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Experiment 7: Analog to Digital conversion

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1   Introduction

1.1   Objectives

1. To quantize the voltages after sampling.

2   Instruments and Materials Used

1. RIGOL Signal Generator

2. ScientiFIC SMO10C Digital Signal Oscilloscope

3. +12V, -12V DC source and ground

4. Resistors

5. Capacitors

6. Diodes

7. Breadboard

8. Connecting wires

9. JFET

10. ADC 0802

3   Theory

In the previous experiment, we sampled the signal which discretized it in the time domain. However, the values of the signal were still taking values in a continuum. Thus to process it using a discrete setup, we would need to obtain an output which only takes up finite values i.e. we need to discretise the voltage levels.
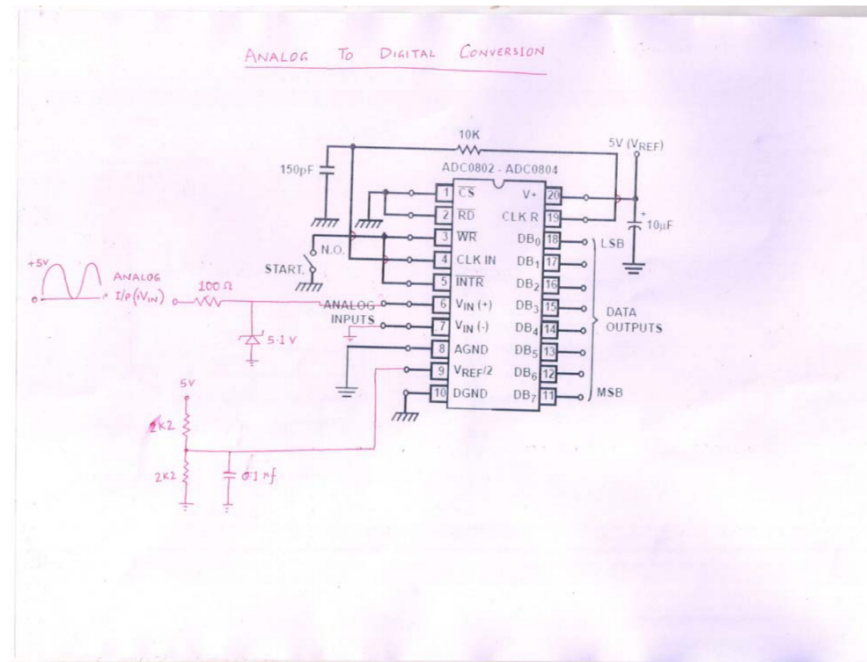
4   Circuit Diagram

Figure 1: Circuit for quantizing the sample and hold signal from Expt 6.
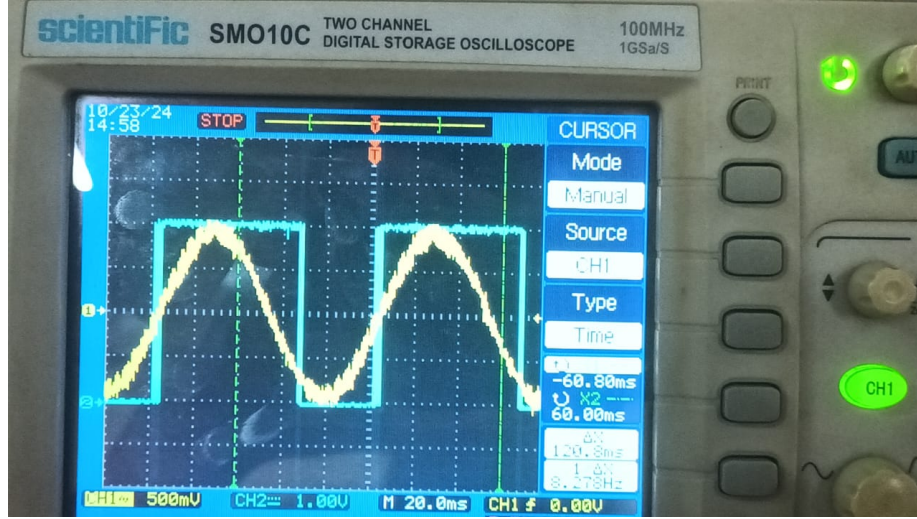
5 Observations and Results

Figure 2: Sample and hold signal, and the Most significant bit(MSB) @ 10Hz

6 Discussion

6.1 Samyak Sheersh, 22EC30045

1. The IC we used for Analog to Digital Conversion (ADC 8202) was an 8-bit converter with reference voltage was from 0 to 5V.

2. We had input the signal with $V_{pp} = 2V$ with an offset of $V_{dc} = 3V$ such that the signal never goes to negative voltage. Thus, the actual variation we get is from $V_{min} = 1V$ to $V_{max} = 5V$.

3. Since it represents the voltages using 8 bits, where 00000000 would correspond to $0V$ and 11111111 would correspond to $5V$. Thus the MSB would be on whenever the reference signal goes above 2.5V, as we can clearly see from the DSO output

4. We could also see (by using LED pins) that the MSB was changing the slowest of them all, while the LSB had the highest frequency, which is expected since even changes of $\frac{5}{2^8-1} \approx 0.02V$ would lead to a change in the level that the sample is assigned to.

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