# Design Assignment 4

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## I. Deliverable 1: Table of Unfiltered and Filtered ADC Values

| $I_{Sense}$ (Setting on Power Supply 2) | $V_{out1}$ (Unfiltered ADC) | $V_{out2}$ (Filtered ADC) |
|---|---|---|
| 0.010A | 286 | 312 |
| 0.020A | 295 | 323 |
| 0.030A | 303 | 332 |
| 0.050A | 321 | 351 |
| 0.100A | 364 | 397 |
| 0.150A | 407 | 444 |
| 0.200A | 449 | 491 |
| 0.300A | 537 | 588 |
| 0.400A | 625 | 680 |
| 0.500A | 712 | 769 |
| 1.000A | 1147 | 1228 |
| 2.000A | 2018 | 2131 |
| 2.500A | 2455 | 2695 |
| 3.000A | 2900 | 3151 |
| 3.200A | 3068 | 3329 |

Table 1: Comparison of $V_{out1}$ (Unfiltered ADC) and $V_{out2}$ (Filtered ADC) against $I_{Sense}$

**Note: The current limit for the power supply at MC402 went only up to 3.2A, thus, 3.250A and 3.500A were not measured.*

The ADC values for unfiltered and filtered outputs increase linearly with $I_{Sense}$ with no missing points. As expected, the filtered output is uniformly higher than the unfiltered output and no inconsistencies were observed during measurement.

## II. Deliverable 2: Scatter plots for $I_{Sense}$ versus ADC values (unfiltered and filtered)

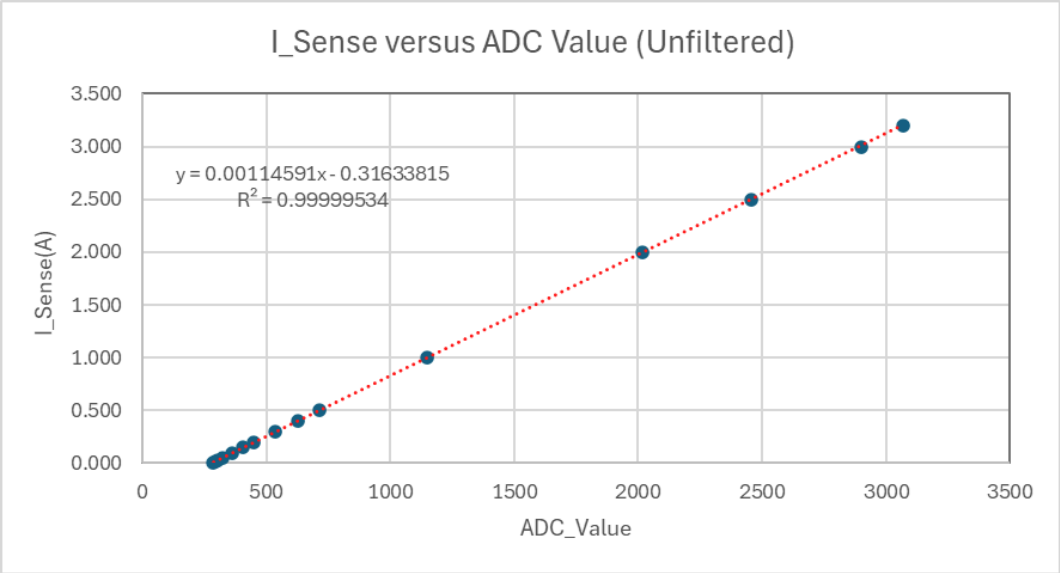


Figure 1: Calibration curve showing the relationship between $I_{Sense}$ and the Unfiltered $V_{out1}$

