AEDB-9340 Series
Commutation Encoder Module and Codewheel Alignment Techniques

Application Note 5283
1000/1024/1250/2000/2048/2500 CPR

Introduction

The objective of this application is to provide a step by step procedural instruction to align and mount the above mentioned encoder module on a Brushless DC motor.

The Brushless DC motor has many features that are different from the standard AC induction or brush type DC motor. The Brushless DC motor usually has stator windings, where its arrangement is determined by rotor pole- pairs made of permanent magnet. Therefore, the Brushless DC motor could not run directly from three phase AC power or a constant DC voltage. The process of activating current flow through the appropriate motor phase windings in order to produce an output torque is called commutation. It is powered from a control or drive unit, with a feedback device that provide positional information on the position of the rotor. With this rotor positional information, the control unit channels power to the leads of the motor with the correct polarity and sequence to rotate the rotor. The commutation logic and switching electronics convert the rotor position information for proper excitation of the stator phases.

Commutation feedback devices provide rotor position to control unit. These feedback devices may also send other information to control unit, e.g., speed, acceleration, rotational direction, number of revolutions, etc. Hall-effect sensors are the most widely used devices. This cost-effective sensing system had matured since its introduction in the late 1970s. One of the more recent alternatives is the optical incremental encoder with commutation. This encoder generates precise angular encoding signals and is often recommended where greater resolution is desired. This means the commutation tracks of the encoder need to be aligned to rotor position. The following sections show the installation guide for above mentioned commutation encoder.

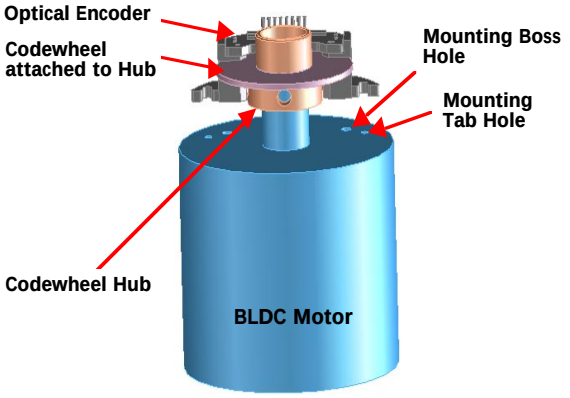
Alignment Tool

The right alignment tool must be used based on the Commutation Encoder CPR. Table 1 below shows the alignment tool part number.

Table 1. Alignment Tool Part Number

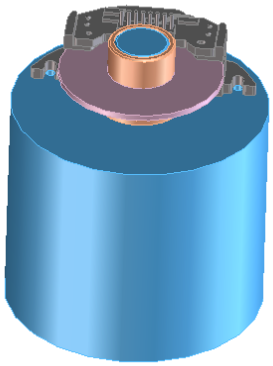
HEDS-8950 - Alignment tool for 1000/2000 CPR
HEDS-8951 - Alignment tool for 1024/2048 CPR
HEDS-8952 - Alignment tool for 1250/2500 CPR

Encoder to Motor Installation Procedure



Step 1:

Slide the Optical encoder and Codewheel hub together onto the motor shaft.



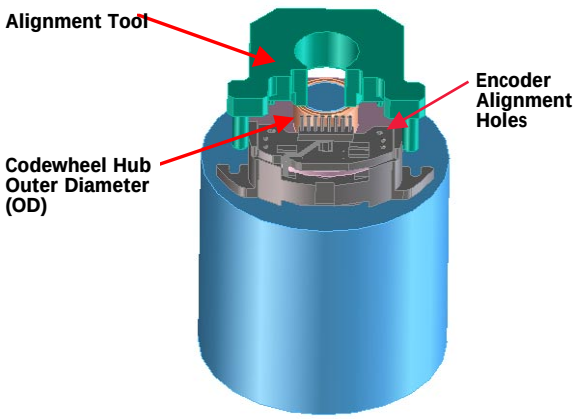
Step 2:

Locate the two Encoder guiding bosses into motor locating boss holes.

Note:

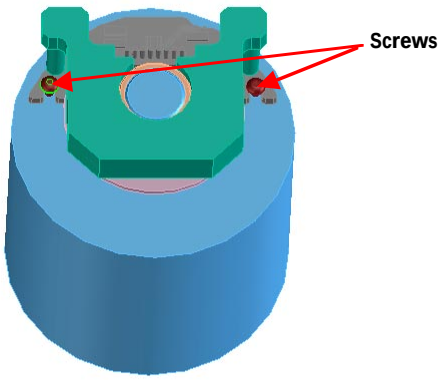
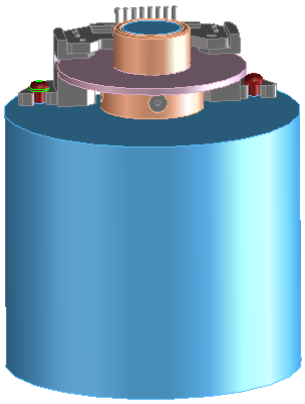
The guiding bosses pre-align the Encoder to Motor Base.

Recommended mounting boss hole diameter = 2.20 ± 0.10 mm.



