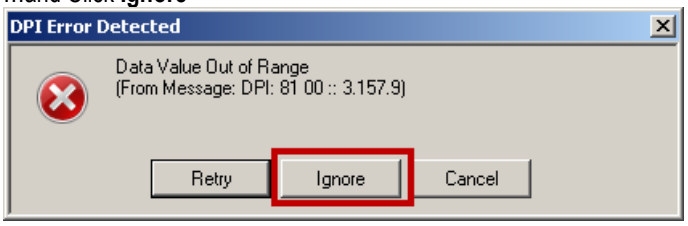
…and Click **Ignore**



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



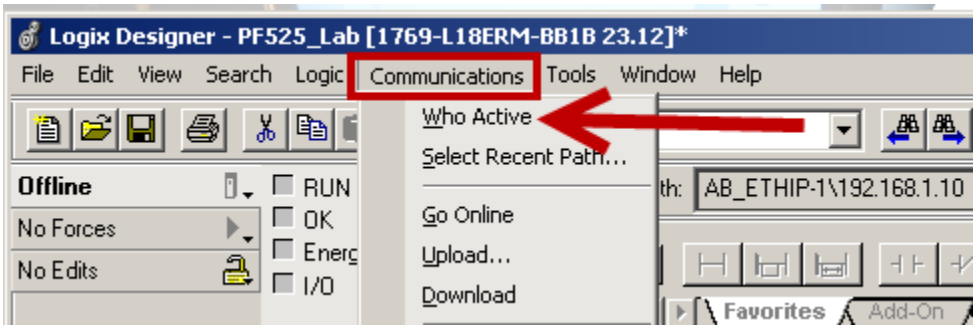
…and Click **Ignore**



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.

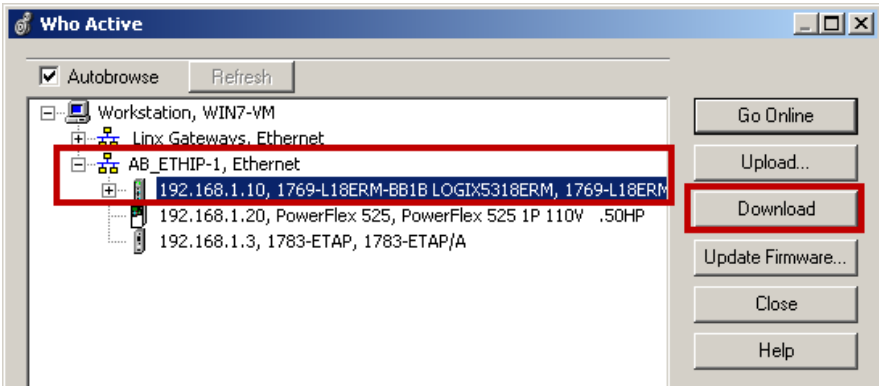
11. Click the **"OK"** button to close the Module Properties window,

12. Click on **"Communcations"** in the menu bar and select **"Who Active"**.



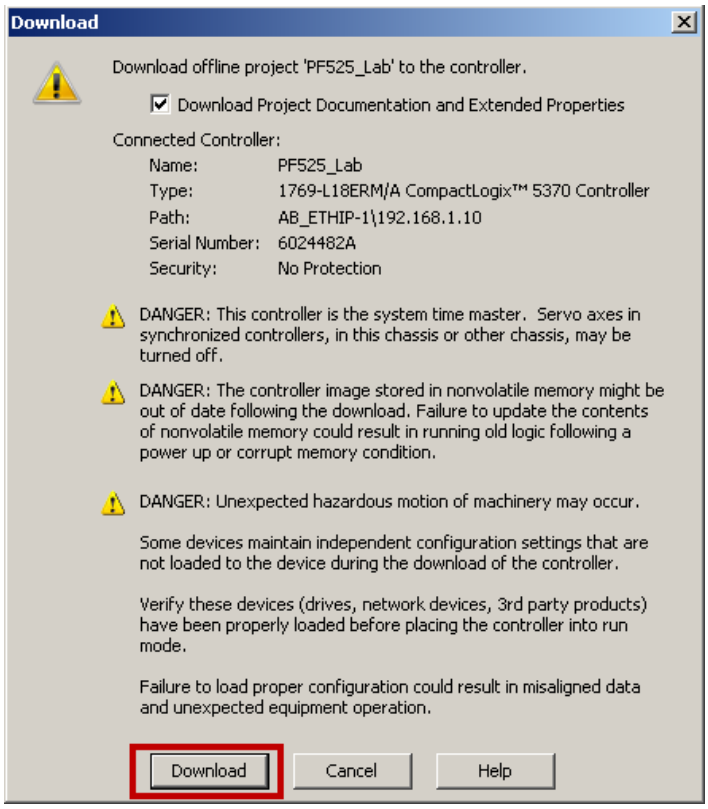
The Who Active window will appear.

13. 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.

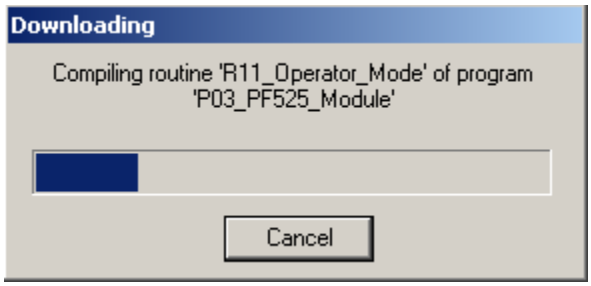


The Download window will appear.

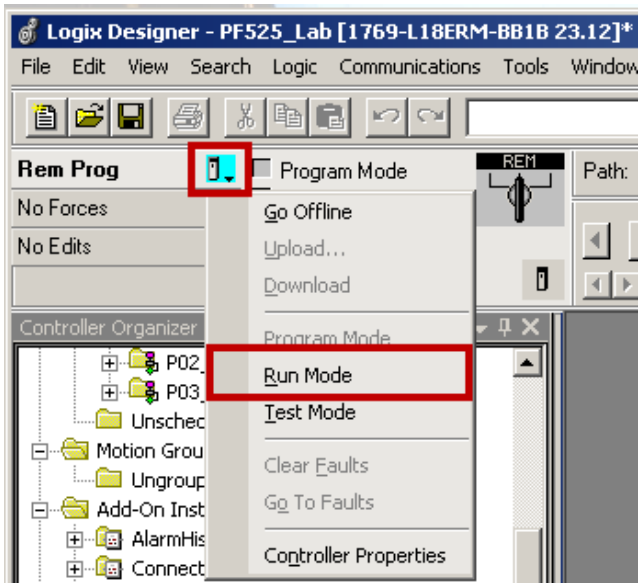
14. When the confirmation window appears, click the **“Download”** button again.



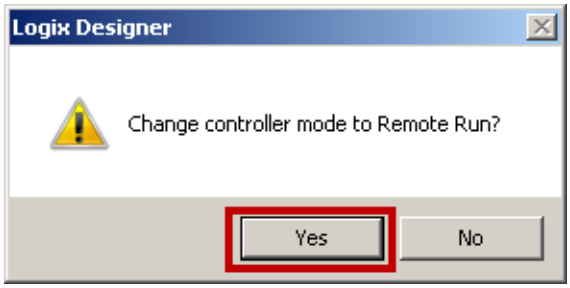
You will see a progress bar



15. Put the controller in “Run” mode. One way to do this is by clicking on the mode drop-down arrow and select **“Run Mode”**.



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



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

Continue to the next section of the lab.

About Drives and Motion Accelerator Toolkit (DMAT)

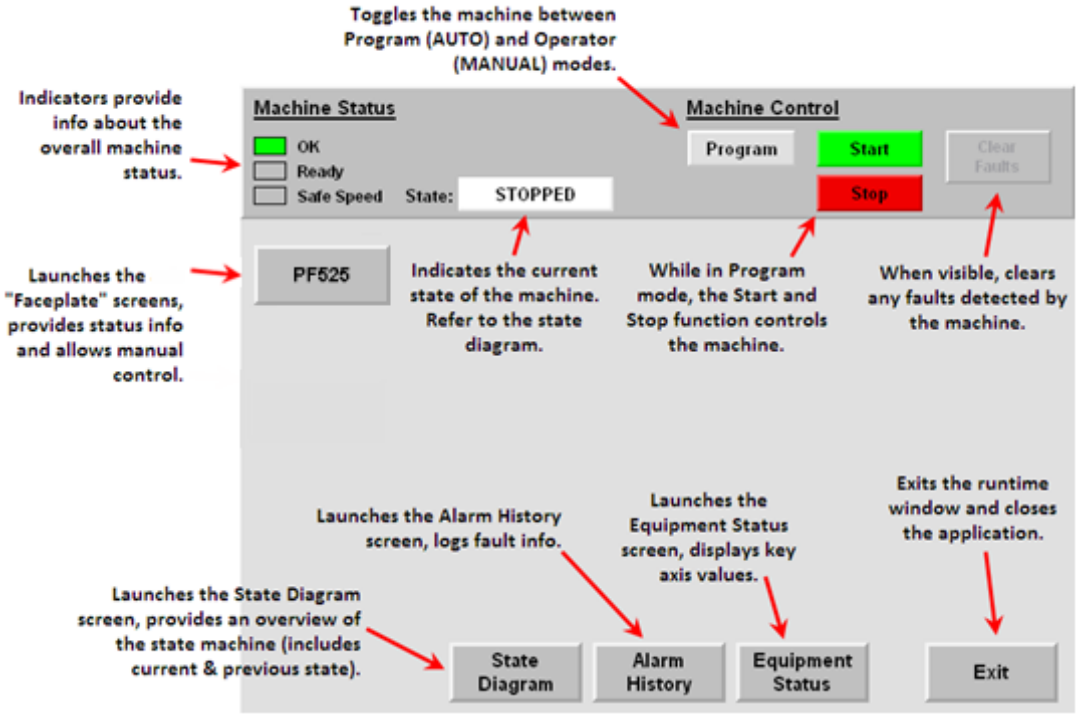
Publication IASIMP-QS019 is a quick start guide that provides step by step instructions for using the Drives and Motion Accelerator Toolkit to help you design, install, operate, and maintain a drive system. Included are selection tools, layout and wiring drawings, and pre-configured logic and HMI files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

Switch to the HMI Application

1. Minimize Studio 5000 Logix Designer so that the HMI screen on the desktop can be seen.
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

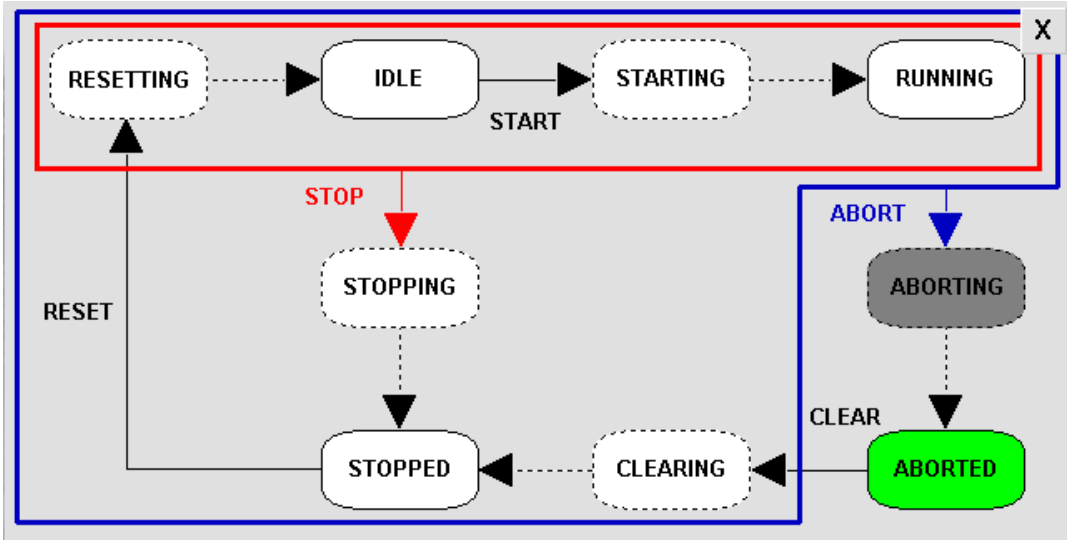
The Startup screen display provides machine control as well as the main navigation screen to launch all other faceplates or screens that provide additional equipment control, status, and alarm history. This display can be configured to suit your machine or system needs.

