ELEC 3300

LAB 5: ADC FUNCTIONS

A. OBJECTIVE:

1. To familiarize yourself with the MINI-V3 Development Board.
2. To understand programming of the ADC function.

B. PRE-LAB ASSIGNMENT:

1. Study the information about MINI-V3 Development Board from the course website.
2. Study the ADC Section of the Reference Manual of STM32.
3. Study the tutorial information related to LAB5.

C. LAB SETUP DETAILS

1. Download the LAB5.zip from the course website and unzip it.
2. Open Keil. Go Project → Open Project... Navigate to the project file for this lab, the project file should be under …/LAB5/Project/RVMDK/LAB5.uvprojx.
3. Connect the Fire Debugger according to the information about Fire debugger. Make sure that the Green LED of the Fire Debugger is ON.

D. EXPERIMENT

In this LAB, there are 4 tasks.

Task 1 – Display Single ADC Conversion result on LCD when K1 is pressed.
Task 2 – Display Continuous Conversion ADC results on LCD.
Task 3 – LDR Measurements.
Task 4 – EMG Sensor Measurements.

E. PROCEDURES

This LAB is an extension from LAB2 and LAB3, it will use the LCD to display the ADC information and K1 for input. You need to refer to Tutorial 2 and 3 for corresponding information.

Task 1 – Display Single ADC Conversion result on LCD when K1 is pressed.

Refer to Tutorial 5, in order to finish Task 1, For hardware part, you need to assemble a simple VR circuit to input to PC.4. For the software initialization part, you need to do the following.

a. Configure the PC.4 as analogue input (Refer to Tutorial 5)
b. Configure K1 and input (Refer to LAB2 and Tutorial 2)
c. Configure ADC1 to get input from PC.4

Below is the ADC Setting

Mode	Independent
Scan Conversion Mode	Disable
Continuous Conversion Mode	Disable
External Trigger Conversion	None
Data Alignment	Right
Number of Channel	1

d. Configure ADC Clock, please refer to the tutorial notes.
e. Connect Channel 14 to ADC1 and enable ADC1, please refer to the tutorial notes.
f. Do a self-calibration on ADC1, please refer to the tutorial notes.

For the implementation, you need to do the following

a. When K1 is pressed, start a software conversion.
b. Wait for conversion time, after that get the conversion results.
c. Display the conversion result on LCD, you may need to refer to LAB3 for display

```
void LCD_DrawChar(uint16_t usC, uint16_t usP, const char cChar);
void LCD_DrawString(uint16_t usC, uint16_t usP, const char * pStr);
```

Show your result to TA.

Task 2 – Display Continuous Conversion ADC results on LCD.

Change your program such that the LCD will be able to update the result at a certain period without pressing K1

Show your result to TA.

Task 3 – LDR Measurements.

Step 1: Replace your Variable Resistor circuit with a LDR circuit.

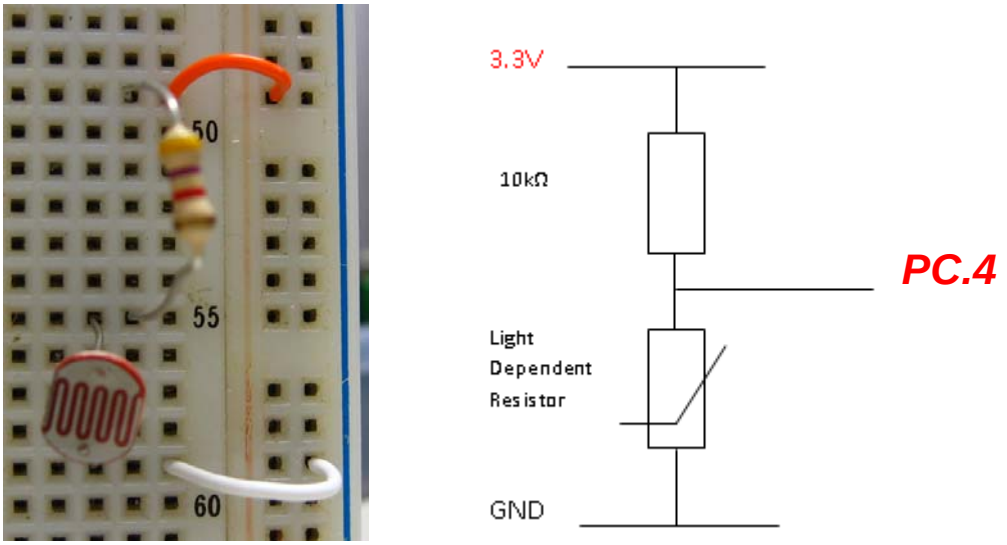


Figure 1: Light Dependent Resistor Circuit

Step 4: In your PC, click Debug → Start/Stop Debug Session

Step 5: Click Debug → Run

Step 6: Observe LCD display and the value shown on Display

Step 7: Cover the Light Sensor by hand.

What is the value shown on LCD Display? _____

Step 8: Use some light to shine on the Light Sensor

What is the value shown on LCD Display? _____

Step 9: Stop the debugging process by clicking Debug → Start/Stop Debug Session

Step 10: Now, swap the position of the sensors. i.e.

