Introduction:

This experiment introduces the basic configuration and operational characteristics of an Allen-Bradley, **PowerFlex 40**, Variable Frequency Drive (VFD) that is being used to supply a three-phase, squirrel-cage, induction motor. The keypad provided on the faceplate of the drive will be used both to configure the drive and to control the operation of the induction motor.

Procedure: (Steps 1 through 6 should already be completed for you.)

Initial configuration of the Lab-Volt Equipment:

1. Configure the Lab-Volt system such that a Squirrel Cage Induction Motor is belted to the Dynamometer and connect the 24V$_{AC}$ power supply to the Dynamometer using a gray power-supply cable.

2. On the front panel of the dynamometer, set the large **MODE** switch to **DYN**, set the smaller **MODE** switch within the Load Control section to **MAN**, rotate the **MANUAL** control knob within the Load Control section to its **MIN (CCW)** position, and set the **DISPLAY** switch to **SPEED**.

Connecting the PowerFlex 40 (PF40) VFD to the Lab-Volt Supply and to the 3Φ Induction Motor:

3. Connect the three **blue** leads attached to terminals **L1**, **L2**, and **L3** of the PF40 to terminals **1,2**, and **3** of the Lab-Volt, **constant 120/208V**, three-phase supply.

4. If available, do **not** connect the fourth **blue** lead attached to the **Ground** terminal of the PF40 to the Ground terminal of the Lab-Volt supply. Again… **Do NOT Ground** the VFD.

5. Connect the three **red** leads attached to terminals **T1**, **T2**, and **T3** of the PF40 to terminals **1**, **2**, and **3** of the Squirrel-Cage Induction Machine.

6. Connect terminals **4**, **5**, and **6** of the Induction Machine together using two yellow patch cables.

If you have any questions regarding the setup or wiring, check with your instructor <u>before</u> proceeding to the next page. **Note that the VFD might already be configured as part of the larger motor control system that is required for the PLC Tutorial Lab. If so, you do not need to make any modifications to that system in order to perform this lab.**
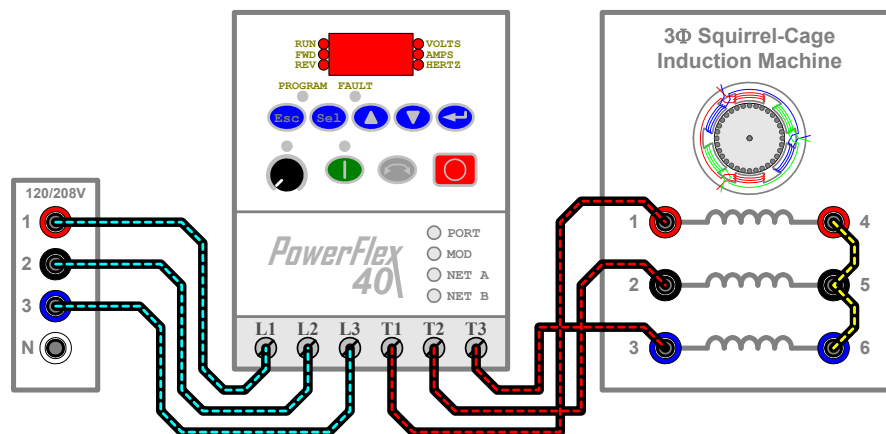

Figure 6.1 – Wiring Diagram for the PF40 VFD

PowerFlex 40 VFD's Operating Parameters:

The PowerFlex 40's **operating parameters**, such as the frequency of its output voltages, are determined by various values that are stored in the drive's memory. These values are organized into two groups; a **Basic Program Group (P)** that contains the most commonly used parameters that define the drive's basic operation, and the **Advanced Group (A)** containing parameters that may be accessed in order to modify the more technical aspects of the drive's operation.

Along with the basic and advanced program groups, a third set of memory registers is organized into a **Display Group (d)** that contains information pertaining to the operational state of the drive, such as the magnitude of the drive's output voltages or the drive's temperature. After power-up, the drive's LED display defaults to showing the value stored in the most recent user-selected *Display Group* parameter.

Note that all of these parameters may be accessed using the keypad on the front panel of the drive in order to view and/or modify their values.

Factory default parameter values allow the drive to be controlled directly from the keypad on its faceplate. No programming is required to start, stop, change direction, and control speed directly from the keypad.

Energizing and Resetting the PowerFlex 40 to its Default Operating Parameters:

7. Switch **ON** the "main" Lab-Volt **power supply** (large black switch) to energize the PF40 and the additional 24V$_{AC}$ supply (red switch) to energize the Dynamometer. Wait roughly 10 seconds to allow the PF40 to complete its initialization process.

