



ALLEN-BRADLEY BULLETIN 1336 PLUS Flying Start

APPLICATION NOTE # 113

January 2, 1997

PURPOSE

The purpose of this document is to provide guidelines for applying software features of the Bulletin 1336 PLUS AC Drive. This document is to be used as information only. Users must ensure that installations meet applicable codes and that drive setup and programming are suitable for the application.

WHAT THIS NOTE CONTAINS

This note contains information and explanation of the flying start feature of the 1336 PLUS. The theory of operation and the typical setup are included.

INTENDED AUDIENCE

This application note is intended to be used by personnel familiar with the hardware components and programming procedures necessary to operate the Bulletin 1336 PLUS.

WHERE IT IS USED

The diagrams, parameter settings, and auxiliary hardware used in this application note are designed to address specific issues in many different applications. Some changes by the Users may be necessary to apply the concepts of this document to a specific application.

TERMS AND DEFINITIONS

Flying Start is a feature that allows the 1336 PLUS to determine the speed and direction of a spinning motor and begin the output voltage and frequency at that speed / direction. Without Flying Start, the drive will begin its output (after a Start command) at zero volts / zero hertz and attempt to ramp to the commanded speed. If the inertia or direction of rotation of a load requires the motor to produce a large amount of torque, excess current may result and overcurrent trips may occur on the drive. These problems are eliminated with Flying Start .

DESCRIPTION

Activating Flying Start in the 1336 PLUS requires that the correct parameters be programmed in the drive memory. there are three parameters for Flying Start;

1. Flying Start En
2. FStart Forward
3. FStart Reverse

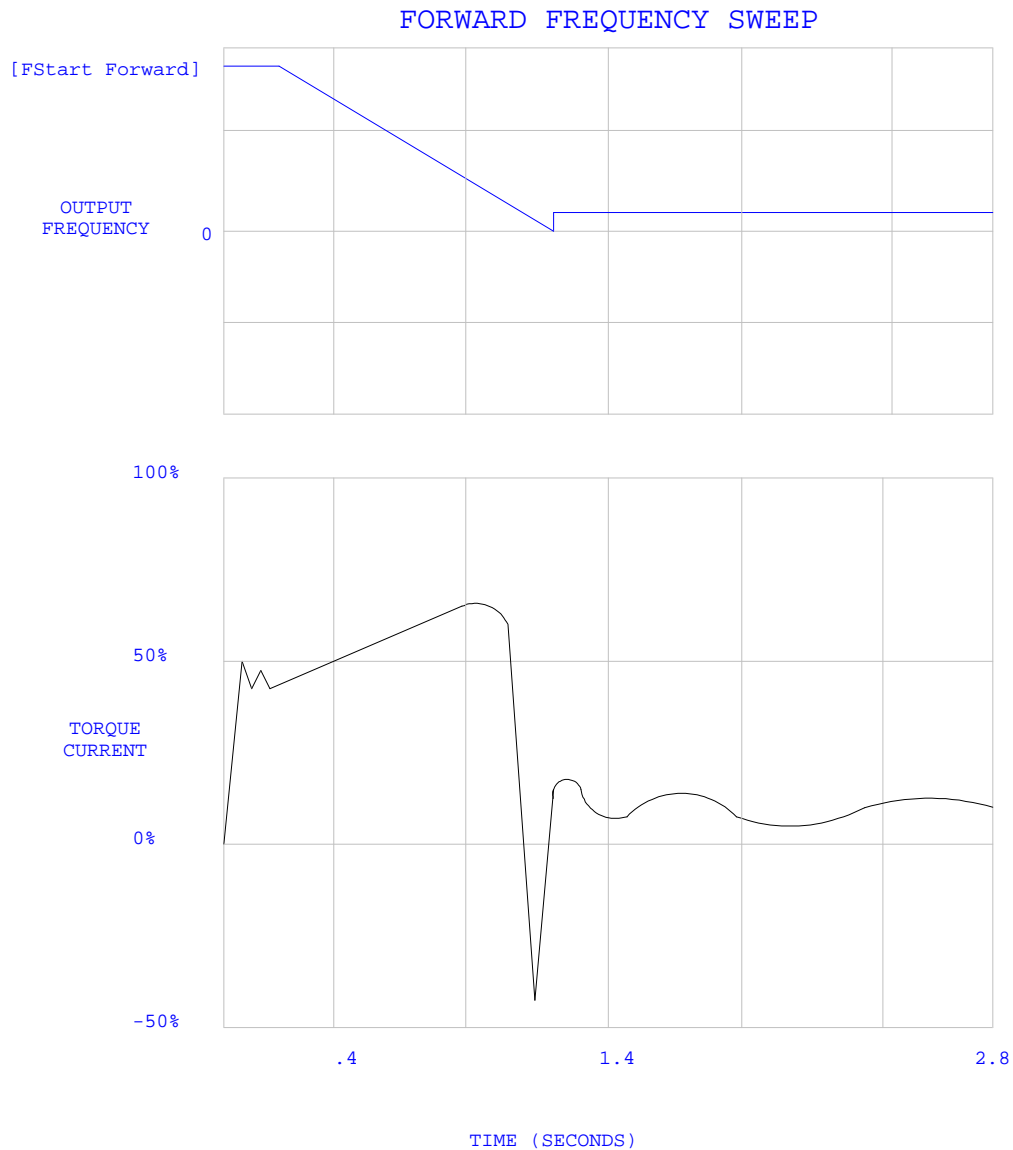
Flying Start En enables the flying start feature in one of two modes; Sweep and Encoder. Flying Start will be active for every start while this parameter is set to a value other than "Disabled".

