



# PowerFlex<sup>®</sup> 700S Drives with Phase II Control (4.001)

These release notes correspond to major revision (4), minor revision (1) of firmware for PowerFlex<sup>®</sup> 700S drives with Phase II control.

## Introduction

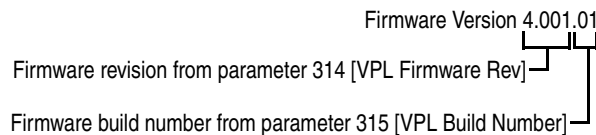
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## Determining Firmware Revision Level

To determine the firmware version for a PowerFlex 700S drive, view parameters 314 [VPL Firmware Rev] and 315 [VPL Build Number]. The firmware version is the combination of the data in these parameters.

Example:



## Firmware Upgrades

This section describes procedures for upgrading your firmware:

When updating firmware version 1.xx to version 2.xx or higher, boot code v1.06 must be flashed into the drive. Use the following procedure to upgrade the boot code along with the application code:

Upgrading from version 1.12 (or before 2.xx release)

1. Flash 700S2bt01\_06.bin using 1203-SSS Series B and HyperTerminal.
2. Cycle the power (automatically).
3. HIM displays "No System Application..." error message - ignore this error.
4. Flash 700S2ap04\_001.bin using 1203-SSS Series B and HyperTerminal.
5. Cycle the power (automatically).
6. HIM displays as normal.

If upgrading firmware version after version 2.xx (i.e., v2.03), upgrading the application firmware only is required.

## Enhancements

This section describes the enhancements included in this revision:

### Added Electronic Gear Ratio User Function in Task 1

The new Electronic Gear Ratio user function was added to task 1 to work in conjunction with the new Virtual Master Interface for the Heidenhain Feedback option card.

The following parameters were added/updated to support this function:

- 1161 [EGR Config]
- 1162 [EGR Mul]
- 1163 [EGR Div]
- 1164 [EGR Pos Input]
- 1165 [EGR Pos Output]
- 1166 [EGR Pos Preset]

These new parameters have been added to the new "Electronic Gear Ratio" group in the "User Functions" file under the Parameter > "FGP" selection in the HIM's main menu and in the device pane of the DriveExecutive™ software.

- Added bit 7 "EGR" to parameter 1000 [UserFunct Enable] in order to enable the new Electronic Gear Ratio user function.

### Added “Find Home” and “Return Home” Selection to Digital Inputs

The Digital Inputs (parameters 825, 826, 827, 828, 829 and 830) can now be assigned values 41 “Find Home” and 42 “Return Home” for use with the “Homing” function.

The following parameters were updated to support this function:

- Added values 41 “Find Home” and 42 “Return Home” to parameters 825 [Dig In1 Sel], 826 [Dig In2 Sel], 827 [Dig In3 Sel], 828 [Dig In4 Sel], 829 [Dig In5 Sel], and 830 [Dig In6 Sel]
- Deleted value 39 “Home Switch” from parameters 827 [Dig In3 Sel], 828 [Dig In4 Sel], 829 [Dig In5 Sel], and 830 [Dig In6 Sel]

### Added Flux Producing Current (Ids) Test for Field Oriented Control (FOC) Encoder Mode

A new flux producing (d-axis) current (Ids) test for the FOC encoder mode has been added to this firmware revision. This test is run at drive start-up as part of the inertia test and establishes the initial flux current level for the motor. After the drive is running, the flux current level is determined by the Vqs regulator. The Ids test is disabled by default (parameter 153 [Control Options], bit 31 “Ids Test En” set to “0”), but can be run at any time by setting bit 31 “Ids Test En” to “1”. When the Ids test is enabled, the motor will accelerate twice during the inertia test.

This new test defines the slope for the amount of compensation for the Ids command when the Vqs regulator is off. The point on the compensation curve used for the Ids value is a function of the motoring and/or regenerative load. This test should be used if torque accuracy at low speeds, with Vqs regulator off, is necessary for the application.