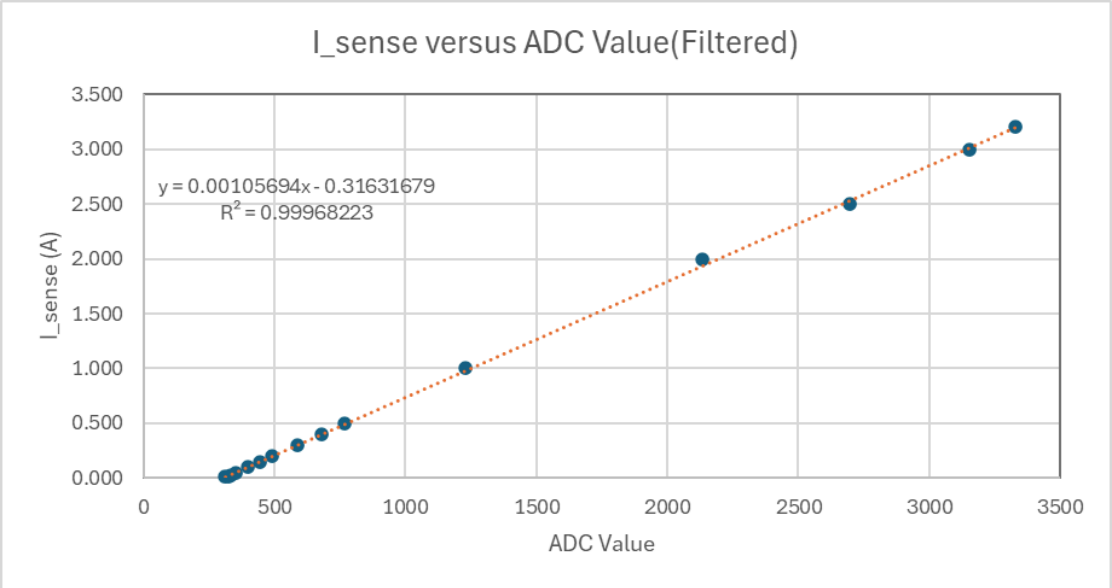


Figure 2: Calibration curve showing the relationship between $I_{Sense}$ and the Filtered $V_{out2}$

Both the filtered and the unfiltered graphs show a strong linear relationship between $I_{Sense}$ and the ADC values. As shown above, while both graphs demonstrate a strong linear relationship, Figure 1 has a slightly higher $R^2$ value of 0.99999534 whereas Figure 2 has an $R^2$ value of 0.99968223 and has a small outlier of 2A. Therefore, parameters in Figure 1 were selected for calibration to ensure the highest possible precision.

## III. Deliverable 3A: Comparison of $V_{out}$ setting on UI versus measured $V_{out}$

| Target $V_{out}$ on UI | Measured $V_{out}$ |
|---|---|
| 1V | 0.91V |
| 5V | 4.95V |
| 10V | 9.98V |
| 13V | 12.99V |
| 15V | 15.01V |

Table 2: Target $V_{out}$ on UI versus Measured $V_{out}$

The measured $V_{out}$ values are similar to the set UI $V_{out}$ values with deviations ≤0.1V across the full output range. This shows that the voltage regulation loop and $V_{out}$ calibrations are functioning accurately and as intended.

## IV. Deliverable 3B: Comparison of $I_{out}$ setting on UI versus measured $I_{out}$

| Target $I_{out}$ on UI | Measured $I_{out}$ |
|---|---|
| 0.2A | 0.20A |
| 0.5A | 0.49A |
| 0.8A | 0.79A |
| 1.0A | 0.99A |
| 2.0A | 1.99A |

Table 3: Target $I_{out}$ on UI versus Measured $I_{out}$

The measured $I_{out}$ values are closely matches the set UI $I_{out}$ values with a difference of 0.01-0.02A for all tested values. This shows that the current-limiting control loop and current-sense calibration are operating accurately and as intended.

