

Lab Exercise 4-2: Configuring the PowerFlex 525 Training Unit

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

1. Interpret the wiring diagram for the PF525 VFD
2. Interpret the wiring diagram for the NSCC PF525 Training Unit
3. Test the control signals with a DMM based on the electrical print
4. Configure the PF525 based on the motor nameplate data
5. Monitor the status of Control and Digital Inputs through the PF525 Control Module
6. Monitor the status of the Digital Outputs through the PF525 Control Module
7. Change the default Acceleration and Deceleration Times for the motor
8. Disable the Reverse Direction pushbutton.

PowerFlex 525 Control I/O Wiring Block Diagram

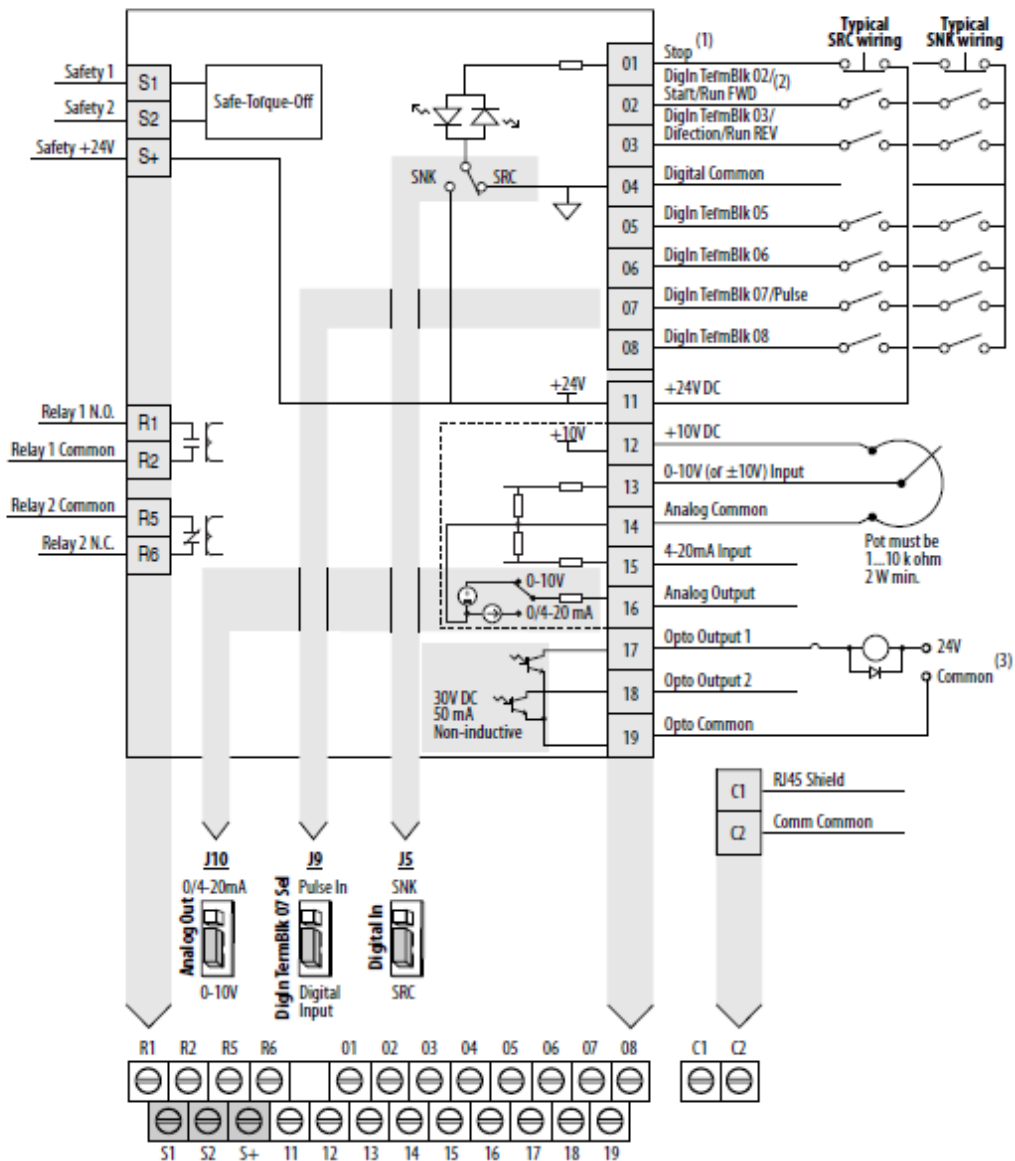


Figure 1. The wiring and setup diagram for a PF525 VFD.

