

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 10 lab session, there will be no option to hand it in late.
- Make reasonable assumptions if something is not explicitly specified. State all those assumptions to the tutor when you are getting marked.

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 – Lift door opening and closing (4 Marks)

The opening and the closing of the lift door are denoted by the motor rotation. Connect the motor to OC3B (labelled PE2 on the board, note that this PE2 labelled pin is actually connected to PE4 pin of the microcontroller). Opening and closing are distinguished by rotating the motor at two different speeds – for instance 20% of full PWM speed for opening and 80% of full PWM speed for closing. You should select the two distinct speeds such that a speed change of the motor is clearly observable. The motor should rotate for one second when the door opens or close. You should display the speed of the motor

You can demonstrate the door opening and closing functionality by

- using the two push buttons (left push button for door open and right button for door close) or
- combining with your lift controller emulator from the previous labs

Part C – Motor control based on feedback (3 Marks)

Create a feedback system to control the motor speed. Connect the motor to OC3B (labelled PE2 on the board, note that this PE2 labelled pin is actually connected to PE4 pin of the microcontroller), 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 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.**

