***Efficient Embedded Course***

**LAB 6**

**COMPARATOR LAB EXERCISE:**

**VOLTAGE MONITOR**

Note. The figures shown in solutions may vary subject to different experimental environments

**Issue 1.0**

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# Introduction

## Lab overview

In this project you will implement a software based comparator to monitor the voltage froma a potentiometer-based divider. You will evaluate the polling software.

# Requirements

In this lab, we will be using the following hardware and software:

* **KEIL µVision5 MDK IDE**
  + Please check the Getting Started with KEIL guide on how to download and install it.
* **STM32 Nucleo-F401RE**
  + For more information, click [here](https://www.st.com/en/evaluation-tools/nucleo-f401re.html).
* **Potentiometer**

# Details

## Hardware

A picture containing diagram

Description automatically generated

Figure 1. Nucleo-F401RE pinout.

### Connections

Diagram, schematic

Description automatically generated

Figure 2. Potentiometer circuit forming voltage divider for comparator monitoring.

Build the circuit shown in Figure 2 on your breadboard. Connect the potentiometer signals to MCU board as shown in table below. This matches the pins used in the lab code.

Table 1. Signals and connections

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Signal Name | Description | Direction | MCU | |
| P3V3 | Positive supply voltage | Power | |  |
| GND | Ground | Power |  | |
| VCompNeg | Variable input voltage | Input to MCU | PA\_0 | |
| VCompPlus | Fixed voltage reference | Input to MCU | PA\_1 | |

## Procedure

1. Compile the supplied lab software for polling operation, load it onto the MCU and run it.
2. Measure the 3V3 supply rail, which is divided for the comparator’s negative reference voltage.   
   V3v3. = \_\_\_\_\_\_\_\_\_\_\_V.

3.3 V

1. At what input voltage (from the potentiometer) does the LED change color? Use a multimeter to measure this voltage.

About 1.6 V

1. At what input voltage do you expect the LED to change color, given theinput to VCompNeg? Does this match the actual code?

Since the potential divider divides by two, we would expect the threshold voltage to be ½ \* 3.3V = 1.65V

1. Change the source code to use interrupts (controlled by the #if in the main function). Verify the code still has the same threshold voltage. What has changed?

The led colors have changed from yellow/blue to red/green.

1. Modify the resistors to change LED color at 1V. Verify that your changes work.

R1+R2=2M.

Vcc\*R2/(R1+R2)

R1 = 1.3M, R2 = 620K.