Lab Exercise 4-1: Getting Started with the PowerFlex 525 Training Unit

Upon completion of this lab the student should be able to:

1. Identify the components on the NSCC PF525 training unit
2. Navigate through the menus of the PF525
3. Reset the PF525 to the factory default settings
4. Operate the PF525 through local start/stop/speed control
5. Configure the display of the PF525 to view drive characteristics
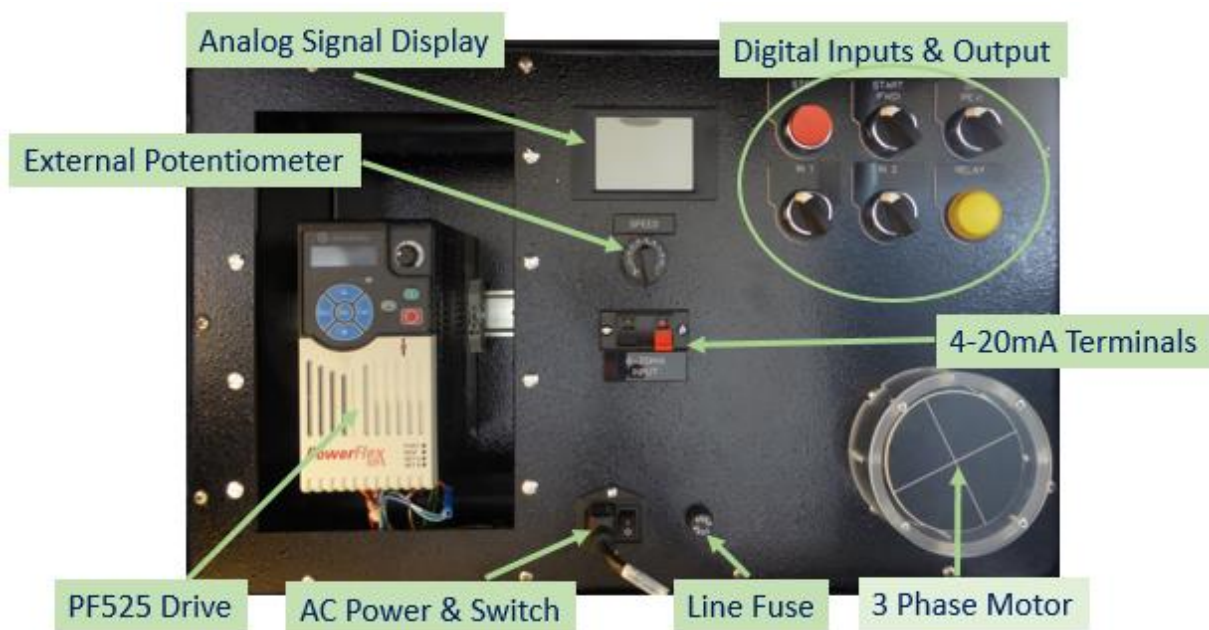6. Explain the correlation between the output frequency and output voltage on a VFD
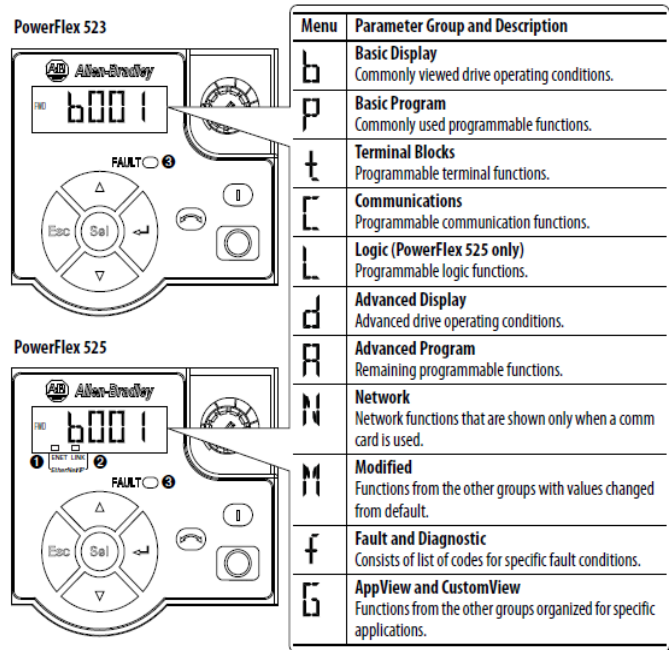

Figure 1. Identifying the components on a PF525 VFD training unit.

1. Identify all the parts and components on the NSCC PF525 training unit.

2. Power the PF525 training unit to view the displays and diagnostic indicators on a power up.

Figure 2. Identifying the devices on a PF525 VFD.

