ALLEN-BRADLEY
BULLETIN 1336 PLUS
SLIP COMPENSATION

APPLICATION NOTE # 1336S-20

June 24, 1997

PURPOSE

The purpose of this document is to provide guidelines for wiring and control schemes for the Bulletin 1336 PLUS AC Drive. This document is to be used as a suggestion only. Users must ensure that installations meet applicable codes and are suitable for the existing conditions.

WHAT THIS NOTE CONTAINS

The Bulletin 1336 PLUS AC Drive can be configured to automatically adjust the output frequency command to compensate for speed changes due to motor loading. This feature utilizes an open loop, current feedback, slip compensation circuit. The [SPEED CONTROL] parameter must be set to SLIP COMP to enable this feature.

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

This feature is used where the motor must run at a relatively constant speed regardless of torque output. 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.

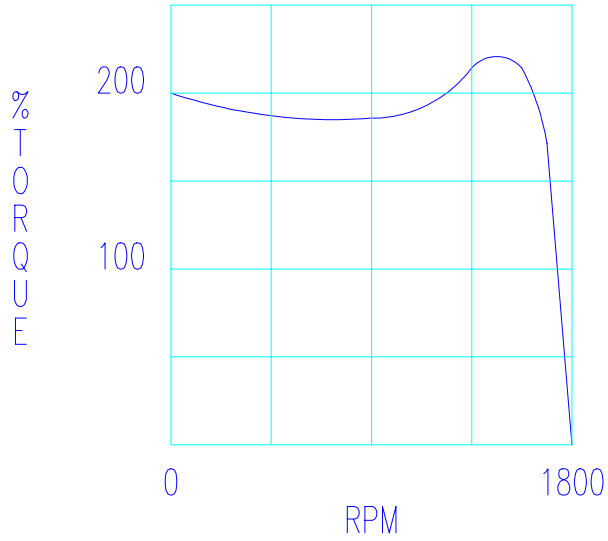
TERMS AND DEFINITIONS

GROUP	Categorized block of parameters with related functions.
ELEMENT	Individual parameters within a given group.
[ ]	Denotes a parameter name

DESCRIPTION

The design of a NEMA B induction motor requires *slip* of the rotor speed (RPM) relative to the stator speed (frequency) to develop torque. A typical 4 pole machine will have a synchronous speed of 1800RPM at 60Hz. The base speed will be roughly 1750RPM at full load and about 1795RPM at no-load. The amount of slip is directly affected by the loading of the machine. Refer to figure 1.

Figure 1



Slip Compensation works as an open loop speed regulator that increases the output frequency of the drive as the load is increased, or decreases the frequency as the load drops. The drive has hardware and software to determine a measured value of torque current. This is the component of the fundamental current that is in phase with the fundamental voltage.

APPLICATION CONSIDERATIONS

The Slip Compensation function is enabled by selecting *Slip Comp* as the speed control method. [Speed Control] is a parameter located in the FEATURE SELECT group. The other parameter in the FEATURE SELECT group that is used to setup the Slip Comp function is [Slip @ F.L.A.]. The value programmed into this parameter is the amount of frequency that will be added to the output at full load. The [Maximum Freq] parameter, located in both the SETUP and ADVANCED SETUP groups, also needs to be increased by the value set in [Slip @ F.L.A.] to allow the drive to maintain the speed regulation at top speeds for a given application.

[Slip Comp Gain] is the parameter used to adjust the response time of the slip compensation circuit.

PARAMETER SETTINGS

GROUP	PARAMETER	SETTING
Setup	**Maximum Freq**	**61.7**
Advanced Setup	**Maximum Freq**	**61.7**
Feature Select	**Speed Control**	**Slip Comp**
Feature Select	**Slip @ F.L.A.**	**1.7**
Feature Select	**Slip Comp Gain**	**1 - 40**

When operating in "Sensorless Vector" control, the motor nameplate information should be programmed during the start-up procedure.

Formula 1

$$\frac{(Motor\ Base\ Speed)}{(Base\ Frequency)} = RPM\ /\ Hz$$

Formula 2

$$(Synchronous\ RPM) - (Base\ Speed\ in\ RPM) = Slip\ RPM$$

Example:

Motor Data HP: 5 Volts/Hz: 460/60 FLA: 6.25 Base Speed: 1750

Drive Data HP: 5 Volts/Hz: 460/60 FLA: 8.7

1. $\frac{(1750)}{(60)} = 29.1666\ RPM\ /\ Hz$

2. $1800 - 1750 = 50\ Slip\ RPM$

3. $\frac{(50)}{(29.1666)} = 1.714\ Slip\ Frequency$

4. $1.7 = [Slip\ @\ F.L.A.]\ Parameter\ Setting$

BAKING LINE

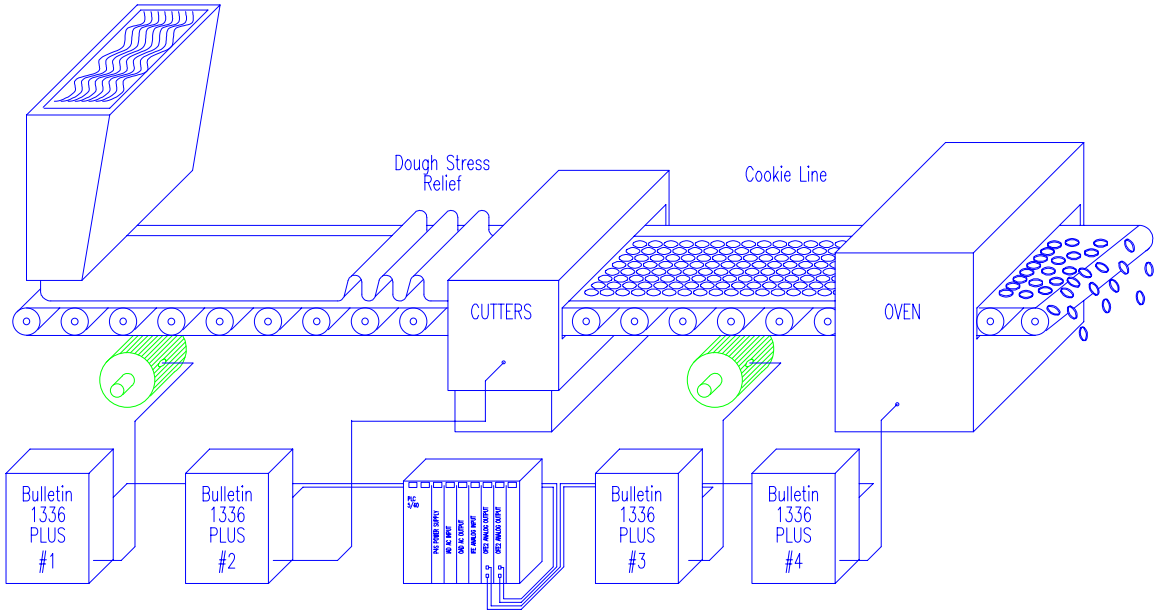


Figure 2

APPLICATION EXAMPLE

Figure 2 shows a typical application for the Slip Compensation feature. The 1771-OFE2 cards control the frequency reference for all four of the 1336 PLUS AC Drives. Drive #1 and Drive #3 control the speed of the belt conveyor. Slip Compensation will be used to maintain the RPM independent of load changes caused by the cutter or dough feed. By maintaining the required RPM, the baking time remains constant and therefore the end product is consistent.

With the Slip Compensation feature, the process will only require a new speed reference when the product is changed. The User will not have to *tune* the drive due to a different load characteristic.