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 1. The wiring diagram for the NSCC PF525 Training Unit

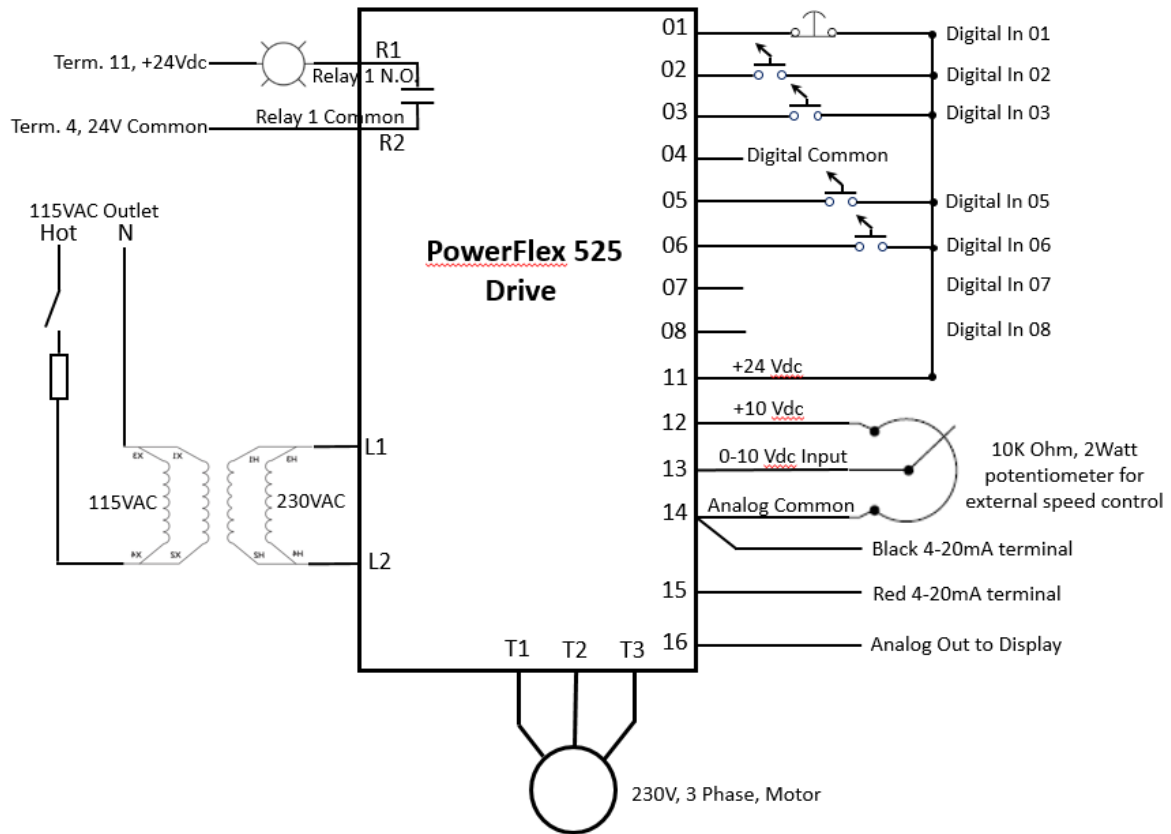


Figure 2. The wiring and setup diagram for a PF525 VFD cont.

3. Identify the components on the front of the PF525 drive as shown in the graphic in Figure 1.
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.

