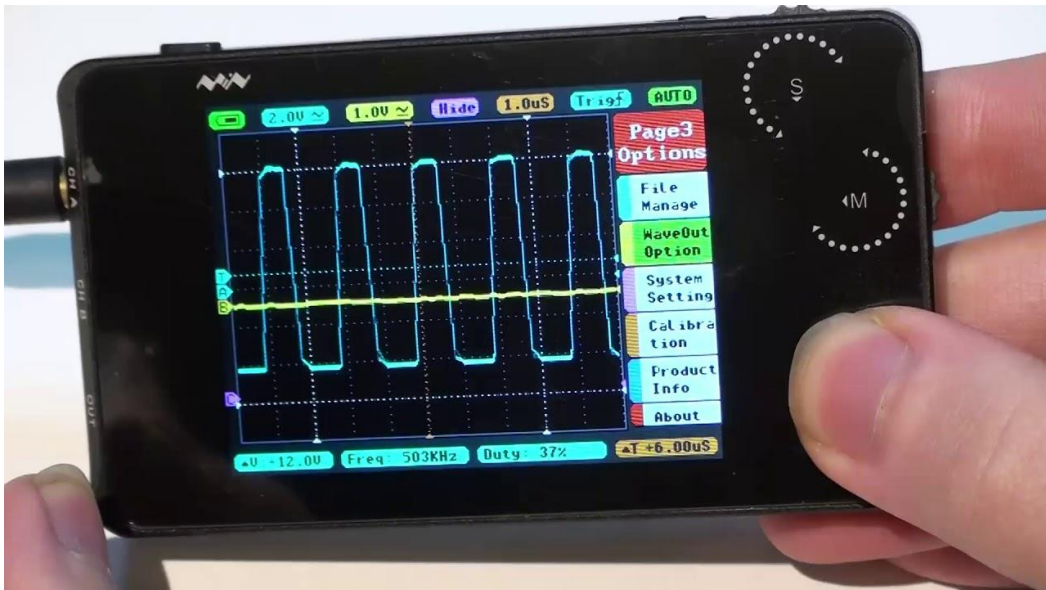
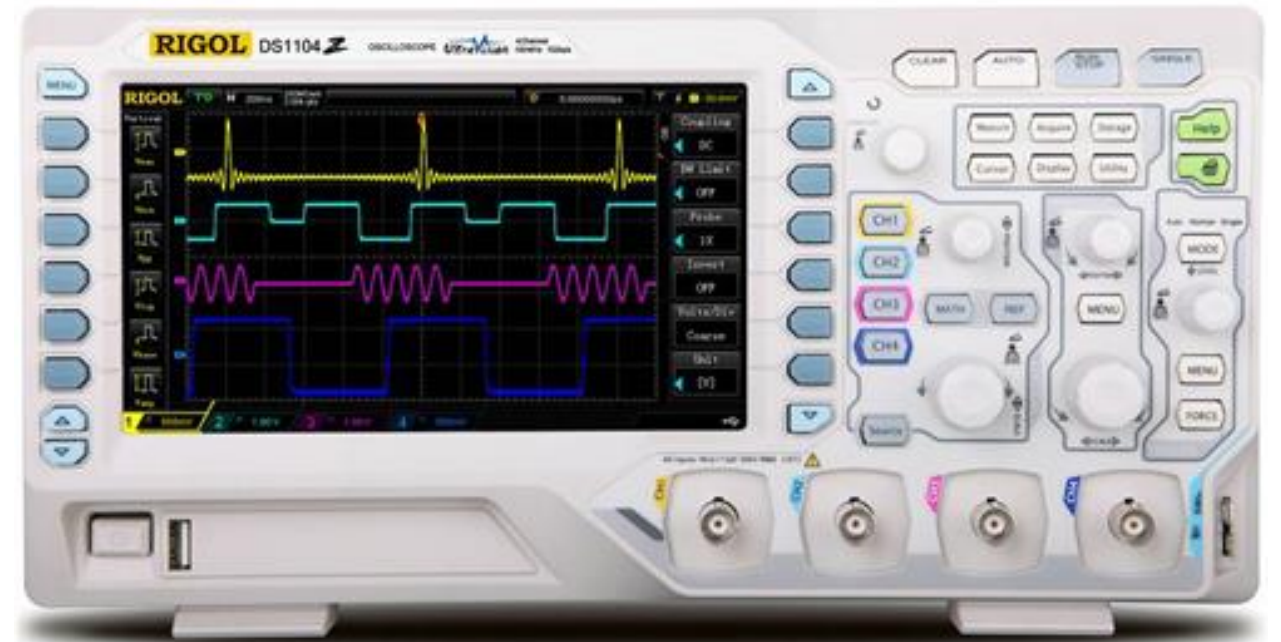
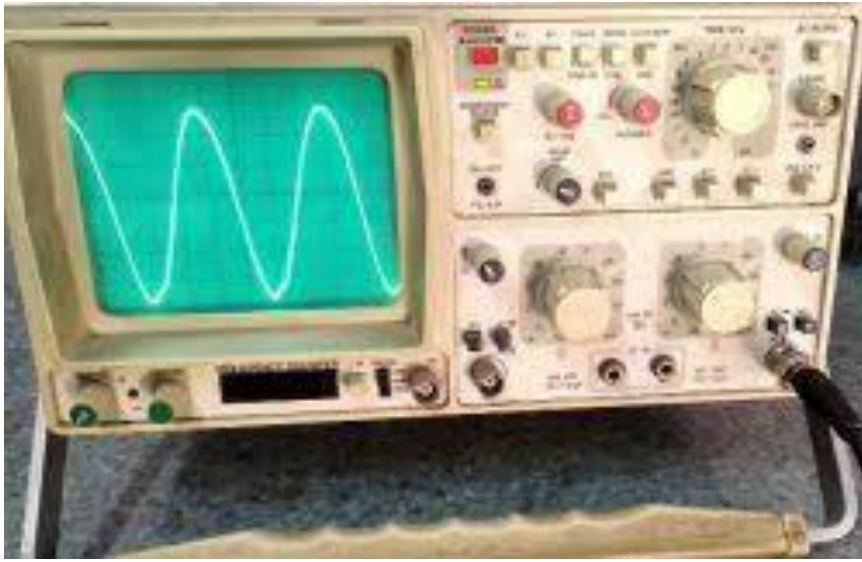


Evolution of oscilloscope



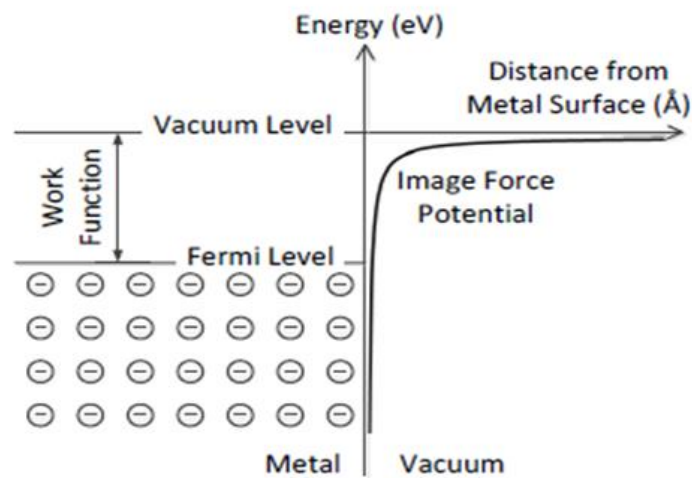
Cathode Ray Oscilloscope (CRO)

* CRO is used to display, measure and analyze various types of waveforms and other phenomena in electrical and electronics circuits.

