



PowerFlex 700 Drive w/Vector Control Option (Revision 40.001)

These release notes correspond to the firmware version 40.001 for PowerFlex[®] 700 drives using the new Variable Boost Voltage function. This version of firmware incorporates all functions included in PowerFlex 700 drive firmware version 6.001.

Determining Firmware Revision Level

To determine the firmware version for a PowerFlex 700 Drive, view parameter 29 [Control SW Ver].

Firmware Upgrade Procedure

This section describes procedures to flash upgrade your drive firmware. Downloads are provided on the Allen-Bradley Web Updates site located at <http://www.ab.com/support/abdrives/webupdate>. For a detailed explanation of the flash procedure, refer to <http://www.ab.com/support/abdrives/powerflex700vc/phase1/firmware/index.html>.



ATTENTION: Risk of drive damage exists if drive power is removed during the Boot Flash segment of the upgrade/download. To guard against damage, Do Not Remove Power to the drive until the download is complete and the drive has been reset.

Important: Once a flash update has been started, do not remove drive power until the download is complete and the drive has been reset. If power is removed during Boot Flash, the drive may be permanently damaged. A drive that has been damaged in this way cannot be repaired. If power is removed during Application Flash, the drive will remain in Boot and can be reflashed.

1. Remove/disconnect any HIMs before proceeding.
2. Install the “v40.001 Flash Kit” from the Allen-Bradley Web Updates site. This automatically installs the latest version of the ControlFLASH utility on your computer. ControlFLASH, DriveExplorer or DriveExecutive can now be used to update the drive using the following instructions.

Using ControlFLASH

Important: This method requires RSLinx.

1. Launch ControlFLASH (if it is not already running).
2. Follow the screen prompts until the flash procedure is completed and the new firmware version is displayed.

Using DriveExplorer Lite/Full

1. Exit the ControlFLASH program (if it is running) and launch DriveExplorer. Make a connection to the drive.
2. In the DriveExplorer treeview, select the appropriate drive. Then select the Information icon.
3. On the Properties screen, select the “Details” tab.
4. Select “Flash Update” and follow the screen prompts until the procedure is completed and the new firmware version is displayed.

Using DriveExecutive

Important: This method requires RSLinx.

1. Exit the ControlFLASH program (if it is running) and launch DriveExecutive. Make a connection to the drive.
2. In the DriveExecutive treeview, select the appropriate drive. Then select the Information icon.
3. On the Properties screen, select “Component Details.”
4. Select “Flash Update” and follow the screen prompts until the procedure is completed and the new firmware version is displayed.

Enhancements

This section describes the enhancements included in this revision:

Variable Boost Voltage Function

The Variable Boost Voltage function provides a reliable means of selecting the appropriate fixed-value boost voltage in V/Hz mode to allow a drive(s) to start a load with a high variable level of breakaway torque and to allow a drive(s) to start into a rotating load in order to provide a controlled deceleration when shutting down.