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**	ABORTED → *CLEARING* → STOPPED
STOPPED – Press **Start**	STOPPED → *RESETTING* → IDLE → *STARTNG* → RUNNING
RUNNING – Press **Stop**	RUNNING → *STOPPING* → STOPPED

> 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.

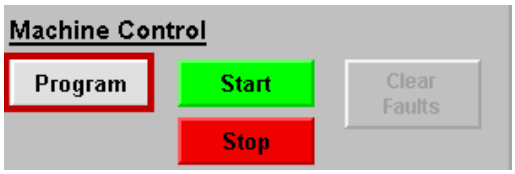
Run the Machine

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.

POWERFLEX
RUN FORWARD / REVERSE

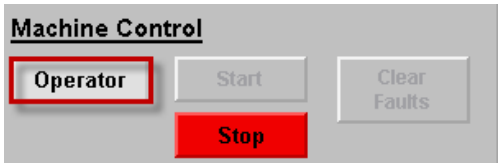
The following application example demonstrates how to control a PowerFlex drive using sequencers.
While the Machine is STARTING / RUNNING, the drive will be operated as follows:

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".



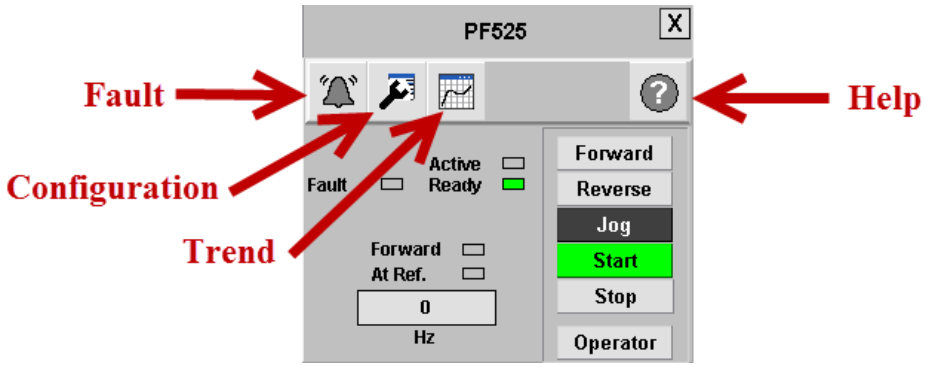
> The machine must be stopped before you can switch control modes. When in Operator (MANUAL) mode, you can individually control each axis from its corresponding faceplate.

Continue to the next section.

Using the PowerFlex 525 Drive Faceplate

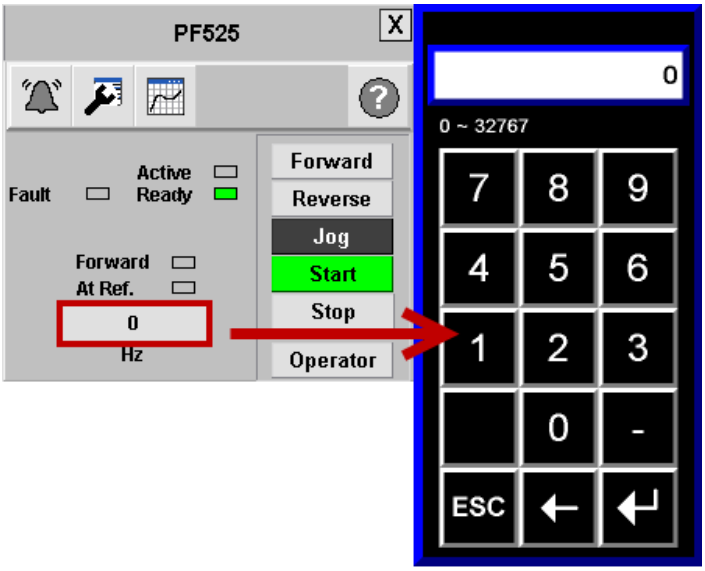
1. Press the **"PF525"** button from the Startup screen.

The faceplate will appear.



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.

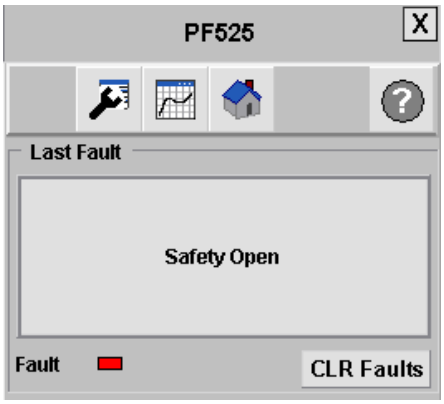
5. After making the motor come to reference speed, click the **"Stop"** button in the PF525 faceplate.

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.

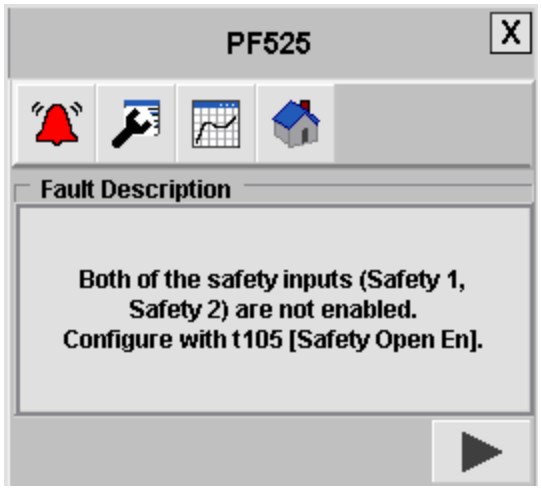
7. On the demo box, **push in** the red **"Safe Off"** button to generate a fault on the drive. This will generate a F059 – Safety Open fault.

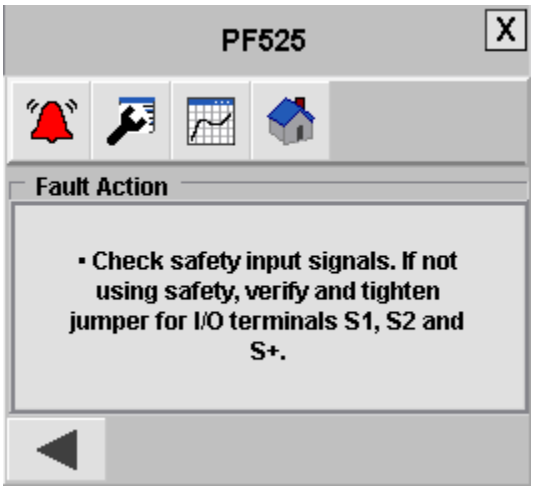


8. Press the **"Help"** button for more information about the fault.

The Help screen displays the fault descriptions and actions.

9. Press the arrows to switch between screens.



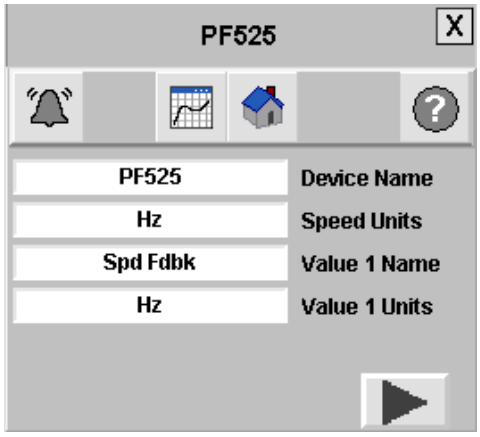


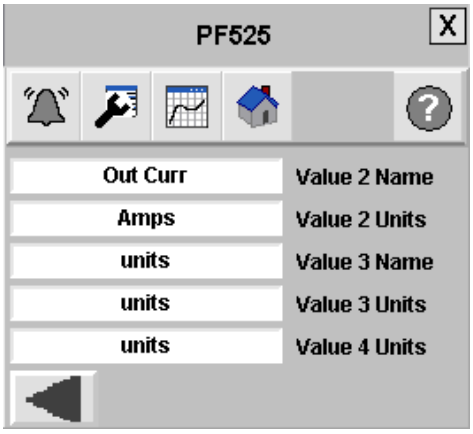
You can clear faults from the Startup screen or, if in Operator mode, from the Fault display. The Alarm History screen logs fault information from all of the devices.

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.

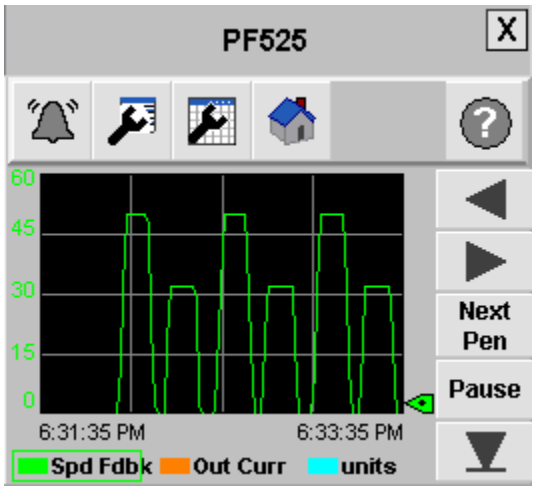




Some of the labels are used on the Equipment Status faceplate.

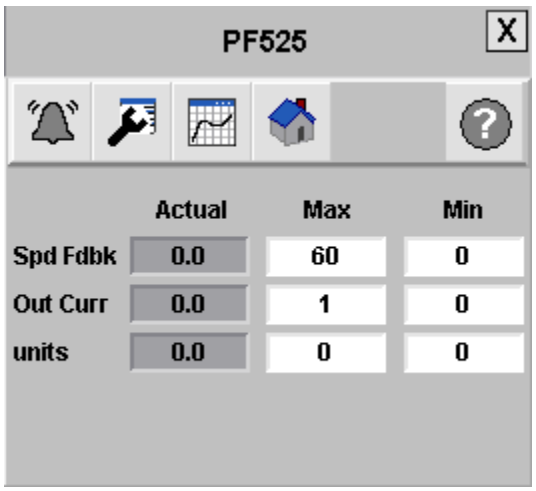
12. Press the **"Trend"** button.

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.



The Trend Configuration screen lets you adjust the trend scales.

