MEEE ELECTRIC MACHINES – Laboratory 4

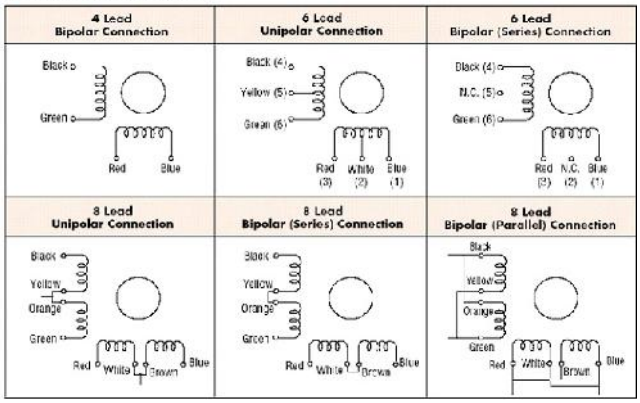
Group # :	Name-Surname: Student ID #:	Point:

LABORATORY CONTENT: Driving a universal stepper motor

EQUIPMENT REQUIRED:

Qty	Description
1	6-lead universal stepper motor (buy carefully)
1	Multimeter
1	Breadboard
8	2N2222 npn transistor
4	2N2907 pnp transistor
12	1N4001 diode
12	150 ohm resistor
-	Wiring equipment (jumper cables, crocodiles, etc.)

Wire Connection Diagrams



INTRODUCTION:

Stepper motors are preferred for their cheap prices in the applications where a precise positioning is required. Stepper motors have two standard wiring types: unipolar and bipolar. Unipolar type motors have a center tap in the middle of the windings. The number of poles and the connections may vary in stepper motors. Also, the cable colors may not be identically equal in practice for every brand in the market, so an easy method for this is to measure the resistance between each terminal pins where the center tap pin divides the resistance by two, then trying to predict which terminal belongs which side.

Two of most popular stepper motors for hobby-type projects are 5-lead and 6-lead stepper motors. In 5-lead motors, the common terminals of the windings are connected to each other inside the motor by the manufacturer and given out as just one common cable. 6-lead stepper motor type can be called as universal motor, due to the capability of having both unipolar and bipolar stepper motor cabling.

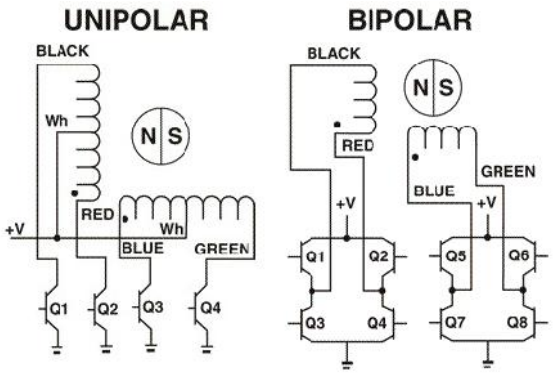
Unipolar and bipolar stepper motors have different driving methods, where each method have sub-methods requiring proper phase sequences with the windings. These sequence is important due to driving methodology which is applied in this exercise. These driving methods can be categorized depending on the resolution of the motion and the torque provided to the rotor. Generally, unipolar motors are preferred for easier do-it-yourself projects where less effort is preferred. But with bipolar stepper motors, a movement with greater resolution can be supplied using a driving technique called micro stepping.

PRELIMINARY QUESTIONS:

1) Find out the driving methods and sequences for driving unipolar and bipolar stepper motors.
2) Find out how many steps are needed for your motor to make a 360° motion.
3) Set up a needle onto the rod of the stepper motor to indicate its facing direction (to observe its amount of motion) (a basic one would be OK, a piece of paper or a kind of needle glued onto the rod)
4) Investigate the protection methods in circuits for protecting semi-conductors in the driving circuits.

EXERCISE STEPS:

1) Determine the motor pins by measuring the resistance between the terminals and write down the colors.
2) Prepare the given circuits for driving the motors with unipolar and bipolar configurations.
3) Apply the circuits and rotate the motor with a desired sequence. Do this in both directions.



POSTLIMINARY QUESTIONS:

1) Search for NEMA standards and how they are applied to the stepper motors.
2) Search for hybrid stepper motor and explain its working principle.

Design due to next week: Bipolar drive with L293.