

**Aim** ➡ To study the operation of a Digital Storage Oscilloscope (DSO) and its use in measuring voltage, frequency, and time period.

### **Equipment Required** ➡

Digital Storage Oscilloscope [DSO], function generator, probes, power supply, and connecting leads.

### **Theory** ➡

A Digital Storage Oscilloscope (DSO) is an advanced instrument used to visualize and analyze electrical signals over time, differing from traditional oscilloscopes by digitizing and storing waveforms for detailed analysis. DSOs capture transient events that may not be observable in real-time, making them invaluable in both educational and industrial applications. The main components of a DSO include input probes, an analog-to-digital converter (ADC), digital memory, a microcontroller, and a display screen.



Fig. i) Digital Storage Oscilloscope

The inner structure of a DSO begins with input probes that capture electrical signals, which are then fed into the ADC. The ADC converts these analog signals into digital data by sampling them at specified intervals. The sampling rate is crucial; higher rates allow for a more accurate representation of fast-changing

signals. Once digitized, the data is stored in the device's memory, enabling users to replay and analyze captured waveforms.

The working principle of a DSO involves sampling, storing, and processing signals. When an input signal is applied, the DSO samples it, digitizes the data, and the microcontroller processes this information. This includes features such as triggering and scaling, which enhance signal analysis. The DSO's display presents processed waveforms, allowing for detailed observation of signal characteristics like amplitude and frequency. Understanding how to operate a DSO effectively is essential for troubleshooting and verifying circuit performance.

### Procedure ↔

1. Connect the DSO probes to the signal source you wish to measure.
2. Adjust the volts/div setting until the waveform fits within the display. To calculate the peak voltage, count the vertical divisions the waveform covers and multiply by the volts/div setting.
3. Set the time/div setting to ensure that one complete cycle of the waveform is visible on the screen. To determine the time period, count the horizontal divisions for one full cycle and multiply by the time/div setting.
4. Calculate the frequency using the formula  $f = \frac{1}{T}$

### Output Calculation ↔

- Peak Voltage = 12.05V
- Frequency = 997.1Hz
- Time Period = 1ms



### Result ↔

The experiment demonstrated the DSO's capability to measure voltage, frequency, and time period accurately, with the readings aligning with the expected values.

### Conclusion ↔

This experiment introduced the basic operation of a DSO, a crucial tool for modern electronic analysis. It allows precise waveform measurements and signal storage, providing valuable functionality for both educational and industrial applications.

## **Precautions ↗**

- Ensure proper calibration of the DSO before taking measurements.
- Use appropriate voltage ranges to prevent overloading the device.
- Avoid direct contact with high-voltage components to prevent electric shock.
- Handle the probes carefully to avoid damaging sensitive circuit components.