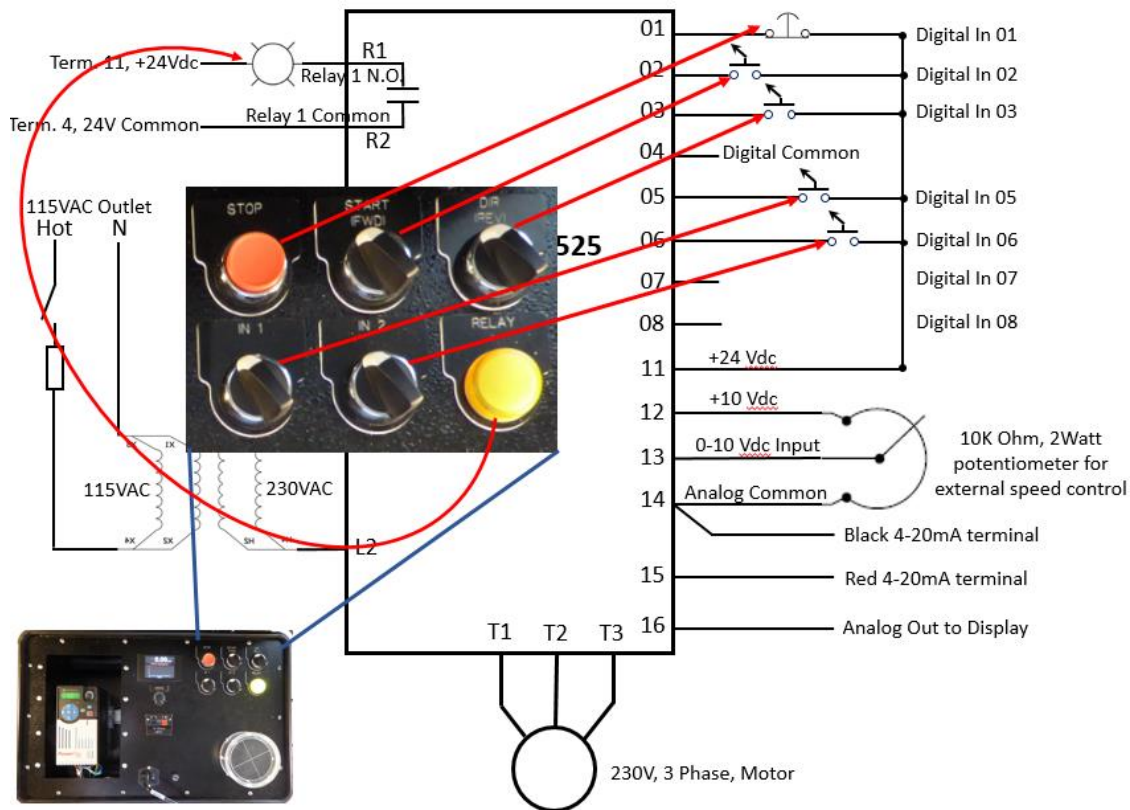


Figure 3. Which inputs terminals the devices are wired to.

Information on Components inside the PF525 Training Unit

Motor: OM (Oriental Motor), 41K25AA-5H: 230V, 25W, 60Hz, 0.22A, 1600 rpm.
1/30HP (25W) -- $(1/30) * 746 = 24.8W$.

<http://catalog.orientalmotor.com/item/ac-motors-gearmotors-/world-k-series-induction-motors/4ik25aa-sh#>

Transformer (mounted internally): This transformer is rated for 240/480 V on the high side, and 120/240 on the low side. The purpose of this transformer is to step the incoming voltage (120VAC) up to 240V, to feed the PF525 with 240V single phase. The VFD can be fed by single phase, but must be derated by 50%. It will still put out three phase power to the motor. The unit is a Hammond Power Solutions Inc: Catalog #: SP350MQMJ. It is rated for 350VA, but is derated to 250VA based on the European Union (CE) lower spec.

PF525 VFD: Catalog #: 25B-B2P5N104. Power: 0.4KW/0.5HP

Input: 3 phase, 200-240VAC, 47-63 Hz., Output: 3 phase, 0-600Hz, 0-230VAC,
Since this drive is powered by single phase, it must be derated by 50%, which means it only be able to power a 0.2KW/0.25HP motor ($.25HP * 746 = 186$ watts). It has plenty of power for the motor on the training unit, which is only 25W.

Control Module (HIM): PowerFlex 25B, series A

PanelPilot SGD-28-M - Analog Display, info at www.PanelPilot.com, This is a programmable device with free software from their website and a USB cable.