8. Access the **Basic Program Group** – **P041** parameter and set its value to **one** (**1**) in order to reset the **PF40** to its default configuration by completing the following steps (**a**) through (**g**):
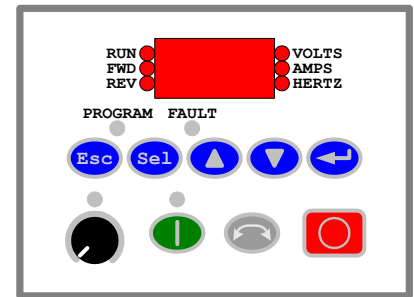
    a) Press the **Esc** button on the front panel of the **PF40** to display the last user-selected **Display Group** parameter. The parameter number will flash.

    b) Press the **Esc** button a second time to enter the group menu. The left-most (group) character in the LED display will flash. (For example – "**d**" for **Display Group**).

    c) Press the ▲ or ▼ buttons to scroll through the available menu groups (**d**, **P** and **A**).

    d) Choose group **P**, the **Basic Program Group**, and press the ↵ (**Enter**) button or the **Sel** button to enter that group. The right digit of the last-viewed parameter in that group will now flash.

    e) Use the ▲ or ▼ button to scroll through the available parameter numbers in the **Basic Program Group** until "**P041**" is shown in the LED display. Once "**P041**" is displayed, press the **Enter** or the **Sel** button to view that parameter's value. *(Note – if you don't want to edit the value, press **Esc** to return to the parameter number.)*

    f) Press the **Enter** or the **Sel** button again to enter the program mode in order to edit the parameter's value. The right digit of the value will flash and the Program LED on the faceplate will illuminate if the parameter can be edited.

    g) Use the ▲ or ▼ button to change the parameter value from "**0**" to "**1**" and press **Enter** (↵). This will immediately reset the **PF40** to its default configuration.

The **default configuration** allows the VFD to receive **start**, **stop**, **forward** and **reverse** commands from its keyboard and its **speed reference** (output frequency) from the potentiometer on its front panel. See the attached parameter tables for a complete list of the default parameter values.

9. The *PF40's* display should be flashing the *fault-code* "**F048**" and the **Fault** LED should be illuminated.

A **fault** is a condition that stops the drive. Fault code *48* occurs when the *VFD's* parameters are reset to their default values.

Press the red "**Stop**" button on the faceplate of the drive to acknowledge and **clear the fault**.

10. Before proceeding, rotate the black **potentiometer** on the drive's faceplate to its **CCW-most position**.

The default configuration of the *PF40* assigns the **potentiometer** as the means for setting the output frequency of the drive, which can range from 0Hz (CCW-most position) to 60Hz (CW-most position).

PowerFlex 40 Operation – Display Parameters:

11. Using the keypad, select *Display Group* parameter "**d001**" ("*Output Frequency*") and press **Enter**. The value contained in this parameter is the actual frequency of the output voltages being produced by the drive. Once selected, the display should show a value of **0.0Hz**.

12. Press the green "**Start**" button on the keypad to **enable** the drive.

13. Slowly raise the frequency of the drive's output voltages to **10Hz** by slowing rotating the potentiometer in the **CW** direction. As the frequency increases, the supplied motor should slowly begin to accelerate, eventually reaching a speed that is slightly less than 300 rpm when the frequency reaches 10Hz.

14. While watching the value of the frequency shown in the display and listening to the pitch of the motor as it accelerates, quickly rotate the potentiometer all the way to its **CW-most** position, which relates to an output frequency of **60Hz**.

Note that the displayed frequency does not instantly rise up to 60Hz, nor does the motor instantly accelerate to its new steady-state speed of roughly 1800rpm. The reason for this is that the *PF40* contains a parameter (**P039**) that defines the rate at which the drive will actually increase its output frequency (i.e. – accelerate the motor).

The default value for parameter **P039** is ten (**10**) seconds, which relates to a 10 second rise time for the drive's output frequency to increase from its minimum value (0Hz) to its maximum value (60Hz). The rise times for lesser changes in frequency are scaled linearly from the stored value. I.e. – the default rise time for the frequency to increase from 10Hz to 40Hz (a 30Hz change) is 5 seconds.

15. Once the motor achieves steady-state operation, return the potentiometer back to the **10Hz** setting.

16. Press **ESC** to display the current *Display Group* parameter number (**d001**).

17. Use the ▲ button to change to parameter "**d002**" ("*Commanded Frequency*") and press **Enter**.

18. Once again, while watching the value of the frequency shown in the display and listening to the pitch of the motor as it accelerates, quickly rotate the potentiometer all the way to its **CW-most** position.

Note that this time, the displayed value instantly changed to 60Hz even though the motor still accelerated slowly based on the 10-second *Accel Time* set by parameter **P039**. The reason for this is that *Display Group* "**d002**" ("*Commanded Frequency*") contains the frequency value set by the position of the potentiometer, which may differ from the actual output frequency depending on the status of the drive, such as whether it is still accelerating or decelerating to reach a newly commanded frequency value.

19. Once the motor achieves steady-state operation, return the potentiometer back to the **10Hz** setting.

20. Press **ESC** to display the current *Display Group* parameter number (**d002**).

21. Use the ▲ button to change to parameter "**d003**" ("*Output Current*") and press **Enter**. This parameter contains the magnitude of the output currents being supplied to the motor by the drive.

22. Slowly raise the frequency from **10Hz** to **60Hz**. While raising the frequency, note the value displayed for parameter "**d003**" as the motor accelerates to its new steady-state operational speed.

23. Return the potentiometer back to the **10Hz** setting.

24. Change to parameter "**d004**" ("*Output Voltage*") and press **Enter**. This parameter contains the magnitude of the line voltages being supplied to the motor by the drive.

25. Slowly raise the frequency from **10Hz** to **60Hz**. While raising the frequency, note the value displayed for parameter "**d004**" as the motor accelerates to its new steady-state operational speed.

26. Rotate the potentiometer to its **0Hz** position.

27. Adjust the drive to once again display the value contained in parameter "**d001**".

PowerFlex 40 Operation – Acceleration & Deceleration Parameters:

28. Quickly increase the frequency of the drive from **0Hz** to **60Hz** and time or count how long it takes for the drive to reach an output frequency of **60Hz**.

