ECE 362 Lab Verification / Evaluation Form

Experiment 7

Evaluation:

IMPORTANT! You must complete this experiment during your scheduled lab period. All work for this experiment must be demonstrated to and verified by your lab instructor *before the end* of your scheduled lab period.

STEP	DESCRIPTION	MAX	SCORE
1	Coding	**8**	
2	Interfacing	**4**	
3	Demonstration	**8**	
4	Thought Questions	**5**	
	TOTAL	**25**	

Signature of Evaluator: ____

Academic Honesty Statement:

IMPORTANT! Please carefully read and sign the Academic Honesty Statement, below. *You will not receive credit for this lab experiment unless this statement is signed in the presence of your lab instructor.*

"In signing this statement, I hereby certify that the work on this experiment is my own and that I have not copied the work of any other student (past or present) while completing this experiment. I understand that if I fail to honor this agreement, I will receive a score of ZERO for this experiment and be subject to possible disciplinary action."

Printed Name: ________________________ Class No. __ __ __ __ - __

Signature: ____ Date: ________

Experiment 7: Digital Voltmeter (DVM)

Instructional Objectives:

- To illustrate how the 9S12C32 analog-to-digital (ATD) converter works
- To illustrate another use for the RTI subsystem

Parts Required:

- Two 10 KΩ potentiometers (available from the Instrument Room, EE 168)
- Two RED, two YELLOW, and two GREEN LEDs (from ECE 270 parts kit, also available from Instrument Room)
- Four 330 Ω resistors (available from Instrument Room)
- Breadboard and wire (from ECE 270 parts kit)

Prelab Preparation:

- Read this document in its entirety
- Review the material on the RTI and ATD subsystems
- Create your solution in "C" using Code Warrior

Overview

The objective of this lab is to create a simple digital voltmeter (DVM) consisting of a 9S12C32 development kit interfaced to two potentiometers (referenced to 5 VDC). The DVM will sample the two analog input channels once every half-second and display the converted values on the terminal screen as two 3-digit decimal numbers (N.NN):

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Ch 0 = 3.92 v    Ch 1 = 1.72 v
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Note: This display should be refreshed *in place* on the emulated terminal screen

The left pushbutton on the docking board will be used to stop the DVM, while the right pushbutton will be used to start (or restart) the DVM. The left LED on the docking board should be on when the DVM is stopped, while the right LED should be on when the DVM is running.

In addition to the text display of the values on the terminal screen, a set of three LEDs (YELLOW, GREEN, and RED) will be used to indicate the approximate range of the voltage input on each channel (0 and 1) using an LED "bar graph" display. The YELLOW LED for a given channel should be illuminated if the input voltage on that channel is *greater than* THRESH1 but *less than* THRESH2. The GREEN LED should be illuminated if the input voltage is *greater than or equal to* THRESH2 but *less than* THRESH3. Finally, the RED LED should be illuminated if the input voltage is *greater than or equal to* THRESH3. These external LEDs will be interfaced to pins on Port T (PTT.2 through PTT.7), as indicated on the schematic. The threshold values (THRESH1 – THRESH3) are defined in the provided skeleton file.

Step 1. Coding

Complete the "C" skeleton file provided on the course website. Note that the "finished product" should work in a "turn key" fashion, i.e., your application code should be stored in flash memory and begin running upon power-on or reset.

Step 2. Interfacing

Complete the interface circuit shown below.

NOTE: The locally-available GREEN and YELLOW LEDs are NON-RESISTOR, while the RED LEDs have an integrated current limiting resistor.

