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Computer Engineering Lab III (CPE-427-01)

Tech Memo Lab 1

2023

Western New England University
CPE 427

Lab 1

Power Supply Circuit and Reset Circuit

Our first tech memo will begin the process of demonstrating that your PCB is functional. We start with verifying the 5-volt regulator as well as the ISP interface. The memo should provide *stand-alone* evidence that your solution works. Scope captures and schematics are placed in an appendix, while the text of the memo refers to them and supports the premise that your solution works.

Part I - Power Supply Circuit

The microcontroller will be powered by a battery. You will need to construct a conditioning circuit that will provide the necessary 5 volts for your system. The circuit shown in Figure 1 will provide a possible implementation. Be sure to refer to the *suggested* board layout since the 7805 will require a heat sink. Test your circuit with a variety of input voltages between 8 volts and 14 volts. Use scope traces to capture your system's performance. Write a one-page tech memo documenting your results.

SW2 is a *power switch* to disconnect your circuit from the battery.

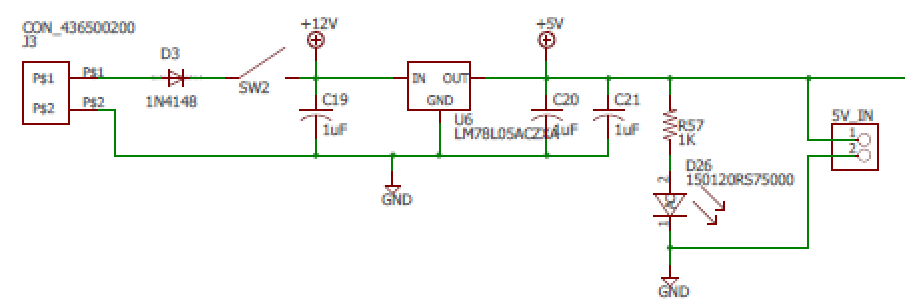


Figure 1
Power Conditioning Circuit

Part II - Reset Circuit, ISP and LED blink
As in Part I, obtain the necessary components from your parts kit. Verify that the reset pulse you see is *as expected.* Next, verify you can program the ATMEGA8 and *blink* the LED on PB0. The microcontroller has an external 8 MHz oscillator.