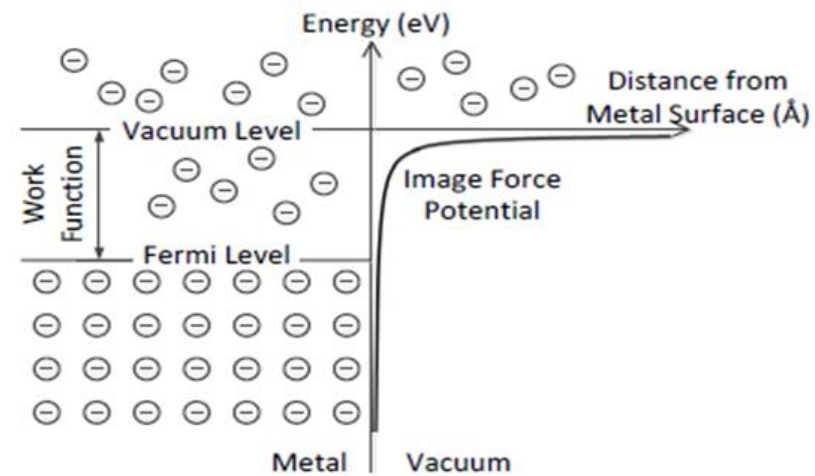
* CRO is a test instrument which allows an individual to "plot" and "view" two-dimensional graphs of electronic signals.

Components of CRO

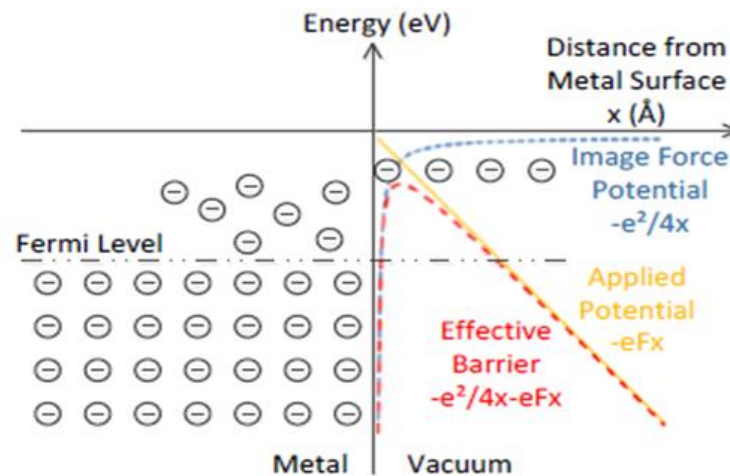
- 1) Cathode Ray Tube (CRT)
- 2) Vertical Amplifier
- 3) Delay Line
- 4) Horizontal Amplifier
- 5) Time-Base Generator
- 6) Triggering Circuit
- 7) Power Supply.