FStart Forward determines the starting frequency for the search in the Forward when the mode chosen previously is "Sweep"

FStart Reverse determines the starting frequency for the search in the Reverse when the mode chosen previously is "Sweep"

DESCRIPTION (Cont.)**Encoderless**

When "Sweep" is selected as the Flying Start mode, the drive, upon receiving a valid Start command, will produce a voltage of sufficient magnitude to produce approximately 75% of drive rated current in the motor. The frequency of that voltage will initially be the programmed frequency in FStart Forward.



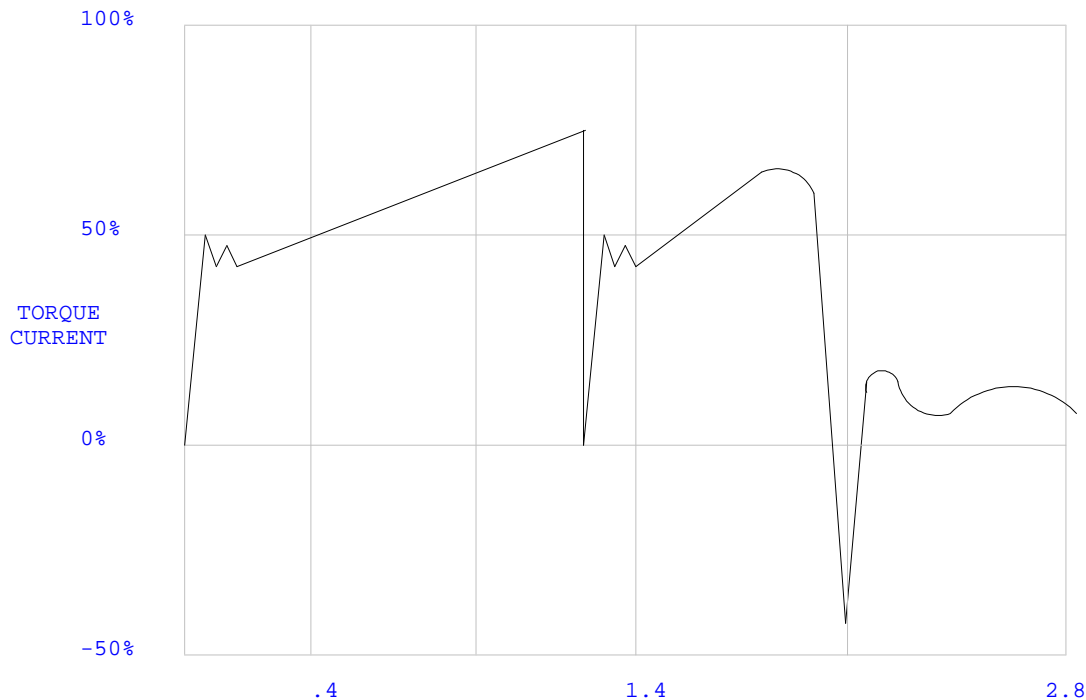
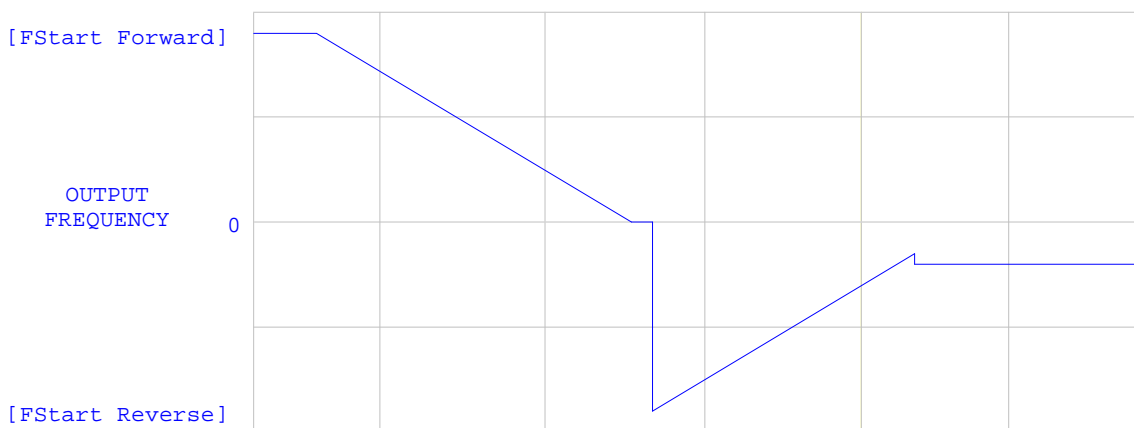
Once current is produced in the motor, the drive will begin to decrease the output frequency and monitor output current. As long as the frequency is higher than the actual motor speed, the current will be

