

Application Note - Baldor SynRM² Motor Startup Guidance

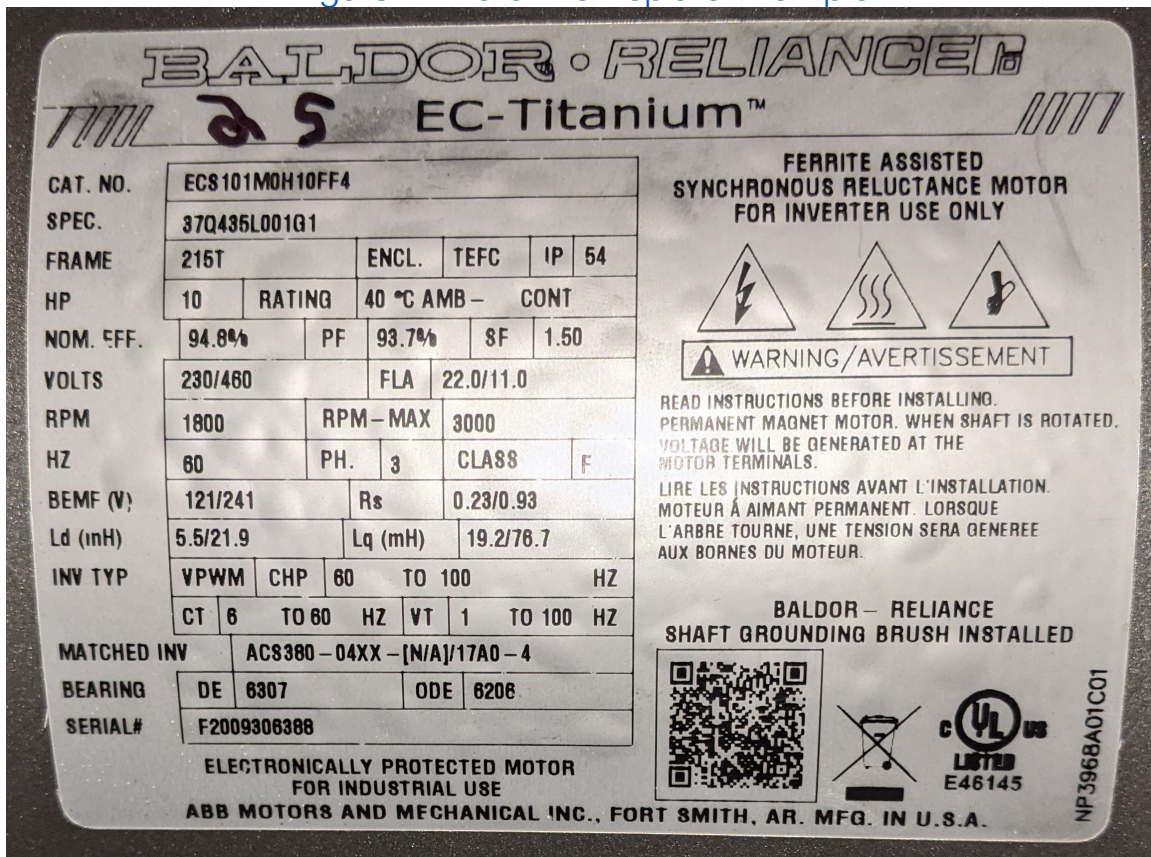
Overview

The purpose of this document is to provide basic guidance regarding how to program a Yaskawa drive to run a Baldor SynRM² motor, which is referred to as a ferrite-assisted synchronous reluctance motor. This document is relative specifically to the Baldor EC-Titanium branded motors.

Applicable Products:

- GA800
- GA500
- HV600
- A1000
- V1000
- Z1000
- U1000

Figure 1: Motor Nameplate Example



A quick glance at the nameplate for one of these motors reveals that it has specifications for Ld, Lq, and BEMF, common specifications normally seen on permanent magnet motor datasheets. Although this is a synchronous reluctance motor, the additional ferrite gives this motor some characteristics similar to that of a permanent magnet motor. Therefore, when setting up a Yaskawa drive to run this motor, start by setting A1-02 to the appropriate PM control method.