Configure the Drive with the Motor Parameters:



Configure the basic motor parameters into the drive, to have it match the motor specifications. Update the parameter values as follows:

1. Parameter P033, enter a value of .2 amps
2. Parameter P034, enter a value of .2 amps (motor nameplate)
3. Parameter P036, enter a value of 1600 rpm (motor nameplate)
4. Parameter P039, enter a value of '0', this will set the drive to V/Hz for constant torque

The following is the parameter definitions for motor setup.







Smart Start-Up with Basic Program Group Parameters


The PowerFlex 520-series drive is designed so that start-up is simple and efficient. The Basic Program group contains the most commonly used parameters. See the PowerFlex 520-Series Adjustable Frequency AC Drive User Manual, publication [520-UM001](#) for detailed descriptions of the parameters listed here, as well as the full list of available parameters.

 = Stop drive before changing this parameter.
 = Parameter is specific to PowerFlex 525 drives only.



No.	Parameter	Min/Max	Display/Options	Default
P030	[Language] Selects the language displayed. Important: The setting takes effect after the drive is power cycled.	1/15	1 = English 2 = Français 3 = Español 4 = Italiano 5 = Deutsch 6 = Reserved 7 = Português 8 = Reserved 9 = Reserved 10 = Reserved 11 = Reserved 12 = Polish 13 = Reserved 14 = Turkish 15 = Czech	1

Figure 4. Setting the language for the PF525 VFD.

P031 	[Motor NP Volts]	10V (for 200V Drives), 20V (for 400V Drives), 25V (for 600V Drives) / Drive Rated Volts	1V	Based on Drive Rating
	Sets the motor nameplate rated volts.			
P032 	[Motor NP Hertz]	15/500 Hz	0.1 A	60 Hz
	Sets the motor nameplate rated frequency.			
P033	[Motor OL Current]	0.0/(Drive Rated Amps x 2)	0.1 A	Based on Drive Rating
	Sets the motor nameplate overload current.			
P034	[Motor NP FLA]	0.0/(Drive Rated Amps x 2)	0.1 A	Drive Rated Amps
	Sets the motor nameplate FLA.			
P035	[Motor NP Poles]	2/40	1	4
	Sets the number of poles in the motor.			
P036 	[Motor NP RPM]	0/24000 rpm	1 rpm	1750 rpm
	Sets the rated nameplate rpm of motor.			
P037 <small>(PF 525)</small>	[Motor NP Power]	0.00/Drive Rated Power	0.01 kW	Drive Rated Power
	Sets the motor nameplate power. Used in PM regulator.			
P038 	[Voltage Class]	2/3	2 = "480V" 3 = "600V"	3
	Sets the voltage class of 600V drives. Only applicable to 600V drives.			
P039 	[Torque Perf Mode]	0/3	0 = "V/Hz" 1 = "SVC" 2 = "Economize" 3 = "Vector" ⁽¹⁾	1
	Selects the motor control mode. (1) Setting is specific to PowerFlex 525 drives only.			
P040 	[Autotune]	0/2	0 = "Ready/Idle" 1 = "Static Tune" 2 = "Rotate Tune"	0
	Enables a static (not spinning) or dynamic (motor spinning) autotune.			
P041	[Accel Time 1]	0.00/600.00 s	0.01 s	10.00 s
	Sets the time for the drive to accel from 0 Hz to [Maximum Freq].			
P042	[Decel Time 1]	0.00/600.00 s	0.01 s	10.00 s
	Sets the time for the drive to decel from [Maximum Freq] to 0 Hz.			

 = Stop drive before changing this parameter.

(PF 525) = Parameter is specific to PowerFlex 525 drives only.