3. Identify the components on the front of the PF525 drive as shown in the graphic above.

4. The following images shows the PF525 display and the parameter groups. There are over 700 unique parameters that are divided into the parameter groups (b, P, t, C, etc). The next graphic shows the different keys on the PF525 control module and their definitions.

PowerFlex 523

PowerFlex 525

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 (PowerFlex 525 only)** Programmable logic functions.
d	**Advanced Display** Advanced drive operating conditions.
A	**Advanced Program** Remaining programmable functions.
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.
f	**Fault and Diagnostic** Consists of list of codes for specific fault conditions.
G	**AppView and CustomView** Functions from the other groups organized for specific applications.

Key	Name	Description	Key	Name	Description
▲ ▽	Up Arrow Down Arrow	Scroll through user-selectable display parameters or groups. Increment values.	⌢	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].
Esc	Escape	Back one step in programming menu. Cancel a change to a parameter value and exit Program Mode.	▯	Start	Used to start the drive. Default is active. Controlled by parameters P046, P048, and P050 [Start Source x].
Sel	Select	Advance one step in programming menu. Select a digit when viewing parameter value.	◎	Stop	Used to stop the drive or clear a fault. This key is always active. Controlled by parameter P045 [Stop Mode].
↵	Enter	Advance one step in programming menu. Save a change to a parameter value.		Potentiometer	Used to control speed of drive. Default is active. Controlled by parameters P047, P049, and P051 [Speed Referencex].

Figure 3. Display and button definition on a PF525 drive.

5. The following graphics show how to navigate to different parameters within the PF525 menus, and how to change to a different parameter, or enter a value into a parameter.

Step		Key	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.)	–	FWD 0.00 HERTZ
2	Press Esc to display the Basic Display Group parameter number shown on power-up. The parameter number will flash.	Esc	FWD b001
3	Press Esc to enter the parameter group list. The parameter group letter will flash.	Esc	FWD b001
4	Press the Up Arrow or Down Arrow to scroll through the group list (b, P, t, C, L, d, A, f and Gx).	△ or ▽	FWD P031
5	Press Enter or Sel to enter a group. The right digit of the last viewed parameter in that group will flash.	↵ or Sel	FWD P031
6	Press the Up Arrow or Down Arrow to scroll through the parameter list.	△ or ▽	FWD P031
7	Press Enter to view the value of the parameter. Or Press Esc to return to the parameter list.	↵	FWD 230 VOLTS
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.	↵ or Sel	FWD 230 VOLTS PROGRAM
9	Press the Up Arrow or Down Arrow to change the parameter value.	△ or ▽	FWD 229 VOLTS PROGRAM
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.	Sel	FWD 229 VOLTS PROGRAM
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.	Esc or ↵	FWD 230 VOLTS or FWD 229 VOLTS
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.	Esc	FWD P031

Figure 4. Group settings on a PF525 VFD training unit.

Calculate and Display the DC BusVoltage:

6. Any VFD will create a Bus Voltage (DC) that will then be inverted to an AC waveform

   a. To calculate the Bus Voltage, multiply the supply voltage to the drive by 1.414.

b. In this case, 115VAC feed, stepped up to **230VAC * 1.414 = 327Vdc**

c. Display the Bus Voltage on the display of the drive. Navigate to basic display parameters and view parameter **b005** on the display. What value does it show?

Reset the PF525 to Factory Defaults

7. Sometimes a situation occurs that requires the user to reset the drive back to the factory defaults, in other words, the same setting before it was installed.

a. Does RUN appear in the upper left corner of the display window?

P053	[Reset To Defalts]	0/3	0 = "Ready/Idle"
⭕	Resets parameters to their factory defaults values. After a Reset command, the value of this parameter returns to zero.		1 = "Param Reset" 2 = "Factory Rset" 3 = "Power Reset"

Figure 5. Resetting the PF525 VFD to factory defaults.

b. Navigate to P053 parameter, then enter a number "2" for Factory Reset.

c. What occurs when this number is entered?

d. Does the drive fault out?

e. What is the Fault Code?

f. ***Reset the Fault by pressing the Stop Button on the PF525***.

Operate the PF525 through local start/stop/speed control

8. Factory default allows the PF525 to be controlled with the local start/stop/speed commands.

a. Press the Start Button to start the drive/motor.

b. Does RUN appear in the upper left corner of the display window?

c. Does FWD (forward) appear on the left side of the display window?

d. Vary the position of the speed potentiometer on the PF525. Does the motor speed change proportional to position?

e. Press the REVERSE direction key (left of the start/stop pushbuttons).

f. Does the motor reverse direction?

Monitoring some Basic Display Parameters on the PF525

9. Many times a user will need to display basic parameters that show the output of the VFD. The following is a chart from the PF525 user's manual of some basic drive output parameters.

