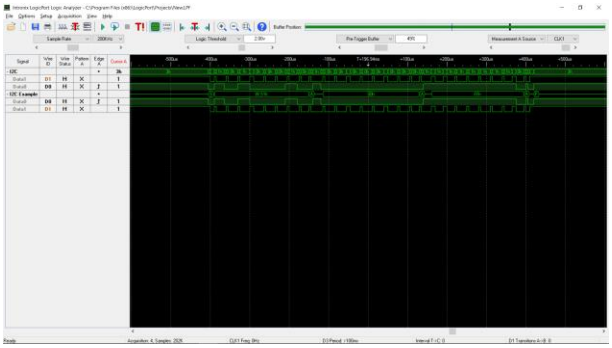
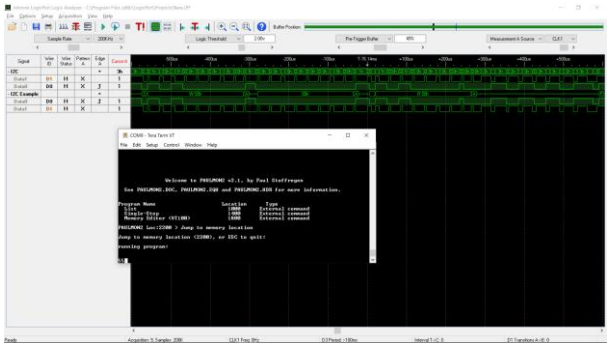
# Lab 4 WriteUp

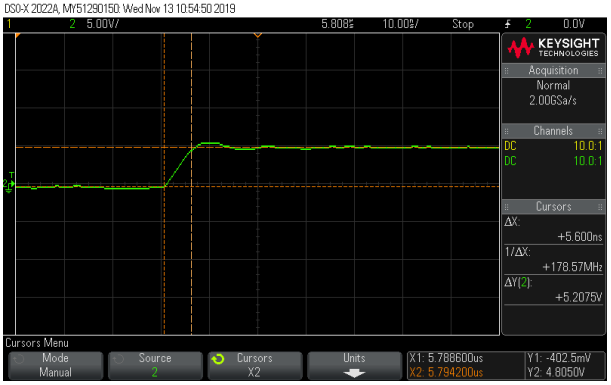
Git Repo: https://github.com/IMNG7/ESD_LAB4