Step 3:

Apply Alignment Tool by placing the center hole to the codewheel hub outer dimension (OD) and two guide pins to encoder alignment holes.

	**Step 4:** Press the Alignment Tool firmly against the encoder while securing it with mounting screws. **Note:** Recommended Mounting Screw = M1.6 x 0.35 Recommended Mounting Torque = 1 Lbin (0.113 Nm)
	**Step 5:** Remove the Alignment Tool. Now the Encoder is aligned to motor.

U, V, W Alignment–(Codewheel to BLDC Rotor Alignment) Procedure

At the codedisc tracks level, the index track "I" has been aligned to commutation track "U." Therefore, the user can use the Index "I" as a reference signal to align the codewheel to the BLDC rotor phase "U." The following steps below describe the alignment procedure.

Step 1:

Energize the BLDC motor phase winding "U" with motor rated phase voltage to lock the rotor. It is done by connecting positive supply voltage to phase winding "U" and ground to the phase winding "V."

Motor shaft will return to same position when rotated in either direction by hand. This will validate that the rotor is in lock position.

Step 2:

Apply power to the encoder module. Install test cable from encoder module channel "I" output to oscilloscope.

Step 3:

Rotate the codewheel using Allen key or with fingers by holding the codewheel outer diameter (OD) till Index Channel "I" is triggered high. Then, secure the hub to the motor shaft using the set screw provided.

Note: Care must be taken when holding the codewheel with fingers (for example, avoid getting finger prints onto codewheel surface).

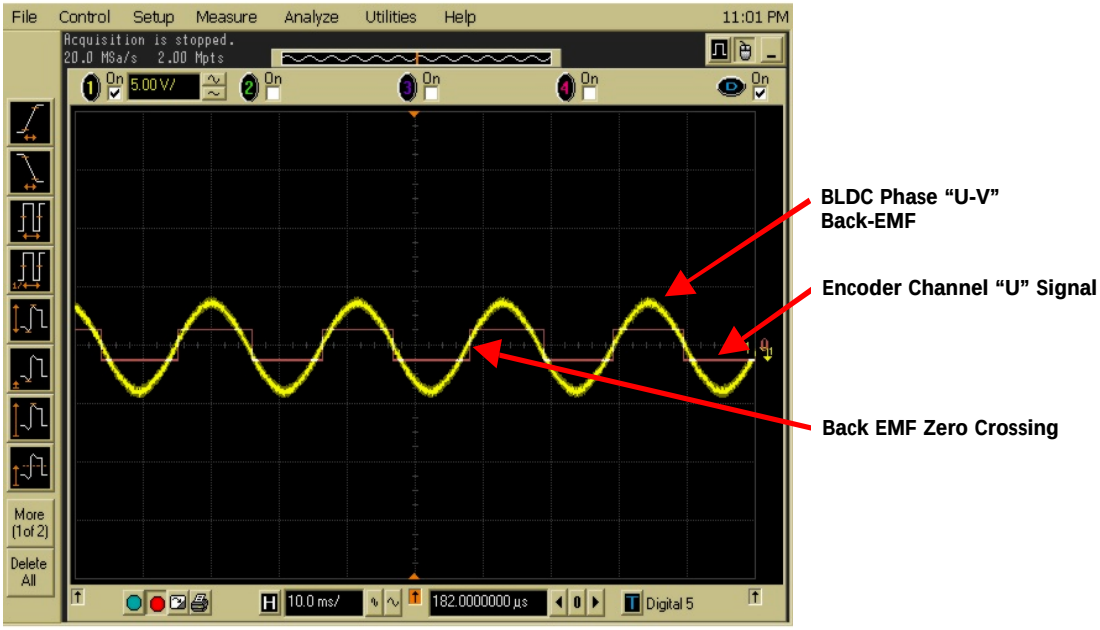
Step 4:

Verify proper commutation alignment by rotating motor shaft slightly in either direction. Index Logic level will remain at the same logic state "High" when motor shaft returns to locked rotor position. If this does not occur, loosen set screw and repeat Step 3 again.

Further Verification

Further verification procedure for the alignment is as follows:

1. Backdrive the BLDC motor assembled with the encoder module. Back drive used to describe the usage of another motor (e.g., DC motor) to spin the shaft of BLDC motor assembled with the encoder module. Shaft of one motor can be engaged to another motor via shaft coupling.
2. Use the Oscilloscope, connect signal Probe (+ve) to motor phase winding "U" and ground Probe (gnd) to motor phase winding "V." This connection allows the scope to display the BLDC motor phase to phase Back-EMF when the BLDC motor shaft is back-driven.
3. Use another Oscilloscope probe to tap the Encoder channel "U" signal.
4. With back driving aid, spin the BLDC motor shaft and observe the BLDC motor phase "U -V" waveform with respect to Encoder channel "U" signal.
5. The Back-EMF signal zero crossing should correspond to the rising edge of channel "U" signal from encoder module. If commutation signal alignment is done correctly, the typical result is shown in the output waveform below.



For further information on all the above mentioned procedure, please contact factory.

For product information and a complete list of distributors, please go to our website: **www.avagotech.com**

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