No.	Parameter	Min/Max	Display/Options	Default
P043 	[Minimum Freq]	0.00/500.00 Hz	0.01 Hz	0.00 Hz
	Sets the lowest frequency the drive outputs.			
P044 	[Maximum Freq]	0.00/500.00 Hz	0.01 Hz	60.00 Hz
	Sets the highest frequency the drive outputs.			
P045	[Stop Mode]	0/11	0 = "Ramp, CF" ⁽¹⁾ 1 = "Coast, CF" ⁽¹⁾ 2 = "DC Brake, CF" ⁽¹⁾ 3 = "DCBrkAuto, CF" ⁽¹⁾ 4 = "Ramp" 5 = "Coast" 6 = "DC Brake" 7 = "DC BrakeAuto" 8 = "Ramp+EM B, CF" ⁽¹⁾ 9 = "Ramp+EM Brk" 10 = "PointStp, CF" ⁽¹⁾ 11 = "PointStop"	0
	Stop command for normal stop. Important: I/O Terminal 01 is always a stop input. The stopping mode is determined by the drive setting. Important: The drive is shipped with a jumper installed between I/O Terminals 01 and 11. Remove this jumper when using I/O Terminal 01 as a stop or enable input. (1) Stop input also clears active fault.			



P046, P048, P050 	[Start Source x]	1/5	1 = "Keypad" ⁽¹⁾ 2 = "DigIn TrmBlk" ⁽²⁾ 3 = "Serial/DSI" 4 = "Network Opt" 5 = "Ethernet/IP" ⁽³⁾	P046 = 1 P048 = 2 P050 = 3 (PowerFlex 523) 5 (PowerFlex 525)
	Sets the default control scheme used to start the drive unless overridden by P048 [Start Source 2] or P050 [Start Source 3]. (1) When active, the Reverse key is also active unless disabled by A544 [Reverse Disable]. (2) If "DigIn TrmBlk" is selected, ensure that the digital inputs are properly configured. (3) Setting is specific to PowerFlex 525 drives only.			
P047, P049, P051	[Speed Reference x]	1/16	1 = "Drive Pot" 2 = "Keypad Freq" 3 = "Serial/DSI" 4 = "Network Opt" 5 = "0-10V Input" 6 = "4-20mA Input" 7 = "Preset Freq" 8 = "Anlg In Mult" ⁽¹⁾ 9 = "MOP" 10 = "Pulse Input" 11 = "PID1 Output" 12 = "PID2 Output" ⁽¹⁾ 13 = "Step Logic" ⁽¹⁾ 14 = "Encoder" ⁽¹⁾ 15 = "Ethernet/IP" ⁽¹⁾ 16 = "Positioning" ⁽¹⁾	P047 = 1 P049 = 5 P051 = 3 (PowerFlex 523) 15 (PowerFlex 525)
	Sets the default speed command of the drive unless overridden by P049 [Speed Reference2] or P051 [Speed Reference3]. (1) Setting is specific to PowerFlex 525 drives only.			
P052	[Average kWh Cost]	0.00/655.35	0.01	0.00
	Sets the average cost per kWh.			
P053 	[Reset To Defaults]	0/3	0 = "Ready/Idle" 1 = "Param Reset" 2 = "Factory Rset" 3 = "Power Reset"	0
	Resets parameters to their factory defaults values. After a Reset command, the value of this parameter returns to zero.			

Figure 5. Parameter definitions for the PF525 VFD.

Monitor the Control Inputs (DigIn 1, 2 & 3) on the PF525 Training Unit

- Navigate to parameter b013, then push the Enter key to view the data within the parameter. This should show the status of the 3 control inputs, as shown in Figure 3. Digital Input 1 is always the stop pushbutton, Digital Input 2 is always the start pushbutton (though it has a selector switch wired to it), and Digital 2 is always the reverse direction input.
- Measure the voltage at Digital Input 1 on the control module terminal strip. V=_____
- Push the stop pushbutton on the PF525 training unit. What is the voltage on Digital Input 1? _____. Does the corresponding bit on the display change to 0?