## V. Deliverable 3C: Images of working project

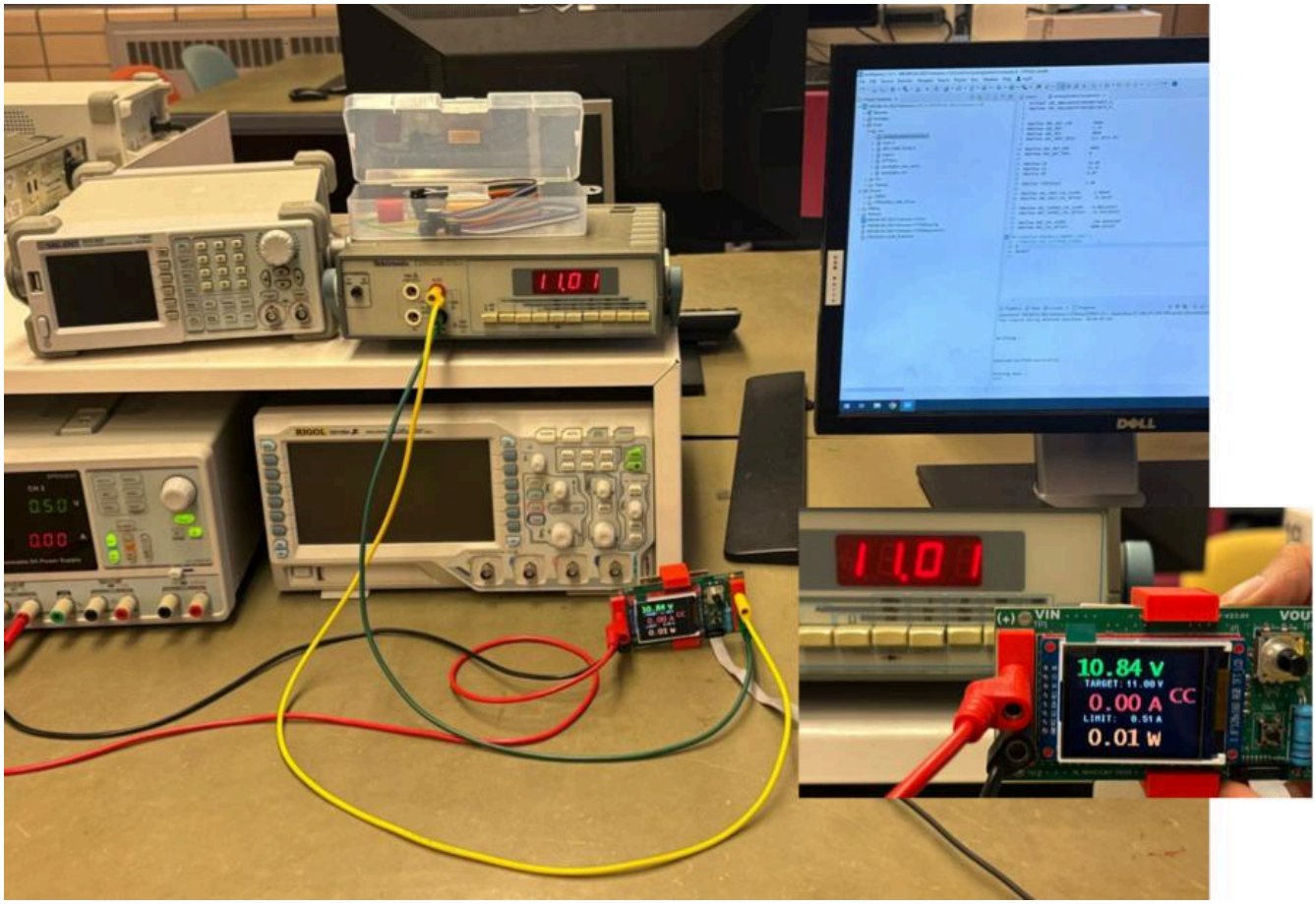


Figure 3: Final power supply in operation with active LCD and firmware running. This picture shows when the UI is set to 11V and the multimeter reads 11.01V, confirming correct operation.