No.	Parameter	Min/Max	Display/Options
b001	[Output Freq]	0.00/[Maximum Freq]	0.01 Hz
	Output frequency present at T1, T2 & T3 (U, V & W). Does not include slip frequency.		
b002	[Commanded Freq]	0.00/[Maximum Freq]	0.01 Hz
	Value of the active frequency command even if the drive is not running.		
	Important: The frequency command can come from a number of sources.		
b003	[Output Current]	0.00/(Drive Rated Amps x 2)	0.01 A
	Output current present at T1, T2 & T3 (U, V & W).		
b004	[Output Voltage]	0.0/Drive Rated Volts	0.1V
	Output voltage present at T1, T2 & T3 (U, V & W).		
b005	[DC Bus Voltage]	0/1200VDC	1VDC
	Filtered DC bus voltage level of the drive.		

Figure 6. Determining the output display value on a PF525 VFD.

a. Press the Start Button to start the drive/motor.

b. Monitor b001 parameter. Adjust the speed potentiometer.

Does the output frequency change proportional to the speed potentiometer?

c. Monitor b004 parameter. Adjust the speed potentiometer.

Does the output voltage change proportional to the speed potentiometer?

d. Monitor b005 parameter.

What is the DC Bus Voltage?

e. Monitor b003 parameter.

What is the output current of the motor?

Compare Output Frequency and Output Voltage

9. Through this lab, monitor the output frequency and output voltage and compare:
    b001 – Output Frequency
    b004 – Output Voltage (3 phase to the motor)

    a. Press the Start Button to start the drive/motor. Adjust the potentiometer for speed control.

    b. Monitor b001 parameter. Adjust the speed pot to a frequency output of 10 Hz. Monitor b004 parameter. What is the Output Voltage? _____

    c. Monitor b001 parameter. Adjust the speed pot to a frequency output of 20 Hz. Monitor b004 parameter. What is the Output Voltage? _____

    d. Monitor b001 parameter. Adjust the speed pot to a frequency output of 30 Hz. Monitor b004 parameter. What is the Output Voltage? _____

    e. Monitor b001 parameter. Adjust the speed pot to a frequency output of 40 Hz. Monitor b004 parameter. What is the Output Voltage? _____

    f. Monitor b001 parameter. Adjust the speed pot to a frequency output of 50 Hz. Monitor b004 parameter. What is the Output Voltage? _____

    g. Monitor b001 parameter. Adjust the speed pot to a frequency output of 60 Hz. Monitor b004 parameter. What is the Output Voltage? _____

Disable the Reverse Direction Pushbutton

1. One of the options on most VFDs is to disable the Reverse Direction button. This is valuable is the VFD is running a pump motor. A pump should run in only one direction. Disabling the reverse button eliminates possible mistakes by users of pushing this button by accident and creating a major problem. Parameter A544 is used to disable the reverse direction button. A "1" will disable it, and a "0" will enable it, as shown below: Notice the default value will enable the button.

A544	[Reverse Disable]	0/1	0 = "Rev Enabled" 1 = "Rev Disabled"	0 = "Rev Enabled"
⊙	Enables/disables the function that allows the direction of motor rotation to be changed.			

Figure 7. Enable/Disable reversing on a PF525 VFD.