Based on the value contained in parameter **P039**, it should have taken **10** seconds to accelerate from 0Hz to 60Hz.

29. Quickly decrease the frequency of the drive from **60Hz** to **0Hz** and count how long it takes for the drive to reach an output frequency of **0Hz**.

The drive contains another parameter (**P040**) that defines the rate at which the drive will **decrease** its output frequency from 60Hz to 0Hz. Similar to the *Accel Time*, the default value for the *Decel Time* is 10 seconds, and this value also scales linearly for lesser changes in frequency.

30. Raise the frequency of the drive back to **60Hz** and then, without adjusting the potentiometer, press the "**Stop**" button on the keypad to **disable** the drive and note the rate at which the motor comes to a complete stop. Does the motor stop immediately or does the *Decel Time* still apply?

31. Without adjusting the potentiometer, press the green "**Start**" button to **re-enable** the drive and note the rate at which the frequency returns to **60Hz**.

32. Using the buttons on the keypad, select the *Basic Program Group* (**P**) and change the values contained in parameters **P039** and **P040** from "**10**" to "**2**".

33. Quickly increase the frequency from **0Hz** to **60Hz** and note the rate at which the motor accelerates.

34. Quickly decrease the frequency from **60Hz** to **0Hz** and note the rate at which the motor decelerates.

35. What effect did changing the values of **P039** and **P040** to a "**2**" have on the drive's operation?

36. Raise the output frequency back to **60Hz**.

PowerFlex 40 Operation – Directional Control:

37. Once the output reaches **60Hz**, press the ↔ "**Reverse**" button on the keypad and note any changes on the display as well as any changes in the operation of the motor, including how long it takes for the motor to reach steady-state operation once again.

38. Press the ↔ "**Reverse**" button on the keypad again to reset the drive for **Forward** operation and note the operation of both the drive and the motor.

39. Lower the output frequency of the drive to **0Hz**.

40. Press "**Stop**" to **disable** the drive.

41. Switch OFF both the "main" Lab-Volt **supply** (large black switch) and the 24V$_{AC}$ supply (red switch).

This concludes the experimental portion of this lab. You do not need to submit anything to the instructor to verify that you completed the lab. You just need to make sure that you know how to reset the *PF40* back to its default configuration and how to change the values stored in the Basic Program Group's parameters because you will also be required to do such for the next lab experiment.

But unlike this experiment during which you controlled the operation of the *PF40* by means of the drive's keypad, in the next experiment you will configure the *PF40* to receive commands via its network port, and you will utilize the drive as part of a complex, PLC-based, motor control system.

Note – the remaining pages of this handout contain reference information from the **PF40 Quick Start Guide**, including a complete list of the parameters contained in the Display, Basic Program, and Advanced Program groups.

Reference Information from the PowerFlex 40 Quick Start Guide:

Integral Keypad
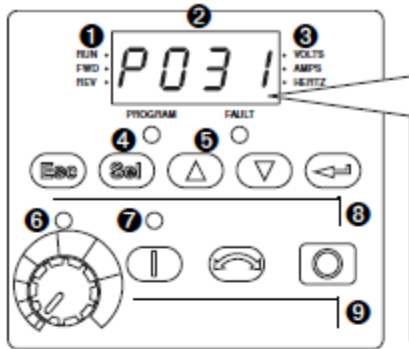
Menu	Description
d	**Display Group (View Only)** Consists of commonly viewed drive operating conditions.
P	**Basic Program Group** Consists of most commonly used programmable functions.
A	**Advanced Program Group** Consists of remaining programmable functions.
F	**Fault Designator** Consists of list of codes for specific fault conditions. Displayed only when fault is present.

No.	LED	LED State	Description
1	Run/Direction Status	Steady Red	Indicates drive is running and commanded motor direction.
		Flashing Red	Drive has been commanded to change direction. Indicates actual motor direction while decelerating to zero.
2	Alphanumeric Display	Steady Red	Indicates parameter number, parameter value, or fault code.
		Flashing Red	Single digit flashing indicates that digit can be edited. All digits flashing indicates a fault condition.
3	Displayed Units	Steady Red	Indicates the units of the parameter value being displayed.
4	Program Status	Steady Red	Indicates parameter value can be changed.
5	Fault Status	Flashing Red	Indicates drive is faulted.
6	Pot Status	Steady Green	Indicates potentiometer on Integral Keypad is active.[1]
7	Start Key Status	Steady Green	Indicates Start key on Integral Keypad is active. The Reverse key is also active unless disabled by A095 [Reverse Disable].

No.	Key	Name	Description
8	Esc	Escape	Back one step in programming menu. Cancel a change to a parameter value and exit Program Mode.
	Sel	Select	Advance one step in programming menu. Select a digit when viewing parameter value.
	△ ▽	Up Arrow Down Arrow	Scroll through groups and parameters. Increase/decrease the value of a flashing digit. Used to control speed of IP66, NEMA/UL Type 4X rated drives when P038 [Speed Reference] is selected.
	⏎	Enter	Advance one step in programming menu. Save a change to a parameter value.
9	(potentiometer)	Potentiometer[1]	Used to control speed of drive. Default is active. Controlled by parameter P038 [Speed Reference].
	⏸	Start	Used to start the drive. Default is active. Controlled by parameter P036 [Start Source].
	⟲	Reverse	Used to reverse direction of the drive. Default is active. Controlled by parameters P036 [Start Source] and A095 [Reverse Disable].
	◻	Stop	Used to stop the drive or clear a fault. This key is always active. Controlled by parameter P037 [Stop Mode].