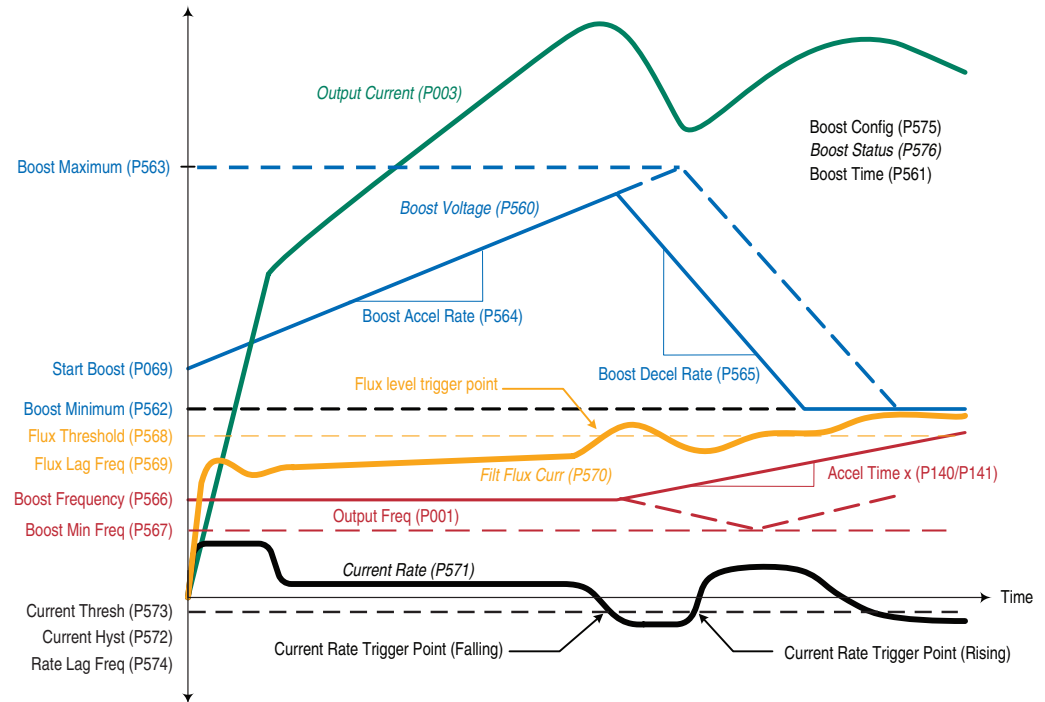
Configuration and Operation

To enable the variable boost voltage function:

1. Set [Motor Cntl Sel], parameter 53 to 2 “Custom V/Hz”
2. Set bit 0 “VB Enable” of parameter 575 [Boost Config] to “1”

Bit 0 “VB Enabled” of parameter 576 [Boost Status] is set to “1” when the above two conditions are met.

Immediately following a valid drive run command, the drive produces the motor voltage specified in [Start Boost], parameter 69 at the frequency specified in [Boost Frequency], parameter 566. The actual motor boost voltage can be viewed in [Boost Voltage], parameter 560. Parameter 23 [Speed Reference], regardless of the speed reference source, and parameter 2 [Commanded Speed], regardless of the linear ramp and S-curve settings, are held at the value of [Boost Frequency]. The boost voltage (in [Boost Voltage]) ramps up at the value specified in [Start Boost], parameter 69 at the rate set in [Boost Accel Rate], parameter 564 (in volts per second).



This occurs until the value of [Boost Maximum], parameter 563 is reached or one of the variable boost voltage trigger events occurs and bit 2 “Triggered” of [Boost Status], parameter 576 is set to “1” (true). When the maximum boost voltage value is reached or a trigger event occurs, [Boost Voltage] ramps down at the value specified in [Boost Decel Rate], parameter 565 (in volts per second) to the voltage value set in [Boost Minimum], parameter 562. Whenever the drive is stopped, the value of [Boost Voltage] is reset to the value of [Start Boost]. Coincident with a voltage trigger event, the commanded speed of the drive ramps according to the linear ramp and S-curve settings. Typically, the selected speed reference will be greater than the value set in [Boost Frequency], but is not required.

Boost voltage trigger event sources are individually enabled via bits in [Boost Config], parameter 575 with a corresponding status bit displayed in [Boost Status]. The boost voltage trigger events are derived from the following sources:

- The level of [Filt Flux Curr], parameter 570
- The slope and level of [Current Rate], parameter 571
- The level of [Output Freq], parameter 1
- The level of [Boost Voltage], parameter 560 (always enabled)

[Current Rate], Parameter 571 is the derivative of the value of [Output Current], parameter 3 passed through a first order low-pass filter with a cutoff frequency equal to the value of [Rate Lag Freq], parameter 574. The trigger event associated with this value is enabled by setting bit 1 “Current Rate” in [Boost Config]. The trigger condition is defined by the level of [Current Thresh], parameter 573 with a hysteresis band equal to the value of [Current Hyst], parameter 572. In addition, the slope of [Current Rate] is set to either rising or falling via bit 2 “Rising Edge” in [Boost Config].

If these trigger conditions are met, bit 3 “Current Trig” in [Boost Status] is set to “1” (true).

[Filt Flux Curr], Parameter 570 is the drive calculated value of the unfiltered motor flux current passed through a first order low-pass filter with the cutoff frequency equal to the value specified in [Flux Lag Freq], parameter 569. The trigger event associated with this value is enabled by setting bit 3 “Flux Level” in [Boost Config]. The trigger condition is defined by the level of [Flux Threshold], parameter 568. If [Filt Flux Curr] is greater than or equal to the value of [Flux Threshold] then bit 4 “Flux Trigger” in [Boost Status] is set to “1” (true).

The third trigger source is derived from the value of [Output Freq], parameter 1 and is enabled via bit 4 “Minimum Freq” in [Boost Config]. If the value of [Output Freq] is less than or equal to the value of [Boost Min Freq], parameter 567 then bit 5 “Freq Trigger” of [Boost Status] is set to “1” (true).

If the boost voltage (set in [Boost Voltage]) reaches the value of [Boost Maximum], parameter 563 before any of the other trigger events cause the boost voltage to ramp down, then bit 6 “Max Boost” in [Boost Status] is set to “1” (true) and the boost voltage ramps down at the rate specified in [Boost Decel Rate], parameter 565 (in volts per second) to the value set in [Boost Minimum], parameter 562. This trigger condition is always enabled and therefore has no corresponding bit in [Boost Config] and is not constrained by the time set in [Boost Time], parameter 561.