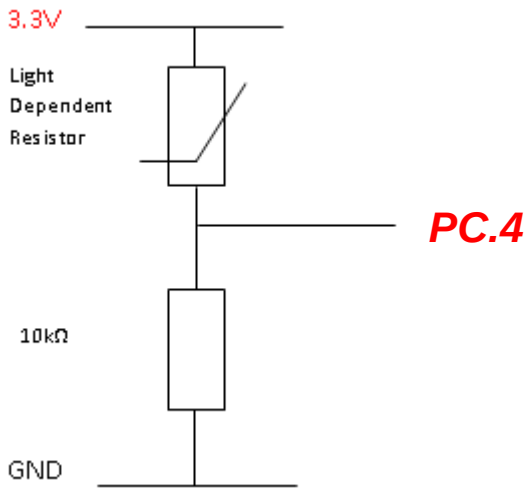


Figure 2: Swapped LDR Circuit

Step 11: In your PC, click Debug → Start/Stop Debug Session

Step 12: Click Debug → Run

Step 13: Observe LCD display and the value shown on Display

Step 14: Cover the Light Sensor by hand.

What is the value shown on LCD Display? _____

Step 15: Use some light to shine on the Light Sensor

What is the value shown on LCD Display? _____

What is the relationship between the intensity to the resistance of LDR?

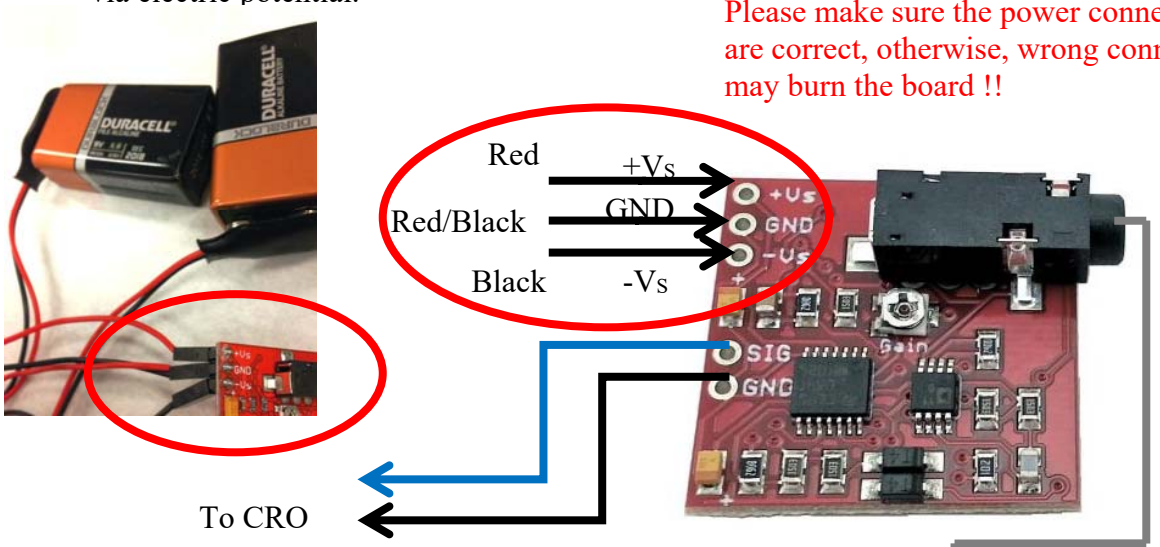
_____

Show your result to TA.

Task 4 – EMG Sensor Measurements.

You will now be given an electromyography (EMG) Sensor, please follow the connection below to connect the EMG Sensor. The function of the EMG Sensor is to measure muscle activation via electric potential.

Please make sure the power connections are correct, otherwise, wrong connection may burn the board !!

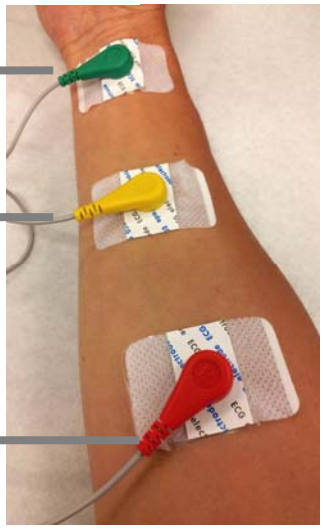


Connect the electrodes

Place one at one end of the muscle body; connect this electrode to the Green Cable's snap connector.

Place another electrode in the middle of the muscle body; connect this electrode to the Yellow Cable's snap connector.

Place a third electrode on a bony or non-muscular part of your body near the targeted muscle; connect this electrode to the Red Cable's snap connector.



After connecting to the CRO, try to stretch (move) your fingers and release your fingers. Measure the voltage difference via the CRO. There should be a voltage difference when you stretch and release your fingers, otherwise, there should be a problem with your connection or the position of the electrodes.

What is the maximum and minimum voltage you can get from the sensor?

Maximum: _____ Minimum: _____

Show your result to your TA

Referring to your results, if the analogue signal is applied to your ADC input, what would be the corresponding ADC values that appear on the LCD?

Maximum: _____ Minimum: _____