Display Group Parameters

No.	Parameter	Min/Max	Display/Options			
d001	[Output Freq]	0.0/[Maximum Freq]	0.1 Hz			
d002	[Commanded Freq]	0.0/[Maximum Freq]	0.1 Hz			
d003	[Output Current]	0.00/(Drive Amps × 2)	0.01 Amps			
d004	[Output Voltage]	0/Drive Rated Volts	1 VAC			
d005	[DC Bus Voltage]	Based on Drive Rating	1 VDC			
d006	[Drive Status]	0/1 (1 = Condition True)	Bit 3 Decelerating	Bit 2 Accelerating	Bit 1 Forward	Bit 0 Running
d007-d009	[Fault x Code]	F2/F122	F1			
d010	[Process Display]	0.00/9999	0.01 – 1			
d012	[Control Source]	0/9	Digit 1 = Speed Command (See P038; 9 = "Jog Freq")		Digit 0 = Start Command (See P036; 9 = "Jog")	
d013	[Contrl In Status]	0/1 (1 = Input Present)	Bit 3 DB Trans On	Bit 2 Stop Input	Bit 1 Dir/REV In	Bit 0 Start/FWD In
d014	[Dig In Status]	0/1 (1 = Input Present)	Bit 3 Digital In 4	Bit 2 Digital In 3	Bit 1 Digital In 2	Bit 0 Digital In 1
d015	[Comm Status]	0/1 (1 = Condition True)	Bit 3 Comm Error	Bit 2 DSI Option	Bit 1 Transmitting	Bit 0 Receiving
d016	[Control SW Ver]	1.00/99.99	0.01			
d017	[Drive Type]	1001/9999	1			
d018	[Elapsed Run Time]	0/9999 Hrs	1 = 10 Hrs			
d019	[Testpoint Data]	0/FFFF	1 Hex			
d020	[Analog In 0-10V]	0.0/100.0%	0.1%			
d021	[Analog In 4-20mA]	0.0/100.0%	0.1%			
d022	[Output Power]	0.00/(Drive Power × 2)	0.01 kW			
d023	[Output Powr Fctr]	0.0/180.0 deg	0.1 deg			
d024	[Drive Temp]	0/120 degC	1 degC			
d025	[Counter Status]	0/9999	1			
d026	[Timer Status]	0.0/9999 Secs	0.1 Secs			
d028	[Stp Logic Status]	0/7	1			
d029	[Torque Current]	0.00/(Drive Amps × 2)	0.01 Amps			

Smart Start-Up with Basic Program Group Parameters

The PowerFlex 40 is designed so that start up is simple and efficient. The Program Group contains the most commonly used parameters.

[◉] = Stop drive before changing this parameter.

No.	Parameter	Min/Max	Display/Options	Default
P031 [◉]	[Motor NP Volts] Set to the motor nameplate rated volts.	20/Drive Rated Volts	1 VAC	Based on Drive Rating
P032 [◉]	[Motor NP Hertz] Set to the motor nameplate rated frequency.	15/400 Hz	1 Hz	60 Hz
P033	[Motor OL Current] Set to the maximum allowable motor current.	0.0/(Drive Rated Amps×2)	0.1 Amps	Based on Drive Rating
P034	[Minimum Freq] Sets the lowest frequency the drive will output continuously.	0.0/400.0 Hz	0.1 Hz	0.0 Hz
P035 [◉]	[Maximum Freq] Sets the highest frequency the drive will output.	0/400 Hz	1 Hz	60 Hz
P036 [◉]	[Start Source] Sets the control scheme used to start the drive. [1] When active, the Reverse key is also active unless disabled by A095 [Reverse Disable].	0/6	0 = "Keypad"[1] 1 = "3-Wire" 2 = "2-Wire" 3 = "2-W Lvl Sens" 4 = "2-W Hi Speed" 5 = "Comm Port" 6 = "Momt FWD/REV"	0
P037	[Stop Mode] Active stop mode for all stop sources [e.g. keypad, run forward (I/O Terminal 02), run reverse (I/O Terminal 03), RS485 port] except as noted below. **Important:** I/O Terminal 01 is always a coast to stop input except when P036 [Start Source] is set for "3-Wire" control. When in three wire control, I/O Terminal 01 is controlled by P037 [Stop Mode].	0/9	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" 9 = "Ramp+EM Brk" [1] Stop input also clears active fault.	0
P038	[Speed Reference] Sets the source of the speed reference to the drive. **Important:** When A051 or A052 [Digital Inx Sel] is set to option 2, 4, 5, 6, 13 or 14 and the digital input is active, A051, A052, A053 or A054 will override the speed reference commanded by this parameter. Refer to Chapter 1 of the PowerFlex 40 *User Manual* on CD for details.	0/7	0 = "Drive Pot" 1 = "InternalFreq" 2 = "0-10V Input" 3 = "4-20mA Input" 4 = "Preset Freq" 5 = "Comm Port" 6 = "Stp Logic" 7 = "Anlg In Mult"	0 1 (IP66, Type 4X)
P039	[Accel Time 1] Sets the rate of accel for all speed increases.	0.0/600.0 Secs	0.1 Secs	10.0 Secs
P040	[Decel Time 1] Sets the rate of decel for all speed decreases.	0.1/600.0 Secs	0.1 Secs	10.0 Secs
P041 [◉]	[Reset To Defalts] Resets all parameter values to factory defaults.	0/1	0 = "Ready/Idle" 1 = "Factory Rset"	0
P042 [◉]	[Voltage Class] Sets the voltage class of 600V drives.	2/3	2 = "Low Voltage" (480V) 3 = "High Voltage" (600V)	3
P043	[Motor OL Ret] Enables/disables the Motor Overload Retention function.	0/1	0 = "Disabled" 1 = "Enabled"	0