2. Stop the drive, navigate to parameter A544, and change the value to a "1" to disable.
   Notice you have to put the drive into Stop mode to change this parameter.
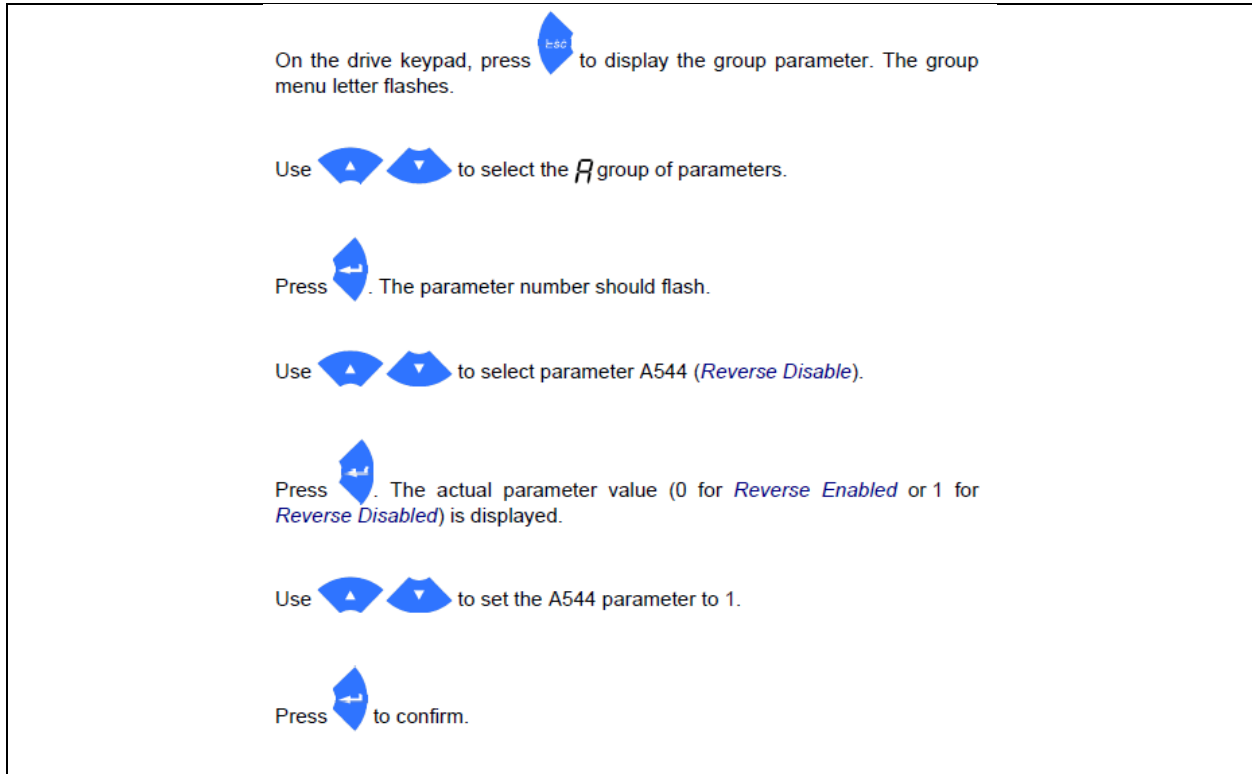   The following steps will help you navigate to the parameter.

On the drive keypad, press [Esc] to display the group parameter. The group menu letter flashes.

Use [▲] [▼] to select the A group of parameters.

Press [↵]. The parameter number should flash.

Use [▲] [▼] to select parameter A544 (*Reverse Disable*).

Press [↵]. The actual parameter value (0 for *Reverse Enabled* or 1 for *Reverse Disabled*) is displayed.

Use [▲] [▼] to set the A544 parameter to 1.

Press [↵] to confirm.

Figure 8. How to navigate the disable reversing parameter on a PF525 VFD.

3. Start the motor from the Start pushbutton on the drive.

4. Press the Reverse Direction button on the drive. Does the motor reverse? _____

Questions:

1. Explain the correlation between output frequency and output voltage in a VFD.

2. Why does the output voltage go down as the frequency go down?

3. What parameter number monitors the output frequency of the PF525?

4. What would be the DC Bus Voltage for a 480V, three phase VFD?

5. How does the user clear a fault on a PF525 drive?

6. What parameter on the PF525 will reset the drive?

7. What value in the parameter mentioned in Question 6 will reset the drive to Factory Default?

8. What parameter on the PF525 will monitor the load current of the motor?

The answers to these questions can be found on the next page.

Questions:

1. Explain the correlation between output frequency and output voltage in a VFD.

As the output frequency going to the motor goes up, so does the output voltage going to the motor. Output frequency and output voltage is directly proportional. For a 230V drive, the amount of voltage output change for a change of 1 hertz, is approximately 3.8V.

2. Why does the output voltage go down as the frequency go down?

The output voltage goes down as frequency goes down so the motor does not burn up. What limits the line current of a motor is the Counter EMF (voltage) generated within the motor. This CEMF opposes line voltage, balancing at the full load amps. If the speed of the motor goes down (less frequency), then the speed goes down and the CEMF goes down. Realize that there will be other settings in the drive to increase the voltage to frequency ratio (called Boost) to help with getting more torque out of the motor.

3. What parameter number monitors the output frequency of the PF525?

Parameter b001 monitors the output frequency of the PF525.

4. What would be the DC Bus Voltage for a 480V, three phase VFD?

DC Bus Voltage = Vphase * 1.414
480V * 1.414 = 678Vdc

5. How does the user clear a fault on a PF525 drive?

A fault is cleared on the PF525 by pressing the Stop Pushbutton, located on the VFD, or if an external N.C. wired stop pushbutton is wired into the PF525.

6. What parameter on the PF525 will reset the drive?

P053 (Reset to Defaults) is the parameter that is used to reset the PF525

7. What value in the parameter mentioned in Question 6 will reset the drive to Factory Default?

A value of "2" in P053 parameter will reset the drive to factory defaults

8. What parameter on the PF525 will monitor the load current of the motor?

Parameter b003 (Output Current) is the parameter that will motor the load current of the PF525

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