Introduction to DSO, Breadboard and RC Circuit Experiment

1. Introduction to Digital Storage Oscilloscope

What is a Digital Storage Oscilloscope?

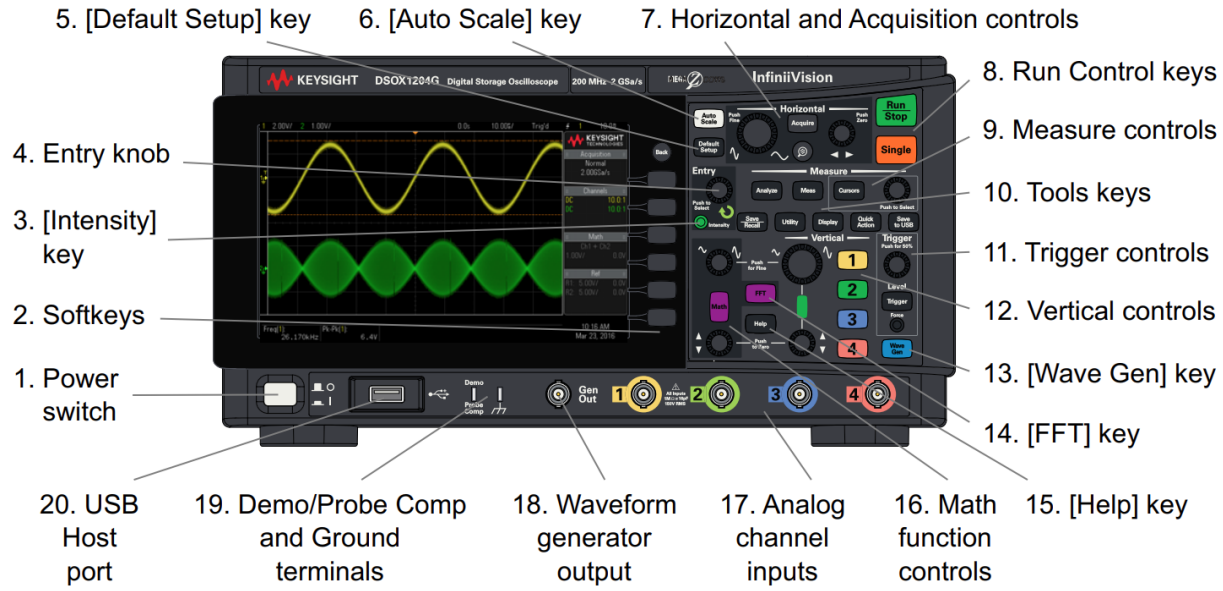
A Digital Storage Oscilloscope (DSO) is an electronic test instrument that allows you to observe and analyze electrical signals. Unlike traditional analog oscilloscopes, DSOs convert the measured voltage into digital information, which can be stored, processed, and displayed.

Key Features of DSOs

1. **Waveform Display:** DSOs show voltage-time graphs of electrical signals.
2. **Multiple Channels:** Most DSOs can display multiple signals simultaneously.
3. **Sampling:** DSOs sample the input signal at regular intervals.
4. **Triggering:** This feature stabilizes repetitive waveforms.
5. **Storage:** DSOs can save waveforms for later analysis.
6. **Measurements:** Automated measurements of signal parameters.
7. **Math Functions:** Perform calculations on displayed waveforms.

Basic DSO Controls

1. **Vertical Controls:** Adjust the voltage scale and position.
2. **Horizontal Controls:** Adjust the time base and trigger position.
3. **Trigger Controls:** Set trigger level and mode.
4. **Input Coupling:** Switch between AC, DC, and ground coupling.
5. **Acquisition Controls:** Set sampling rate and acquisition mode.
6. **Display Controls:** Adjust how waveforms are displayed.



Please go through the user manual for details :- Manual

2. Breadboard

The circuit to be studied will have to be assembled on the breadboard. Fig. 1 shows the schematic of the breadboard. It has 128 vertical strips, 64 on each side of the horizontal divider in the middle, each strip consisting of 5 spring-loaded tie-points internally connected to one another. Each connection among the circuit components is made with the help of tie-points connected on the same strip. The breadboard also has 8 horizontal strips, four on the top side and 4 on the bottom side, each having 25 tie-points. These strips are generally used for making power supply connections.

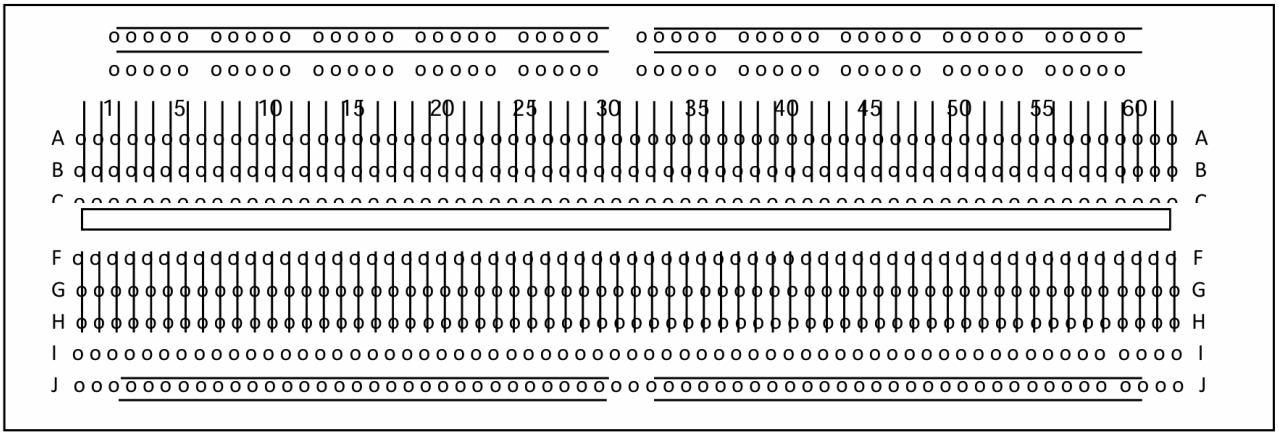


Figure 1: Breadboard Schematic

3. Procedure for RC Circuit Experiment

Equipment Needed

- Breadboard
- Resistors (various values)
- Capacitors (various values)
- Digital Storage Oscilloscope (DSO)

Procedure

1. Connect the RC circuit on the breadboard as shown in Fig. 2.
2. Apply a square wave using the function generator.
3. Observe the waveform across the capacitor on the DSO screen.
4. For each combination of R and C:
   - Calculate the theoretical time constant (τ) using:

$$\tau = R \cdot C$$

   - Measure the practical time constant from the DSO waveform.
   - Calculate the theoretical cutoff frequency (f_c) using:

$$f_c = \frac{1}{2\pi RC}$$

   - Measure the practical cutoff frequency using the DSO.
5. Record your results in the observation table.

Figure 2: RC Circuit

6. Repeat steps 4–5 for three different combinations of R and C values.

Analysis and Result

In your notebook, compare the theoretical and practical values for both time constant and cutoff frequency. Discuss any discrepancies and potential sources of error in your measurements.

Sr No	**R (Ω)**	**C (µF)**	**Theoretical Time Constant (τ)**	**Practical Time Constant (τ)**	**Theoretical Cutoff Freq. (f_c)**	**Practical Cutoff Freq. (f_c)**

Table 1: Observation Table format