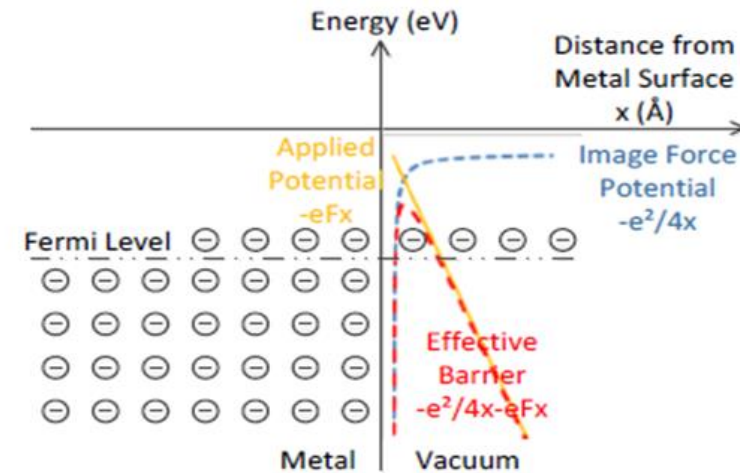
Metal-Vacuum Potential



Thermionic Emission



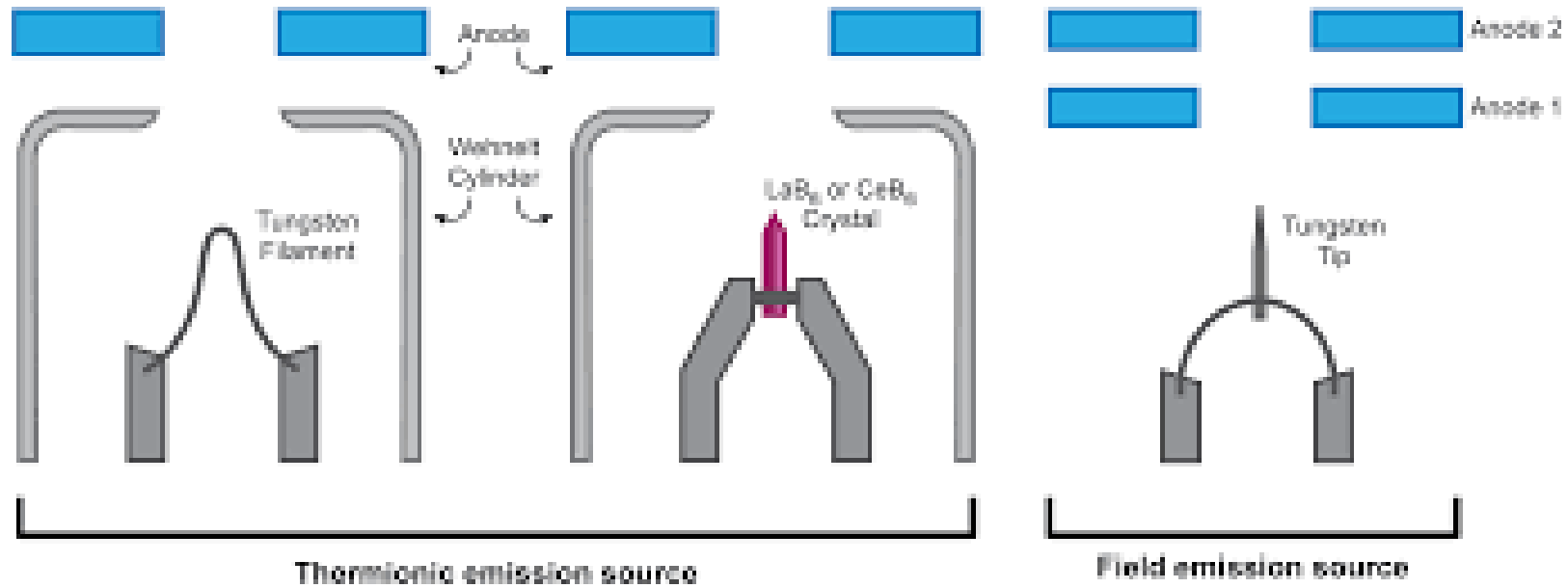
Schottky Emission

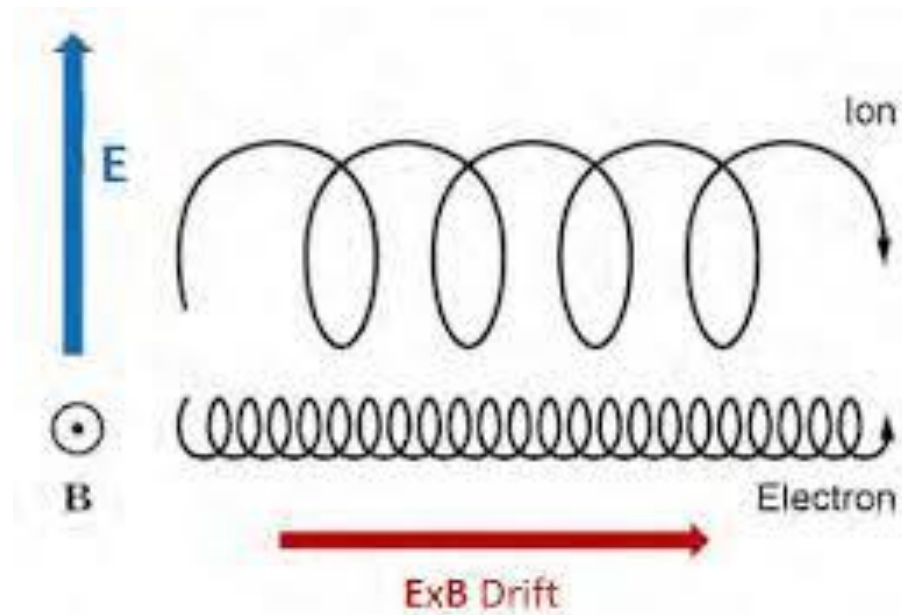
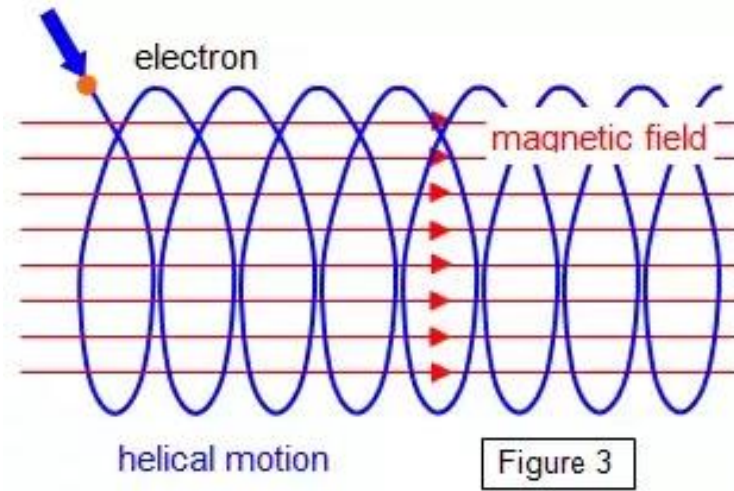
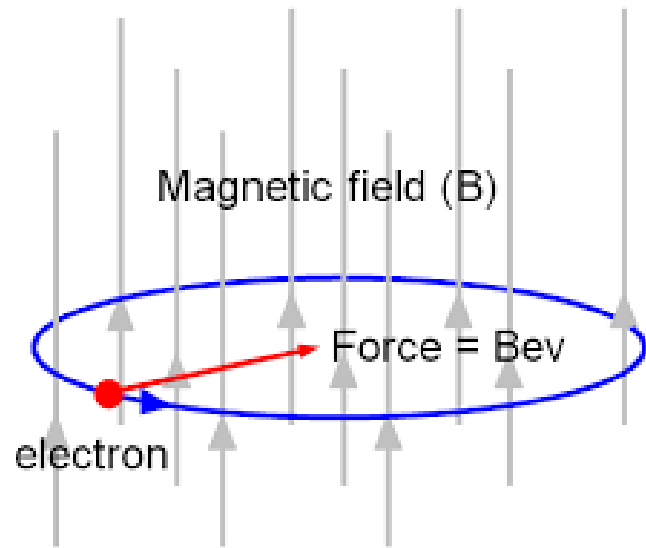


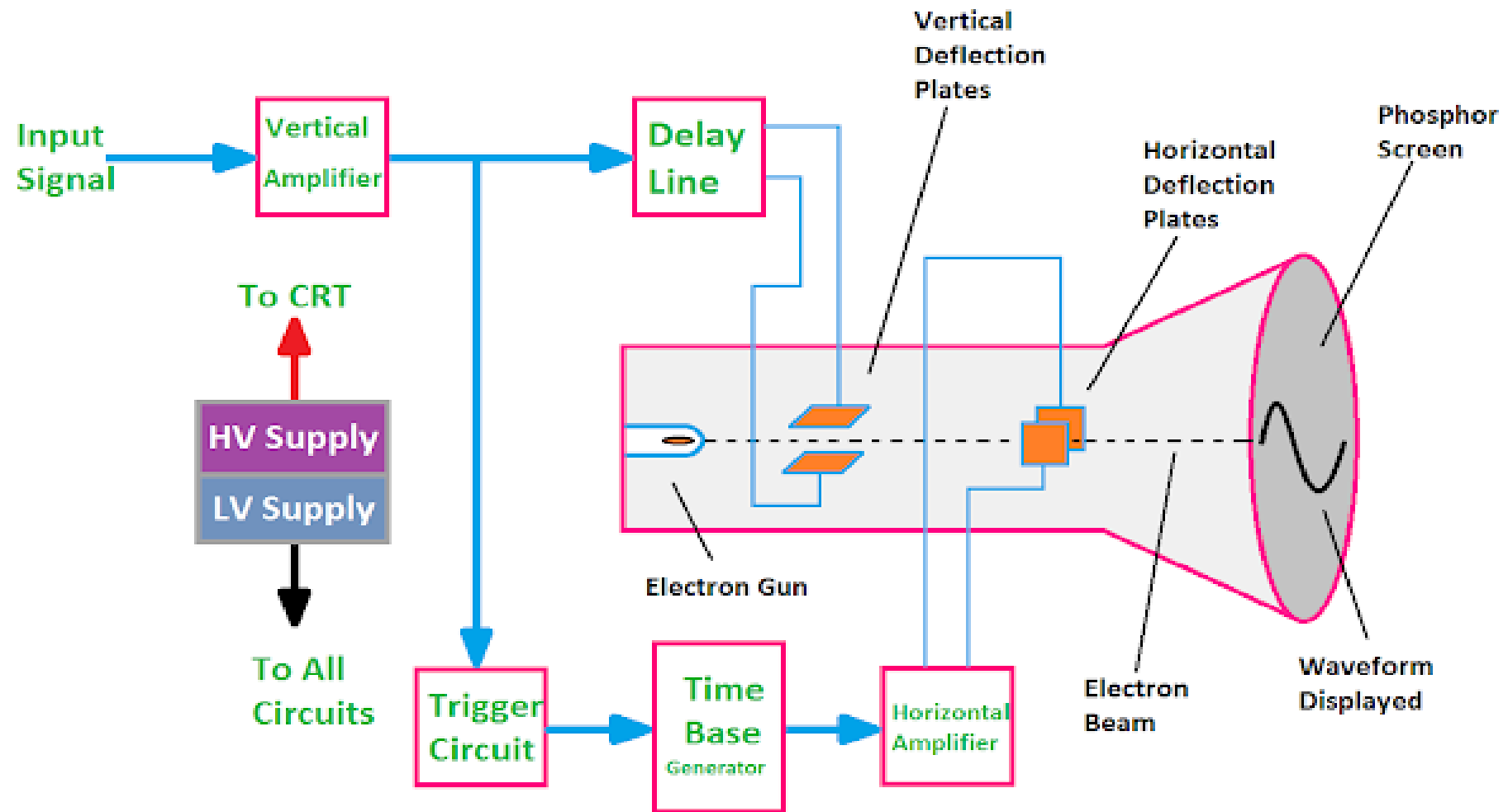
Field Emission

Figure 2-6: Schematic diagram of thermionic emission,
Schottky emission and field emission

Evolution of Electron Gun







CRO Block Diagram

Cathode Ray Tube (CRT)

* Heart of CRO.

* CRT is a vacuum sealed glass envelope that has a source of electrons which emits electrons, that are accelerated to pass through two-pairs of plates before striking a phosphor coated screen internally so as to provide a visual display of signal.

Various parts of CRT →

- 1) Electron gun
- 2) Deflection plate system
- 3) Fluorescent screen
- 4) Glass Envelope
- 5) Base.

Electron Gun :-

* source of accelerated, energized and focused beam of electrons.

1) Heater \rightarrow to heat the cathode.