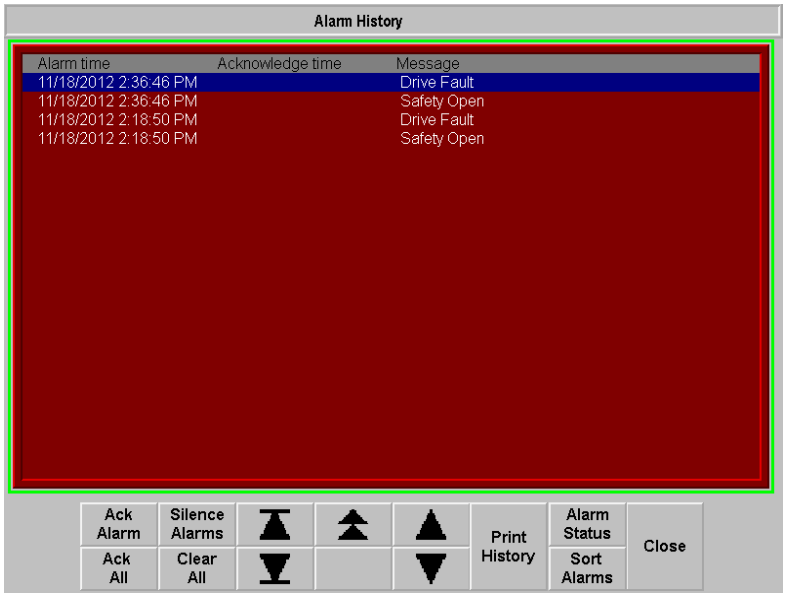
14. When you have finished exploring the PowerFlex 525 drive faceplate, close it by pressing the [X] in the top right corner of the faceplate.

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.



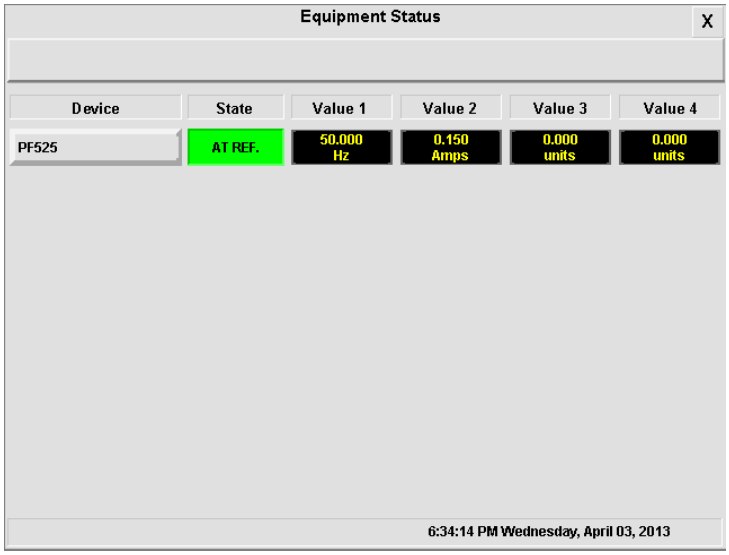
2. When you are done with the Alarm History faceplate, close it by pressing the **Close** button on the bottom of the screen.

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.

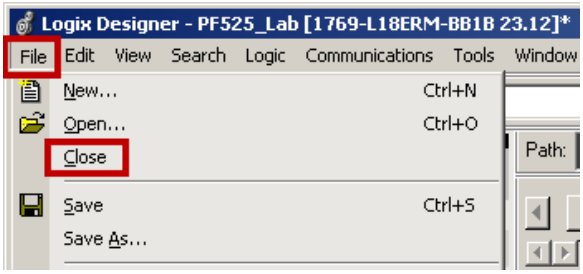
1. Press the "Equipment Status" button on the Startup screen to open the faceplate.

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.

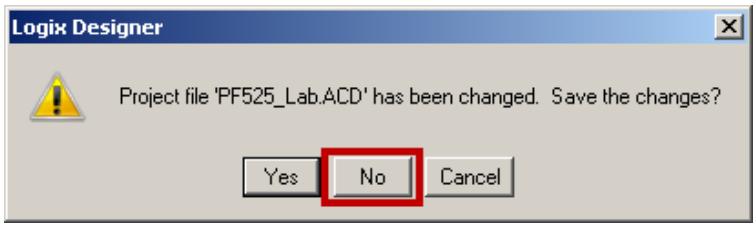


2. When you are done with the Equipment Status faceplate, close it by pressing the **[X]** in the top-right corner.

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 525 AC drive

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 whenever the Logix controller establishes an EtherNet/IP network connection to a PowerFlex 525 drive and its associated peripherals.

> ADC is available when the PowerFlex 525 drive is connected using the embedded EtherNet/IP adapter or EtherNet/IP DLR adapter to a compatible controller. ADC is available when the PowerFlex 523 is connected using the EtherNet/IP DLR adapter to a compatible controller.

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)

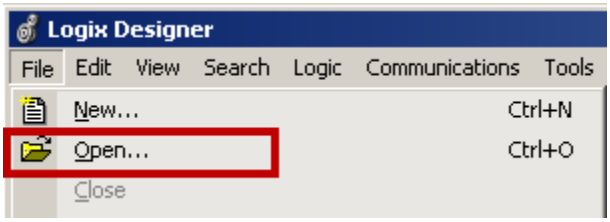
ADC can also work in tandem with Firmware Supervisor. When Firmware Supervisor is set up and enabled in the project, and if the respective ControlFLASH firmware kit is installed on the computer when the project is downloaded, the drive and peripherals will be automatically brought to appropriate firmware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

> The controller project owns the configuration of the drive. ADC will be triggered any time the controller detects a configuration signature mismatch when establishing an EtherNet/IP network I/O connection.
>
> The use of other configuration tools, such as a HIM or Connected Components Workbench software should be minimized and restricted to monitor-only operation. Any configuration changes made by these tools will cause a configuration signature mismatch the next time the Logix controller connects to the device and ADC will write over any changes made by the other tool(s). Any drive configuration changes should be made with the drive Add-On Profile.

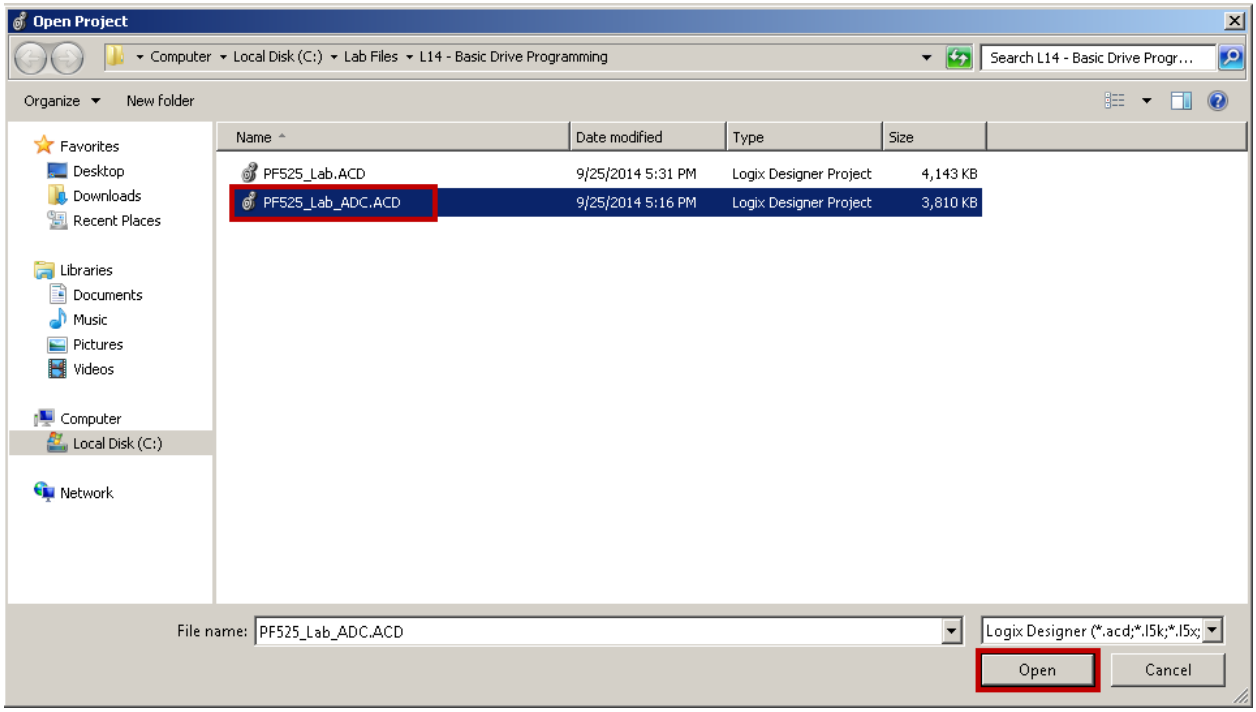
This exercise will help teach you how to set up ADC for a drive. For more information in regards to the PowerFlex 525 drive and Automatic Device Configuration (ADC), refer to the PowerFlex 525 Embedded EtherNet/IP Adapter User Manual. There is also information about Automatic Device Configuration (ADC)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

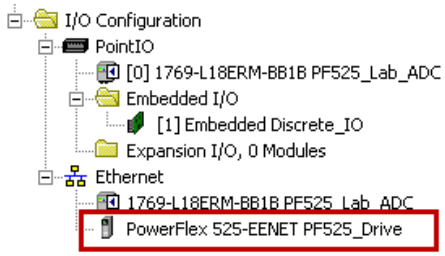


2. Select the **"PF525_Lab.ACD"** file and click the **"Open"** button.



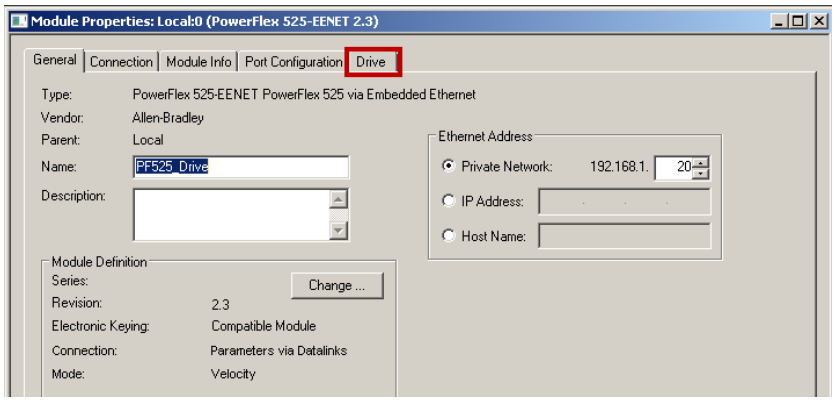
Lab files are located within the "C:\Lab Files\L14 – Basic Drive Programming" folder.

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-EENET PF525_Drive"**.



The Module Properties window will appear.