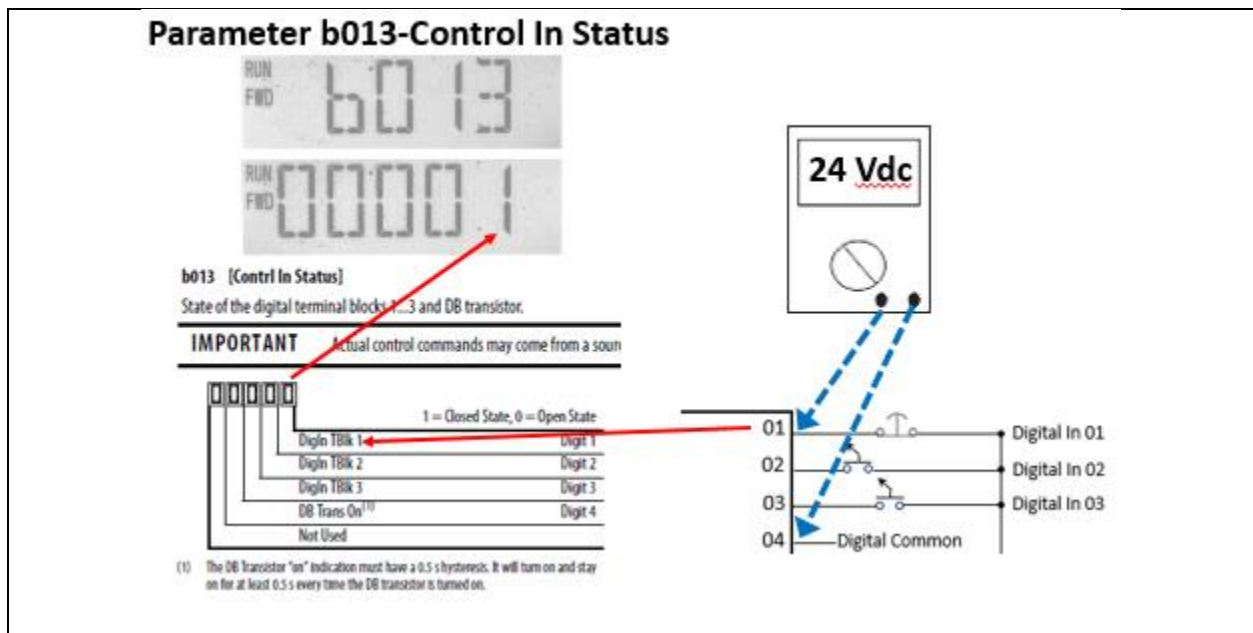


Figure 6. Measuring the voltage & monitoring the status of Control Inputs.

4. Measure the voltage at Digital Input 2 (with the selector switch off – turned to left) on the control module terminal strip. $V = \underline{\hspace{2cm}}$. What is the value for the bit on the display?
5. Turn on the Selector switch
6. Measuring and monitoring the voltage at Digital Input 1

Monitor the Digital Inputs (DigIn 5, 6, 7 & 8) on the PF525 Training Unit

1. Navigate to parameter b014, then push the Enter key to view the data within the parameter. This should show the status of the 4 Digital Inputs, as shown in Figure 4. Notice that these Digital Inputs (b014) are different from the Control Inputs (also digital but in b013). The Control Inputs are predefined. The Digital Inputs can be used in the parameter list to do things like set a predefined speed for the motor.
2. Measure the voltage at Digital Input 6 on the control module terminal strip. $V = \underline{\hspace{2cm}}$
3. Turn the selector switch for Input 6 to the right to turn it on, on the PF525 training unit (this unit may be marked on the selector switch as IN2, but it is actually IN6). What is the voltage on Digital Input 6? $\underline{\hspace{2cm}}$. Does the corresponding bit on the display change to 0?