If any of the preceding trigger conditions are met and bit 0 “VB Enable” in [Boost Status] is set to “1” (true), then bit 2 “Triggered” in [Boost Status] is set to “1” (true). This bit and the trigger status bits are cleared (set to false) at the moment the drive starts. You may clear the individual trigger status bits at any time by toggling the corresponding enable bit in [Boost Config]. All trigger status bits are cleared if bit 0 “VB Enable” in [Boost Config] is cleared (set to “0”).

Following a valid drive run command, the trigger sources, with the exception of the “Max Boost” trigger (based on the value of [Boost Maximum]), are not enabled until the amount of time specified in [Boost Time], parameter 561 has expired. When the value of [Boost Voltage] reaches the value of [Boost Maximum], the boost voltage begins ramping down and the output frequency is released from the value set in [Boost Frequency], regardless of [Boost Time].

New Parameters

The following parameters are added for this firmware version and support the Variable Boost Voltage function:

File	Group	No.	Parameter Name & Description	Values		Related
APPLICATIONS	Boost Config	560	<p>[Boost Voltage]</p> <p>Displays the output value of the voltage-axis intercept of the V/Hz curve. When the variable boost function is enabled the value of [Boost Voltage] is ramped up/down according to the settings of the variable boost function when the drive is running.</p> <p>[Boost Voltage] is equal to parameter 69 [Start Boost] when the drive is stopped or when bit 0 "VB Enable", of parameter 575 [Boost Config], is set to "0".</p>	Default:	Read Only	
				Min/Max:	0.0/Drive Rated Volts	
				Units:	0.1 VAC	
		561	<p>[Boost Time]</p> <p>Sets the time delay for which the variable voltage boost trigger becomes active following a drive start.</p> <p>The [Boost Time] begins counting down when the drive enters the run state. Valid trigger conditions may only be met in the time following the expiration of the [Boost Time] to cause a trigger event. This time delay does not affect the trigger condition associated with parameter 563 [Boost Maximum].</p>	Default:	1.0 Secs	
				Min/Max:	0.0/100.0 Secs	
				Units:	0.1 Secs	
		562	<p>[Boost Minimum]</p> <p>Sets the minimum voltage boost level for the variable boost voltage function.</p> <p>If parameter 560 [Boost Voltage] reaches the value of parameter 563 [Boost Maximum] or one of the variable boost voltage trigger events occurs, then [Boost Voltage] decelerates at the rate corresponding to the value set in parameter 565 [Boost Decel Rate].</p>	Default:	Based on Drive Rating	
		Min/Max:	0.0/563 [Boost Maximum]			
		Units:	0.1 VAC			
563	<p>[Boost Maximum]</p> <p>Sets the maximum voltage boost level for the variable boost voltage function.</p> <p>If parameter 560 [Boost Voltage] reaches the value of [Boost Maximum] then [Boost Voltage] decelerates at the rate corresponding to the value of parameter 565 [Boost Decel Rate].</p>	Default:	Based on Drive Rating			
		Min/Max:	69 [Start Boost] / 71 [Break Voltage]			
		Units:	0.1 VAC			
564	<p>[Boost Accel Rate]</p> <p>Sets the rate of acceleration of parameter 560 [Boost Voltage] for the variable boost voltage function.</p>	Default:	0.75 V/s			
		Min/Max:	0.01/327.67 V/s			
		Units:	0.01 V/s			
565	<p>[Boost Decel Rate]</p> <p>Sets the rate of deceleration of parameter 560 [Boost Voltage] for the variable boost voltage function following a trigger event.</p>	Default:	6.00 V/s			
		Min/Max:	0.01/327.67 V/s			
		Units:	0.01 V/s			
566	<p>[Boost Frequency]</p> <p>Sets the initial frequency reference for the variable boost voltage function.</p>	Default:	0.8 Hz			
		Min/Max:	0.5/10.0 Hz			
		Units:	0.1 Hz			