4. Click on the tab labeled **"Drive".**



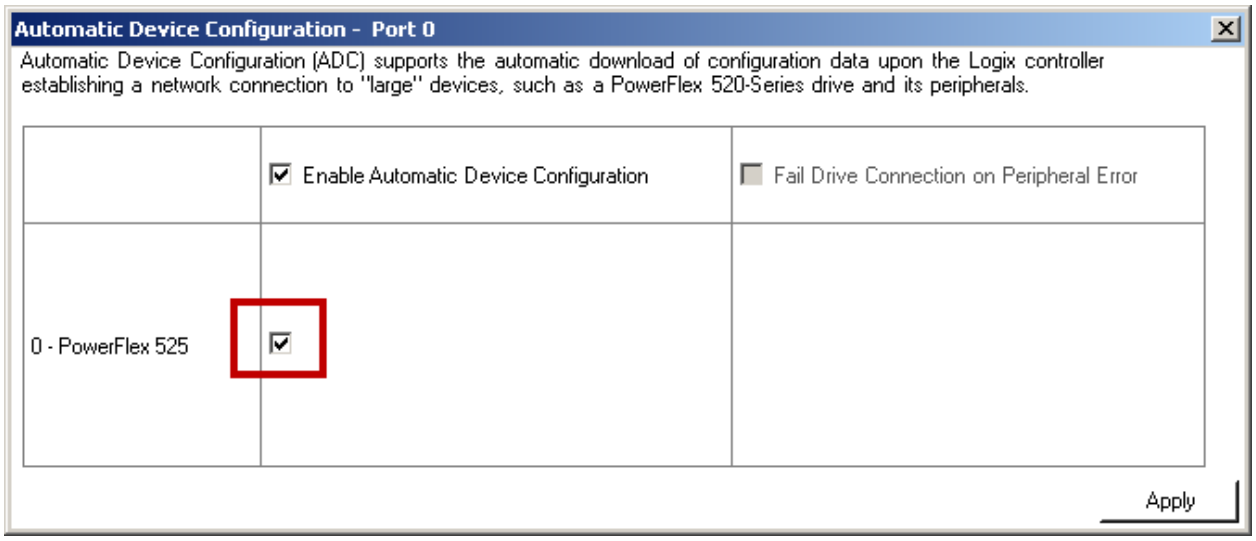
The Drive tab will appear. The drive AOP requires deliberate action to enable ADC. This helps ensure that ADC is fully understood prior to turning it on.

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 his highlighted below to enable ADC.



7. Click the **"Apply"** button in the Automatic Device Configuration window and close the window.

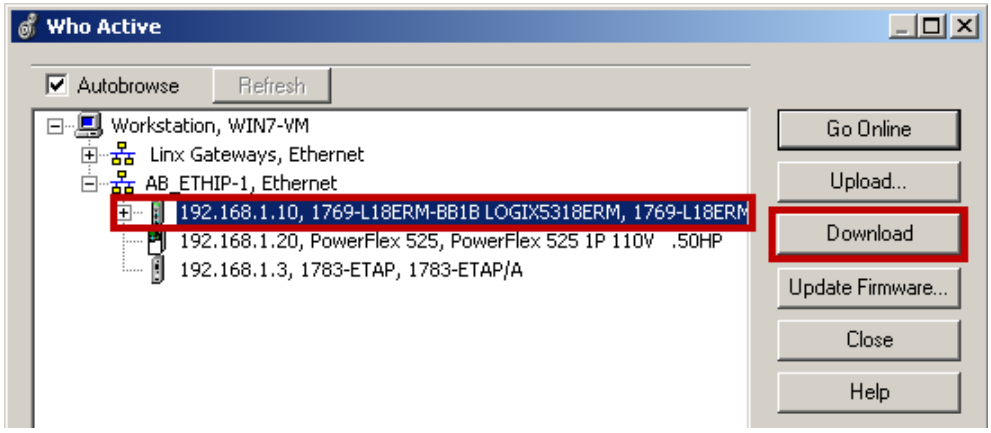
> In order for setting changes to take effect, you must click the "Apply" button before closing the window with the **[X]** at the top corner.

8. Click the **"OK"** button to close the Module Properties window.

9. Click on **"Communcations"** in the menu bar and select **"Who Active"**.

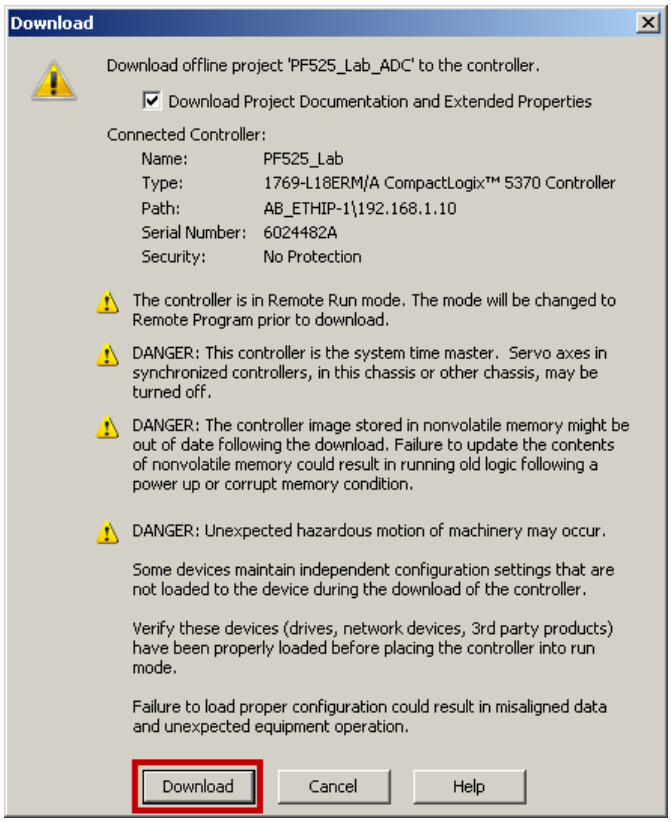
The Who Active window will appear.

10. 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.



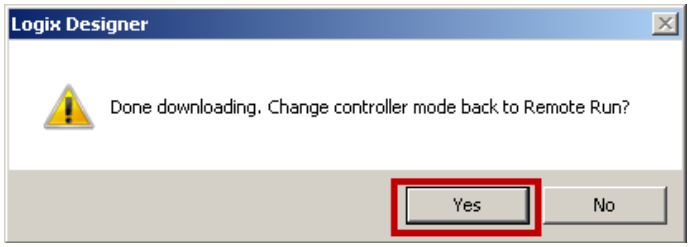
The Download window will appear.

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

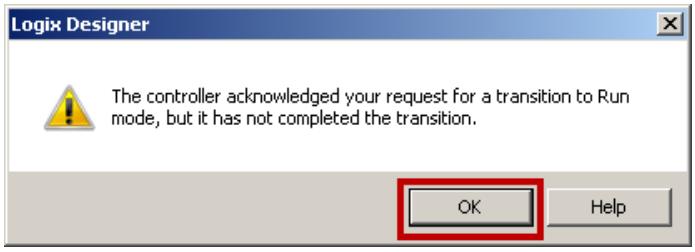


If you reach this step in the lab but do not end up completing the entire ADC exercise, please notify an instructor as you leave so that the controller may be reset for the next session.

12. When prompted to confirm switching the controller back to "Remove Run", click the **"Yes"** button.



13. 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.

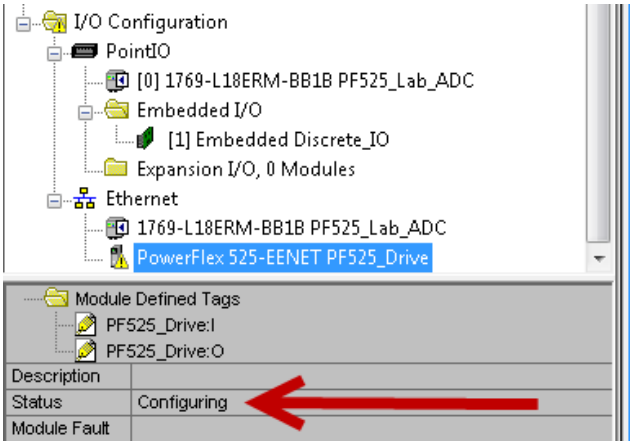
3. Press the **Stop**  button to clear the fault from the drive.

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

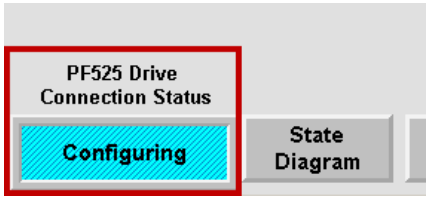
5. Reconnect the Ethernet cable to the drive. This will reinitiate communication between the drive and the controller, which starts with verifying the configuration signature.

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.

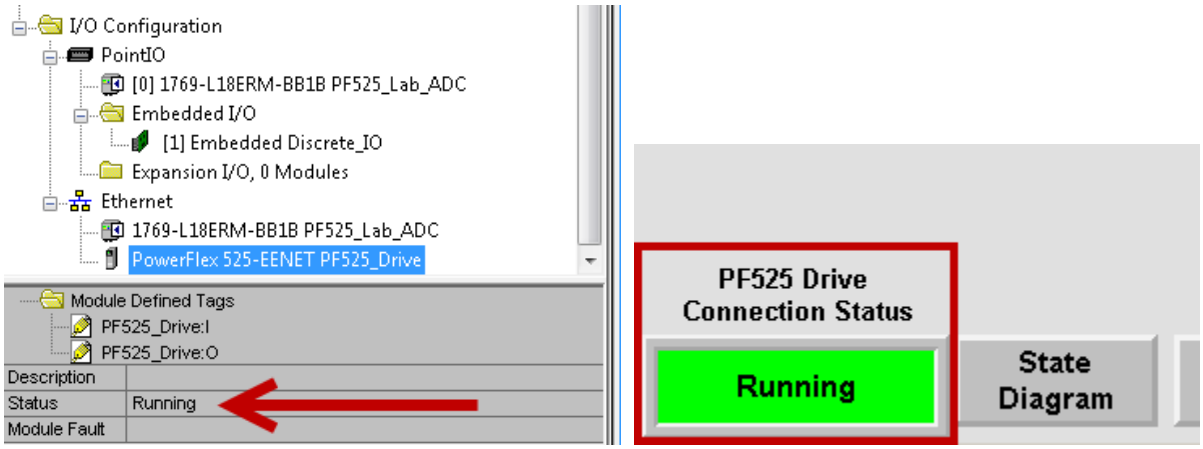


7. Minimize Logix Designer so that the HMI is visible. On the Startup screen of the HMI, there is a multistate indicator which shows the connection status of the PowerFlex 525 drive.



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.

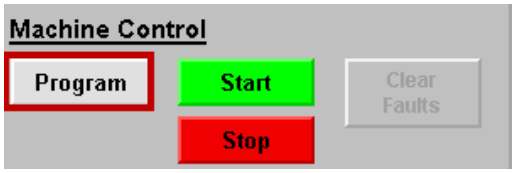


ADC will automatically reset (power cycle) the drive as part of the configuration process. This is done because some parameters require a reset before they take effect. If a drive is being replaced with an out-of-the-box drive, you will typically see one or more resets during the ADC process.

