## Application Information (continued)

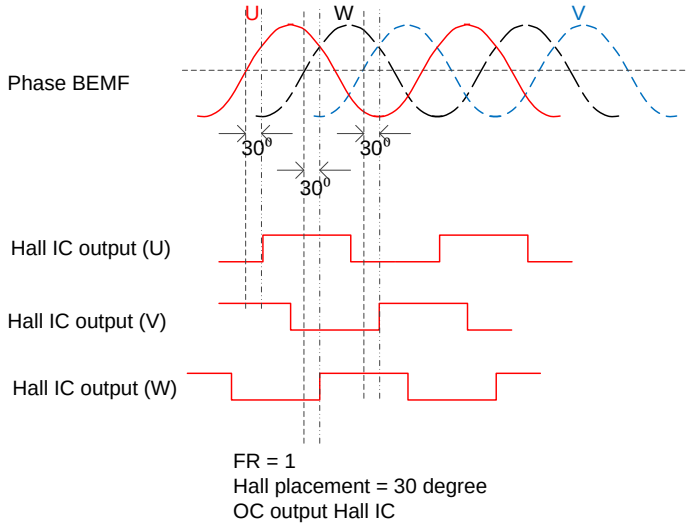


**Figure 28. Correspondence Between Motor BEMF and Hall Signal (FR = 1, 30° Placement, Hall IC)**

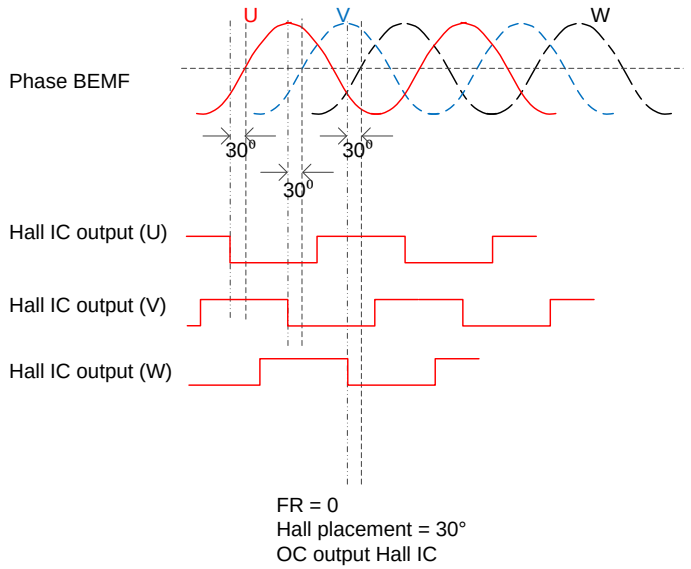


**Figure 29. Correspondence Between Motor BEMF and Hall Signal (FR = 0, 30° Placement, Hall IC)**

If the motor terminal definition is different from the previous description, rename the motor phase U, V, W, or the Hall U, V, W, or swap the positive and negative of the Hall sensor output to make it match.

Use these tips to find the correct U, V, and W phases and the respective Hall sensors:

1. Assume motor phases and Hall outputs do not have labels. If named, remove them.
2. Label A, B, C to the motor terminals (phases). Label Da and Db, Ea and Eb, Fa and Fb to the Hall output pairs. If Hall ICs are used, just label the digital outputs as D, E, F.
3. Use three 10-kΩ resistors, connect them to motor terminals - A, B, C with star connection. The center is called COM.
4. Provide power to the Hall sensors.

## Application Information (continued)

5. Use 4 channel Scope to observe signals. Connect probe -1, 2, 3 to A, B, C terminals of the motor (phases), probe-4 connects to Hall Da (or D). Name the probe 1 (terminal-A) as U-phase. (see Figure 30)
6. Turn the rotor manually in clock-wise direction. If the waveform on probe-1 (U-phase) is leading probe-2 (terminal-B) by 120°, name the terminal-B as phase W and terminal-C as phase V. Else if waveform on the probe-2 is leading probe 1 (U) by 120°, terminal-B as V, terminal-C as W. At this stage all three phases of the motor are identified.
7. Motor manufacturers have two popular Hall placement options. The first is 0° Hall placement (BEMF and Hall signals are in-phase) and the second is 30° Hall placement (BEMF leads Hall signal by 30°). If the probe-4 is in-phase (or lagging 30°) with phase-U, name Da as Hall U positive (U_HP), Db as Hall U negative (U_HN). If probe-4 is in-phase with phase U (or lagging 30°), but inverted polarity, name Da as U_HN, Db as U_HP. If the probe-4 is not in-phase (or lagging 30°) with respect to U but aligns with phase-V or W, name accordingly as V_HP/V_HN or W_HP/W_HN. Repeat this step to map Ea/Eb and Fa/Fb in the same way. By end of this step, all three sets of Hall signals are mapped to respective phase signals - phase U & Hall U_HP/HN, phase V & Hall V_HP/V_HN and phase W and W_HP/W_HN. Care should be taken while judging 30° Hall placement, sometimes 30° and 60° look alike. If U phase is leading Hall Da by 60°, there will be another phase (V or W) with in-phase or lagging by 30° relationship. Hence it's important to check all three phases before concluding.
8. When Hall ICs are used, if the Hall D is in-phase or lagging 30° with respect to phase U but inverted polarity, name the Hall D output as U_HN, and 2.5-V reference voltage to U_HP. If Hall D is leading 30°, then turn the rotor in counter clock-wise direction and map remaining E & F Hall outputs.
9. After phase UVW and Hall UVW positive negative are identified, manually rotate the motor again, check if the result matches Figure 24 and Figure 25 (0° placement) or Figure 26 and Figure 25 (30° placement).
10. Connect U,V,W and Hall U,V,W to the DRV10970, with the FR = 1, it should rotate with direction you manually spun it. Connect FR = 0, the motor will spin in the other direction.

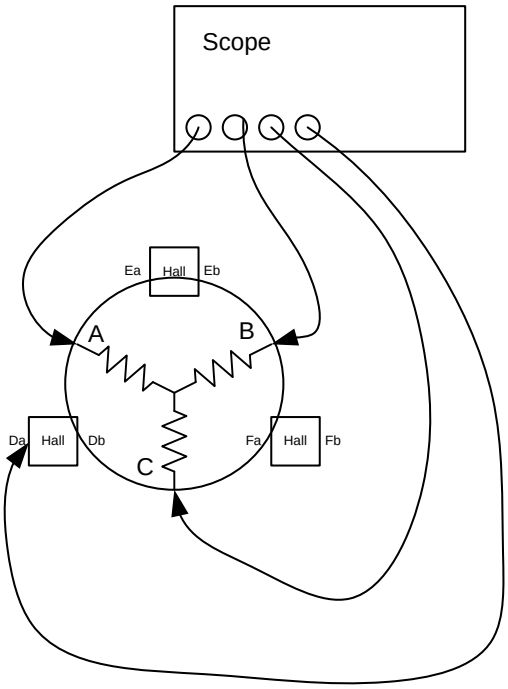


**Figure 30. Motor Measurement**