The following parameters were added/updated to support this function:

- Added bit 31 “Ids Test En” to parameter 153 [Control Options]
- Added test point selections 55 “ids Motoring”, 56 “IqsRef Motor”, 57 “Ids Regen”, 58 “IqsRef Regen”, and 59 “Ids Test Counter” to parameter 161 [Logic TP Sel]
- Added parameter 459 [IdsCompCoeff Mot]
- Added parameter 460 [IdsCompCoeff Reg]
- Added parameter 461 [SlipReg Off Iqs]
- Added parameter 462 [VqsReg Off Freq]
- Changed the following values of parameter 466 [MC TP1 Select]: 95 “FieldInitTm” to “IdsCompMon” and value 105 “FluxIdsFfFlt” to “IdsCmdFilter”
- Added bit 7 “Ids Comp En” to parameter 510 [FVC Mode Config]
- Added parameter 586 [IdsCmd Slew Rate]

### **Added Stator Resistance (Rs) Temperature Compensation**

Added the Stator Resistance (Rs) Temperature Compensation feature. This feature changes the Rs value based on the Slip Regulator output. Generally this feature is not used. However, when torque accuracy is required on low horse power applications this feature can be used to compensate for stator resistance temperature, improving accuracy.

The following parameters were added/updated to support this function:

- Added test point selections 53 “Rs Temp Coef” to parameter 357 [Curr Ref TP Sel]
- Added bit 12 “SlipRsCompEn” to parameter 510 [FVC Mode Config]
- Added parameter 590 [RsTempCoefAdjust]
- Added parameter 591 [RsTmpCoefAdjstEn]

### **Added Selection 11 “SL Buff Rx10” to Parameter 701 [FdbkAxis FdbkSel]**

This selection makes the Feedback Axis available via buffer word 10 for SynchLink.

The following parameters were updated to support this function:

- Added value 11 “SL Buff Rx10” to parameter 701 [FdbkAxis FdbkSel]

### **Added Support for New Parameter Descriptor Bit**

The new descriptor bit allows either DriveExplorer™ or the HIM to download parameter values to the drive when they are different than the default values for the parameter.

## Added Support for Parameter Offline Defaults

The parameters listed below will always be set to the drive-rated values when working off-line with DriveTools SP™ or DriveExplorer:

- 1 [Motor NP Volts]
- 2 [Motor NP FLA]
- 3 [Motor NP Hz]
- 4 [Motor NP RPM]
- 5 [Motor NP Power]
- 6 [Mtr NP Pwr Units]
- 169 [SrLss ZeroSpdLim]
- 400 [Rated Amps]
- 401 [Rated Volts]
- 402 [PWM Frequency]
- 403 [Voltage Class]
- 404 [Dead Time]
- 486 [Rated Slip Freq]
- 488 [Flux Current]
- 491 [StatorResistance]
- 531 [Maximum Voltage]
- 532 [Maximum Freq]
- 551 [CurrFdbk AdjTime]

## Added Torque Performance Improvements

The following changes were made to the torque loop to improve torque performance. The new operating range of the Flux Producing Voltage ( $V_{qs}$ ) regulator ranges from 17% of base speed through the complete field range. The torque current reference (parameter 350 [Iq Actual Ref]) is calculated to produce the commanded torque (parameter 303 [Motor Torque Ref]) based on the induction motor torque equation, which is a function of the estimated Stator Flux ( $\lambda_{ds}$ ,  $\lambda_{qs}$ ) and Flux Current ( $I_{ds}$ ). The  $V_{qs}$  regulator compensates for errors in the slip regulator ( $V_{ds}$ ) by adjusting  $I_{ds}$ , thus, providing more accurate steady state torque performance than previous versions of firmware. Note that errors in the  $V_{ds}$  regulator play a larger roll in steady state torque performance in higher rated horsepower machines. In previous firmware releases the  $V_{qs}$  regulator was only active in the field range. Additionally, the extended range eliminates any torque perturbation when the  $V_{qs}$  regulator turns on or off at the point of base speed. Parameters 459 [IdsCompCoeff Mot] and 460 [IdsCompCoeff Reg] have been added to scale the flux current level (output of the  $V_{qs}$  Reg.), when the  $V_{qs}$  regulator is not active. Parameter 459 sets the flux current level as a function of Torque Producing Current ( $I_q$ ) for motoring operation and parameter 460 sets the flux current level as a function of  $I_q$  for regenerative operation. The default value for parameters 459 and 460 is zero. Parameters 459 and 460 are field adjustments and are set during the commissioning process. The on and off levels of the  $V_{qs}$  regulator is a function of speed only with hysteresis (2%). The turn off level is set by parameter 462 [VqsReg Off Freq] and is defaulted to 15%. Thus, the turn on level is at 17% of base speed. The  $V_{ds}$  turn on is a function of both speed and load.