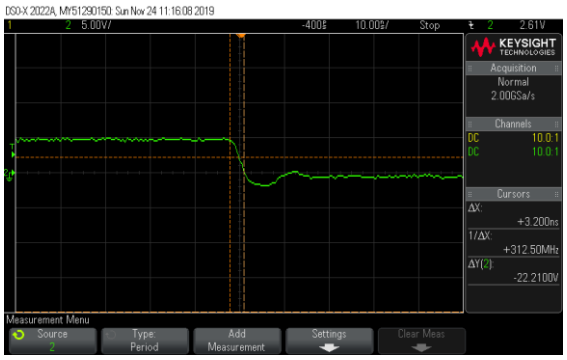
**Part 1**



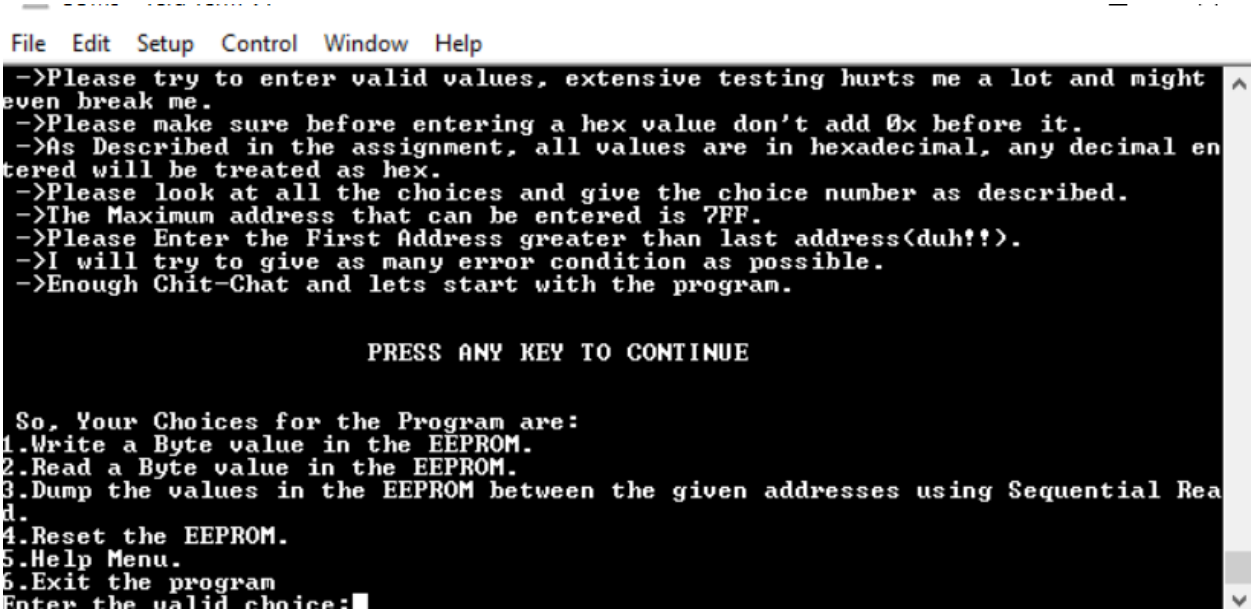


Screenshot of the Logic Analyzer for the write and read Operation.



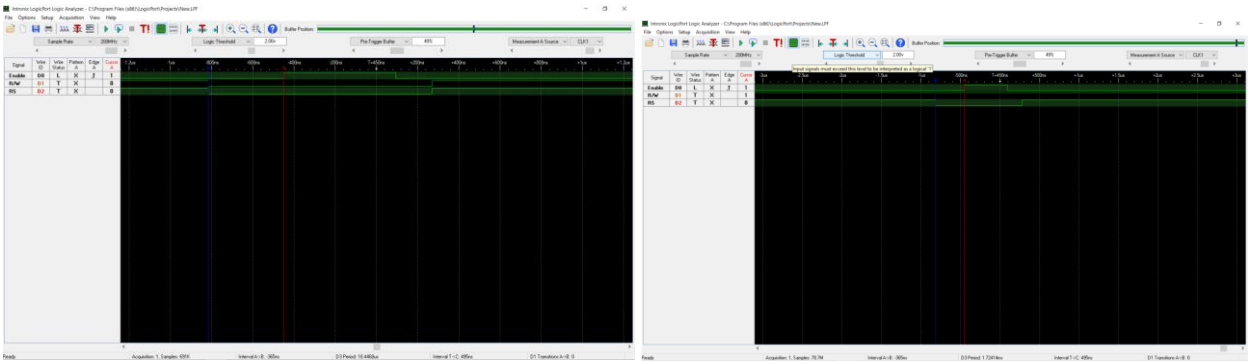

Oscilloscope Screenshot of the Rise time ad fall time of the SCL and User interface for the I2C Program



User Interface for the I2C part.

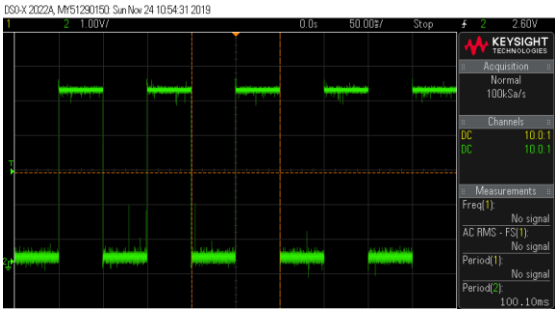
**The major problem that we encountered during the I2C part was the timing between each fuction of the I2C, and taking care that it matches or satisfies the datasheet timing requirements. Other than that, the sign off was pretty smooth. All the functionalities were checked by the TA's.**

