

UNC Charlotte, ECGR 4892/6090/8090, Spring 2004: Lab 6

Logic Analyzer: Timer and Stepper Motor

Learning Objectives

This lab will have students control a stepper motor so that a stick attached to the motor makes one clockwise or one counter-clockwise rotation in one minute. The student will measure several signals using a logic analyzer, and will add the results to their Lab 5 report.

General Information

The general steps for this lab are:

1. Create a new folder for lab 6. Copy your files from lab 5 into the new folder.
2. Generate a new project using the files you just copied. Name your new project Lab5.
3. Open and edit your main.c file to perform the lab functions.
4. Program the lab. Don't forget the necessary include files to get the correct functionality.
5. Compile the code into an .x30 file, and load onto the board.
6. Test the program and repeat steps 4, 5, and 6 until the program works as required.
7. Write your lab report.
8. ~~Demonstrate for the professor and t~~Turn in your report and files.

Prelab Activity

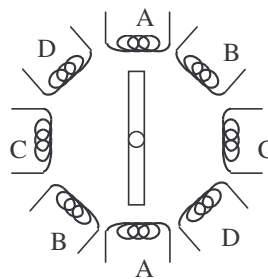
None.

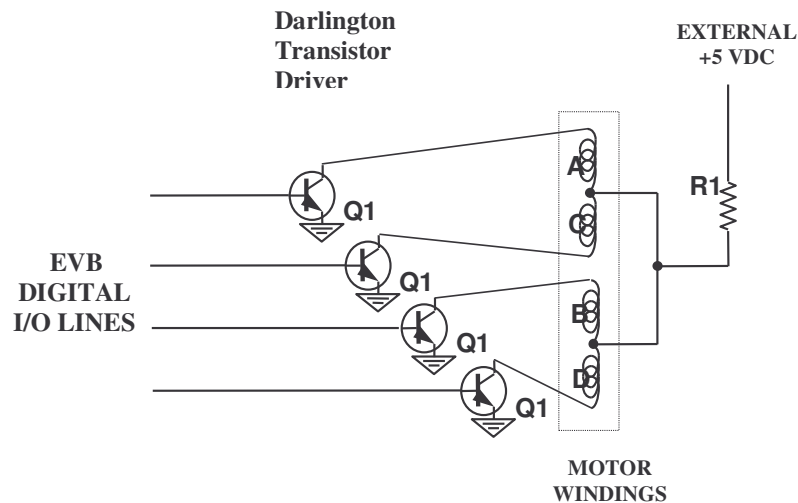
Laboratory Assignments

You may use the PCs in Smith 347 or your own PC to do this lab experiment. The machines in Smith 347 already have the software tools loaded. In this lab you will be utilizing onboard timers and I/O ports of the Renesas board to control a stepper motor.

A stepper motor is a simple way to achieve precise position control without using feedback devices. The purpose of this lab is to build a hardware/software system to properly sequence the windings of a stepper motor. Write a driver program which will turn the individual windings on and off in the proper sequence to achieve clockwise (SW2 pressed) and counter-clockwise (SW3 pressed) rotation of the stepper motor. Use half-stepping, as described in class and below.

Step	A	B	C	D
1	ON			
2	ON	ON		
3		ON		
4		ON	ON	
5			ON	
6			ON	ON
7				ON
8	ON			ON
9	ON			





Steps

1. Modify the main.c file and include the appropriate files. Include commenting along the way.
2. Build your program slowly, testing along the way. Perform compiles and solve each requirement one at a time. Make sure comments are written as you progress.
3. Continue to build and test the program until all of the requirements have been met. Did we mention you should write your comments as you progress, not at the end?
4. If you run into problems, use the break point functionality of KD30 to step through the code until you find the problem.
5. Once all the requirements have been met, ensure that everything works.
6. Finish lab write-up and demonstrate for the professor.
7. Submit your report, C code (*.c) and .map files on a floppy disk, CD ROM, or email.

Requirements

Req. 1 – The code generated is written in C for the MSV30262-SKP

Req. 2 – The code is well commented and easy to follow

Req. 3 – Your lab report should include the final build output from the builder

Req. 4 – The ULN2003 (also may be labeled a DS2003, MC1413) Darlington Transistor Driver chip will be attached to the via four output pins of one port.

Req. 5 – The stepper motor will be attached to the driver chip according to the instruction sheet provided in the **stepper motor box**.

Req. 6 – The general operation of the system is that the stepper motor will rotate 360 degrees in 60 seconds and (as close as possible) resemble the smooth sweep motion of a clock's second hand.

Req. 7 – The system will start out **stationary (not running in a clockwise or counter-clockwise direction)**. If SW2 is pressed, the motion will stay or switch to clockwise. If SW3 is pressed, the motion will stay or switch to counter-clockwise.

Req. 8 – The system will be powered by a 5v bench power supply. **DO NOT** power the stepper motor with a PC's power supply (through the USB Cable). Failure to satisfy this requirement will result in a grade of "0" for the lab.

Req. 9 – Interrupts should be used for the timing, not “delay” loops. This signal should also be routed to an output port.

Req. 10 – The logic analyzer will be attached to the following signals on the Renesas board: Port bit controlling motor winding A, B, C, D (BEFORE the Darlington Transistor Driver), a port bit connected to a timer which triggers every $1/96^{\text{th}}$ of a second, switch SW2 and switch SW3. One analog line will be attached to the board system clock.

Req. 11 – The final report from lab 5 should be expanded to show two “screen shots”, one showing the system working in the clockwise direction and one in the counterclockwise direction. The shot should show the events 1 second before and 10 seconds after SW2 and SW3 are pressed.

Lab Report

Include in your lab report observations and procedure like the following:

The general learning objectives of this lab were . . .

Pre-lab question answers

The general steps needed to complete this lab were . . .

Some detailed steps to complete this lab were . . .

1. *Step one*

2. *Step two*

3. . . .

Code generated for this lab...

Some important observations while completing/testing this lab were . . .

In this lab we learned . . .

Send the code the .map file, and the report to Dr. Conrad via email. **There is no demo for this lab assignment.**