The Vds turn off speed is also set by parameter 462. The Vds torque, or load, turn off point is set by parameter 461 [SlipReg Off Iqs]. The default turn off point is 25% of rated load and is determined by the following equation: Turn Off Point =  $(5 + P461/10)$ . The turn on point is 5% above the turn off load point, Turn Off Point =  $10 + P461/10$ . If the default value for parameter 461 is used, the turn on point is 30% of load. Slew rate limits can be used to soften the transition to the active regulators. Parameter 533 [SlewRateTimeLimt] is used to limit the time for the slew rate operation for both the Vds and Vqs regulators. Parameter 553 [Slip Slew Rate] is used to set the slew rate for the Vds.

The following parameters were added/updated to support this function:

- Updated parameter 360 [Min Flux]
- Added parameter 459 [IdsCompCoeff Mot]
- Added parameter 460 [IdsCompCoeff Reg]
- Added parameter 461 [SlipReg Off Iqs]
- Added parameter 462 [VqsReg Off Freq]
- Renamed and updated parameter 533 [SlewRateTimeLimt]
- Updated parameter 553 [Slip Slew Rate]

### **Added Virtual Encoder Fast Position Output (Task 1)**

This function works in conjunction with the Virtual Master Interface for the Heidenhain option card and provides an accurate interpolation of position data at the Task 1 rate.

The following parameter was added to support this function:

- 1160 [VirtEncPositFast]

### **Added Virtual Master Interface to Heidenhain Option Card**

This feature provides speed reference data to the Heidenhain Feedback option card which is used to generate a simulated digital encoder output signal proportional to the speed reference.

The following parameters were added/updated to support this function:

- Added bit 7 “VM Direction” to parameter 263 [Heidenhain0 Cnfg]
- Added bits 0 “VM Enc Out” and 1 “Emul Enc Out” to parameter 264 [Heidenhain0 Stat]
- Added bit 6 “VrtlMasterEn” to parameter 266 [Heidn Encdr Type]
- Changed the minimum value of parameter 267 [Heidn Encdr PPR] to “1”
- Added parameter 1155 [Heidn VM Pos Ref]
- Added parameter 1156 [Heidn VM Enc PPR]

### **Changed the Homing “Home Position” to be a User Configured Value**

You can now set the actual home position in parameter 1124 [Home Actual Pos] after the Homing sequence is complete.

The following parameters were added/updated to support this function:

- Added parameter 1124 [Home Actual Pos]

### **Changed the Homing Sequence to Start with Rising Edge of the “Find Home” Bit**

The Homing Sequence now starts with the rising edge of bit 24 “Find Home” of parameter 740 [Position Control].

The following parameter was updated to support this function:

- Changed the default value of parameter 1122 [Home Speed] from 0.000 to 0.005 P.U.

### **Changed the Sync Generator I/O Parameters to be Linkable to Both Real and Integer Values**

Updated the following Sync Generator parameters to be an unsigned integer and linkable to a parameter that is a real or integer value:

- 788 [Xsync In 1]
- 789 [Xsync Out 1]
- 790 [Xsync In 2]
- 791 [Xsync Out 2]
- 792 [Xsync Out 2 Dly]
- 793 [Xsync In 3]
- 794 [Xsync Out 3]
- 795 [Xsync Out 3 Dly]

### **Enhanced the External Dynamic Brake Function to use External Dynamic Brake Resistance**

The feature allows you to set the resistance value of an external dynamic braking resistor. This value is then used to determine the power applied to the resistor and thus calculate its temperature.

The following parameters were added/updated to support this function:

- Added parameter 544 [External DB Res]

### **Enhanced Slip Tuning for Large Inertia**

This feature prevents motors with large inertia values from rotating in the reverse direction when the inertia test of the autotune feature has completed.

### **Updated the Firmware Revision Number of VPL and MC to x.xxx Format**

The Velocity Position Loop (VPL) and Motor Control (MC) firmware revision number for the PowerFlex 700S Phase II drive has been updated to the x.xxx format to be consistent with other PowerFlex drives.

