

Aim ➡ To study the operation of a Cathode Ray Oscilloscope (CRO) and its use in measuring voltage, frequency, and time period.

Equipment Required ➡

Cathode Ray Oscilloscope [CRO], function generator, probes, power supply, and connecting leads.

Theory ➡

A Cathode Ray Oscilloscope is a fundamental instrument used for visualizing electrical signals. It converts electrical signals into a visible graph, displaying voltage as a function of time on its screen. This allows for real-time analysis of waveform characteristics such as amplitude, frequency, and phase. The primary components of a CRO include the cathode ray tube (CRT), vertical and horizontal deflection plates, time base, and control knobs for adjustments.

The CRT is at the heart of the CRO, where an electron gun emits a stream of electrons toward a phosphorescent screen. These electrons, accelerated and focused into a narrow beam, create a visible dot where they hit the screen. The vertical and horizontal deflection plates inside the tube manipulate this beam, causing it to move in response to the input signals. The vertical deflection plates respond to the amplitude of the signal, while the horizontal deflection is controlled by a time-based circuit, allowing the waveform to be traced over time.

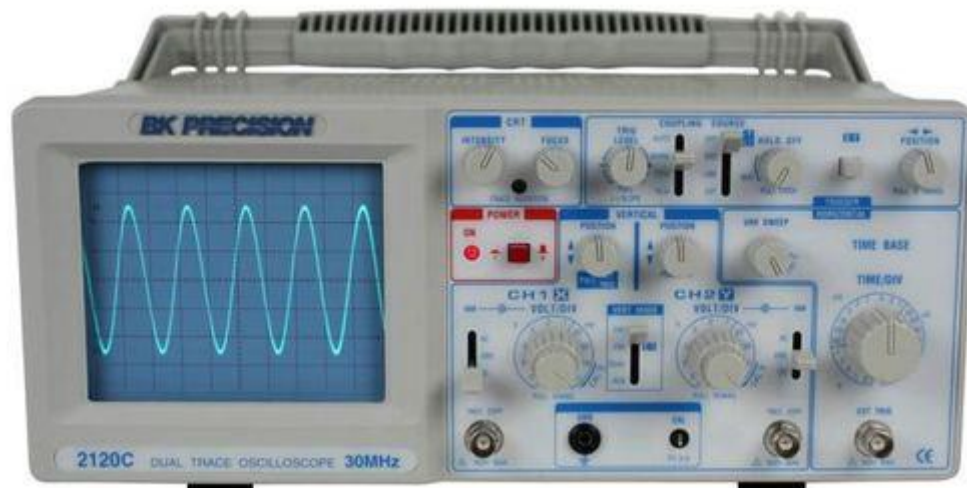


Fig. i) Cathode Ray Oscilloscope

The working of the CRO involves applying an electrical signal to the vertical deflection plates while a sawtooth waveform from the time base generator is applied to the horizontal deflection plates. As the time base voltage increases linearly with time, it sweeps the electron beam horizontally across the screen,

synchronizing with the signal to form a stable waveform. The signal's amplitude controls the vertical movement of the beam, enabling the visualization of the waveform's shape.

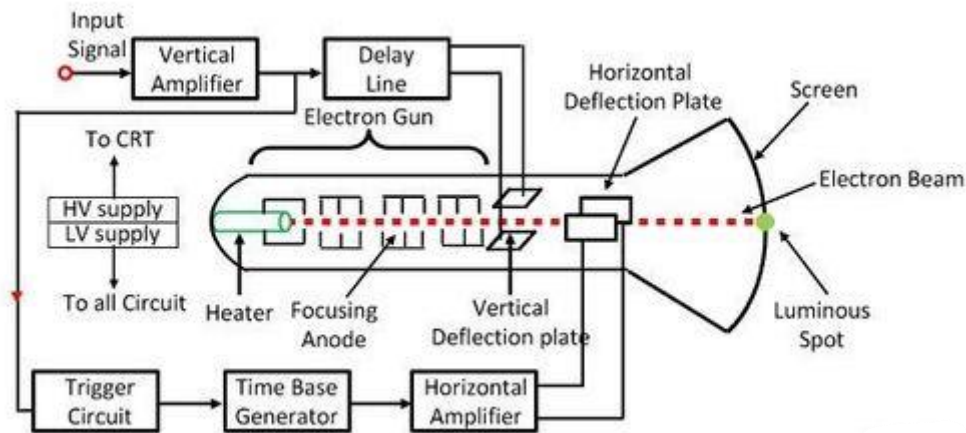


Fig. ii) Inner Structure of CRO

CROs are invaluable for measuring various parameters like peak voltage, time period, and frequency. By analyzing the waveform on the screen, users can determine whether a signal is sinusoidal, square, or triangular. Additionally, CROs are equipped with probes for connecting to the circuit under test and adjusting knobs to control the signal's scaling, position, and focus on the screen.

Procedure ➡

1. Connect the CRO 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. Adjust the time/div setting so that one full cycle of the waveform is visible on the screen. To calculate the time period, count the horizontal divisions for one complete cycle and multiply by the time/div setting.
4. Calculate the frequency using the formula $f = \frac{1}{T}$

Result ➡

The experiment successfully demonstrated the use of a CRO to display waveforms and measure voltage, frequency, and time period accurately. The readings from the CRO matched the expected values, confirming the proper functioning of the device.

Conclusion ↗

This experiment provided hands-on experience in using a CRO for waveform analysis. Understanding how to operate a CRO and interpret waveforms is crucial for diagnosing and analyzing electronic circuits, as it is widely used in both educational and industrial applications.

Precautions ↗

- Ensure the probes are connected correctly to avoid incorrect measurements.
- Set the correct voltage range on the CRO before connecting the circuit to prevent damage.
- Avoid direct contact with high-voltage components to prevent electric shock.
- Turn off the CRO when not in use to extend the lifespan of the instrument.