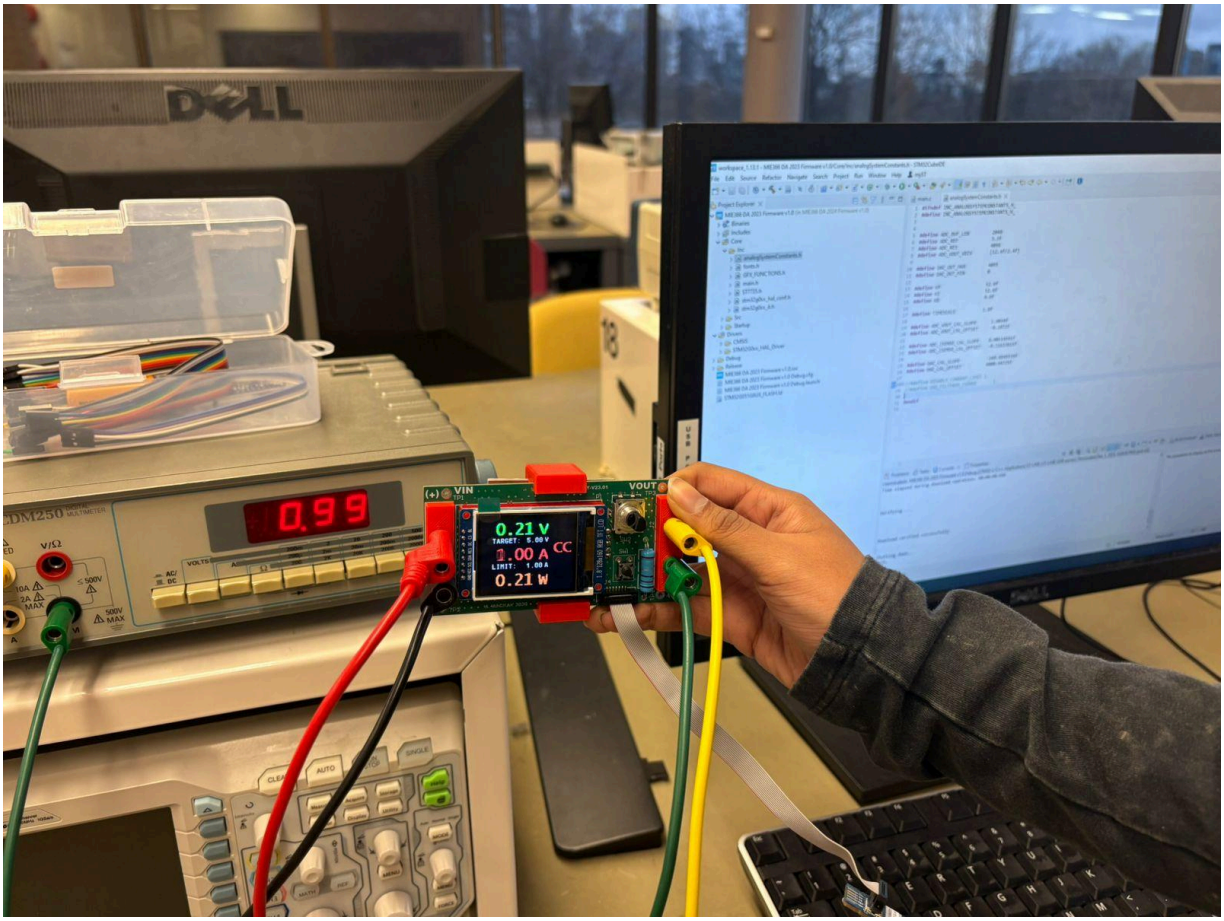


Figure 4: Final power supply in operation with active LCD and firmware running. This picture shows when the UI current limit is set to 1A and the multimeter reads 0.99A, confirming correct operation.

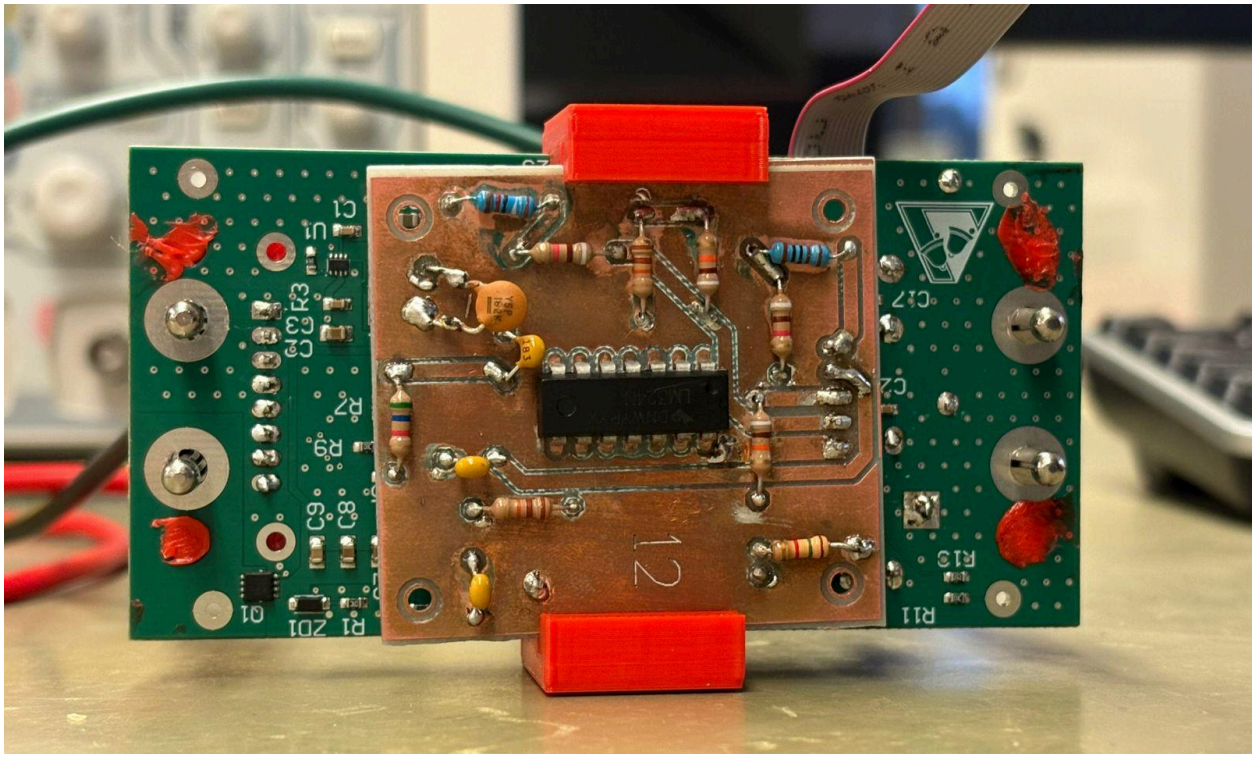

Figure 5: Back side of the assembly showing the DA3 PCB mounted to the main motherboard.