Commutation Phasing Worksheet

Motor Manufacturer: _____
Model Number: _____

This worksheet may be used to determine the correct amplifier commutation sequence for your brushless motor. Use this worksheet if the manufacturer's commutation sequence diagram is available. If the diagram is not provided, determine the proper motor phasing in accordance with Section G of the Advanced Motion Controls Catalog and Technical Manual, *Brushless Amplifier Setup Instructions*.

Please Note: The manufacturer's commutation sequence diagram may not represent the actual phasing sequence of your motor. If this is the case, this procedure will not work properly for your application. Please contact the motor manufacturer for confirmation.

For assistance with this form, see the Example on page 3.

1. Connect motor hall sensors to their corresponding amplifier connections, (i.e. motor halls a, b, c connected to amplifier hall inputs a, b, c, respectively.)

2. On the manufacturer's commutation sequence chart, locate the motor phase waveform which peaks at hall state 1-0-0.

3. Based on the above waveform, place the letter corresponding to the high volt phase next to Amplifier phase C in Figure 1. (**See Example on page 3 for determination of high and low phases**.)

4. Place the letter corresponding to the low volt phase on the above waveform next to Amplifier phase A in Figure 1.

5. Place the letter corresponding to the remaining phase next to Amplifier phase B in Figure 1.

6. On the manufacturer's commutation sequence chart, locate the motor phase waveform which peaks at hall state 0-1-0.

7. Compare the high volt phase indicated on the 0-1-0 waveform to the phase corresponding to Amplifier Phase A in Figure 1. If these do not match, switch the motor phases corresponding to Amplifier Phases A and C in Figure 1.

8. Connect the motor phase wires to your Advanced Motion Controls amplifier as indicated in Figure 1.

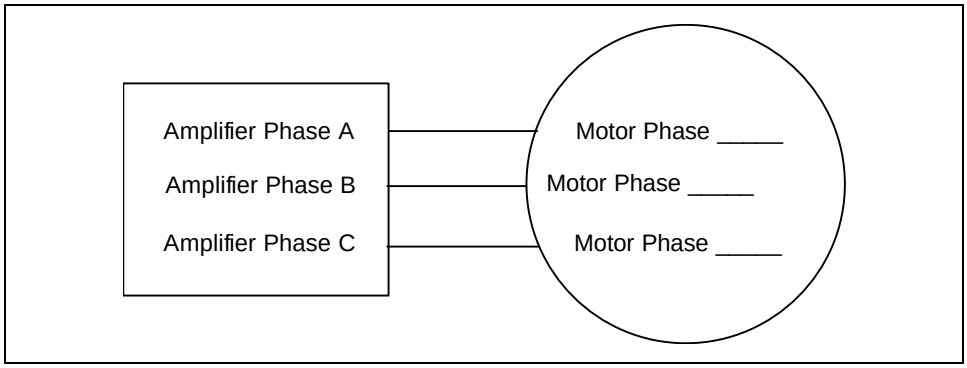


Figure 1: Phasing of Motor Windings

If it is desired to change the direction of motion, proceed as follows:

- Interchange Hall 1 and Hall 3
- Interchange Motor A and Motor B

If the motor runs rough, vibrates heavily, runs faster in one direction than another, or does not run at all then determine the correct phasing by proceeding through all six possible motor phasing combinations in accordance with catalog Section G of the Advanced Motion Controls Catalog and Technical Manual, *Brushless Amplifier Setup Instructions*.

Example

For this example, refer to Figure 2 for motor phasing information. Note that in Figure 2, hall sensors are labeled S1, S2 and S3, and motor phases are Motor a, Motor b, and Motor c. The back EMF labels V_{xy} refer to the voltage level of motor phase x with respect to motor phase y. **Therefore, when V_{ab} is at a peak value, phase 'a' is High and phase 'b' is Low**.

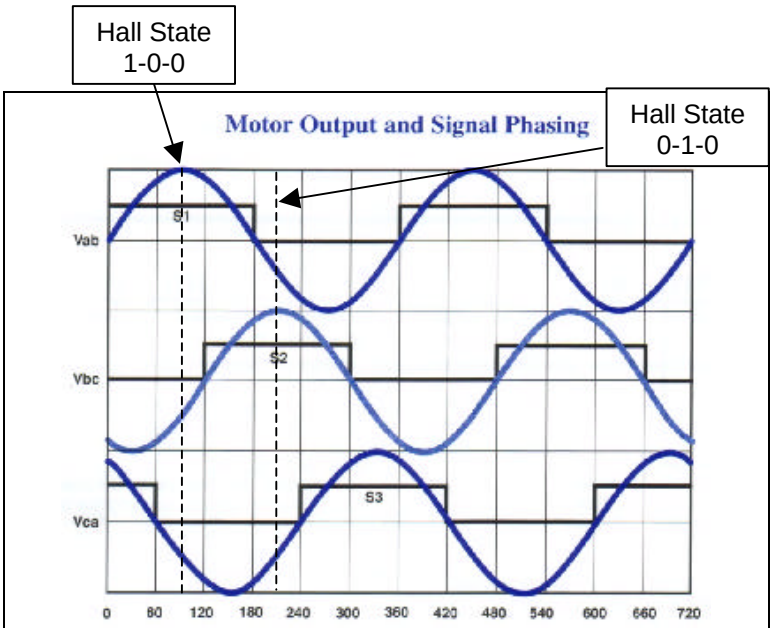
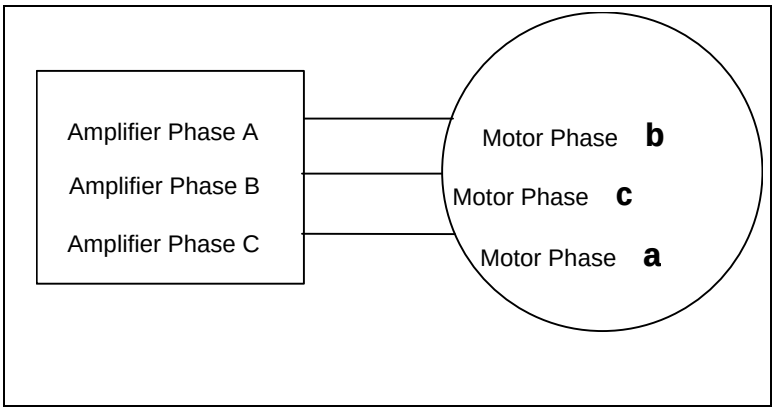


Figure 2: Sample Back EMF and Hall State Motor Phasing Diagram

Steps 1 thru 5:

It can be seen in Figure 1 that for the hall state 1-0-0, V_{ab} is at its peak. Thus, phase 'a' is High, and phase 'b' is low. Place Motor Phase 'b' next to Amplifier phase A, and Motor Phase 'a' next to amplifier phase C. The remaining phase, Motor Phase 'c' is placed next to Amplifier Phase B.



Steps 6 thru 8:

According to the sample diagram in Figure 2, for hall state 0-1-0, V_{bc} is at its peak, therefore phase 'b' is high, and phase 'c' is low. Since phase 'b' is the motor phase which corresponds to amplifier phase A, the combination has been confirmed. If motor phase 'b' did not correspond to Amplifier phase A, we would switch the Motor Phases which correspond to Amplifier Phases A and C.