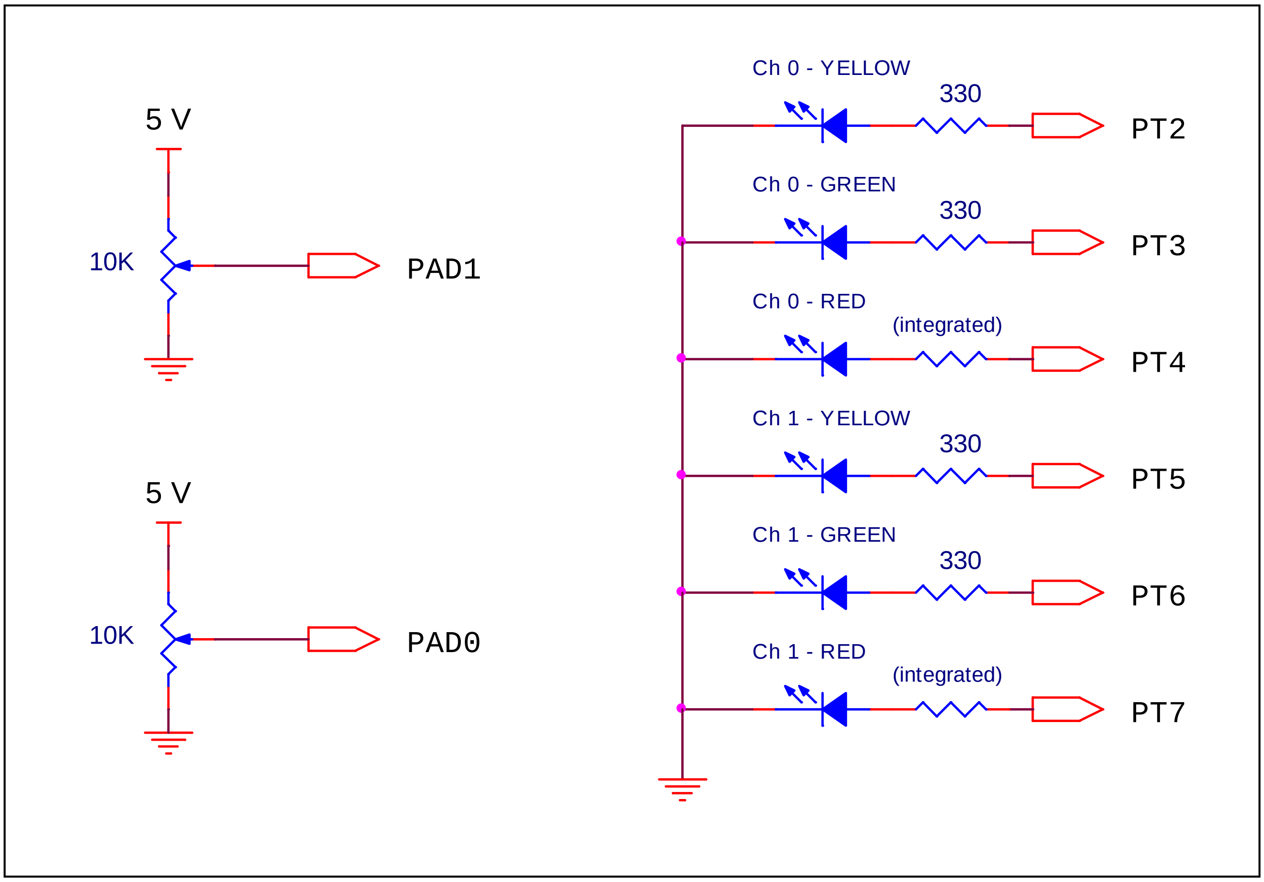

Figure 1. Interface of 10KΩ potentiometers and LEDs to 9S12C32 Development Kit.

Step 3. Demonstration

Demonstrate your working hardware and software to your lab TA, and be prepared to explain your answers to the Thought Questions (below).

Step 4. Thought Questions
Answer the following thought questions in the space provided:

(a) Complete the table below comparing your DVM with the handheld DMM at the laboratory workstation (connect the DMM as well as both DVM input channels to the same variable-voltage power supply). How accurate is your DVM compared to the handheld DMM? Calculate the "worst case" percentage error (based on the measurements tabulated below).

DMM Reading	Ch 0 Reading	Ch 1 Reading	Error (%)
`0.50 V`			
`1.00 V`			
`2.00 V`			
`3.00 V`			
`4.00 V`			
`5.00 V`			

(b) What input voltages do THRESH1, THRESH2, and THRESH3 correspond to?

(c) Describe the hardware and software modifications necessary to measure different voltage ranges (e.g., 0-50, 0-500, 0-5000). What kind of protection mechanism(s) should be incorporated in a practical digital circuit that measures voltage?

(d) Describe the hardware and software modifications necessary to perform a CURRENT measurement. What kind of protection mechanism(s) should be incorporated in a practical digital circuit that measures current? What measures should be taken in order to provide GROUND isolation?

