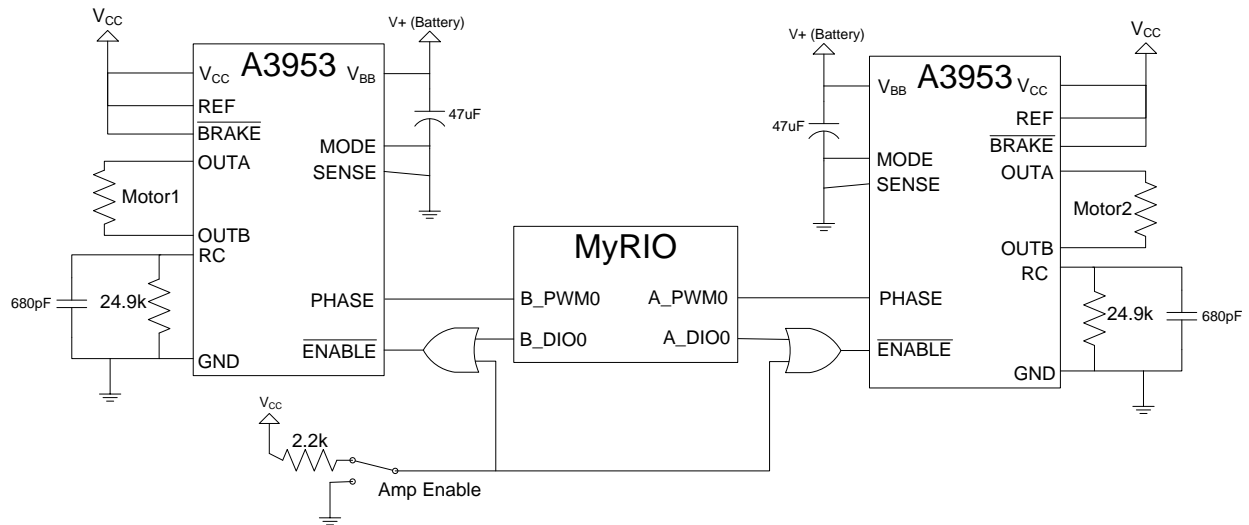


**ME 461 Prelab #7**  
**Fall 2016**  
**Due at the beginning of class on 11/02/2013**

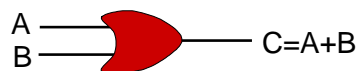
**Suggested Reading:**

- [Allegro A3953 Full-bridge motor controller datasheet.](#)
- <http://www.robotroom.com/FaulhaberGearmotor.html>
- [Lab 7 manual.](#)

1. 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?



2. 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 two 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

3. With the Faulhaber motor's gearing and its single-pulse-per-rotation magnetic quadrature encoder on the input shaft, how many encoder counts will be generated with each rotation of the output shaft in X4 mode? What is the resolution in radians?
4. In quadrature X4 mode, with the Faulhaber motor spinning at top speed (roughly 1.5 rotations/sec), how long will it take for the LabView MyRIO Optical Encoder block's 32-bit counter to overflow if we use a signed 32-bit representation?
5. 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 speed, and A/DIO0 and B/DIO0 will be used to enable or disable the motors. Based on the motor control schematic in question 1, **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.
6. If you sample the Faulhaber motor's encoder every 1 ms and the motor is spinning at 1 rev/s, what is the speed in encoder counts/sample? What is the problem with this? Would changing the sample period help this problem? Explain.
7. Suppose you are sampling the Faulhaber encoders in 5 ms intervals. At a given time instant, the optical encoder count reading of one of the encoders is 15906. At the next sample, the reading is 15872. What is the angular speed (in rad/s) of the motor shaft?