Auto-Tuning

It is recommended to run a rotational auto-tune on the motor with the load uncoupled. If it is not possible to uncouple the load, then a stationary auto-tune may suffice. If the auto-tune is not successful or the drive is not equipped for auto-tuning a PM motor (V1000, Z1000), then the user must program the E5 settings in the drive manually. The motor nameplate will have the values required for the E5 motor settings in the drive. If the motor is mounted in a place such that viewing the nameplate is difficult or impossible, a datasheet provided by Baldor will be necessary.

Programming the Motor Settings Manually

Below is a Baldor datasheet for a SynRM² motor. All of the values that are shown in the datasheet have units that match our drive settings except for resistance. The datasheet shows 3.30 ohms (460V motor winding) which is in units of phase-to-phase. The drive's units for E5-05 are in ohms-per-phase. To convert phase-to-phase to per-phase, simply divide 3.30 ohms by 2. In this example, the correct setting for E5-05 is 1.65 ohms. Not all of the other motor specifications need to be converted. Ld and Lq are already in mH/phase, and the BEMF is already in units of line-line Vrms/kRPM.

Figure 2: Baldor Datasheet for SynRM² Motor

Nameplate									
CAT.NO.	ECS101M0H5EF4								
SPEC.	36T257L051G1								
FRAME	184T			ENCL.	TEFC		IP	54	
HP	5	40	C AMB				CONT		
NOM. EFF.	93.7%		PF	97.3%		SF	1.50		
VOLTS	230/460			FLA	10.5/5.3				
RPM	1800			RPM-MAX	4000				
HZ	60			PH.	3		CLASS	F	
BEMF (V)	126/252			RS (OHMS)	0.82/3.30				
LD (MH)	13.5/54.0			LQ (MH)	47.8/191.0				
VPWM	CHP	60	TO	133					
CT	6	TO	60	VT	1		TO	60	
MATCHED INV	ACS380-04XX-[N/A]/07A2-4								
DE	6206			ODE	6205				
SERIAL #									

The following is the minimum programming required before running the motor using the datasheet (460V winding) in an Open Loop Vector application:

A1-02 = 5

E1-04 = 60 Hz

E1-05 = 460 V

E1-06 = 60 Hz

E5-01 = FFFF

E5-02 = 3.73 kW (5HP)

E5-03 = 5.3 A

E5-04 = 4 Poles

E5-05 = 1.65 ohms/ph

E5-06 = 54.0 mH/ph

E5-07 = 191.0 mH/ph

E5-09 = 0

E5-24 = 252 V/kRPM

n8-62 = 460 V

The Motor and Drive are Ready for a Test Run

Once the motor has been auto-tuned or the required settings described above have been entered manually, the next step is to run the motor. If possible, uncouple the motor from the load. Check for the correct motor rotation by initiating a FWD run command. If the direction is incorrect, shut off main power to the drive the drive and swap two output phases (motor leads) after the charge LED on the drive is completely extinguished. Once the motor is rotating in the correct direction, run the motor at various speeds from 6Hz to 60Hz in the forward direction (and reverse direction if applicable). Please note, it is usually easier to fine tune any additional parameter settings before coupling the motor to the load.

Additional Startup Settings to Consider

- Accel/decel times, C1-01 and C1-02 – Enter adequate times for the motor to accelerate/decelerate.
- S-curve settings, C2-01 through C2-04 – Set all 4 S-curve settings to 10.0 sec.
- Speed search, b3-01 – Set to 1 for fan/blower applications.
- Short circuit braking time at start, b2-12 – Set to 10.0 sec. This helps avoid STo and OV faults at start.
- Pull in current at acceleration, n8-51 – Start at 35% and increase in increments of 5% if STO faults occur during acceleration.
- Motor to load inertia ratio, n8-55 – Set to 3. Adjust per application.
- Dynamic audible noise control, S1-01 – Set to 0 to disable it (Z1000, HV600, and P1000).

Please note that many of these additional settings (or at least some) may be necessary if encountering STo faults.