

ME 461 Prelab #7
Fall 2017
Due at the beginning of class on 11/08/2017

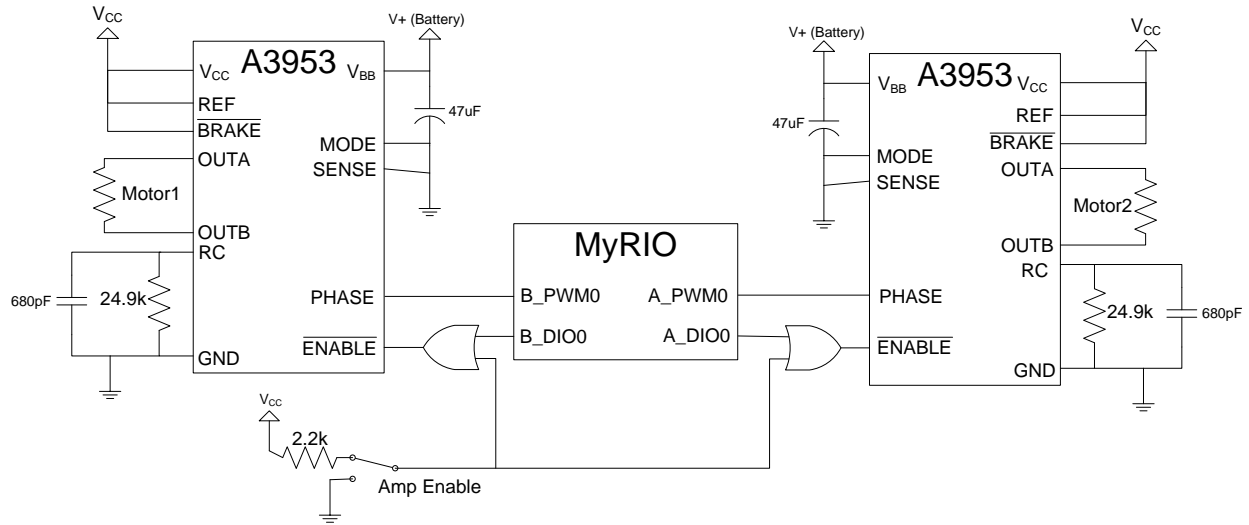
Suggested Reading:

[Allegro A3953 Full-bridge motor controller datasheet.](#)

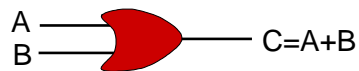
[Lab 7 manual.](#)

1. (Both partners must include this in their Prelab 7 submission for credit.) Explain what you and your partner would like to do for your end of the semester project. Your project MUST use a MSP430 processor. It can also include the robot car, the C.H.I.P. board, the myRIO board and other hardware you have in your possession. We only have 8 robots in the lab and 4 extra myRIOs, so everyone will not be able to use all of these in their projects. Write a few paragraphs explaining your idea and add sketches if that will help explain your idea. The lab has a number of different sensors and actuators you can use in your project. Give me your ideas and after reading your proposal I will help mold your project into a form that is doable before the end of the semester and with sensors that are easily purchased or already owned by the lab. You should try to have both sensing and actuation in your project.

2. A simplified schematic of the motor controller that is used on your robot is shown below. In your own words (i.e., do not simply copy words from the datasheet), **briefly** explain the purpose and use of the REF, BRAKE, MODE, and SENSE pins on the A3953. Why are they connected as shown?



3. To turn the motor amplifier on, should the Amp Enable switch be connected to V_{cc} or GND? Why? Note that the output of the Amp Enable switch feeds one of the inputs of a standard OR gate. The OR gate is a combinational logic gate. A combinational logic gate performs standard binary logic operations on multiple inputs to produce a binary output. The truth table for the OR gate is:



A	B	$C=A+B$
0	0	0
0	1	1
1	0	1
1	1	1

4. With the motor's 30:1 gearing and its 100-pulse-per-rotation quadrature encoder on the motor's shaft, how many encoder counts will be generated with each rotation of the output shaft in X4 mode? What is the resolution in radians?
5. In quadrature X4 mode, with the motor spinning at top speed (roughly 1.5 rotations/sec), how many hours will it take for the LabView MyRIO Optical Encoder block's 32-bit counter to overflow if we use a signed 32-bit representation?

6. As you know from the Lab 7 manual, a 20 kHz PWM signal on A/PWM0 and B/PWM0 will be used to control motor torque, and A/DIO0 and B/DIO0 will be used to enable or disable the motors. Based on the motor control schematic in question 2, **briefly** explain how and why this works. The truth table contained in the datasheet for the A3953 might be helpful in answering this question. Ignore the details of fast/slow current decay modes.

7. Suppose you are sampling the motor encoders in 5 ms intervals. At a given time instant, the optical encoder count reading of one of the encoders is 15706. At the next sample, the reading is 15651. What is the angular speed (in rad/s) of the motor shaft?