positive. When the drive frequency sweeps through the actual motor speed, the current will immediately reverse direction (regeneration begins). The drive senses the reversal of current and uses the frequency that produced the reversal as the motor actual speed. It then calculates the appropriate voltage, based on the programmed Volts/Hertz Curve, and "starts" its running output at the calculated point. From that point, the drive will follow the programmed accel or decel ramp to the commanded speed.

DESCRIPTION (Cont.)

If the motor is spinning in the reverse direction when the drive receives the Start command, the drive will sweep all the way to zero Hz., but this forward sweep will not locate the motor speed (Motor current will never reverse). If no motor speed is found in the forward direction, the drive will continue its sweep by searching in the reverse direction at the frequency set by FStart Reverse.

FORWARD & REVERSE FREQUENCY SWEEP



Again, current reversal will be the indicator of motor speed. If the motor is found to be rotating in the reverse direction, the drive will begin its output in that direction and then ramp to the commanded speed and direction using the programmed accel / decel ramps.

DESCRIPTION (Cont.)

You can control both the starting point and the direction of the sweep by which parameters you program. If the motor is known to be rotating in only one direction, programming the opposite direction start point to zero (factory default) will decrease the time required to complete the Flying Start.

If the user programs the FStart Forward and Reverse parameters too low, so that the coasting speed of the motor is always higher than the sweep start point, the sweep would always be unsuccessful in locating the motor speed. To avoid this problem, the 1336 PLUS Flying Start feature includes a braking feature that reacts to the above programming.

Upon receiving a Start command, the drive will execute its search according to programmed start points. If no motor speed is recognized, the drive will automatically injection brake the motor by outputting a DC voltage to the motor for Approx. 4 seconds at 75% current. This will develop braking torque in the motor and slow down the coasting speed. After braking the motor, the drive will repeat its sweep to locate motor speed. This 2 step process will repeat itself (Sweep, Brake - Sweep, Brake) until the motor speed is below the programmed sweep start point. The next sweep will then locate spinning speed and the drive will begin its output at that point.

With Encoder

When Flying Start En is set to "Use Encoder", the drive will look for encoder pulses coming back from the encoder on the spinning motor. It uses the programmed scale factor to convert the rate of pulses to a frequency command and enters that into drive logic as the command frequency and calculates the proper voltage based on the programmed Volts / Hertz curve. The drive then begins its output at that frequency.

APPLICATION CONSIDERATIONS

With FStart Forward programmed at 60 Hz., the average time to execute a sweep from 60 To synchronous speed, calculate the correct voltage and turn on drive output is 1.5 - 2.0 Seconds.

Programming the Start points below normal motor rotating speed will increase this time due to the braking needed.

If you select "use encoder" as the Flying Start mode, care must be taken to use a quadrature encoder. If the encoder is not a quadrature type, no indication of spinning direction is possible. When the drive calculates the rotating speed of the motor, it will output the correct Voltage / Frequency in the present drive direction. Should the motor be rotating in the opposite direction, sufficient current could be generated to fault trip the drive on overcurrent. In addition, the torque produced could damage mechanical components of the system.