Advanced Group Parameters

No.	Parameter	Min/Max	Display/Options		Default
A051	[Digital In1 Sel] I/O Terminal 05	0/27	0 = "Not Used" 1 = "Acc & Dec 2" 2 = "Jog" 3 = "Aux Fault" 4 = "Preset Freq" 5 = "Local"(1) 6 = "Comm Port" 7 = "Clear Fault" 8 = "RampStop,CF" 9 = "CoastStop,CF" 10 = "DCInjStop,CF" 11 = "Jog Forward" 12 = "Jog Reverse" 13 = "10V In Ctrl"	14 = "20mA In Ctrl" 15 = "PID Disable" 16 = "MOP Up" 17 = "MOP Down" 18 = "Timer Start" 19 = "Counter In" 20 = "Reset Timer" 21 = "Reset Countr" 22 = "Rset Tim&Cnt" 23 = "Logic In1" 24 = "Logic In2" 25 = "Current Lmt2" 26 = "Anlg Invert" 27 = "EM Brk Rlse"	4
A052	[Digital In2 Sel] I/O Terminal 06				4
A053	[Digital In3 Sel] I/O Terminal 07				5
A054 ⊙	[Digital In4 Sel] I/O Terminal 08				11
	(1) **Important:** Speed source for IP66, NEMA/ UL Type 4X rated drives comes from A069 [Internal Freq].				
A055	[Relay Out Sel]	0/23	0 = "Ready/Fault" 1 = "At Frequency" 2 = "MotorRunning" 3 = "Reverse" 4 = "Motor Overld" 5 = "Ramp Reg" 6 = "Above Freq" 7 = "Above Cur" 8 = "Above DCVolt" 9 = "Retries Exst" 10 = "Above Anlg V" 11 = "Logic In 1"	12 = "Logic In 2" 13 = "Logic 1 & 2" 14 = "Logic 1 or 2" 15 = "StpLogic Out" 16 = "Timer Out" 17 = "Counter Out" 18 = "Above PF Ang" 19 = "Anlg In Loss" 20 = "ParamControl" 21 = "NonRec Fault" 22 = "EM Brk Cntrl" 23 = "Above Fcmd"	0
A056	[Relay Out Level]	0.0/9999	0.1		0.0
A058 A061	[Opto Out1 Sel] [Opto Out2 Sel]	0/22	See A055 for Options.		2 1
A059 A062	[Opto Out1 Level] [Opto Out2 Level]	0.0/9999	0.1		0.0

A055, A058 & A061 Setting	A056, A059 & A062 Min/Max
6	0/400 Hz
7	0/180%
8	0/815 Volts
10	0/100%
16	0.1/9999 Secs
17	1/9999 Counts
18	1/180 degs
20	0/1
23	0/400 Hz

No.	Parameter	Min/Max	Display/Options	Default
A064	[Opto Out Logic]	0/3	1	0

A064 Option	Opto Out1 Logic	Opto Out2 Logic
0	NO (Normally Open)	NO (Normally Open)
1	NC (Normally Closed)	NO (Normally Open)
2	NO (Normally Open)	NC (Normally Closed)
3	NC (Normally Closed)	NC (Normally Closed)

No.	Parameter	Min/Max	Display/Options					Default
A065	[Analog Out Sel]	0/23	1					0