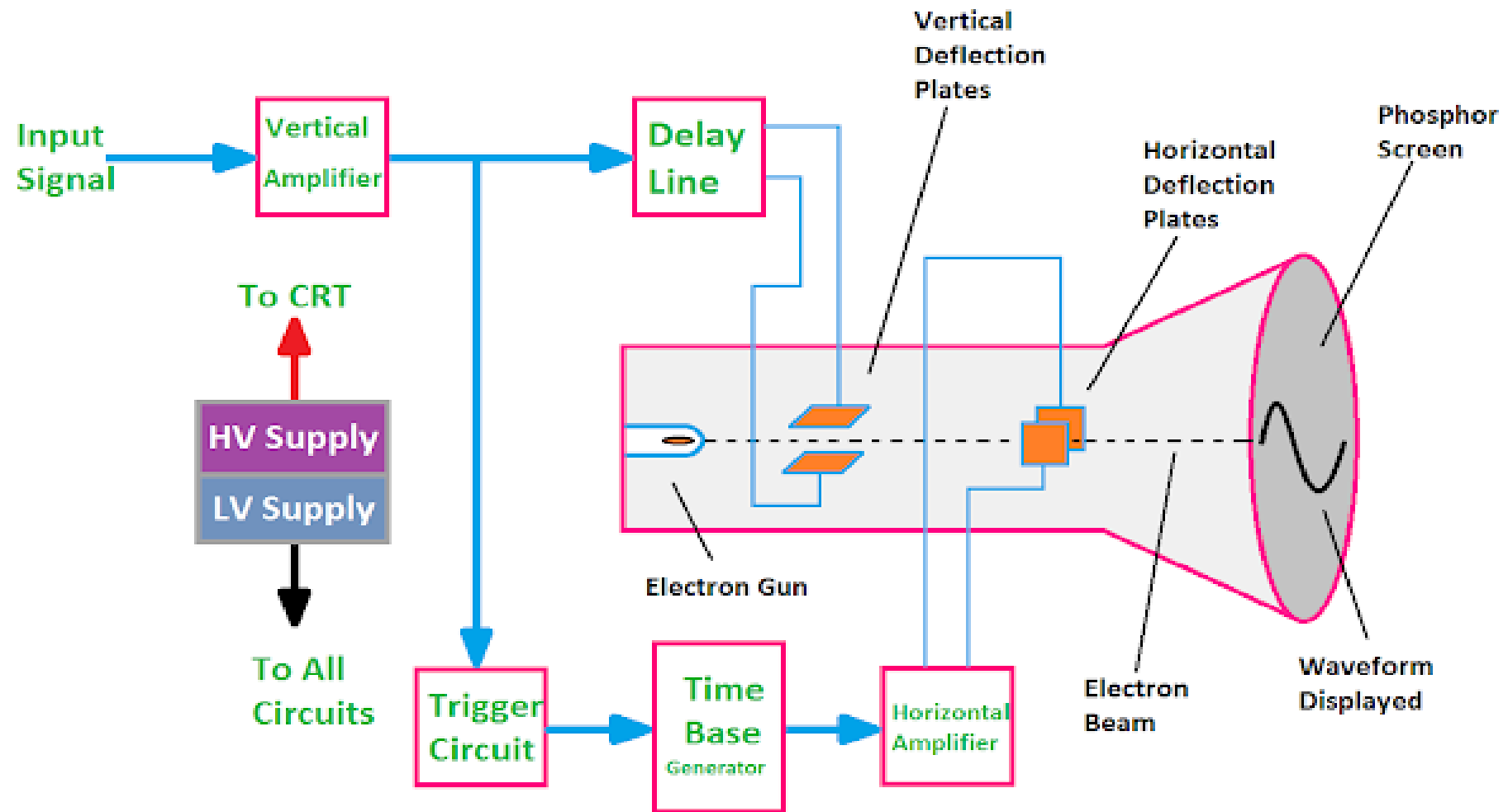
2) Cathode \rightarrow generates the electrons.

\hookrightarrow coated with a layer of barium oxide

3) Control Grid \rightarrow made up of nickel.

controls the number of electrons.

- 4) Pre-Accelerating and Accelerating Anode \rightarrow accelerates the electrons. connected to a common positive potential of 1500 volts.
- 5) Focusing Anode \rightarrow focus the electron beam. connected to a potential of 500 volts



CRO Block Diagram

Deflection system :-
two pair of plates

Horizontal Plates (X)
Vertical Plates (Y)



$Y_1 - Y_1$ $X_1 - X_1$

Dual-trace CRO

Screen :-

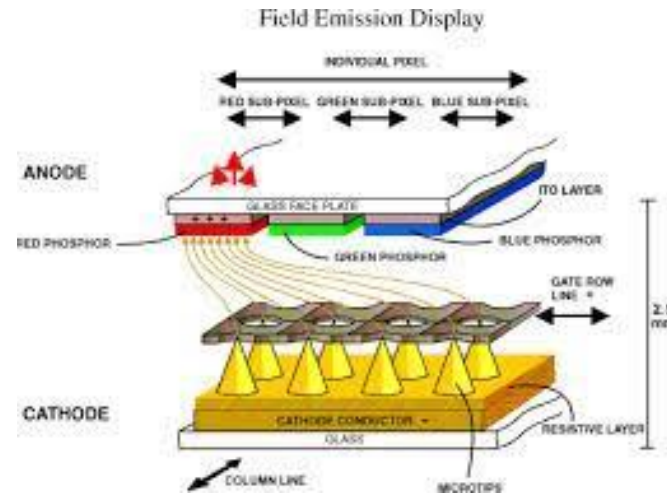
* coated with natural or synthetic phosphor which emits visible light when the electron beam strikes over it.



Fluorescence.

- 1) physical characteristics of phosphor
- 2) No. of e^- bombarding with the screen

