

Lab 5

Instructions

Complete each task and demonstrate the working program to your tutor. Tasks should be demonstrated using the board provided. You will have two lab sessions to work on this lab, and all questions must be marked by the end of the second session.

This lab **MUST** be marked by the end of your week 12 lab session, there will be no option to hand it in late.

Part A – Speed measurement (3 Marks)

Connect the motor (labelled MOT) to the potentiometer (labelled POT) and use it to control the motor's speed. Connect the Opto-interrupter's emitter (labelled OpE) to one of the +5V pins, and the output (labelled OpO) to INT2 (labelled TDX2). Write a program to calculate the speed of the motor's rotation in revolutions per second and display it on the LCD. You should update the display at least every 500ms.

Part B – LED brightness (3 Marks)

Using timer 3 and OC3B (labelled PE2), use PWM to control the voltage supplied to the topmost LED. The LED should fade from full brightness to completely off each second. The voltage supplied should decrease linearly.

Part C – Motor control (4 Marks)

Create a feedback system to control the motor speed. Connect the motor to OC3B, and connect the opto-interrupter as in part A. The target speed should be decreased by 20 revolutions per second if PB1 is pressed, and increased by 20 if PB0 is pressed. The minimum and maximum speeds that can be selected should be 0 and 100 revolutions per second.

The LCD should display the target speed in revolutions per second on the first line, and the measured speed on the second. Your program should adjust the voltage supplied to the motor, to try and make the measured speed match the target speed.

Some of the boards may have an issue where supplying a PWM signal to the motor causes the board to reset, or freeze. To fix this, connect the MOT pin to the POT pin, then remove the right-most isolation jumper above the potentiometer and connect your PWM pin (PE2) to the rightmost jumper pin. Turning the potentiometer will then introduce a resistance in series with the motor, and it should be possible to find a position where the motor spins but does not crash the board. You may not be able to reach 100rps with this configuration. **Do not lose the PE2 jumper.**