Option	Output Range	Minimum Output Value	Maximum Output Value [Analog Out High]	DIP Switch Position
0 "OutFreq 0-10"	0-10V	0V = 0 Hz	P035 [Maximum Freq]	0-10V
1 "OutCurr 0-10"	0-10V	0V = 0 Amps	200% Drive Rated FLA	0-10V
2 "OutVolt 0-10"	0-10V	0V = 0 Volts	120% Drive Rated Output Volts	0-10V
3 "OutPowr 0-10"	0-10V	0V = 0 kW	200% Drive Rated Power	0-10V
4 "TstData 0-10"	0-10V	0V = 0000	65535 (Hex FFFF)	0-10V
5 "OutFreq 0-20"	0-20 mA	0 mA = 0 Hz	P035 [Maximum Freq]	0-20 mA
6 "OutCurr 0-20"	0-20 mA	0 mA = 0 Amps	200% Drive Rated FLA	0-20 mA
7 "OutVolt 0-20"	0-20 mA	0 mA = 0 Volts	120% Drive Rated Output Volts	0-20 mA
8 "OutPowr 0-20"	0-20 mA	0 mA = 0 kW	200% Drive Rated Power	0-20 mA
9 "TstData 0-20"	0-20 mA	0 mA = 0000	65535 (Hex FFFF)	0-20 mA
10 "OutFreq 4-20"	4-20 mA	4 mA = 0 Hz	P035 [Maximum Freq]	0-20 mA
11 "OutCurr 4-20"	4-20 mA	4 mA = 0 Amps	200% Drive Rated FLA	0-20 mA
12 "OutVolt 4-20"	4-20 mA	4 mA = 0 Volts	120% Drive Rated Output Volts	0-20 mA
13 "OutPowr 4-20"	4-20 mA	4 mA = 0 kW	200% Drive Rated Power	0-20 mA
14 "TstData 4-20"	4-20 mA	4 mA = 0000	65535 (Hex FFFF)	0-20 mA
15 "OutTorq 0-10"	0-10V	0V = 0 Amps	200% Drive Rated FLA	0-10V
16 "OutTorq 0-20"	0-20 mA	0 mA = 0 Amps	200% Drive Rated FLA	0-20 mA
17 "OutTorq 4-20"	4-20 mA	4 mA = 0 Amps	200% Drive Rated FLA	0-20 mA
18 "Setpnt 0-10"	0-10V	0V = 0%	100.0% Setpoint Setting	0-10V
19 "Setpnt 0-20"	0-20 mA	0 mA = 0%	100.0% Setpoint Setting	0-20 mA
20 "Setpnt 4-20"	4-20 mA	4 mA = 0%	100.0% Setpoint Setting	0-20 mA
21 "MinFreq 0-10"	0-10V	0V = Min. Freq	P035 [Maximum Freq]	0-10V
22 "MinFreq 0-20"	0-20 mA	0 mA = Min. Freq	P035 [Maximum Freq]	0-20 mA
23 "MinFreq 4-20"	4-20 mA	4 mA = Min. Freq	P035 [Maximum Freq]	0-20 mA

No.	Parameter	Min/Max	Display/Options	Default
A066	[Analog Out High]	0/800%	1%	100%
A067	[Accel Time 2]	0.0/600.0 Secs	0.1 Secs	20.0 Secs
A068	[Decel Time 2]	0.1/600.0 Secs	0.1 Secs	20.0 Secs
A069	[Internal Freq]	0.0/400.0 Hz	0.1 Hz	60.0 Hz
A070	[Preset Freq 0][1]	0.0/400.0 Hz	0.1 Hz	0.0 Hz
A071	[Preset Freq 1]			5.0 Hz
A072	[Preset Freq 2]			10.0 Hz
A073	[Preset Freq 3]			20.0 Hz
A074	[Preset Freq 4]			30.0 Hz
A075	[Preset Freq 5]			40.0 Hz
A076	[Preset Freq 6]			50.0 Hz
A077	[Preset Freq 7]			60.0 Hz

[1] To activate [Preset Freq 0] set P038 [Speed Reference] to option 4.

Input State of Digital In 1 (I/O Terminal 05)	Input State of Digital In 2 (I/O Terminal 06)	Input State of Digital In 3 (I/O Terminal 07)	Frequency Source	Accel / Decel Parameter Used [2]
0	0	0	[Preset Freq 0]	[Accel Time 1] / [Decel Time 1]
1	0	0	[Preset Freq 1]	[Accel Time 1] / [Decel Time 1]
0	1	0	[Preset Freq 2]	[Accel Time 2] / [Decel Time 2]
1	1	0	[Preset Freq 3]	[Accel Time 2] / [Decel Time 2]
0	0	1	[Preset Freq 4]	[Accel Time 1] / [Decel Time 1]
1	0	1	[Preset Freq 5]	[Accel Time 1] / [Decel Time 1]
0	1	1	[Preset Freq 6]	[Accel Time 2] / [Decel Time 2]
1	1	1	[Preset Freq 7]	[Accel Time 2] / [Decel Time 2]

[2] When a Digital Input is set to "Accel 2 & Decel 2", and the input is active, that input overrides the settings in this table.

No.	Parameter	Min/Max	Display/Options			Default
A078	[Jog Frequency]	0.0/[Maximum Freq]	0.1 Hz			10.0 Hz
A079	[Jog Accel/Decel]	0.1/600.0 Secs	0.1 Secs			10.0 Secs
A080	[DC Brake Time]	0.0/99.9 Secs	0.1 Secs			0.0 Secs
	A setting of 99.9 Secs = Continuous					
A081	[DC Brake Level]	0.0/(Drive Amps × 1.8)	0.1 Amps			Amps × 0.05
A082 ⊙	[DB Resistor Sel]	0/99	0 = "Disabled" 1 = "Normal RA Res"	2 = "NoProtection" 3-99 = % of Duty Cycle		0
A083	[S Curve %]	0/100%	1%			0% (Disabled)
A084	[Boost Select] Only active when A125 [Torque Perf Mode] is set to 0 "V/Hz".	0/14	Settings in % of base voltage. 0 = "Custom V/Hz" Variable Torque 1 = "30.0, VT" 2 = "35.0, VT" 3 = "40.0, VT" 4 = "45.0, VT"	Constant Torque 5 = "0.0, no IR" 6 = "0.0" 7 = "2.5, CT" 8 = "5.0, CT" 9 = "7.5, CT"	10 = "10.0, CT" 11 = "12.5, CT" 12 = "15.0, CT" 13 = "17.5, CT" 14 = "20.0, CT"	8 7 4-11 kW (5-15 HP)