Evolution of Display



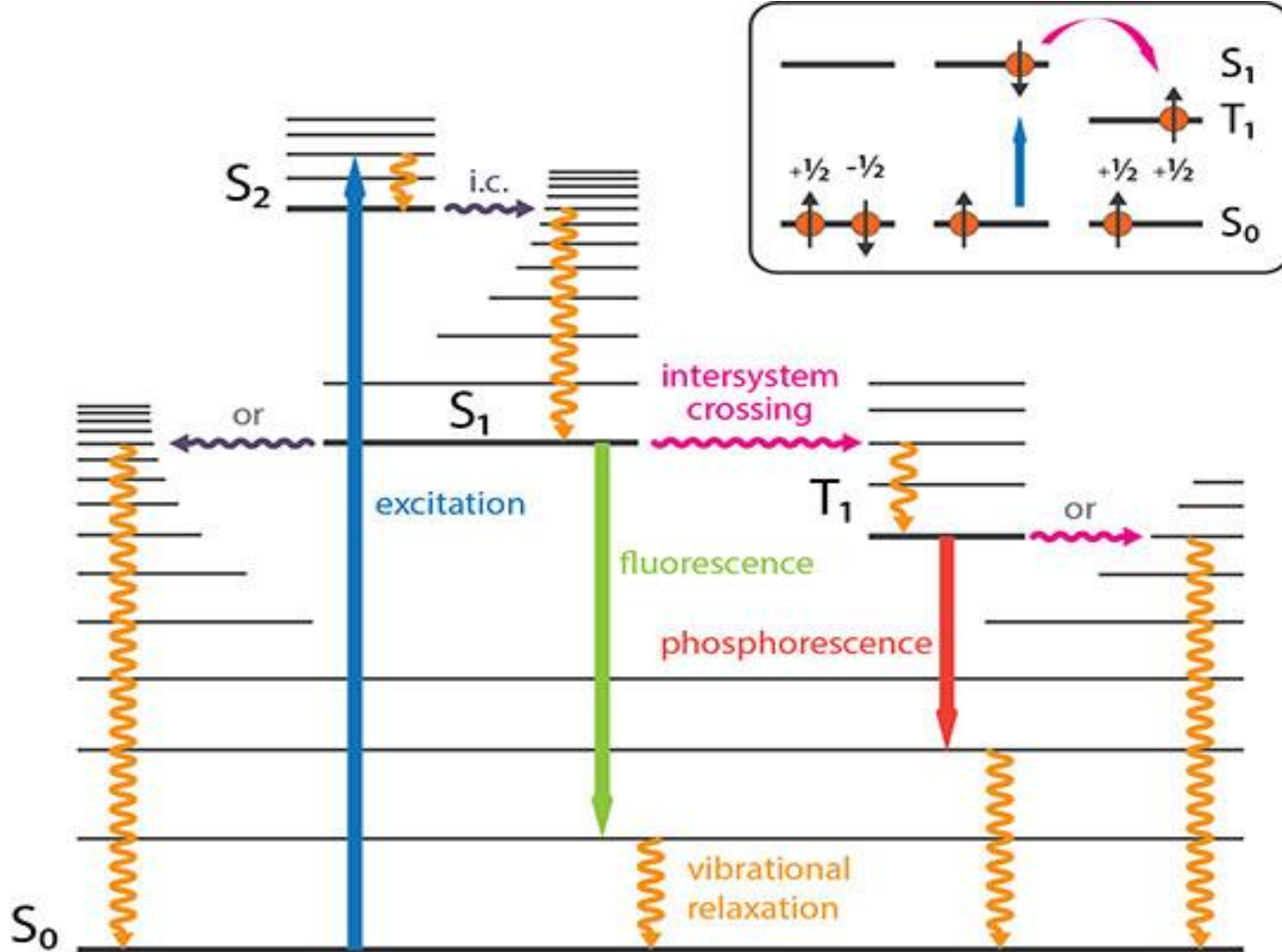
LCD monitor



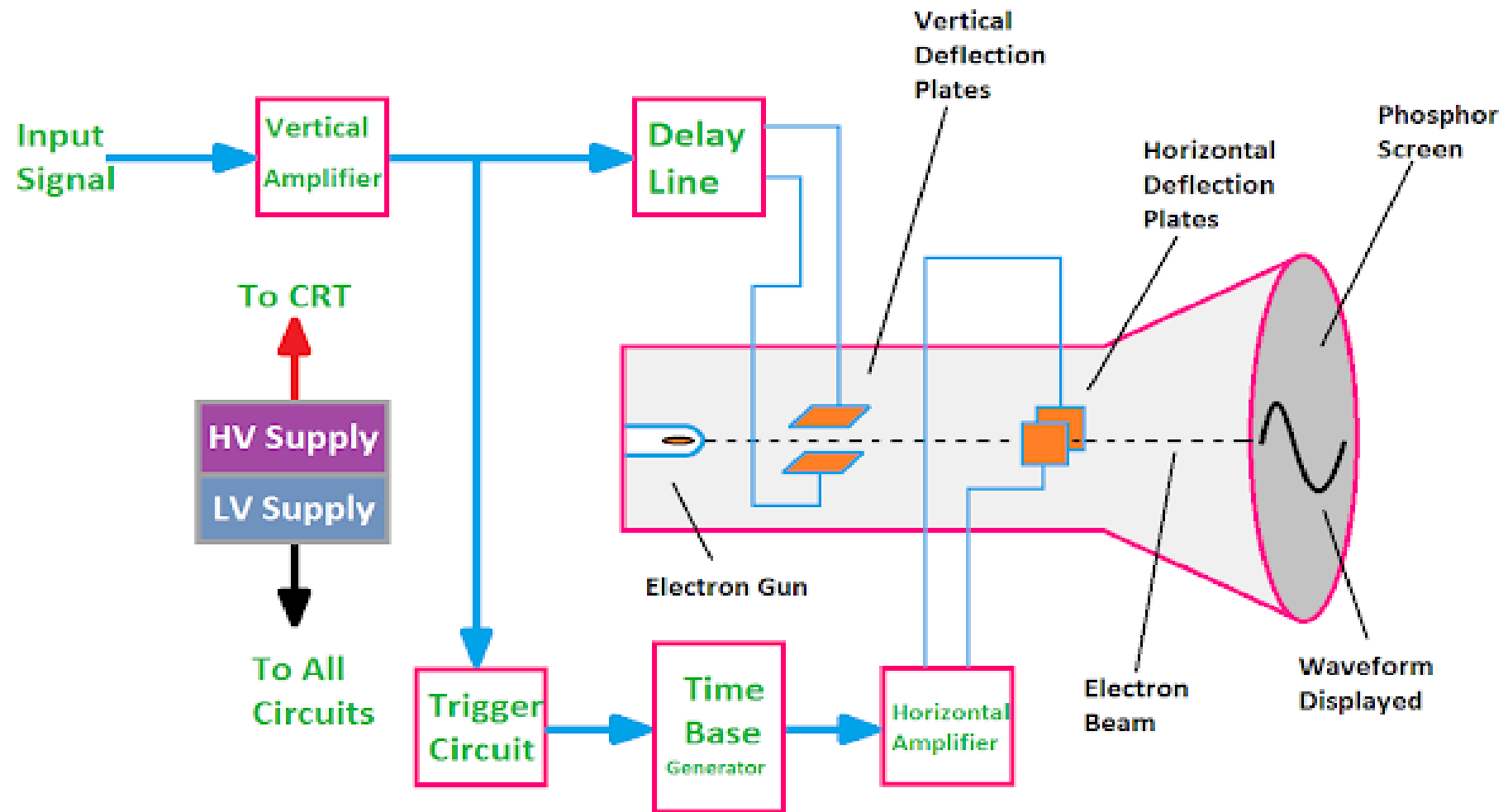
LED Monitor



OLED Monitor



Fluorescence is the emission of light by a substance that has absorbed light or other electromagnetic radiation. It is a form of luminescence. In most cases, the emitted light has a longer wavelength, and therefore a lower photon energy, than the absorbed radiation.



CRO Block Diagram

1) Triggering circuit →

→ It is the link between the signal waveform to be observed (vertical input) and the time-base (horizontal input)

→ It synchronizes the horizontal deflection of the electron beam with the vertical input.

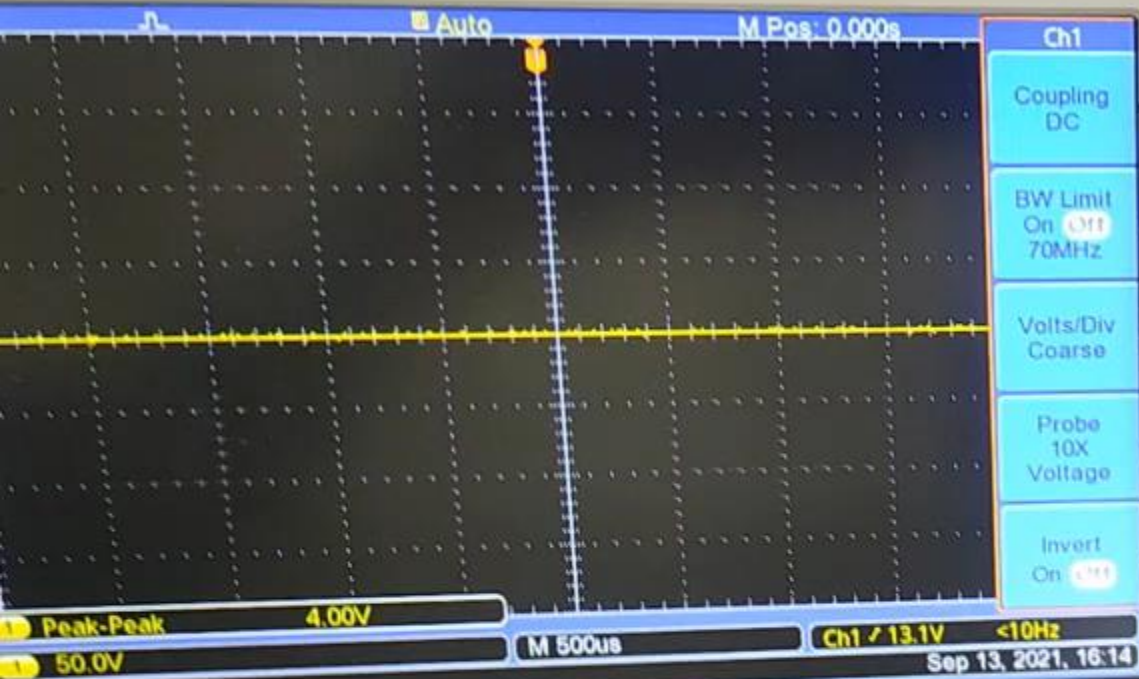
Vertical deflection System:-

- * amplifies small voltages and is used so that the CRO is able to measure even small changes in the vertical or the Y-direction.