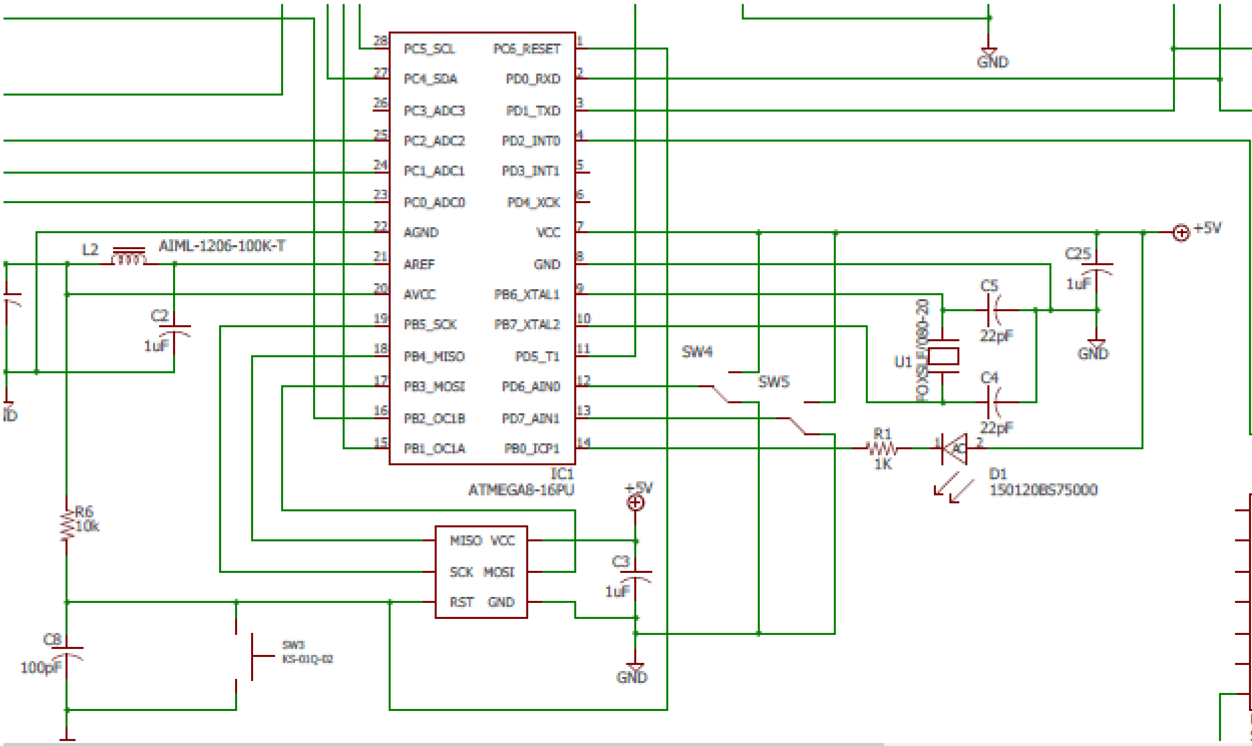


Figure 2 Reset Circuit

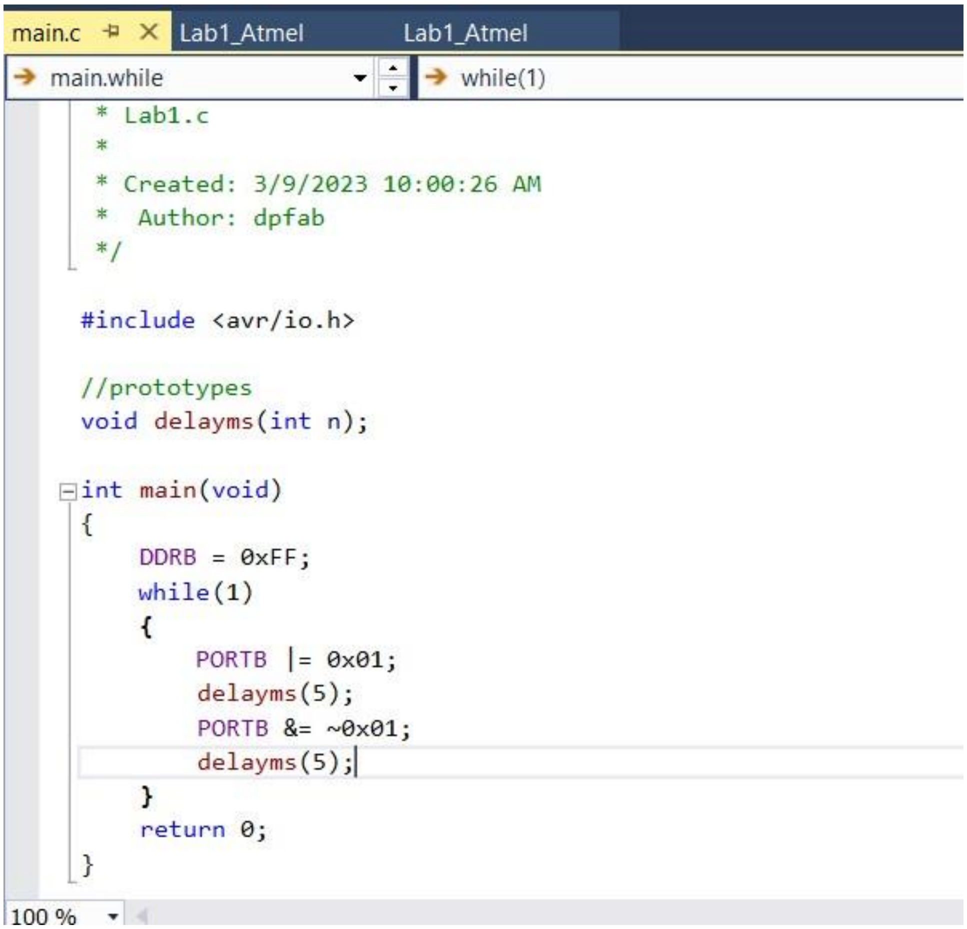
Initially you may use the on-board oscillator, then move to the external crystal.