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 PF525_Lab_ADC project file. You don't need to save changes.
2. **Open** the PF525_Lab project file from the previous lab exercise.
3. **Download** the PF525_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

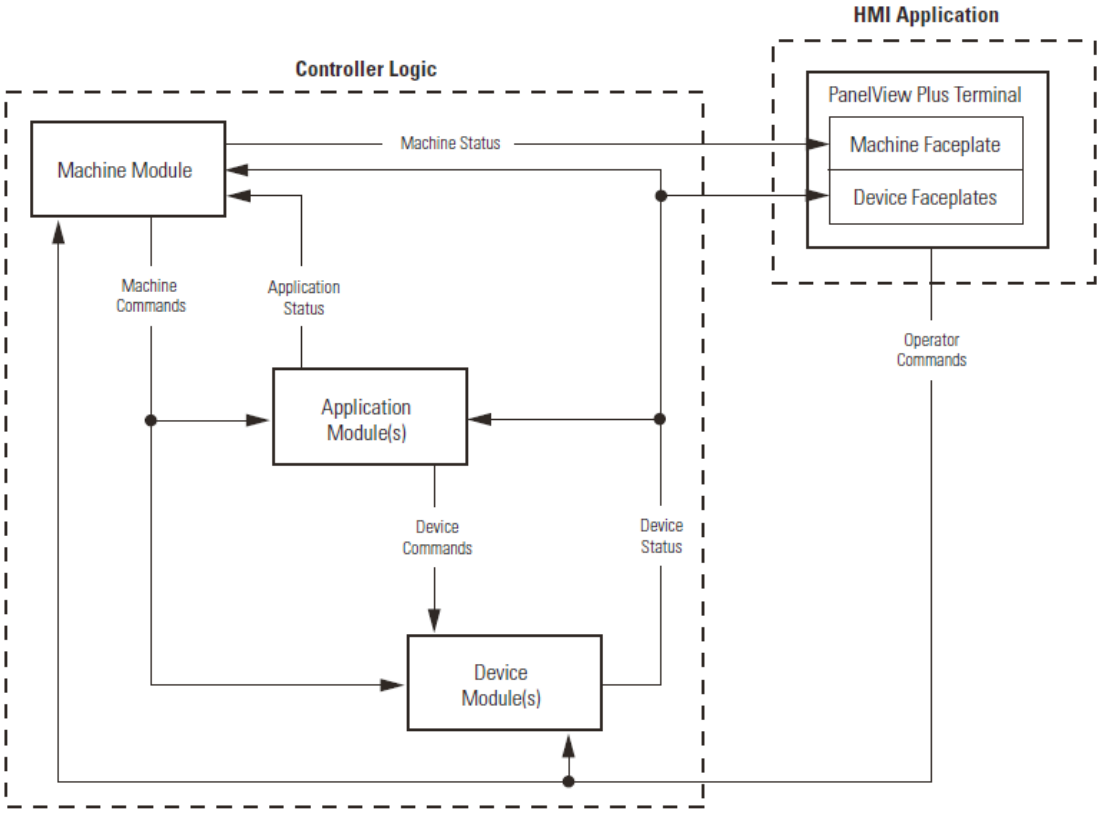
The Drives and Motion Accelerator Toolkit DVD, publication IASIMP-SP017, was developed around a modular concept. Modularity lets you decide which components to incorporate into your machine, providing greater flexibility and a custom fit. The preconfigured logic is specifically designed around this modular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

Logic Module Overview

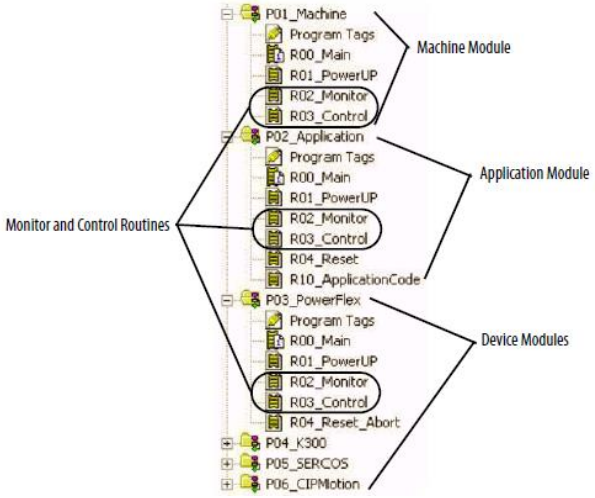
- Machine
    - The machine module contains the high level control for the entire machine. The machine module was built around a simple state machine that you can customize to fit most applications. The machine module broadcasts out commands and receives feedback information from each of the application 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.



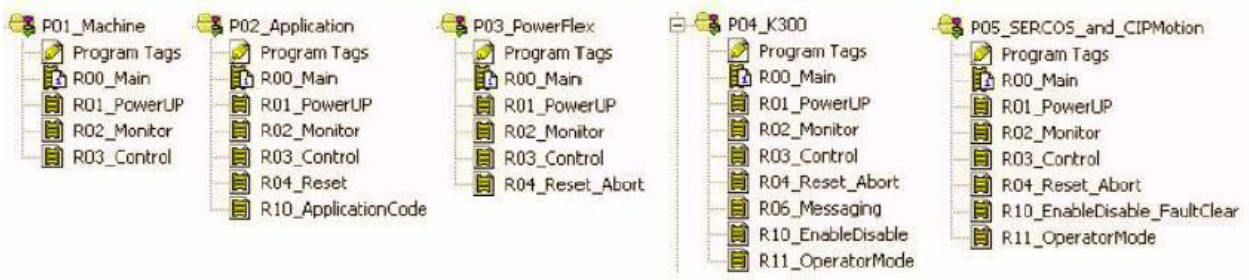
Each of the modules are defined as individual programs in the Logix Project.



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:



Logic Module Type	Routine	Function
Machine	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 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, Stopped). • 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_Abort	• 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.

Logic Module Type	Routine	Function
Kinetix 300	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_Abort	• Contains the RESET sequence logic, used to prepare the application to run. • 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.
	R06_Messaging	Contains all of the explicit messaging logic required for the Kinetix 300 drive.
	R10_EnableDisable	Contains the enable, disable, clear faults logic for the Kinetix 300 drive.
	R11_OperatorMode	Contains the Operator or manual mode logic for the Kinetix 300 drive. This logic is initiated via requests made from drive faceplate located on the HMI terminal.
Sercos or CIP Motion	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_Abort	• Contains the RESET sequence logic, used to prepare the application to run. • Contains the ABORT sequence which ensures that the drives contained within the module are stopped and disabled. The ABORT sequence can also make sure that other devices are placed into a desired state.
	R10_EnableDisable	Contains the enable, disable, clear faults logic for the drives.
	R11_OperatorMode	Contains the Operator or Manual mode logic for the drive. This logic is initiated via requests made from drive faceplate located on the HMI terminal.

Machine Module

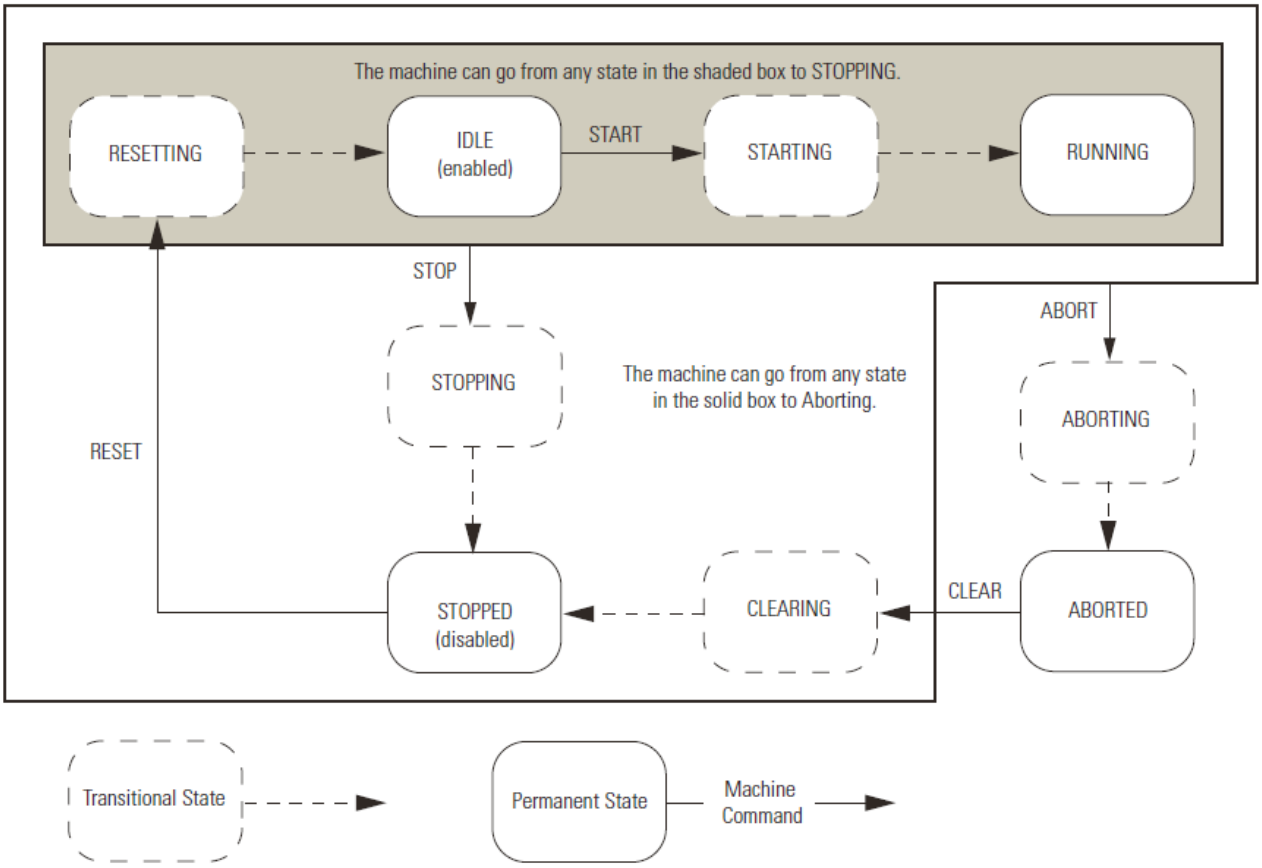
The machine module contains the high level control for the entire machine. The machine module was built around a simple state machine that you can customize to fit most applications. The machine module broadcasts out commands and receives feedback information from each of the application and device modules.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

Machine 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

Machine State	State Type	Description
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 ABORTTING 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 homed). 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.

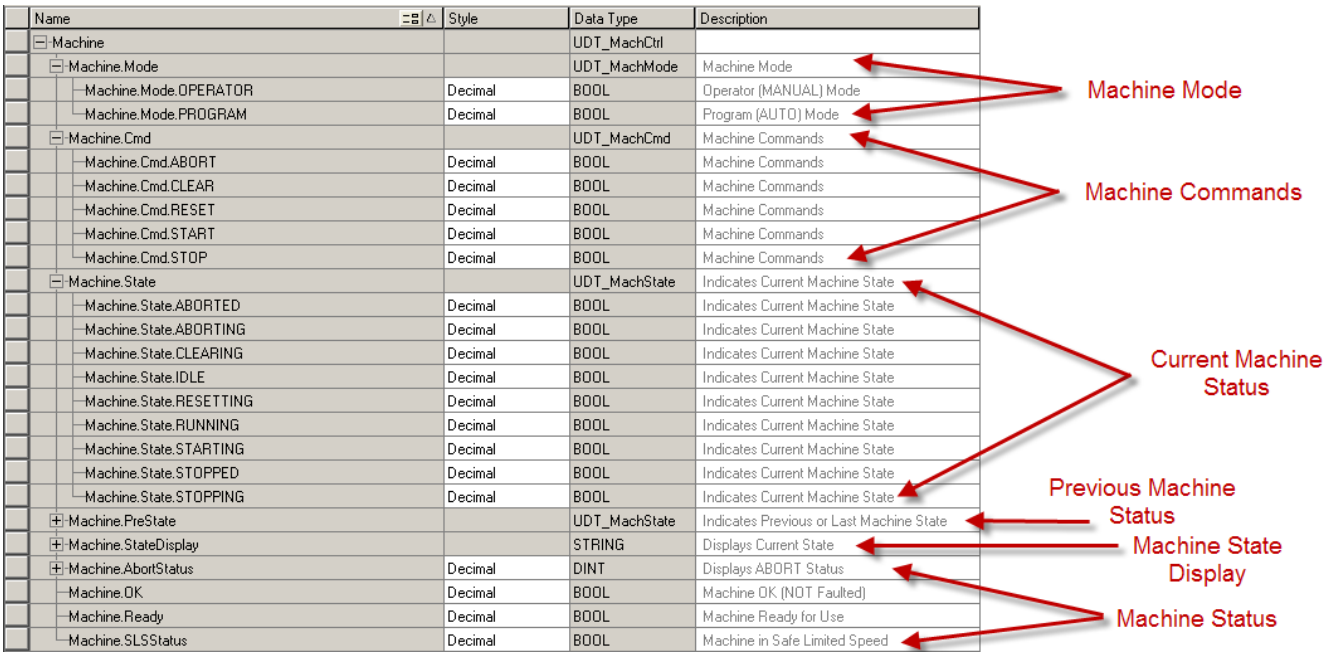
Default Machine Commands

Machine Command	Application Module Response	Device Module Response
ABORT	Halts the application RUN sequence (if active) and initiates the STOP sequence. The STOP sequence attempts to stop and disable all active drives.	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.
CLEAR	Attempts to clear any active faults that exist in the modules.	Attempts to clear any active faults that exist in either the module and/or drive.
RESET	Initiates the application RESET sequence, which prepares the application and/or devices to run. Use this for the coordinated reset of multiple modules.	Initiates the device module RESET sequence, which prepares the device module to run.
START	Initiates the application RUN sequence. Customize the RUN sequence to fit the needs of your application.	Ignored (1)
STOP	Halts the application RUN sequence (if active) and initiates the STOP sequence. The STOP sequence attempts to stop and disable all active drives.	Halts the device module RESET sequence.