- * high class amplifier with a proper gain so that it doesnot distort the i/p signal.

Delay Line: -

- connected in series with amplifier
- introduces a delay in the vertical input.
- The horizontal time-base is triggered by a portion of the i/p signal that starts the sweep generator, the o/p of which is then fed to the horizontal amp^r



Enabling Teaching

Built-in access to fully customizable
courseware content

Multipurpose



Press to Select

Cursor

Measure

Help

Run / Stop

Cursor

Save Recall

Default Setup

Single

Course

Function

Utility

Autoset

Hold for Autorange

Vertical

Math

M

FFT

Ref

R

Position

Menu

Scale

300V 300V CAT II

Horizontal Position

Acquire

Scale

Ext Trig

Trigger

Menu

Level

Force Trig

Reset/Coarse

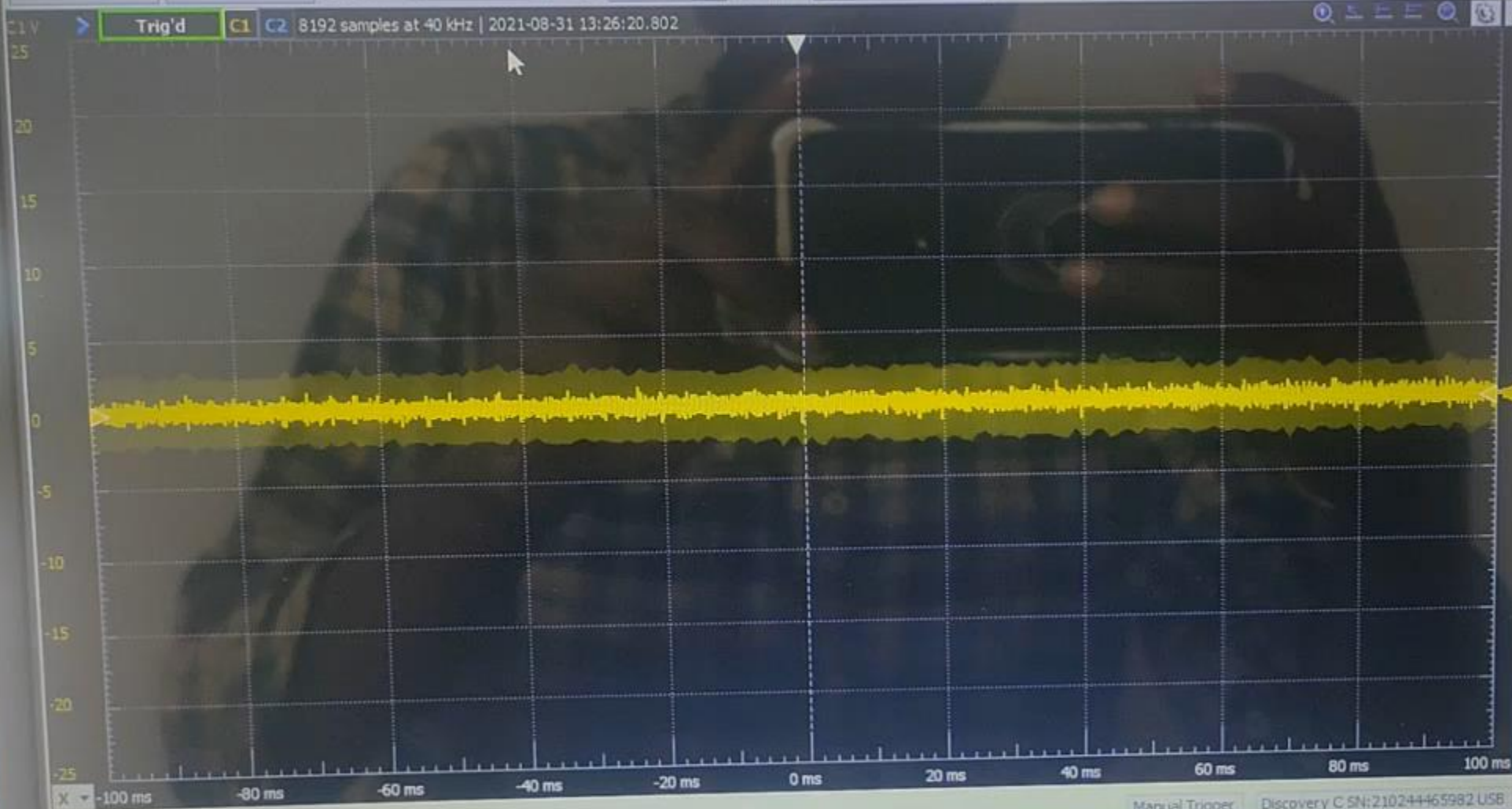


File Control View Window

Export +XY +XYZ 3D +Zoom FFT Spectrogram Spectrogram 3D Histogram Persistence Data Measurements Logging Audio X Cursors Y Cursors Notes Digital Measurements

Single Stop Mode: Repeated Auto Source: Channel 1 Condition: Rising Level: 0 V Hyst.: Auto

Buffer: 10 Auto Set Type: Edge LCondition: Less Length: 100 ns HoldOff: 100 ns



☒ Time

Position: 0 s

Base: 20 ms/div

Options

Add Channel

☒ Channel 1 (1±)

Offset: 0 V

Range: 5 V/div

☐ Channel 2 (2±)