The goal of lab 1 was to begin the operation of testing the PCB to prove it as being functional. Measurements of the output of the 5-volt Regulator show were taken to prove that the power conditioning circuit was built and implemented properly, as well as shown to conditioning much higher voltages than should be needed (Figures 2-6). An LED was blinked through the use of PB0 on the microcontroller to prove that the ISP interface and microcontroller were both fully functional.

Issues were faced that impeded the completion of the lab. The first iteration of testing the power circuit showed that no power was reaching the board from the input. It was concluded that the issue stemmed from the regulator portion of the circuit. It was presumed that the regulator itself was the problem, but it is also possible that an internal connection was severed or had never existed in the first place. To remedy this, a second regulator was acquired and subsequently installed. During this process, the small pads the regulator is meant to be installed in were damaged. This led the regulator to being attached off the board and connected via soldered wires to capacitors attached to its input and output. Power was restored and successfully regulated after this. The Atmel Studio software was not allowing the code to be uploaded without restarting the software every single use. This is believed to be an issue with the software and did not impede completion of the exercise once the overall issues had been remedied, allowing for the blinking of the LED and proof that the ISP interfacing was successful.

To summarize, despite issues with the board, ISP IDE and general software, the 5-volt regulator successfully works, conditioning the input power and providing steady DC voltage sufficient for the microcontroller to operate. The ISP interfacing was also successfully demonstrated and allowed software to be installed on the controller to blink an LED.

Appendix




```c
 * Lab1.c
 *
 * Created: 3/9/2023 10:00:26 AM
 *  Author: dpfab
 */

#include <avr/io.h>

//prototypes
void delayms(int n);

int main(void)
{
    DDRB = 0xFF;
    while(1)
    {
        PORTB |= 0x01;
        delayms(5);
        PORTB &= ~0x01;
        delayms(5);
    }
    return 0;
}
```