(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.



Name	Style	Data Type	Description
Machine		UDT_MachCtrl	
Machine.Mode		UDT_MachMode	Machine Mode
Machine.Mode.OPERATOR	Decimal	BOOL	Operator (MANUAL) Mode
Machine.Mode.PROGRAM	Decimal	BOOL	Program (AUTO) Mode
Machine.Cmd		UDT_MachCmd	Machine Commands
Machine.Cmd.ABORT	Decimal	BOOL	Machine Commands
Machine.Cmd.CLEAR	Decimal	BOOL	Machine Commands
Machine.Cmd.RESET	Decimal	BOOL	Machine Commands
Machine.Cmd.START	Decimal	BOOL	Machine Commands
Machine.Cmd.STOP	Decimal	BOOL	Machine Commands
Machine.State		UDT_MachState	Indicates Current Machine State
Machine.State.ABORTED	Decimal	BOOL	Indicates Current Machine State
Machine.State.ABORTING	Decimal	BOOL	Indicates Current Machine State
Machine.State.CLEARING	Decimal	BOOL	Indicates Current Machine State
Machine.State.IDLE	Decimal	BOOL	Indicates Current Machine State
Machine.State.RESETTING	Decimal	BOOL	Indicates Current Machine State
Machine.State.RUNNING	Decimal	BOOL	Indicates Current Machine State
Machine.State.STARTING	Decimal	BOOL	Indicates Current Machine State
Machine.State.STOPPED	Decimal	BOOL	Indicates Current Machine State
Machine.State.STOPPING	Decimal	BOOL	Indicates Current Machine State
Machine.PreState		UDT_MachState	Indicates Previous or Last Machine State
Machine.StateDisplay		STRING	Displays Current State
Machine.AbortStatus	Decimal	DINT	Displays ABORT Status
Machine.OK	Decimal	BOOL	Machine OK (NOT Faulted)
Machine.Ready	Decimal	BOOL	Machine Ready for Use
Machine.SLSStatus	Decimal	BOOL	Machine in Safe Limited Speed

Machine Tags

Tag Group	Function
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 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.

Device Module Status

Name	Style	Data Type	Description
PF753_Drive		UDT_ModuleStatus	
PF753_Drive.Aborted	Decimal	BOOL	Module Aborted
PF753_Drive.Active	Decimal	BOOL	Module Active (Enabled / Running)
PF753_Drive.Reset	Decimal	BOOL	Module Reset
PF753_Drive.OK	Decimal	BOOL	Module OK (NOT Faulted)
PF753_Drive.Ready	Decimal	BOOL	Module Ready for Use
PF753_Drive.SLSReq	Decimal	BOOL	Module Safe Limited Speed Request
PF753_Drive.Name		STRING	Module Name
PF753_Drive:I		AB:PowerFlex753...	
PF753_Drive:O		AB:PowerFlex753...	
PF753_Drive_FP		PFlex_753_20CO...	
PF755_Drive		UDT_ModuleStatus	
PF755_Drive.Aborted	Decimal	BOOL	Module Aborted
PF755_Drive.Active	Decimal	BOOL	Module Active (Enabled / Running)
PF755_Drive.Reset	Decimal	BOOL	Module Reset
PF755_Drive.OK	Decimal	BOOL	Module OK (NOT Faulted)
PF755_Drive.Ready	Decimal	BOOL	Module Ready for Use
PF755_Drive.SLSReq	Decimal	BOOL	Module Safe Limited Speed Request
PF755_Drive.Name		STRING	Module Name

PowerFlex 753

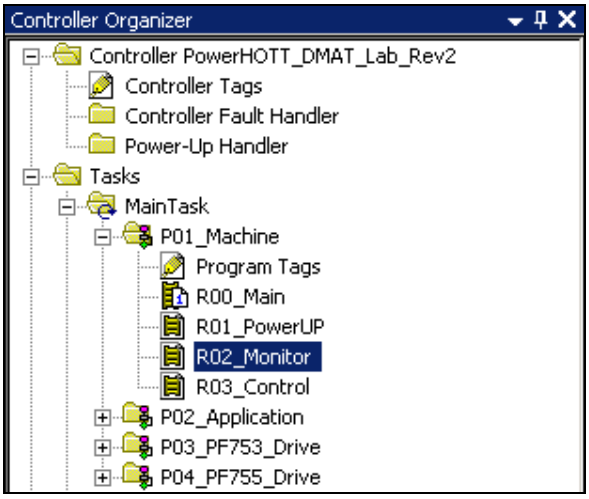
PowerFlex 755

Application Module Status

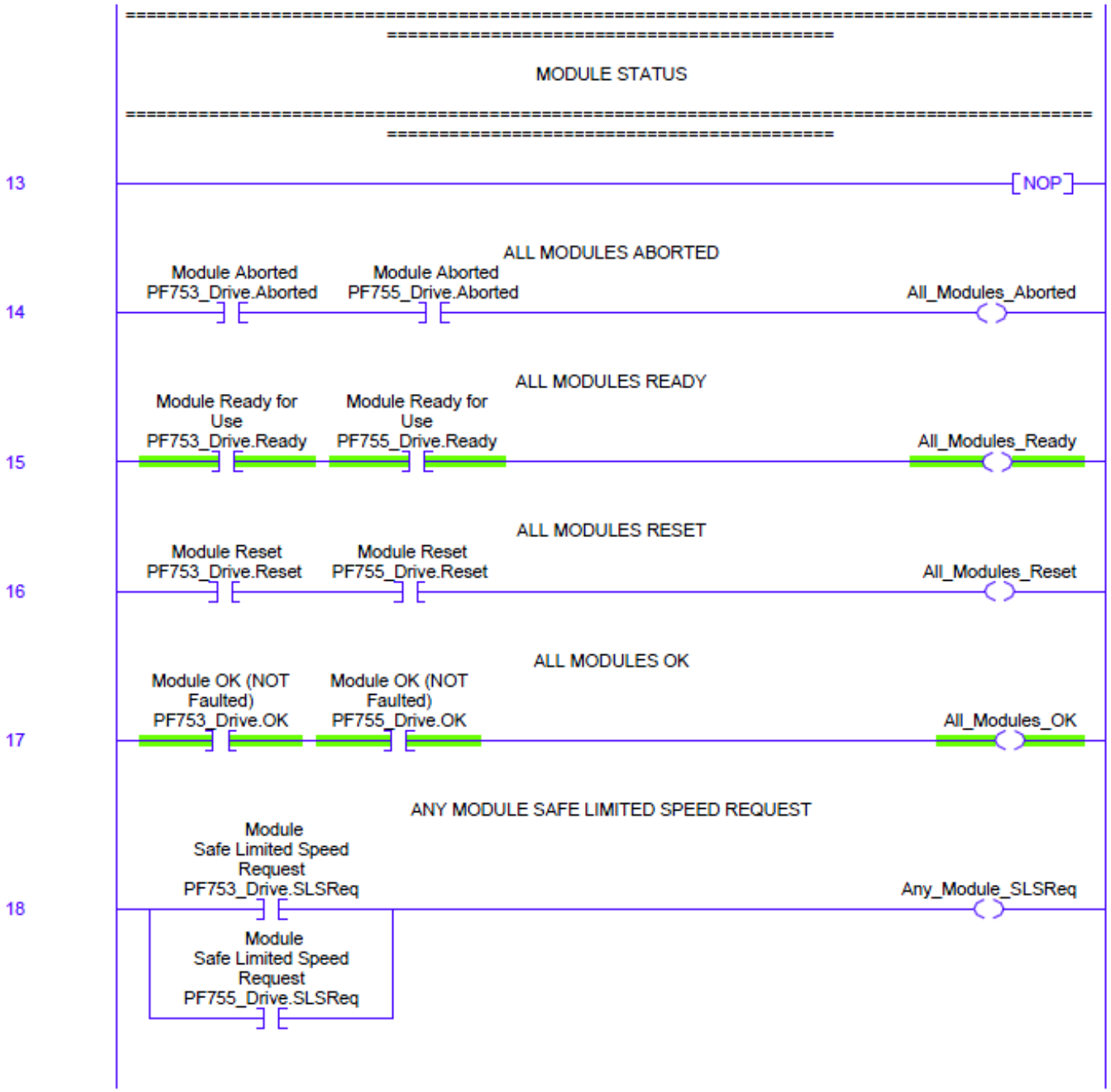
Name	Style	Data Type	Description
Application		UDT_AppStatus	
Application.OK	Decimal	BOOL	Application OK (NOT Faulted)
Application.Ready	Decimal	BOOL	Application Ready for Use
Application.Reset	Decimal	BOOL	Application Reset
Application.Running	Decimal	BOOL	Application Running
Application.Stopped	Decimal	BOOL	Application Stopped
Application.Name		STRING	Application Name

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.