No.	Parameter	Min/Max	Display/Options		Default
A085	[Start Boost]	0.0/25.0%	0.1%		2.5%
	Only active when A084 [Boost Select] and A125 [Torque Perf Mode] are set to "0".				
A086	[Break Voltage]	0.0/100.0%	0.1%		25.0%
	Only active when A084 [Boost Select] and A125 [Torque Perf Mode] are set to "0".				
A087	[Break Frequency]	0.0/400.0 Hz	0.1 Hz		15.0 Hz
	Only active when A084 [Boost Select] and A125 [Torque Perf Mode] are set to "0".				
A088	[Maximum Voltage]	20/Rated Volts	1 VAC		Rated Volts
A089	[Current Limit 1]	0.1/(Drive Amps × 1.8)	0.1 Amps		Amps × 1.5
A090	[Motor OL Select]	0/2	0 = "No Derate"	1 = "Min Derate" 2 = "Max Derate"	0
A091	[PWM Frequency]	2.0/16.0 kHz	0.1 kHz		4.0 kHz
A092	[Auto Rstrt Tries]	0/9	1		0
A093	[Auto Rstrt Delay]	0.0/300.0 Secs	0.1 Secs		1.0 Secs
A094 ⊙	[Start At PowerUp]	0/1	0 = "Disabled"	1 = "Enabled"	0
A095 ⊙	[Reverse Disable]	0/1	0 = "Rev Enabled"	1 = "Rev Disabled"	0
A096	[Flying Start En]	0/1	0 = "Disabled"	1 = "Enabled"	0
A097	[Compensation]	0/3	0 = "Disabled" 1 = "Electrical"	2 = "Mechanical" 3 = "Both"	1
A098	[SW Current Trip]	0.0/(Drive Amps × 2)	0.1 Amps		0.0 (Disabled)
A099	[Process Factor]	0.1/999.9	0.1		30.0
A100 ⊙	[Fault Clear]	0/2	0 = "Ready/Idle"	1 = "Reset Fault" 2 = "Clear Buffer"	0
A101	[Program Lock]	0/9999	0 = "Unlocked"	1 = "Locked"	0
A102	[Testpoint Sel]	400/FFFF	1 Hex		400
A103	[Comm Data Rate] Power to drive must be cycled before any changes will affect drive operation.	0/5	0 = "1200" 1 = "2400" 2 = "4800"	3 = "9600" 4 = "19.2K" 5 = "38.4K"	3
A104	[Comm Node Addr] Power to drive must be cycled before any changes will affect drive operation.	1/247	1		100
A105	[Comm Loss Action]	0/3	0 = "Fault" 1 = "Coast Stop"	2 = "Stop" 3 = "Continu Last"	0
A106	[Comm Loss Time]	0.1/60.0 Secs	0.1 Secs		5.0 Secs
A107	[Comm Format] Power to drive must be cycled before any changes will affect drive operation.	0/5	0 = "RTU 8-N-1" 1 = "RTU 8-E-1" 2 = "RTU 8-O-1"	3 = "RTU 8-N-2" 4 = "RTU 8-E-2" 5 = "RTU 8-O-2"	0
A108	[Language]	1/10	1 = "English" 2 = "Français" 3 = "Español" 4 = "Italiano" 5 = "Deutsch"	6 = "Reserved" 7 = "Português" 8 = "Reserved" 9 = "Reserved" 10 = "Nederlands"	1
A109	[Anlg Out Setpt]	0.0/100.0%	0.1%		0.0%
A110 ⊙	[Anlg In 0-10V Lo]	0.0/100.0%	0.1%		0.0%
A111 ⊙	[Anlg In 0-10V Hi]	0.0/100.0%	0.1%		100.0%
A112 ⊙	[Anlg In4-20mA Lo]	0.0/100.0%	0.1%		0.0%
A113 ⊙	[Anlg In4-20mA Hi]	0.0/100.0%	0.1%		100.0%
A114	[Slip Hertz @ FLA]	0.0/10.0 Hz	0.1 Hz		2.0 Hz
A115	[Process Time Lo]	0.00/99.99	0.01		0.00
A116	[Process Time Hi]	0.00/99.99	0.01		0.00
A117	[Bus Reg Mode]	0/1	0 = "Disabled"	1 = "Enabled"	1
A118	[Current Limit 2]	0.1/(Drive Amps × 1.8)	0.1 Amps		Amps × 1.5
A119	[Skip Frequency]	0/400 Hz	1 Hz		0 Hz
A120	[Skip Freq Band]	0.0/30.0 Hz	0.1 Hz		0.0 Hz