Figure 1: Code used to blink LED

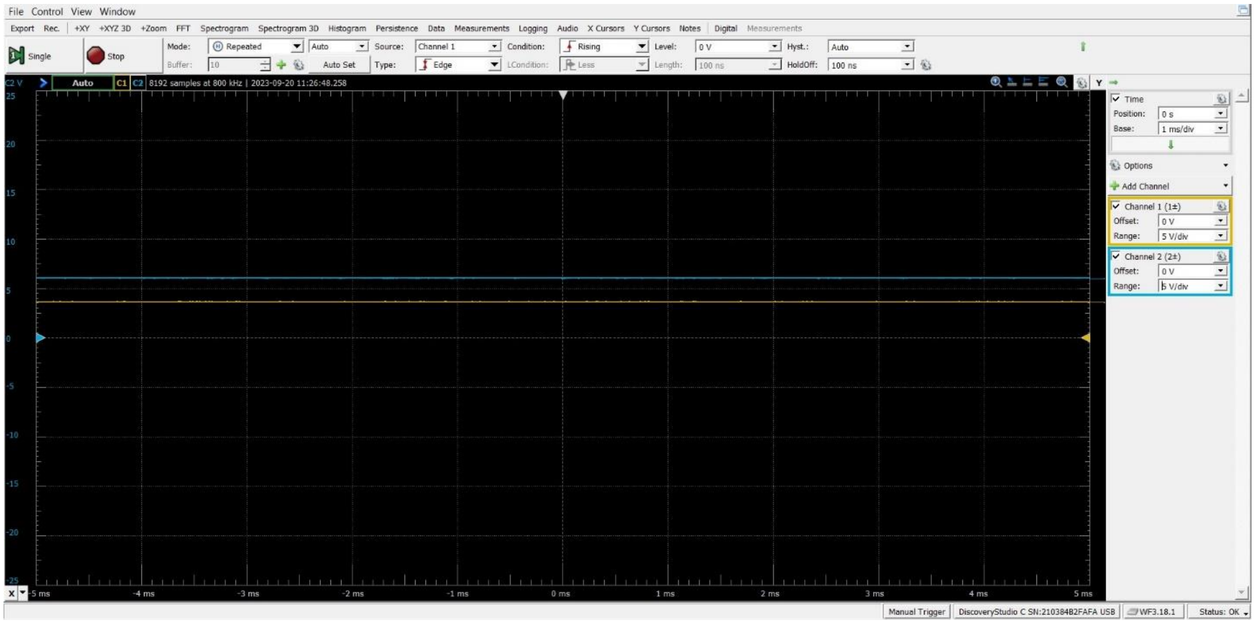


Figure 2: Input (blue) to voltage regulator of 6V and output (yellow) of under 5V

