16.317 Microprocessor I, Spring 2007
Lab 5: Stepper Motor Control using PIC16F684 Microcontroller
Due on 05/11/2007, 12:30pm EDT

Reference

[1] PIC16F684 Microcontroller Datasheet
[2] R. Laidman, Stepper Motors and Control, Part II - Bipolar Stepper Motor and Control, http://www.stepperworld.com/Tutorials/pgBipolarTutorial.htm
[3] D. Jones, Stepping Motor Types, http://www.cs.uiowa.edu/~jones/step/types.html

Objective

Program a PIC microcontroller to control a bipolar stepper motor.

Content

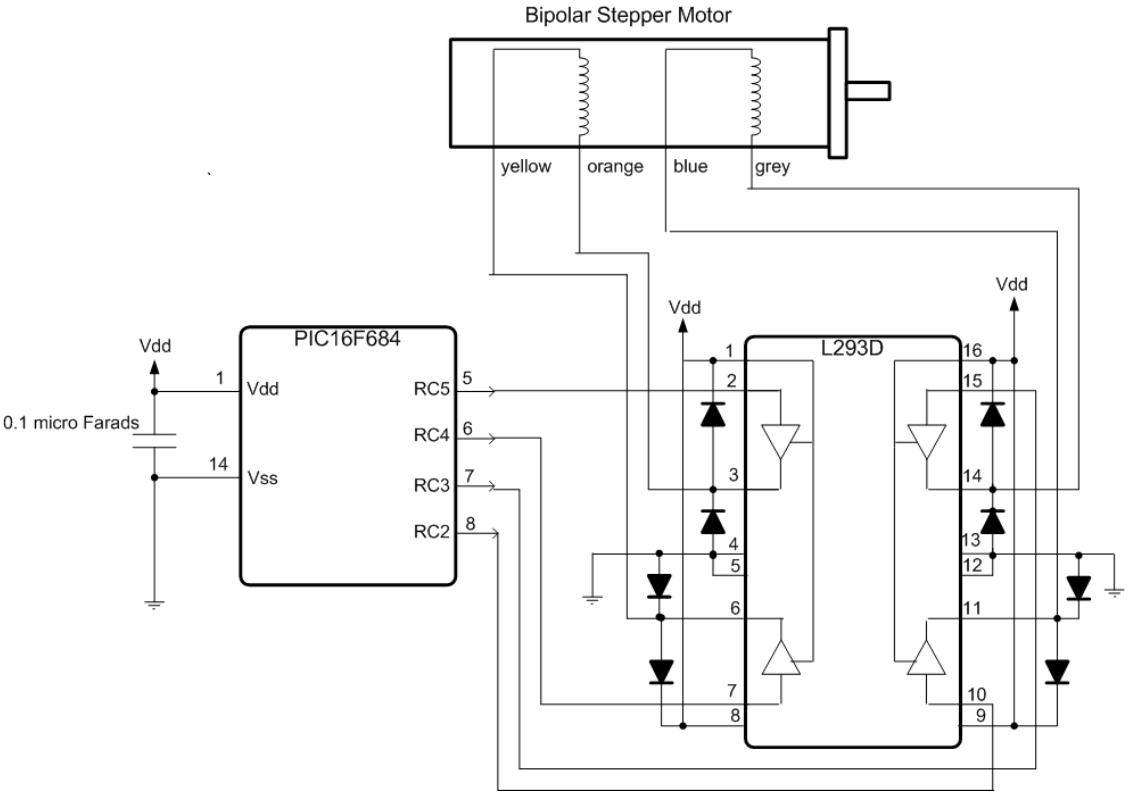
In this lab, you will program the PIC16F684 microcontroller to control a bipolar stepper motor. You need to program the PIC microcontroller to generate a series of control signals needed for rotating the stepper motor. You need to wire a driver circuit (schematic given below) on your breadboard since the motor is a current driven device. Your final system consists of a PIC16F684 microcontroller, the driver circuit and a stepper motor.

Theory of Operation

There are two kinds of stepper motors available: unipolar and bipolar. The coils of each kind are wired differently. In this lab, we are going to use a bipolar stepper motor. For a detailed description of the stepper motors and the animation showing how they work, please visit the tutorial at http://www.cs.uiowa.edu/~jones/step/types.html

Schematic

The following schematic shows the connection of the PIC16F684, driver circuit and bipolar stepper motor. The parts used in the design include a 0.1uF capacitor, one L293D H-bridge driver, one stepper motor and 8 diodes. (Diodes and chip sockets are available from the stock room.). Vdd = 5V.



Check Off

There are several check-off steps in this lab. Completing each step earns a percentage of the total grade.

1. Demonstrate the pattern of the four output pins (RC2-5) of PIC16F684 using the oscilloscope. (10%) (note: you need to record the waveform and include that in your reports.)
2. Demonstrate the driver circuit wired on your breadboard and show the signal pattern on the oscilloscope. (20%)
3. Demonstrate the rotation of the stepper motor (20%) (note: you need to measure the rotation speed, e.g. xx seconds/step. Such data should be included in your reports.)
4. Vary the rotation speed of the stepper motor (30%) (note: you need to explain in your reports how you change the rotation speed and what is the new speed.)

Report format

Your report needs to follow the format below.

Lab # and title:
Student Name:
Partner's Name:

Lab Purpose:

<It is usually the objective of the lab.>

Lab Content:

< Answer the questions in lab specification. Describe what you do in the lab, e.g. what commands you practiced. It has to be at least one page with 11pt font size. Try to organize and summarize the lab in itemized lists.>

Include your schematic and source code in the report.

Difficulties:

< state what difficulties you encountered in the lab and how you managed to solve it. If not, what have you tried? >

Conclusion and Suggestions:

Date of Grading _____

Student Name _____ Student ID _____

LAB FIVE RUBRICS

Component	**grade**	**Actual points**
Demo the pattern from PIC output pins	10	
Demo your complete circuit and signal pattern	20	
Demo the motor rotation	20	
Vary motor rotation speed and demo	30	
Report (see the check-off notes)	20	
Total	100	