No.	Parameter	Min/Max	Display/Options		Default
A121	[Stall Fault Time]	0/5	0 = "60 Seconds" 1 = "120 Seconds" 2 = "240 Seconds"	3 = "360 Seconds" 4 = "480 Seconds" 5 = "Flt Disabled"	0
A122	[Analog In Loss]	0/6	0 = "Disabled" 1 = "Fault (F29)" 2 = "Stop" 3 = "Zero Ref"	4 = "Min Freq Ref" 5 = "Max Freq Ref" 6 = "Int Freq Ref"	0
A123	[10V Bipolar Enbl]	0/1	0 = "Uni-Polar In"	1 = "Bi-Polar In"	0
A124 ⊙	[Var PWM Disable]	0/1	0 = "Enabled"	1 = "Disabled"	0
A125 ⊙	[Torque Perf Mode]	0/1	0 = "V/Hz"	1 = "Sensrls Vect"	1
A126	[Motor NP FLA]	0.1/(Drive Amps × 2)	0.1 Amps		Rated Amps
A127	[Autotune]	0/2	0 = "Ready/Idle" 1 = "Static Tune"	2 = "Rotate Tune"	0
A128	[IR Voltage Drop]	0.0/230.0 VAC	0.1 VAC		Rated Volts
A129	[Flux Current Ref]	0.00/[Motor NP FLA]	0.01 Amps		Rated Amps
A130	[PID Trim Hi]	0.0/400.0	0.1		60.0
A131	[PID Trim Lo]	0.0/400.0	0.1		0.0
A132	[PID Ref Sel]	0/8	0 = "PID Disabled" 1 = "PID Setpoint" 2 = "0-10V Input" 3 = "4-20mA Input" 4 = "Comm Port"	5 = "Setpnt, Trim" 6 = "0-10V, Trim" 7 = "4-20mA, Trim" 8 = "Comm, Trim"	0
A133	[PID Feedback Sel]	0/2	0 = "0-10V Input" 1 = "4-20mA Input"	2 = "Comm Port"	0
A134	[PID Prop Gain]	0.00/99.99	0.01		0.01
A135	[PID Integ Time]	0.0/999.9 Secs	0.1 Secs		0.1 Secs
A136	[PID Diff Rate]	0.00/99.99 (1/Secs)	0.01 (1/Secs)		0.01 (1/Secs)
A137	[PID Setpoint]	0.0/100.0%	0.1%		0.0%
A138	[PID Deadband]	0.0/10.0%	0.1%		0.0%
A139	[PID Preload]	0.0/400.0 Hz	0.1 Hz		0.0 Hz
A140-A147	[Stp Logic 0-7]	0001/bAFF	4 Digits For a list of digit options, refer to the PowerFlex 40 *User Manual* on the CD supplied with the drive.		00F1
A150-A157	[Stp Logic Time 0-7]	0.0/999.9 Secs	0.1 Secs		30.0 Secs
A160	[EM Brk Off Delay]	0.01/10.00 Secs	0.01 Secs		2.00 Secs
A161	[EM Brk On Delay]	0.01/10.00 Secs	0.01 Secs		2.00 Secs
A162	[MOP Reset Sel]	0/1	0 = "Zero MOP Ref"	1 = "Save MOP Ref"	1
A163	[DB Threshold]	0.0/110.0%	0.0%		100.0%
A164	[Comm Write Mode]	0/1	0 = "Save"	1 = "RAM Only"	0
A165	[Anlg Loss Delay]	0.0/20.0 Secs	0.1 Secs		0.0 Secs
A166	[Analog In Filter]	0/14	1		0

Fault Codes

To clear a fault, press the Stop key, cycle power or set A100 [Fault Clear] to 1 or 2.

No.	Fault	Description
F2	Auxiliary Input[1]	Check remote wiring.
F3	Power Loss	Monitor the incoming AC line for low voltage or line power interruption.
F4	UnderVoltage[1]	Monitor the incoming AC line for low voltage or line power interruption.
F5	OverVoltage[1]	Monitor the AC line for high line voltage or transient conditions. Bus overvoltage can also be caused by motor regeneration. Extend the decel time or install dynamic brake option.
F6	Motor Stalled[1]	Increase [Accel Time x] or reduce load so drive output current does not exceed the current set by parameter A089 [Current Limit].
F7	Motor Overload[1]	An excessive motor load exists. Reduce load so drive output current does not exceed the current set by parameter P033 [Motor OL Current].
F8	Heatsink OvrTmp[1]	Check for blocked or dirty heat sink fins. Verify that ambient temperature has not exceeded 40°C (104°F) for IP 30/NEMA 1/UL Type 1 installations or 50°C (122°F) for Open type installations. Check fan.
F12	HW OverCurrent	Check programming. Check for excess load, improper DC boost setting, DC brake volts set too high or other causes of excess current.
F13	Ground Fault	Check the motor and external wiring to the drive output terminals for a grounded condition.
F29	Analog Input Loss[1]	An analog input is configured to fault on signal loss. A signal loss has occurred.
F33	Auto Rstrt Tries	Correct the cause of the fault and manually clear.
F38	Phase U to Gnd	Check the wiring between the drive and motor. Check motor for grounded phase. Replace drive if fault cannot be cleared.
F39	Phase V to Gnd	
F40	Phase W to Gnd	
F41	Phase UV Short	Check the motor and drive output terminal wiring for a shorted condition. Replace drive if fault cannot be cleared.
F42	Phase UW Short	
F43	Phase VW Short	
F48	Params Defaulted	The drive was commanded to write default values to EEPROM. Clear the fault or cycle power to the drive. Program the drive parameters as needed.
F63	SW OverCurrent[1]	Check load requirements and A098 [SW Current Trip] setting.
F64	Drive Overload	Reduce load or extend Accel Time.
F70	Power Unit	Cycle power. Replace drive if fault cannot be cleared.
F71	Net Loss	The communication network has faulted.
F80	SVC Autotune	The autotune function was either cancelled by the user of failed.
F81	Comm Loss	If adapter was not intentionally disconnected, check wiring to the port. Replace wiring, port expander, adapters or complete drive as required. Check connection. An adapter was intentionally disconnected. Turn off using A105 [Comm Loss Action].
F100	Parameter Checksum	Restore factory defaults.
F122	I/O Board Fail	Cycle power. Replace drive if fault cannot be cleared.

[1] Auto-Reset/Run type fault. Configure with parameters A092 and A093.