The following parameters were updated to support this function:

- Parameter 314 [VPL Firmware Rev]
- Parameter 457 [MC Firmware Rev]

### **Miscellaneous Database Changes**

- The following database changes were made for this firmware revision:
- Deleted parameter 88 [Speed Reg Filter Selection] (was never functional)
- Added bit 20 “High Bus Volt” to parameter 156 [Start Inhibits]
- Deleted bit 5 “Fast Braking” and 6 “DC Braking” from parameter 414 [Brake/Bus Config]
- Changed parameter 1136 [PPMP Rev Spd Lim] default value from -0.1 to -0.5 and to be linkable
- Changed parameter 1137 [PPMP Fwd Spd Lim] default value from 0.1 to 0.5 and to be linkable
- Changed parameter 1138 [PPMP Over Ride] default value from 1.01 to 1.0, the min. value from 1.0 to 0.0, units from RPM to “None” and to be linkable
- Deleted bit 9 “MP ErrorSum1” from parameter 1145 [PPMP TP Select]

### **Corrected Anomalies**

This section describes the anomalies corrected in this revision:

#### **“Block Write Error” During DriveExplorer Parameter Down Load**

When using DriveExplorer to down load parameters from DriveExecutive to a PowerFlex 700S drive, a “Block Write Error” communication error would occur. This was an intermittent anomaly.

For example: The parameters from a PowerFlex 700S drive were uploaded to DriveExecutive where they were restored to factory defaults. Down loading the parameters from DriveExecutive via DriveExplorer to the PowerFlex 700S drive resulted in the “Block Write Error” communication error.

### **Minimum and Maximum Speed Reference Values Limited**

Parameter 30 [Min Spd Ref Lim] did not allow positive values and parameter 31 [Max Spd Ref Lim] did not allow negative values.

### **SynchLink Communication Selection 1A 3D 14B Now Shows all Buffered Data**

In the previous version of firmware, the lower set of buffer words were hidden. All buffered words are now visible.

### **Parameter 696 [Motn PositErrTol] is Hidden When in Position Control Mode**

In the previous version of firmware, the position error tolerance for the Motion Servo Axis was hidden. The position error tolerance is now visible in all position modes.

### **Indicate Security Aware Drive (Support Extended Product Option Bits)**

A new class message has been added; class 1, instance 0, attribute 29. A security aware device exists when bit 0 of this message is set.

## **Known Anomalies**

This firmware revision contains the following known anomalies:

### **DriveTools SP Alarm Message when Connecting to PowerFlex 700S Phase II Drive with DriveLogix**

The following alarm message displays in DriveTools SP v4.01 and earlier when connecting to a PowerFlex 700S Phase II drive with DriveLogix via the Ethernet:

"The peripheral device port number (0) is invalid. Valid port number range from 1 to 7."

### **“MC Firmware” Fault (F30) Occurs when Downloading Parameters from HIM after Flash Upgrade to Firmware v3.01 and Higher**

At drive start up, an “MC Firmware” (F30) fault will occur for drive frame sizes 9-13 if the following conditions are met:

- You have flash upgraded to firmware v3.01 or higher,
- You have downloaded parameters to the drive from an earlier firmware version via the HIM, and
- Parameter 551 [CurrFdbk AdjTime] is set to a value less than 5

In this case, parameter 551 must be set to the correct value. The correct values are:

- Frame 9, set P551 to 5
- Frame 10, set P551 to 33
- Frame 11, set P551 to 34
- Frame 12, set P551 to 33
- Frame 13, set P551 to 40
- Frames 1-6, P551 should be set to 0

With firmware version 3.01 or higher, the drive will automatically set the correct value for the drive. This is completed at power up, provided the value was not changed manually.

### **Parameter 554 [LED Status] Not Functioning Properly**

Parameter 554 [LED Status], bit 15 “DL ComActive”, does not work.

### **Save to EEPROM via HIM on High Horsepower Drives**

Initiating a save to EEPROM via the HIM can possibly cause High Horsepower drives to experience a Fault 71 “HiHp Drv Ovrload” if the save function is initiated while the motor is turning.

### **SynchLink Does Not Reset Properly when “SL Reset” Bit is Set**

Setting bit 3 “SL Reset” of parameter 904 [SL Node Cnfg] in PowerFlex 700S Phase II drives does not appear to reset SynchLink properly for DriveLogix Motion control. A power cycle is required to reset SynchLink so that the CST master is set and DriveLogix Motion control works or to reset the Timekeeper.

### **Trend Functions May Cause Drive to Stop Running**

When using the trend functions, a PowerFlex 700S drive may stop running. The power to the drive must be cycled in order to correct this condition. If the DriveLogix option is present the 5730 controller may lose its program.