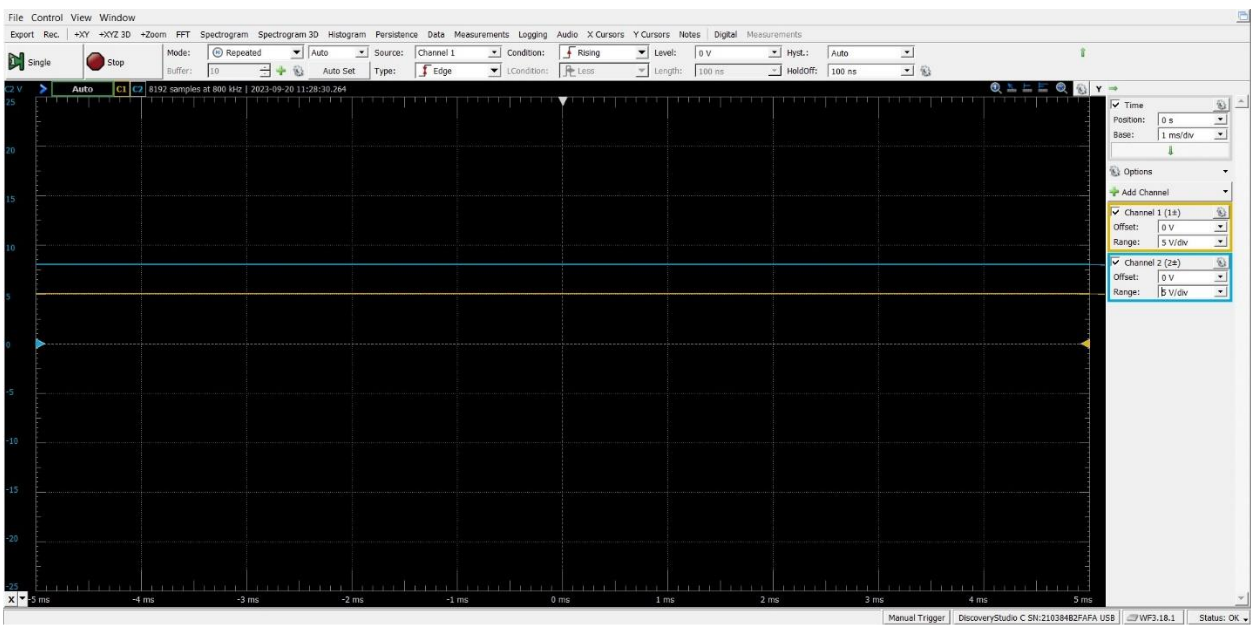


Figure 3: Input of 8V, resulting in just under 5V

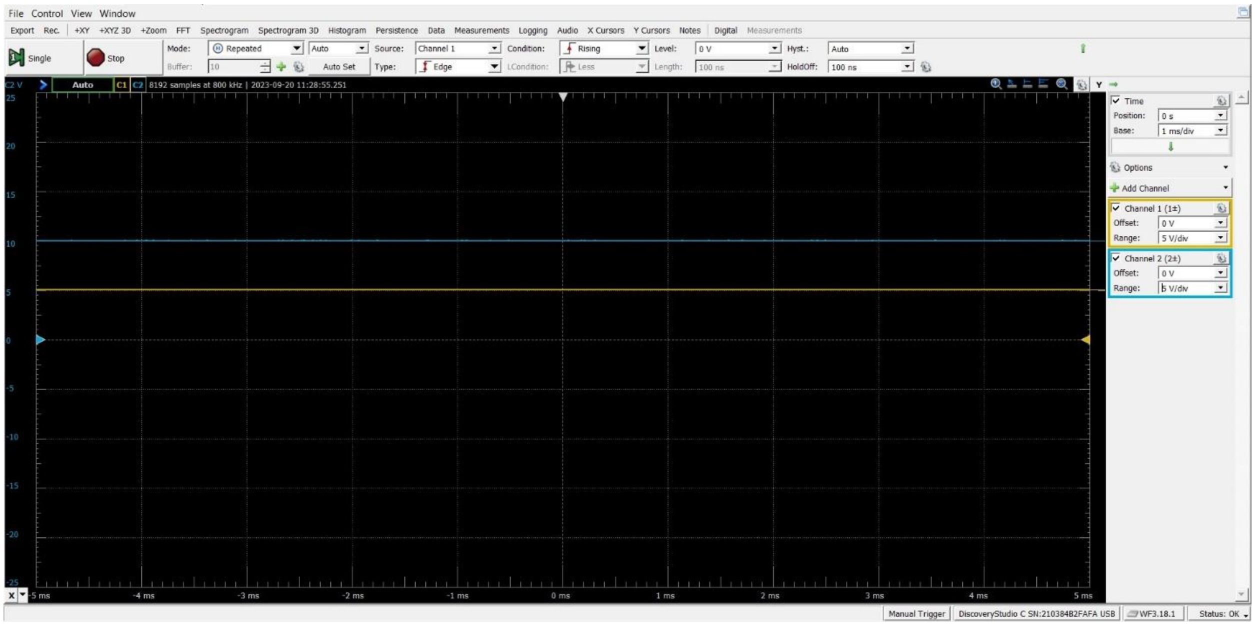


Figure 4: Input of 10V resulting in 5V

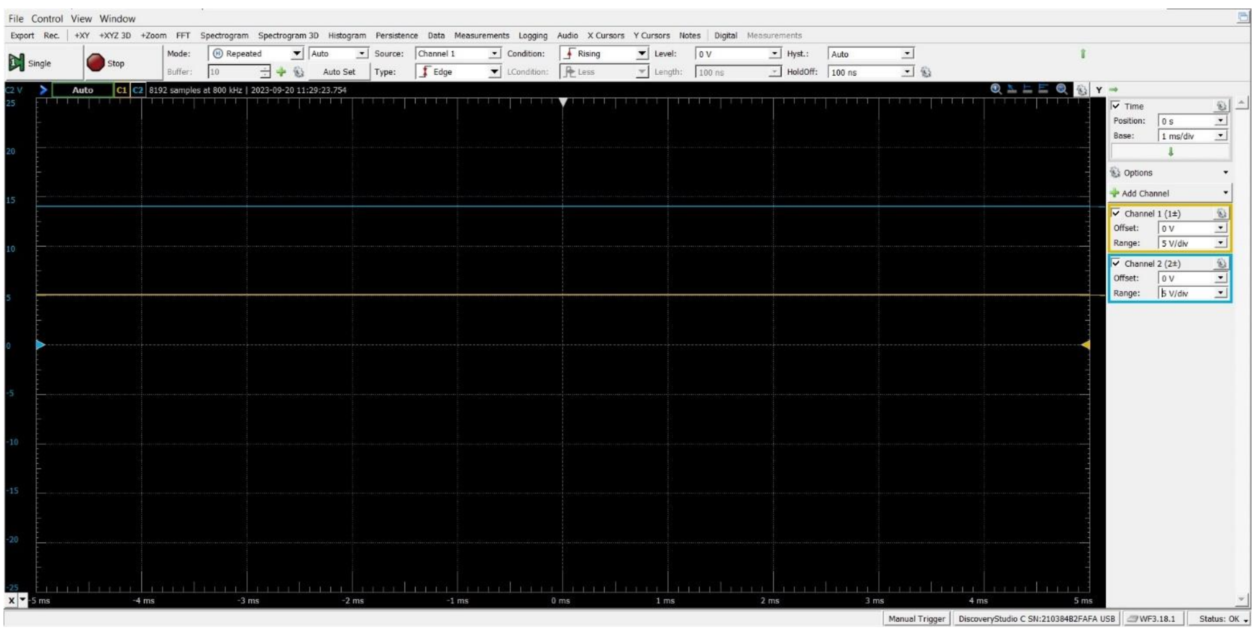