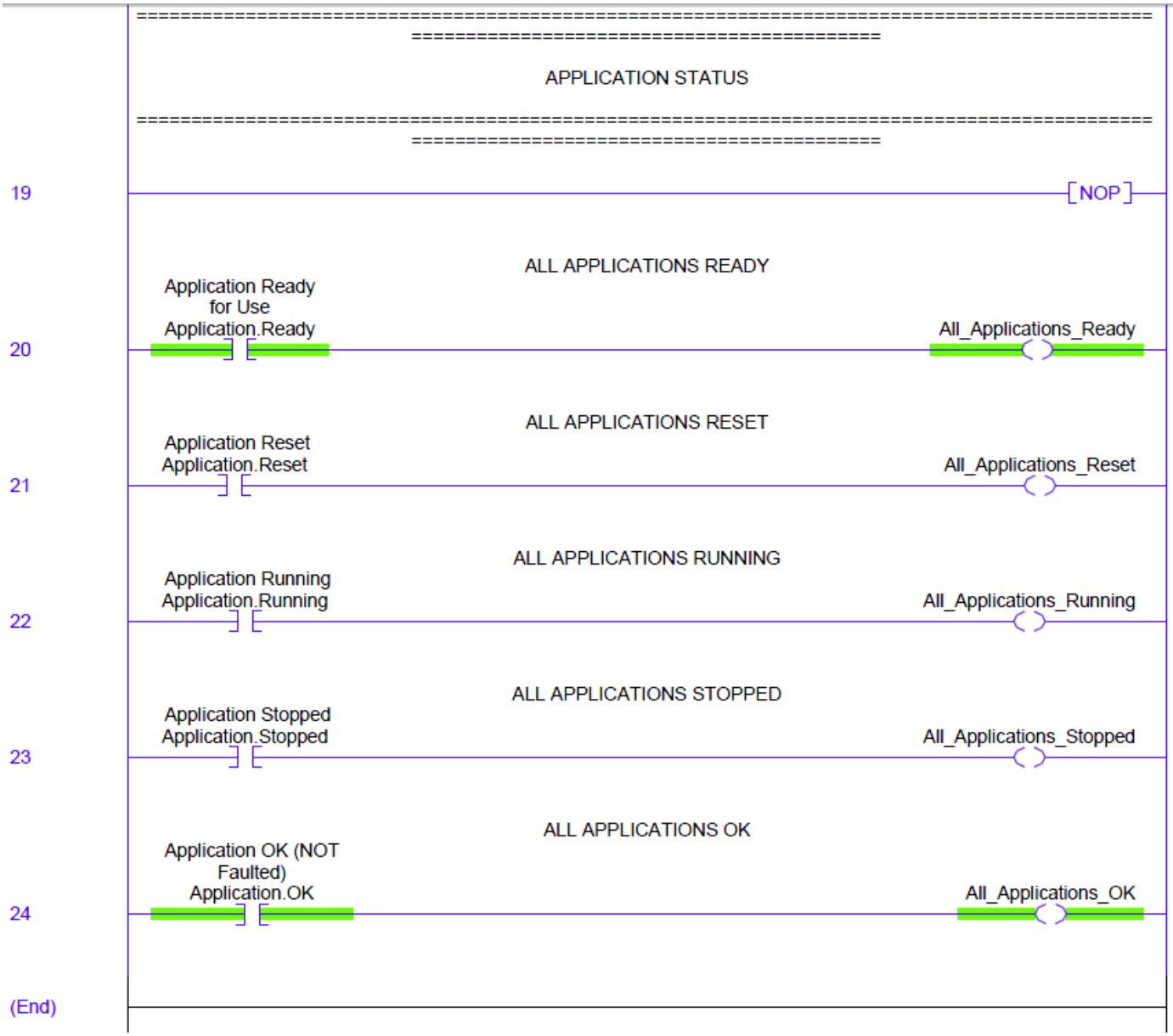
For this Drives and Motion Accelerator Toolkit (DMAT) application example, the rungs are found in the R02_Monitor routine of the P01_Machine program.



DMAT Device Status Rungs

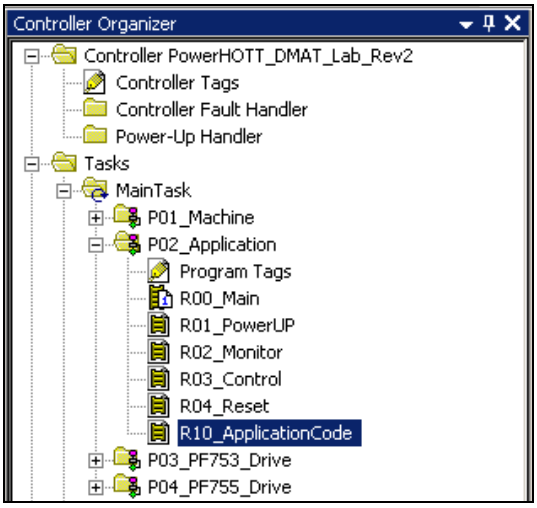


DMAT Application Status Rungs

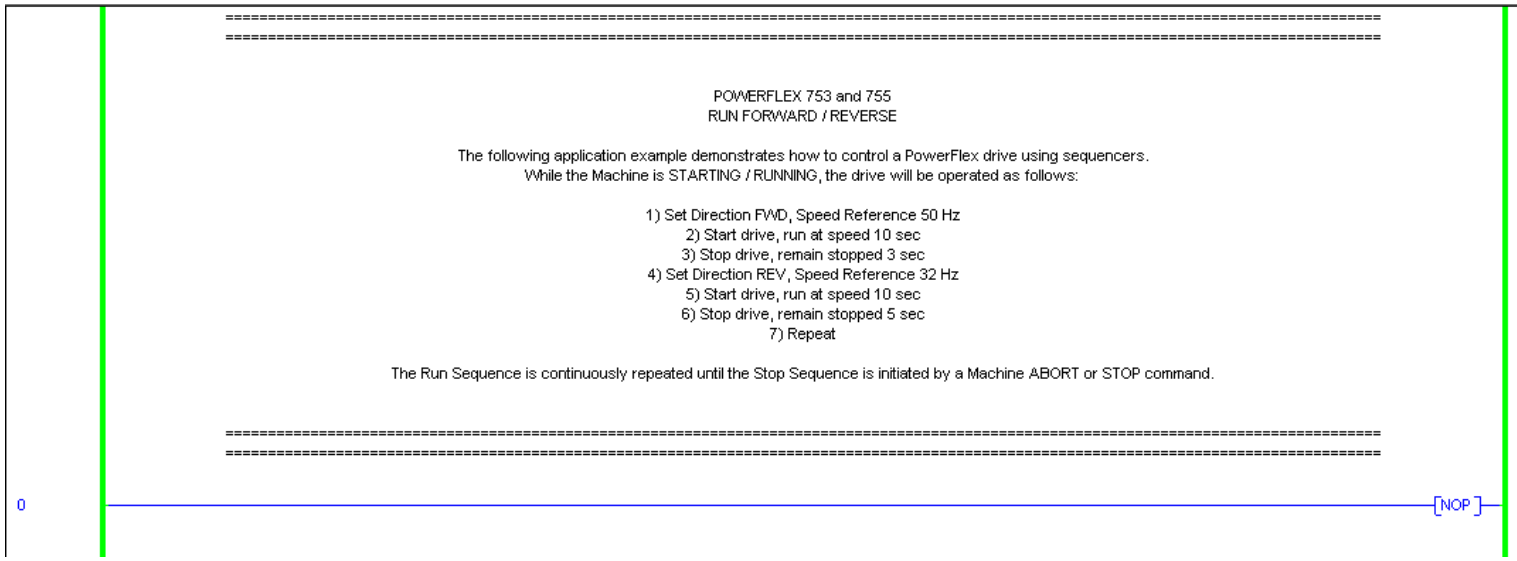


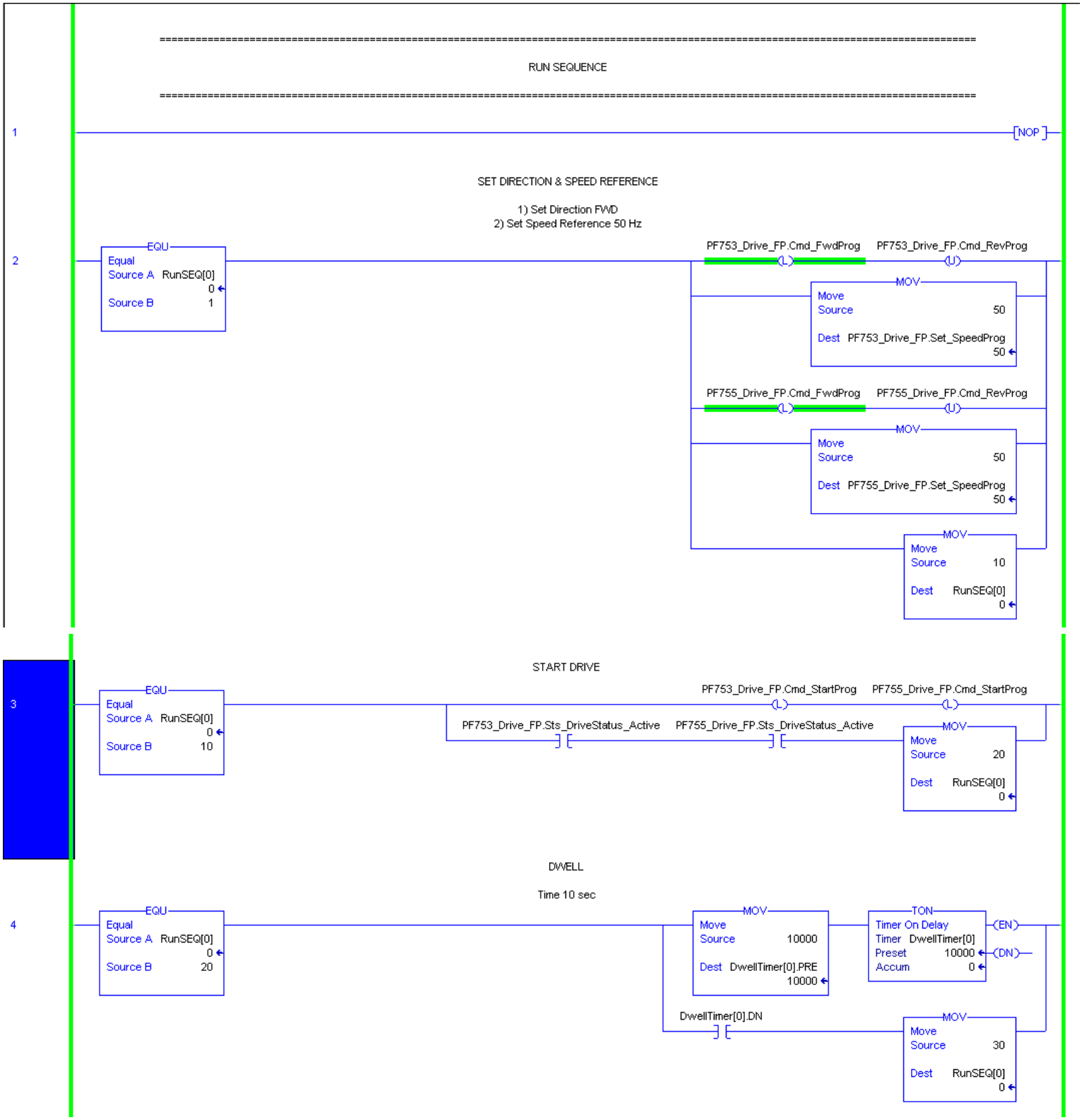
Application Modules

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, is only a part of the application code is shown for the DMAT assembly application.




RUN SEQUENCE
1
NOP
SET DIRECTION & SPEED REFERENCE
1) Set Direction FWD
2) Set Speed Reference 50 Hz
2
EQU
Equal
Source A RunSEQ[0]
0
Source B 1
PF753_Drive_FP.Cmd_FwdProg
L
PF753_Drive_FP.Cmd_RevProg
U
MOV
Move
Source 50
Dest PF753_Drive_FP.Set_SpeedProg
50
PF755_Drive_FP.Cmd_FwdProg
L
PF755_Drive_FP.Cmd_RevProg
U
MOV
Move
Source 50
Dest PF755_Drive_FP.Set_SpeedProg
50
MOV
Move
Source 10
Dest RunSEQ[0]
0
START DRIVE
3
EQU
Equal
Source A RunSEQ[0]
0
Source B 10
PF753_Drive_FP.Cmd_StartProg
L
PF755_Drive_FP.Cmd_StartProg
L
PF753_Drive_FP.Sts_DriveStatus_Active
PF755_Drive_FP.Sts_DriveStatus_Active
MOV
Move
Source 20
Dest RunSEQ[0]
0
DWELL
Time 10 sec
4
EQU
Equal
Source A RunSEQ[0]
0
Source B 20
MOV
Move
Source 10000
Dest DwellTimer[0].PRE
10000
TON
Timer On Delay
Timer DwellTimer[0]
Preset 10000
Accum 0
EN
DN
DwellTimer[0].DN
MOV
Move
Source 30
Dest RunSEQ[0]
0

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.