APPLICATIONS Boost Config	567	[Boost Min Freq] Sets the frequency reference trigger level for the variable boost voltage function. Bit 5 "Freq Trigger" of parameter 576 [Boost Status] is set to 1 when the value of parameter 1 [Output Freq] falls below [Boost Min Freq]. To enable this threshold and trigger event set bits 0 "VB Enable" and 4 "Minimum Freq" in parameter 576 [Boost Config] to "1".	Default: 0.5 Hz Min/Max: 1.0/10.0 Hz Units: 0.1 Hz	
	568	[Flux Threshold] Sets the flux current trigger level for the variable boost voltage function. Bit 4 "Flux Trigger" of parameter 576 [Boost Status] is set to "1" when the value of parameter 570 [Filt Flux Curr] exceeds the value of this parameter. To enable this threshold and trigger event set the bits 0 "VB Enable" and 3 "Flux Level" in parameter 576 [Boost Config] to "1".	Default: 50% Drive Rated Amps Min/Max: 0.0/690.0 Units: 0.1 Amps	
	569	[Flux Lag Freq] Sets the lag (cutoff) frequency of the parameter 5 [Flux Current] low pass filter. The output of this filter is displayed in parameter 570 [Filt Flux Curr].	Default: 0.60 Rads/Sec. Min/Max: 0.01/100.00 Rads/Sec. Units: 0.01 Rads/Sec.	
	570	[Filt Flux Curr] Filtered value of parameter 5 [Flux Current]. Parameter 569 [Flux Lag Freq] sets the cutoff frequency of the low-pass filter.	Default: Read Only Min/Max: 0.0 / 3276.7 Units: 0.1 Amps	
	571	[Current Rate] Output current rate of change.	Default: Read Only Min/Max: -/+1000.0 Amps/Sec. Units: 0.1 Amps/Sec.	
	572	[Current Hyst] Sets the hysteresis level around parameter 573 [Current Thresh] for the variable boost voltage function.	Default: 0.0 Amps/Sec. Min/Max: -/+100.0 Amps/Sec. Units: 0.1 Amps/Sec.	
	573	[Current Thresh] Sets the trigger level of parameter 571 [Current Rate] for the variable boost voltage function. The trigger is not active until the time specified in parameter 561 [Boost Time] time has expired following a drive start. <ul style="list-style-type: none"> When bit 2 "Rising Edge" of parameter 575 [Boost Config] = "0", the value of parameter 571 [Current Rate] must first fall below the value of [Current Thresh] + [Current Hyst], then fall below the value of [Current Thresh] in order to cause a boost voltage trigger event. When bit 2 "Rising Edge" of parameter 575 [Boost Config] = "1", the value of [Current Rate] must first rise above the value of [Current Thresh] - [Current Hyst], then rise above the value of [Current Thresh] in order to cause a boost voltage trigger event. 	Default: -25.0 A/s Min/Max: -/+1000.0 Amps/Sec. Units: 0.1 Amps/Sec.	

MOTOR CONTROL	Motor Data	050	<p>v6 [Motor OL Mode]</p> <p>Provides the ability to preserve the [Motor OL Count] value through a power cycle or drive reset.</p> <p style="font-size: small;">Bit #</p> <p style="font-size: x-small;">Factory Default Bit Values</p>
	<p>Option Descriptions</p> <p>Pwr Cyc Ret If bit 0 is set to “0” (Disabled) the value of [Motor OL Count], parameter 220 is reset to zero by a drive reset or power cycle. A “1” (Enabled) will maintain the value. A transition from “1” to “0” resets [Motor OL Count] to zero.</p>		

Disable Synchronous PWM

At high output frequencies (if [Motor Cntl Sel] is NOT set to “4, FVC Vector”) the PWM frequency is varied to keep it a multiple of the output frequency (synchronous PWM):

$$\text{PWM Frequency} = \text{PWM Ratio} \times \text{Output Frequency}$$

$$\text{PWM Ratio} = 27, 24, 21, 18, 15, 12, 9, \text{ or } 6$$

A bit has been added to [Compensation], parameter 56 to optionally disable synchronous PWM.

MOTOR CONTROL	Torq Attributes	056	<p>[Compensation]</p> <p>Enables/disables correction options.</p> <p style="font-size: small;">Bit #</p> <p style="font-size: x-small;">Factory Default Bit Values</p> <p style="font-size: x-small;">(1) For current limit (except FVC Vector mode). (2) Firmware 6.001 and later..</p>
	<p>Option Descriptions</p> <p>Reflect Wave Disables reflected wave overvoltage protection for long cable lengths. (typically enabled).</p> <p>Enable Jerk In non-FVC Vector modes, disabling jerk removes a short S-curve at the start of the accel/decel ramp.</p> <p>Ixo AutoCalc Not functional – reserved for future enhancements.</p> <p>Xsistor Diag “0” disables power transistor power diagnostic tests which run at each start command. “1” enables transistor diagnostic tests.</p> <p>Rs Adapt FVC w/Encoder Only - Disabling may improve torque regulation at lower speeds (typically not needed).</p> <p>Mtr Lead Rev Reverses the phase rotation of the applied voltage, effectively reversing the motor leads. Note: This bit is reset to “0” when parameters are reset to factory defaults.</p> <p>PWM Freq Lock Keeps the PWM frequency from decreasing to 2 kHz at low operating frequencies in FVC Vector mode without encoder.</p> <p>NoSyncPWM Disables synchronous PWM.</p>		

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