Manual Trigger Discovery C 5N:210244465982 USB WFP3.16.3 Status: OK



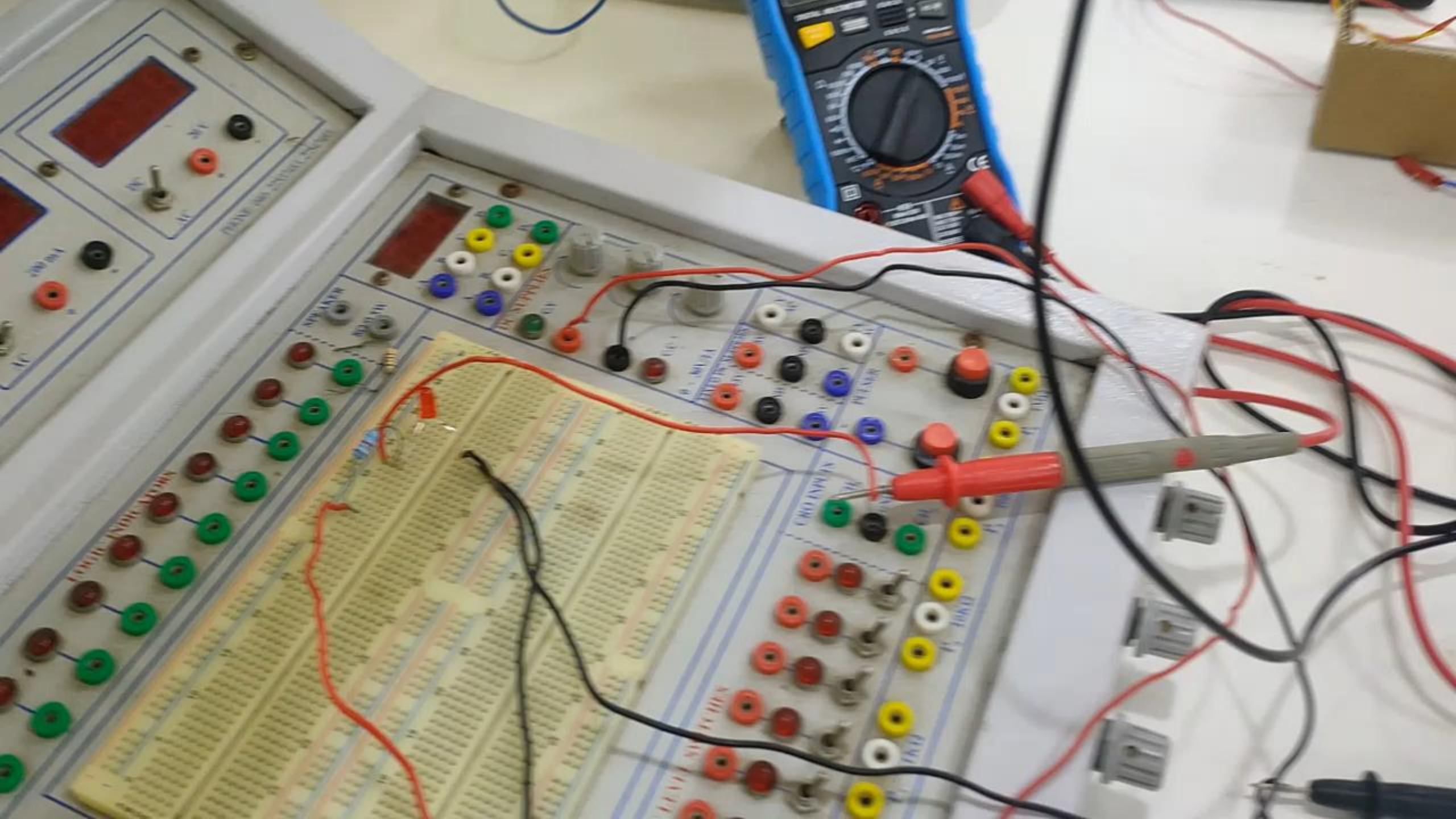
Type here to search

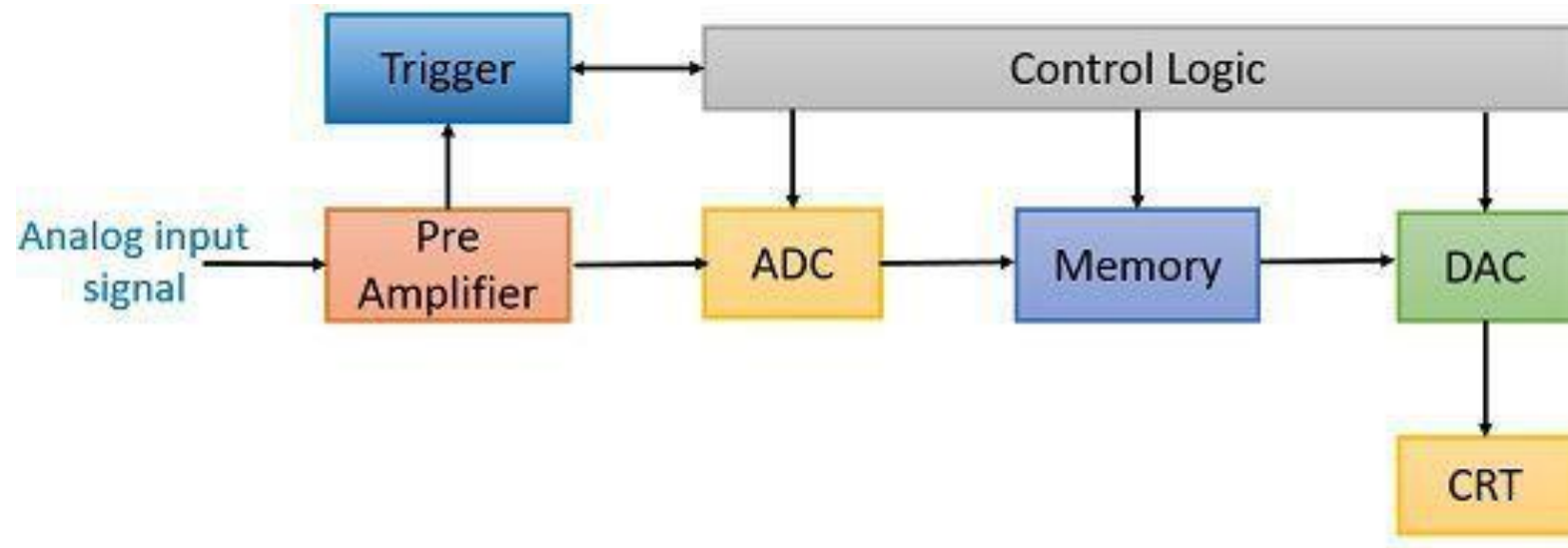


13:26
31-08-2021

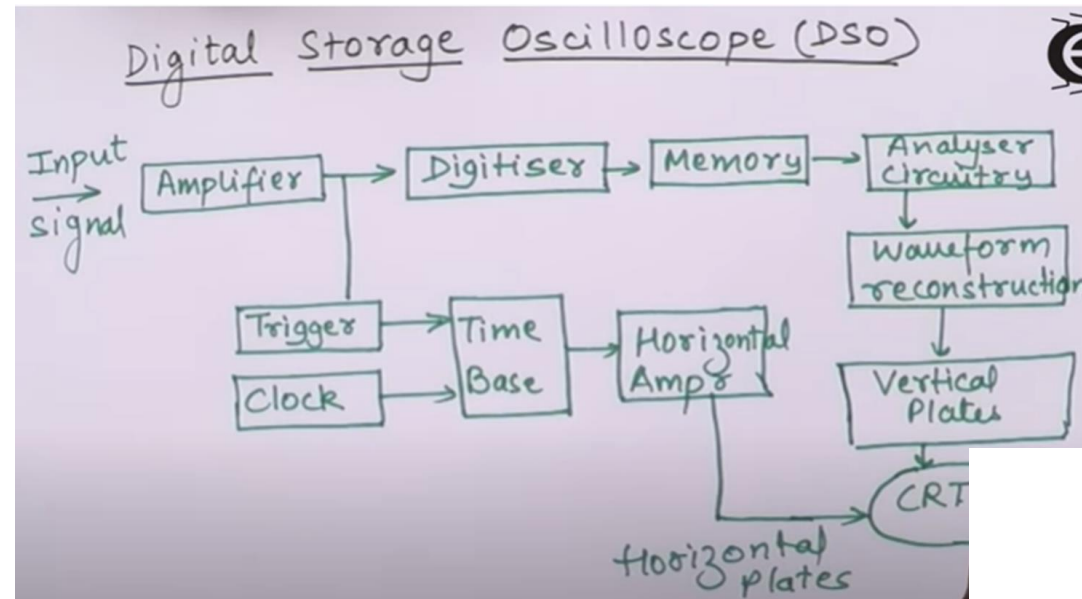






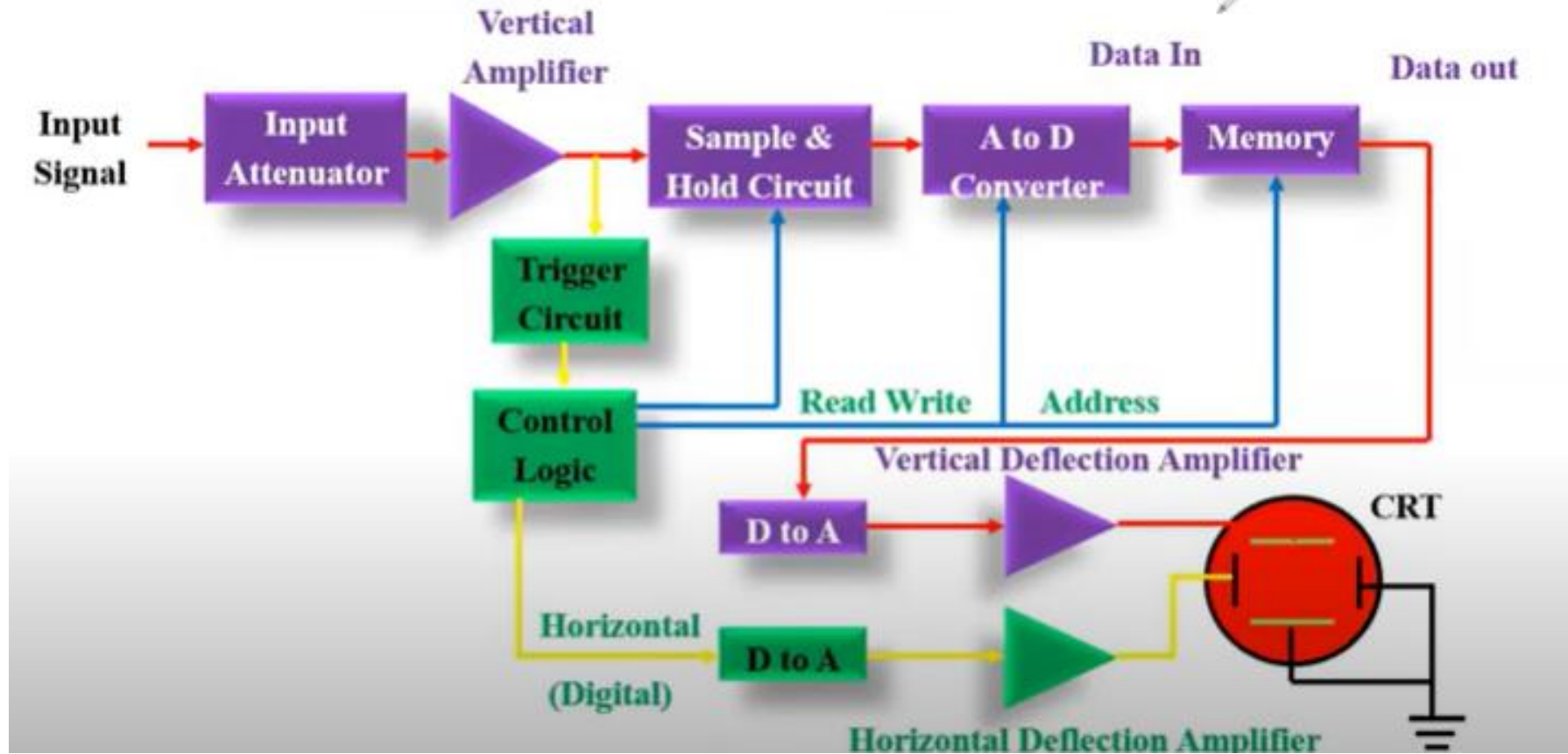


Block diagram of Digital Storage Oscilloscope



Block diagram of Digital storage Oscilloscope (DSO)

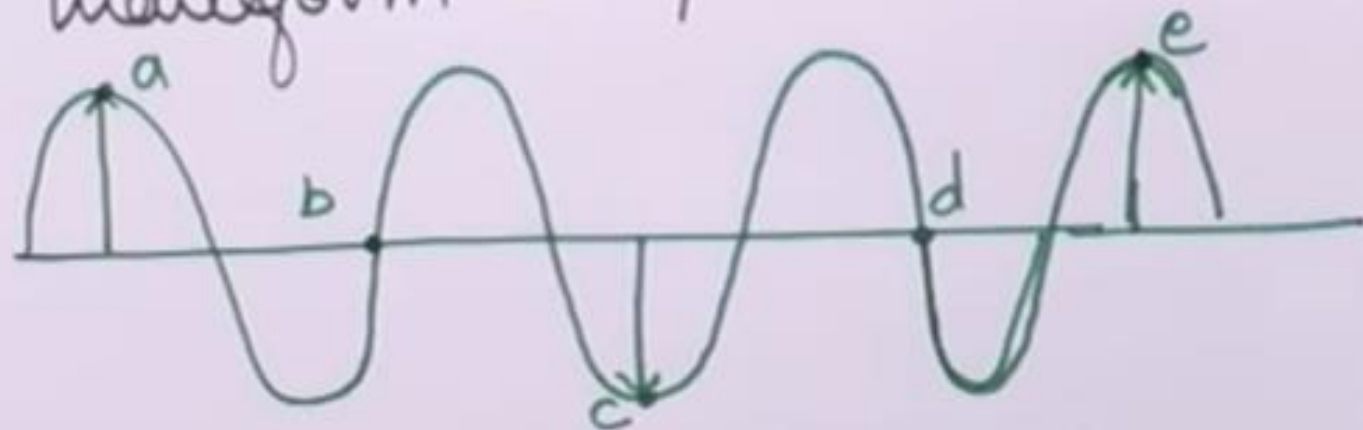
CRO



Three Modes of Operation :

- 1) Roll Mode
- 2) Store Mode
- 3) Hold or Saw Mode

Digitising occurs by taking a sample of the input waveform at periodic intervals.

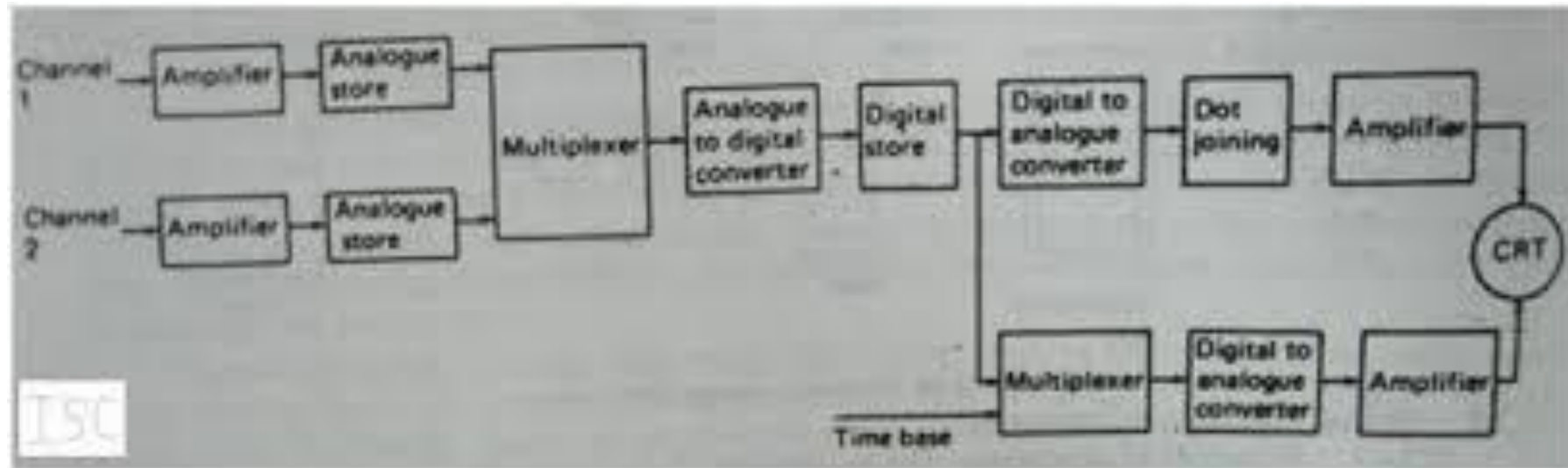


Sampling theorem \rightarrow Sampling rate must be at least twice as fast as the highest frequency in the input signal.

Aliasing.

Resolution of A/D converter is decreased

Analog store.



* when i/p signals are stored in analog store register, they can be read out at a much slower rate to the A/D converter and the results are stored in digital store.

* allows operation at upto 100 megasamples per second.

Transducers: Classification and selection of Transducers, Introduction to Strain, Load, Force, Displacement, Velocity, Acceleration, Pressure and Temperature Measurements; Introduction to Smart sensors and MEMS.