

ECE-412 INTRO TO EMBEDDED SYSTEMS

LAB 4

PWM, Timer/Counter, Interrupt Vectors & Handlers, Reset

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Yellow highlight points out lab related action required from the student.

Green highlight points out report related action required from the student.

Cyan highlight emphasizes certain terms and information.

Lab 4 continues the exploration of Mega328P architecture including the interrupt system and simple interrupt handling. All applicable Xplained Mini Mega328P hardware and software data sheets/user manuals/user guides are recommended for this lab.

Pulse Width Modulation or PWM is a very efficient method of controlling power to a device. In Lab 3, PWM will be explored as a means to control the power to the LCD backlight, thereby; increasing and decreasing the intensity of the backlight as to make it “breath”. Moreover, the Mega328P Timer/Counter will be implemented in Pulse Width Modulation mode and by an interrupt driven system.

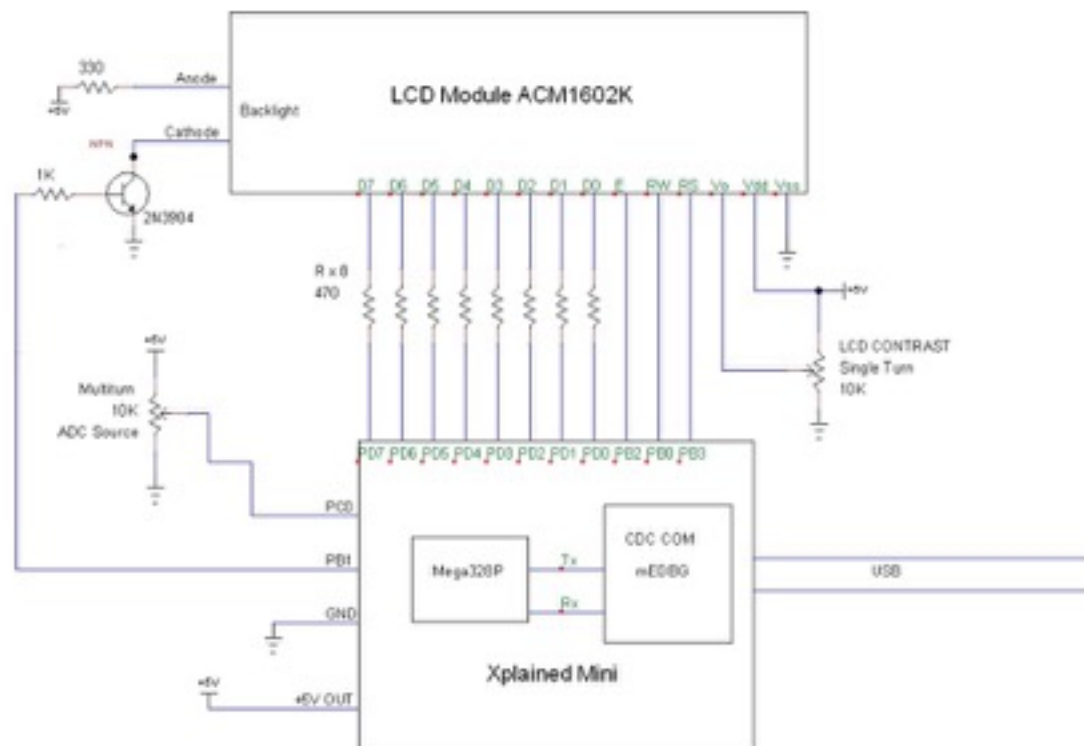
The Mega328P like all other MCUs has an interrupt system that is an important part of reliable operations and communications. In Lab 4, the RESET vector and its associated interrupt handler will be explored. The interrupt system in Lab 4 also includes the TIM1_COMPA interrupt handler. All of the Mega328P interrupt vector table is defined but not all are implemented by default, you are encouraged to explore the other interrupt vectors and associated handlers outside of this lab.

Maintain your hardware from Lab 3 as it will be expanded to successfully complete Lab 4 and its demonstration. A schematic for Lab 4 is provided below.

Part 1: In this part, construct the additional circuitry and modifications attached to lab 3 shown below. It consists of a 1K ohm resistor and a 2N3904 NPN transistor added to the Lab 3 circuit. The circuit is designed to drive the LCD backlight using PWM. A longer duty cycle equates to a brighter display. Port B bit 1 provides the waveform/signal to drive the transistor.

Part 2: In this part, program the Mega32P with the given Lab 4 project code. Use an Oscilloscope to view the waveform at the collector of the 2N3904 transistor. In your report, discuss the default waveform, its duty cycle, its period, and frequency. In your report, discuss in detail how the Oscilloscope measurements relate to the given timer code in the RESET handler and the TIM1_COMPA handler.

Part 3: In this part, modify the RESET and or TIM1_COMPA handler(s) in order to achieve an output frequency of approximately 120 HZ. In your report, discuss in detail the modifications.



Title ECE412 Lab 3 Circuit		
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