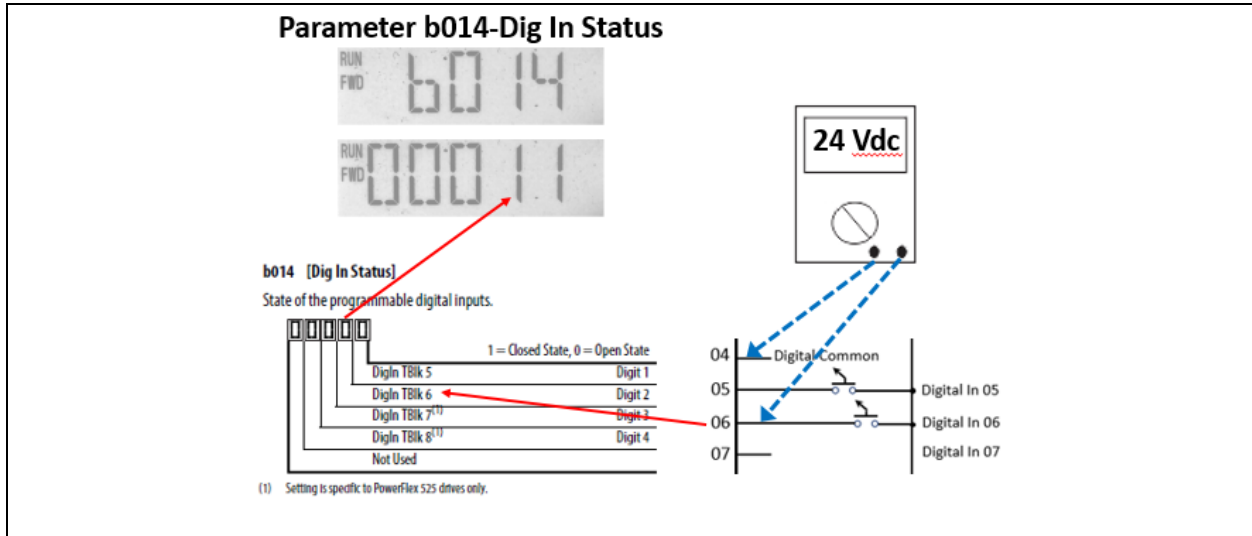


Figure 7. Measuring the voltage & monitoring the status of the Digital Inputs.

Monitor the Digital Outputs (Relay 1&2, and Opto 1&2) on the PF525 Training Unit

1. Navigate to parameter d394, then push the Enter key to view the data within the parameter. This should show the status of the 4 Digital Outputs, as shown in Figure 5. The relay outputs can be used with inductive loads, and the Opto outputs are used with non-inductive loads.
2. Reset the drive to factory defaults. This default Relay 1 to come on when the drive is ready, which means it should be on as soon as you go to factory defaults, and clear the fault. Measure the voltage between terminal 11 (+24) to terminal R1 on the control module terminal strip (this will measure the voltage across the pilot light. V=_____)
3. Go to parameter d394 to view the status of Relay 1. Is the corresponding bit on?

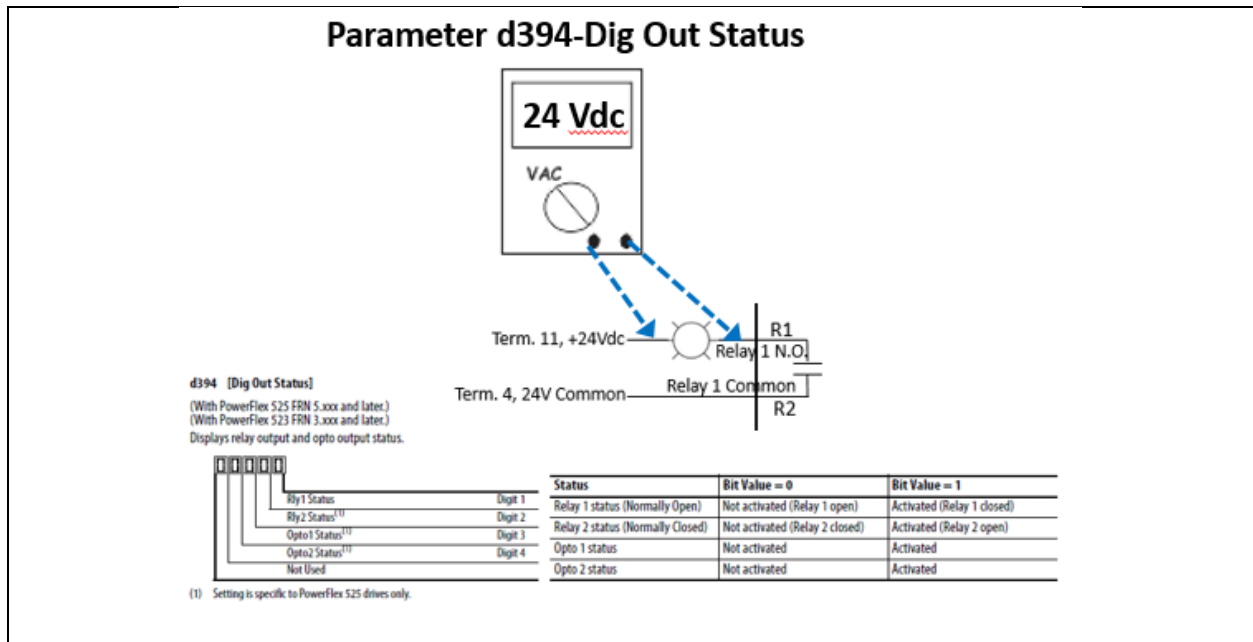


Figure 8. How to monitor the Relay 1 Output.