**Part 2**

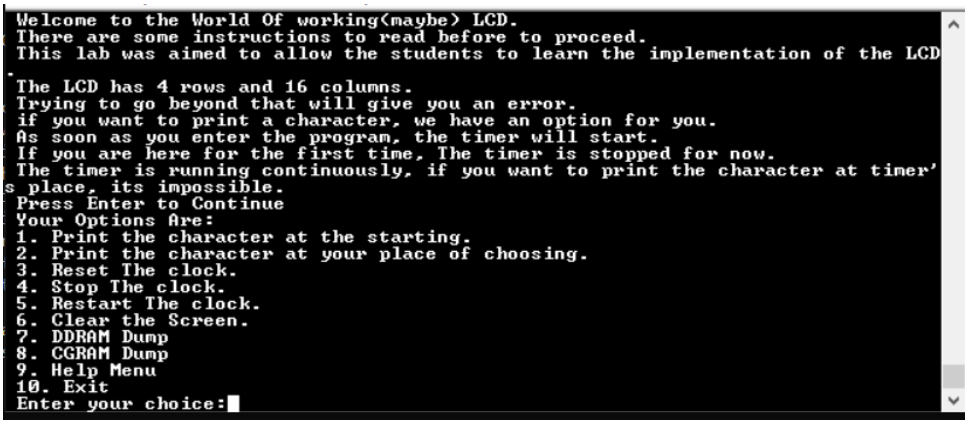


Timing diagrams of the read and write operations on the LCD.

**The most testing part was how to connect the RS, R/W and the Enable pins LCD and interface it with the Microprocessor. After various iterations and discussions with classmates(especially with Abhijeet Dutt Shrivastava and Rakesh Kumar), we got to the conclusion of connecting with different address pins and making the logic differently uploading it to the SPLD logic.**




We used timer 0 for getting the time stamp on the LCD. We calculated the values for the high and low value of the timer 0 and got the ISR working to toggle a pin inside the ISR to test the timing of the timer. Also we made a logic to calculate the time elapsed by incrementing a variable count and calculating seconds, minutes and hours.




All the functionalities were working properly and were demonstrated to the TAs during the Signoff.

User Interface for the LCD and Clock combined.

**Supplemental.**

**Till supplemental, everything was working fine, but after adding the DDRAM dump and CGRAM Dump, the write and the read part was working fine, but the clear function stopped working, I git the github code back from my previous option and still it didin't work.(FYI since I did it some moments before the signoff, there didn't had enough time to debug the problem. Asked the TAs about it but they also didn't had any clue without looking at the code).**

Another Supplemental that I did was the real time clock, I did it on KL25Z board by NXP, but the resetting of time and date of the PC was really difficult, while in MSP432, using the RTC registers, which are both readable and writable, we can adjust the date and time of the Real time clock included in the MSP, and also tried to explore the Alarm functionality of the MSP.


Real time clock using the MSP432.

**ECEN 5613** **Lab #4 Signoff Sheet** **Fall 2019**

You will need to obtain the signature of your TA on the following items in order to receive credit for your lab assignment. Signatures are due by **Friday, November 15, 2019 (Part 1 Elements) and Friday, November 22, 2019 (Part 2 Elements)**.

Print your name below, sign the honor code pledge, circle your course number, and then demonstrate your working hardware & firmware in order to obtain the necessary signatures.

**Student Name:** Nitik Gupta

**Honor Code Pledge**: "On my honor, as a University of Colorado student, I have neither given nor received unauthorized assistance on this work. I have clearly acknowledged work that is not my own."