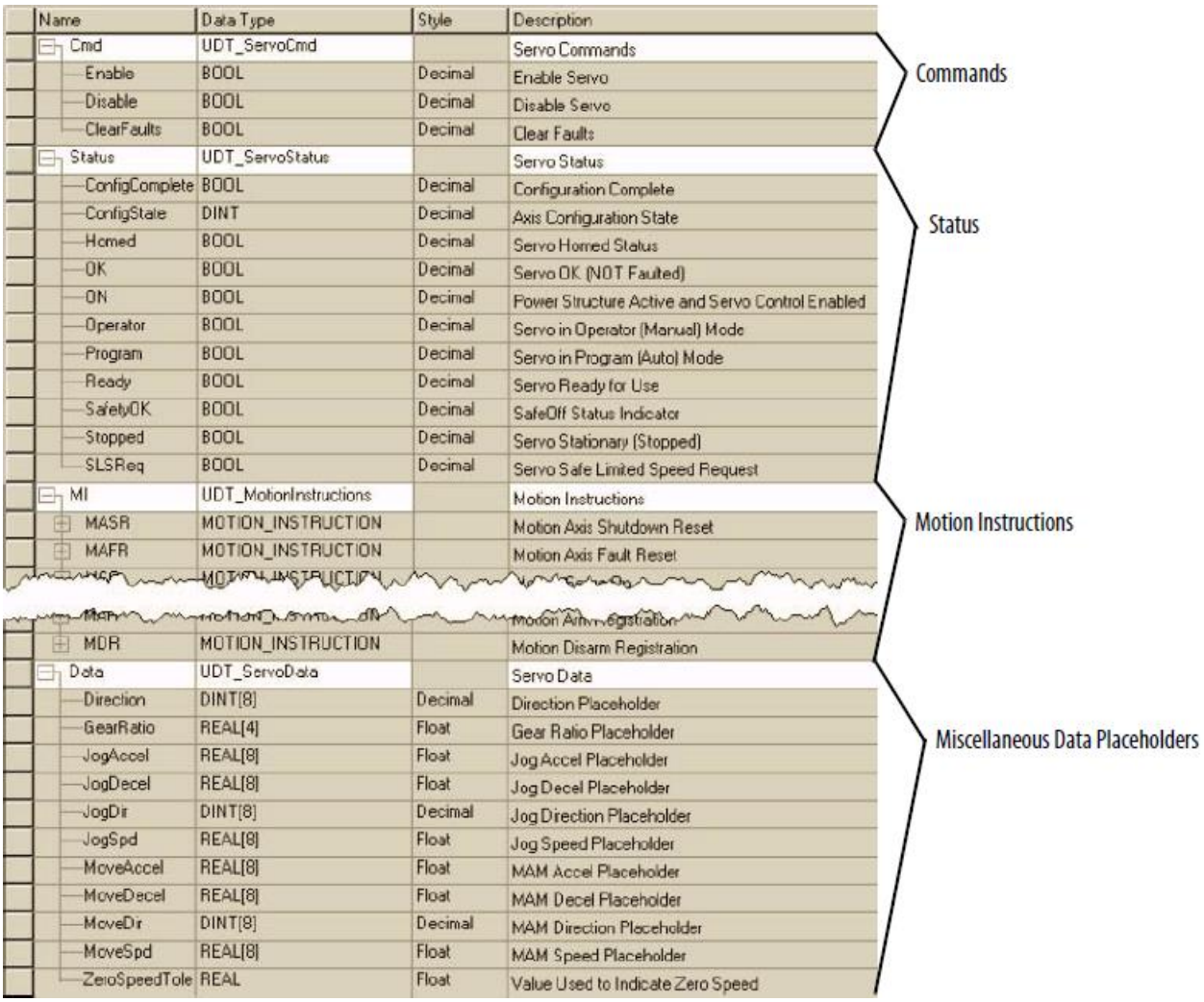
Device Tags

Device Classifications	Covered Products	Data Type
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 Kinetix 6000 Kinetix 6200 Kinetix 7000	User-defined type: UDT_ServoCtrl
SERCOS Feedback-only axis	Applicable SERCOS drives	User-defined type: UDT_ServoCtrl
CIP Motion physical axis	Kinetix 6500 PowerFlex 755	User-defined type: UDT_ServoCtrl
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



Name	Data Type	Style	Description
Cmd	UDT_ServoCmd		Servo Commands
Enable	BOOL	Decimal	Enable Servo
Disable	BOOL	Decimal	Disable Servo
ClearFaults	BOOL	Decimal	Clear Faults
Status	UDT_ServoStatus		Servo Status
ConfigComplete	BOOL	Decimal	Configuration Complete
ConfigState	DINT	Decimal	Axis Configuration State
Homed	BOOL	Decimal	Servo Homed Status
OK	BOOL	Decimal	Servo OK (NOT Faulted)
ON	BOOL	Decimal	Power Structure Active and Servo Control Enabled
Operator	BOOL	Decimal	Servo in Operator (Manual) Mode
Program	BOOL	Decimal	Servo in Program (Auto) Mode
Ready	BOOL	Decimal	Servo Ready for Use
SafetyOK	BOOL	Decimal	SafeOff Status Indicator
Stopped	BOOL	Decimal	Servo Stationary (Stopped)
SLSReq	BOOL	Decimal	Servo Safe Limited Speed Request
MI	UDT_MotionInstructions		Motion Instructions
MASR	MOTION_INSTRUCTION		Motion Axis Shutdown Reset
MAFR	MOTION_INSTRUCTION		Motion Axis Fault Reset
MDR	MOTION_INSTRUCTION		Motion Disarm Registration
Data	UDT_ServoData		Servo Data
Direction	DINT[8]	Decimal	Direction Placeholder
GearRatio	REAL[4]	Float	Gear Ratio Placeholder
JogAccel	REAL[8]	Float	Jog Accel Placeholder
JogDecel	REAL[8]	Float	Jog Decel Placeholder
JogDir	DINT[8]	Decimal	Jog Direction Placeholder
JogSpd	REAL[8]	Float	Jog Speed Placeholder
MoveAccel	REAL[8]	Float	MAM Accel Placeholder
MoveDecel	REAL[8]	Float	MAM Decel Placeholder
MoveDir	DINT[8]	Decimal	MAM Direction Placeholder
MoveSpd	REAL[8]	Float	MAM Speed Placeholder
ZeroSpeedTole	REAL	Float	Value Used to Indicate Zero Speed

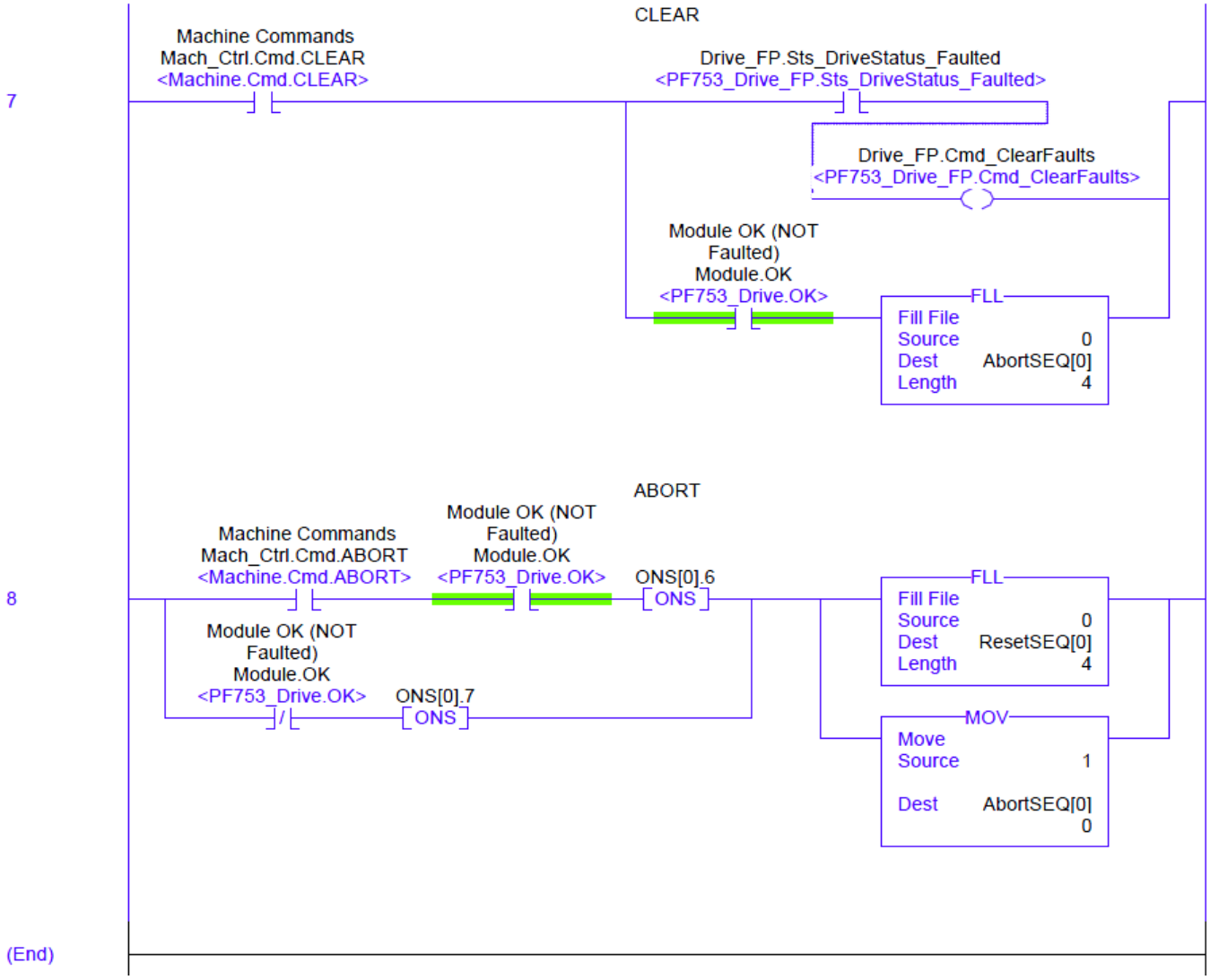
UDT_ServoCtrl Tag

Tag Group	Function
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 one 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 P03_PF753_Drive device module initiates and/or clears the Reset and Abort sequences. It is the same for the R03_Control routine for the P04_PF755_Drive device module.



Notes

www.rockwellautomation.com

Power, Control and Information Solutions Headquarters

Americas: Rockwell Automation, 1201 South Second Street, Milwaukee, WI 53204-2496 USA, Tel: (1) 414.382.2000, Fax: (1) 414.382.4444
Europe/Middle East/Africa: Rockwell Automation NV, Pegasus Park, De Kleetlaan 12a, 1831 Diegem, Belgium, Tel: (32) 2 663 0600, Fax: (32) 2 663 0640
Asia Pacific: Rockwell Automation, Level 14, Core F, Cyberport 3, 100 Cyberport Road, Hong Kong, Tel: (852) 2887 4788, Fax: (852) 2508 1846

Publication CE-DM253-EN-P — Oct 2014