Change the default Acceleration & Deceleration Times for the PF525

1. Reset the drive to factory defaults, and clear the corresponding faults. Navigate to parameter P041 (Accel Time 1). What is the default value in the parameter? _____
2. Navigate to parameter P042 (Decel Time 1).
What is the default value in the parameter? _____
3. Start the drive and stop it a few times to verify the amount of time for the motor to get up to speed when the start is pushed, and to go to stop when the stop button is pushed.
4. Change the value in P041 so the motor will take 8 seconds to get up to full speed.
5. Change the value in P042 so the motor will stop in 2 seconds when the stop is pushed.
6. Start the drive and stop it a few times to verify that you changes are correct.

Questions:

1. What terminal on the PF525 control module is the +24V power supply terminal?
2. T F The PF525 can have either a 0-10Vdc or 4-20mAdc analog output control signal.
3. What terminal on the PF525 control module is the 24Vdc power supply common?
4. Is the PF525 training unit wired for current sinking or current sourcing?
5. T F The PF525, three phase drive can also be power by single phase, and can still put out a 3 phase voltage.
6. What does the stop button designation mean on the parameter table in the PF525 quick start manual.
7. What parameter will the user view on the control panel display to see the status of the standard digital inputs?
8. What is the default times for the Acceleration time and Deceleration time of the motor?

Answers to the Questions:

1. What terminal on the PF525 control module is the +24V power supply terminal?
The +24V power supply terminal is on terminal 11.

9. T F The PF525 can have either a 0-10Vdc or 4-20mAdc analog output control signal.
The answer is True. An analog output signal can be sent to a PLC, to tell the PLC how fast the VFD is running, based on the analog signal. The PF525 can have an analog output signal that is either 0-10V or 4-20mA. The default is 0-10Vdc. A jumper on the control module must be changed to make it a 4-20mA. If the drive is running at 0 speed, the signal could be either 0V or 4mA. If the drive is outputting full speed (60hz), the output signal would be 10V or 20mA.


2. What terminal on the PF525 control module is the 24Vdc power supply common?
The common side of the 24V power supply is on terminal 4.

3. Is the PF525 training unit wired for current sinking or current sourcing?
The PF525 training unit has the inputs wired as current sourcing (positive side of the DC supply is ran to the input switch). A jumper must be changed to make it current sinking.

4. T F The PF525, three phase drive can also be power by single phase, and can still put out a 3 phase voltage.
Most modern day VFDs (including the PF525) can be powered with single phase. Since the capacitors in the DC Link section of the VFD charge to peak, the VFD will still put out three phase. The drive must be de-rated by 50% if it is powered with single phase (A 20HP drive can only power a 10HP motor).

5. What does the stop button designation mean on the parameter table in the PF525 quick start manual.



The Stop Button designation:  means that the drive must be in Stop mode to change the parameter. As an example, on page 21 of the quick start manual, P053 parameter (reset parameters to their factory defaults value) shows the stop button symbol.

6. What parameter will the user view on the control panel display to see the status of the standard digital inputs? D014

7. What is the default times for the Acceleration time and Deceleration time of the motor?
The default time is 10 seconds for both the acceleration and deceleration of the motor.

DOL DISCLAIMER:

This product was funded by a grant awarded by the U.S. Department of Labor's Employment and Training Administration. The product was created by the grantee and does not necessarily reflect the official position of the U.S. Department of Labor. The Department of Labor makes no guarantees, warranties, or assurances of any kind, express or implied, with respect to such information, including any information on linked sites and including, but not limited to, accuracy of the information or its completeness, timeliness, usefulness, adequacy, continued availability, or ownership.



This work is licensed under a [Creative Commons Attribution 4.0 International License](https://creativecommons.org/licenses/by/4.0/).