Figure 5: Input of 14V still results in 5V

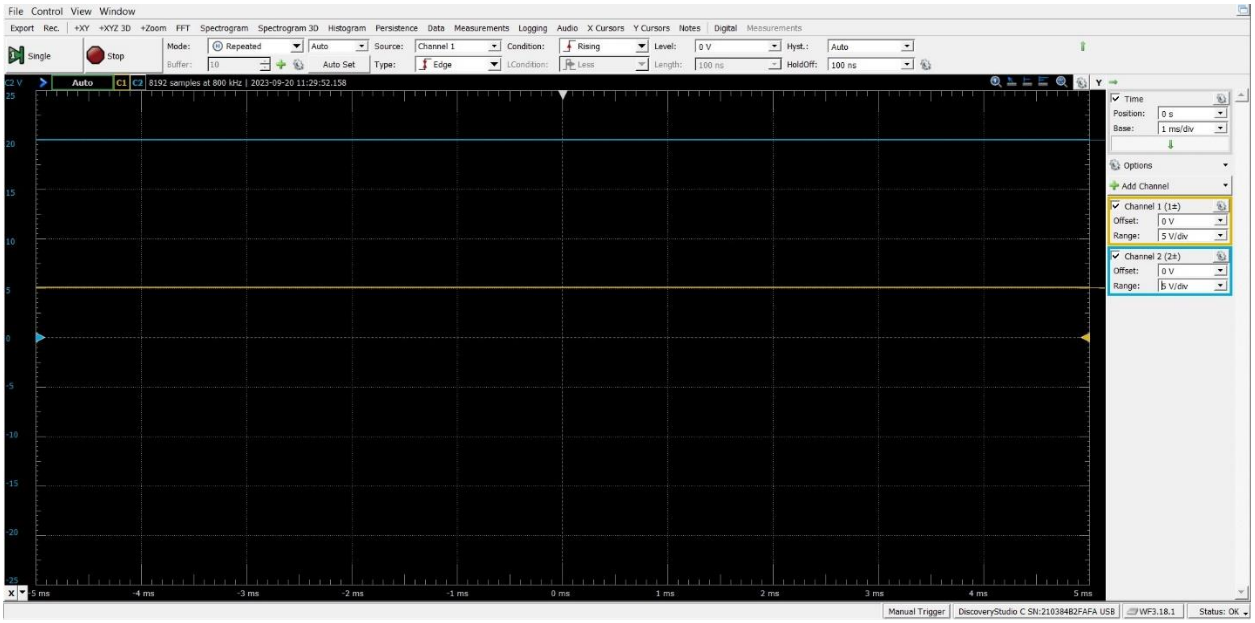


Figure 6: Input of 20V results in 5V

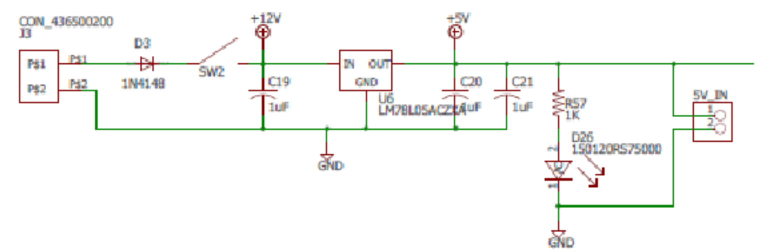


Figure 1
Power Conditioning Circuit

Figure 7: Power Conditioning Circuit Schematic