## Restrictions

The following restrictions apply to this revision of firmware:

### **Clearing the “Find Home” Bit in Parameter 741 [Position Status]**

If bit 24 “Find Home” in parameter 740 [Position Control] is set, bit 15 “Homed” in parameter 741 [Position Status] remains set until a start command is issued.

### **Current Draw Down with Multi-Motor Drive Operation**

When using a PowerFlex 700S drive to run multiple motors, the drive must be sized in order to provide the total current required to run the connected motors plus the current required to line start any disconnected motors. If the drive’s total current rating is not capable of providing the total current described above, the motor speed may slow, possibly to zero, and re-accelerate the motors back to the set speed when line starting a disconnected motor.

### **DC Bus Overvoltage Fault (Fault 24) for High Horsepower Drives**

A DC Bus overvoltage fault may occur for high horsepower drives when executing a flying start within 2 seconds of a commanded stop with no or light loads.

### **Homing to a Switch and Then to a Marker Not Functional with DriveLogix**

When using the Homing function with a PowerFlex 700S Phase II drive with DriveLogix, you can either Home to a Switch or Home to a Marker. However, you cannot Home to a Switch and a Marker in the same command.

### **Motion Registration Input Limited to Digital Input 1 or Registration Input 0**

The Registration input to the drive is limited to Digital Input 1 and Registration Input 0. Therefore, the RSLogix MAR (Motion Arm Registration) instruction will not function properly if Registration Input 1 is used.

## **Operating Mode Configuration Parameters Should Not be Changed**

The following parameters should not be changed by a user:

- 510 [FVC Mode Config]
- 511 [FVC2 Mode Config]
- 512 [PMag Mode Config]
- 513 [V/Hz Mode Config]

## **Position Control Bits Not Available for Controller**

The following bits were added to parameters 740 [Position Control] and 741 [Position Status] as part of the Position Control Static Assembly for firmware version 3.01.

- [Position Control]
  - bit 24 "Find Home"
  - bit 25 "Pos Redefine"
  - bit 26 "Home Dir"
  - bit 27 "Return Home"
  - bit 28 "Home Switch"
  - bit 29 "Home Marker"
- [Position Status]
  - bit 13 "Home Required"
  - bit 14 "Homing"
  - bit 15 "Homed"

However, these bits were not added to the Controller side of the Static Assembly. Therefore, the controller cannot connect to these bits when using the Position Control Communication Format via the static assembly. If it is necessary to have a controller connect to these bits, the User Defined or Custom User Defined Communication format or explicit messaging must be used.

## **Speed Limited Adjustable Torque (SLAT) Bits Not Available for Controller**

Bits 7 "SLAT Minimum" and 8 "SLAT Maximum" were added to parameter 110 [Speed/TorqueMode] as part of the Speed Control Static Assembly for firmware version 3.01. However, these bits were not added to the Controller side of the Static Assembly. Therefore, the controller cannot connect to bits 7 and 8 when using the Speed Control Communication Format. If it is necessary to have a controller connect to these bits, the User Defined or Custom User Defined Communication format or explicit messaging must be used.

## Rockwell Automation Support

Rockwell Automation provides technical information on the web to assist you in using our products. At <http://support.rockwellautomation.com>, you can find technical manuals, a knowledge base of FAQs, technical and application notes, sample code and links to software service packs, and a “MySupport” feature that you can customize to make the best use of these tools.

For an additional level of technical phone support for installation, configuration and troubleshooting, we offer TechConnect Support programs. For more information, contact your local distributor or Rockwell Automation representative, or visit <http://support.rockwellautomation.com>.

## Installation Assistance

If you experience a problem with a hardware module within the first 24 hours of installation, please review the information that's contained in this document. You can also contact a special Customer Support number for initial help in getting your module up and running:

United States	1.440.646.3223 Monday – Friday, 8am – 5pm EST
Outside United States	Please contact your local Rockwell Automation representative for any technical support issues.

## New Product Satisfaction Return

Rockwell tests all of our products to ensure that they are fully operational when shipped from the manufacturing facility. However, if your product is not functioning and needs to be returned:

United States	Contact your distributor. You must provide a Customer Support case number (see phone number above to obtain one) to your distributor in order to complete the return process.
Outside United States	Please contact your local Rockwell Automation representative for return procedure.

## Notes:

U.S. Allen-Bradley Drives Technical Support - Tel: (1) 262.512.8176, Fax: (1) 262.512.2222, Email: support@drives.ra.rockwell.com, Online: www.ab.com/support/abdrives

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