**Student Signature:** Gupta

**Signoff Checklist**

Part 1 Required Elements

- ☑ Pins and signals labeled and decoupling capacitors present on board
- ☑ C code for EEPROM functional, contents present after power cycle
- ☑ I²C diagram/timing analysis

**TA signature and date**

Part 2 Required Elements NOTES ON BACK

- ☑ LCD functional, C code for basic LCD routines functional
- ☑ LCD control signal timing meets specifications (logic analyzer trace/diagram, analysis)
- ☑ Elapsed time stop, restart, reset to "00:00.0": <1s OVER 3MIN DRIFT
- ☐ Good integration with previous code, all functions work, no irregularities

11/22

Part 2 Supplemental Elements

- ½ ☑ LCD Hex/~~DDRAM~~/CGRAM dumps, custom LCD characters, fun logo SEE NOTES
- ☐ SPI interface, logic analyzer trace, compare with I²C.
- ½ ☑ TI MSP432 ARM code development, 2 new features, ISR 2 FEAT SEE NOTES
- ☐ PCF8574 I²C I/O Expander, input, output, ISR

| **FOR TA/INSTRUCTOR USE ONLY Part 1 Elements** | Not Applicable | Poor/Not Complete | Meets Requirements | Exceeds Requirements | Outstanding |
|---|---|---|---|---|---|
| Schematics, SPLD code | ☐ | ☐ | ☑ | ☐ | ☐ |
| Hardware physical implementation | ☐ | ☐ | ☑ | ☐ | ☐ |
| Required Elements functionality | ☐ | ☐ | ☑ | ☐ | ☐ |
| Sign-off done without excessive retries | | ☐ | ☑ | | |
| Student understanding and skills | ☐ | ☐ | ☑ | ☐ | ☐ |
| Overall Demo Quality (Part 1 elements) | ☐ | ☐ | ☑ | ☐ | ☐ |

| **FOR TA/INSTRUCTOR USE ONLY Part 2 Elements** | Not Applicable | Below Expectation | Meets Requirements | Exceeds Requirements | Outstanding |
|---|---|---|---|---|---|
| Schematics, SPLD code | ☐ | ☐ | ☑ | ☐ | ☐ |
| Hardware physical implementation | ☐ | ☐ | ☑ | ☐ | ☐ |
| Required Elements functionality | ☐ | ☐ | ☑ | ☐ | ☐ |
| Supplemental Elements functionality | ☐ | ☐ | ☑ | ☐ | ☐ |
| Sign-off done without excessive retries | | ☐ | ☑ | | |
| Student understanding and skills | ☐ | ☐ | ☑ | ☐ | ☐ |
| Overall Demo Quality (Part 2 elements) | ☐ | ☐ | ☑ | ☐ | ☐ |

**TA/Instructor Comments** ☐☐☐

11/12 PT1 A1057

- NO PULLUPS IN SCHEMATIC (on BOARD THOUGH)
  DECOUPLING CAP COULD BE CLOSER
+ CATCHES ALL INPUT ERRORS (TOO BIG, OUTOF RANGE, NON-HEX)
+ NICE FORMATTED DUMP
+ NICE MENU
  6.43KHz I²C
+ TIMING ANALYSIS RT's, FREQ, LOW/HIGH, SDA SETUP AND HOLDS
- RESET NOT QUITE RIGHT (WRONG START CONDITION, SR WRONG)
+ DECENT RESET UNDERSTANDING (KNOW IT FIXES HANGS, BUT NOT HOW)
- NO NACK HANDLING
+ CROSS PAGE READS WORK

11/22 PT2

~ TIMING ANALYSIS OF RS/EN, BUT NO RECORDED VALS FOR OTHE SIGNALS. SAYS THEY WERE CHECKED THOUGH.

~ RAM DUMP ~~BREAKS~~ BROKE CLEAR SCREEN (CALLS CLEARSCREEN). STILL BROKEN

~ CHARACTER INPUT, NO STRING INPUT
  STRING WRITE FUNCTION, BUT NOT IN INTERACTIVE PROGRAM.

~ HAS DDRAM DUMP BUT APPEARS NON FUNCTIONAL
  NO CGRAM DUMP

+ RTC ON MSP432 PRINTS TIME EVERY SECOND

NO EEPROM CHECK NEEDED