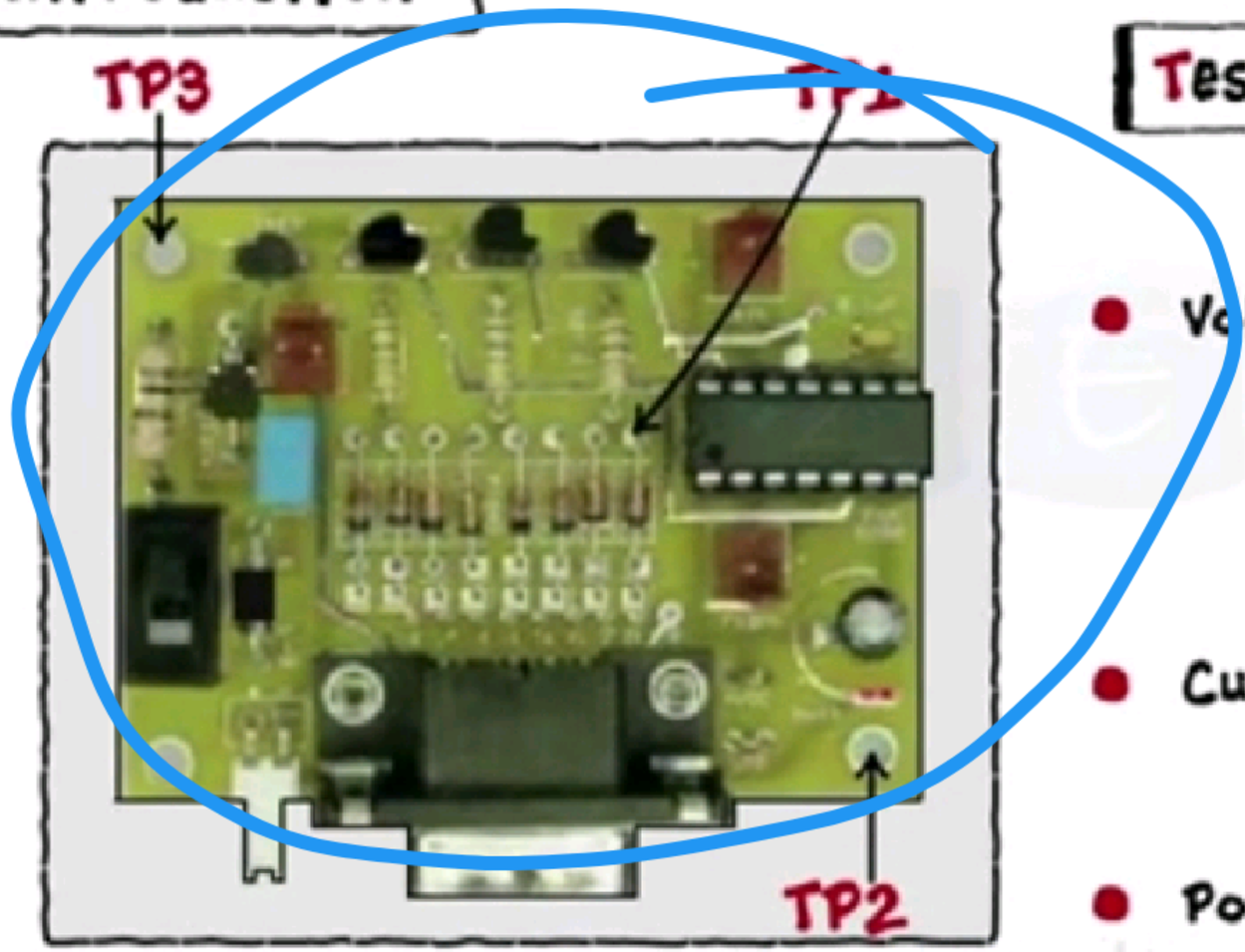
Cathode Ray Oscilloscope (CRO)

Contents

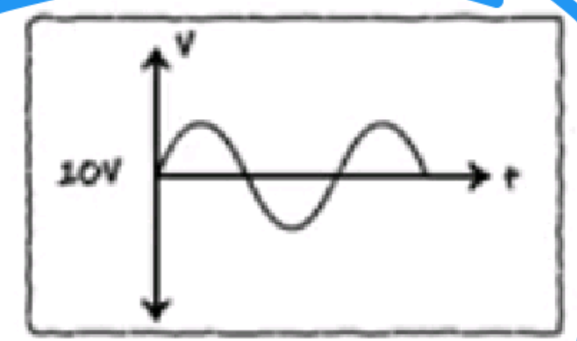
- Introduction
- Block Diagram of CRO
- Cathode Ray Tube (CRT)
- Measurement of Voltage
- Measurement of Frequency
- Component Testing using CRO

Cathode Ray Oscilloscope

Introduction



Test Point 1 :

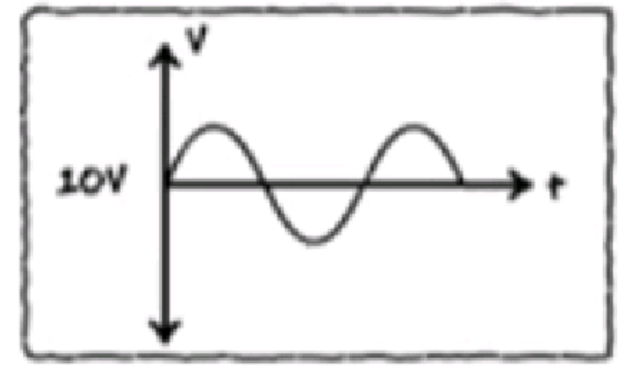


- Voltage = 10 V
- Current = 1.5 A
- Power = 2W

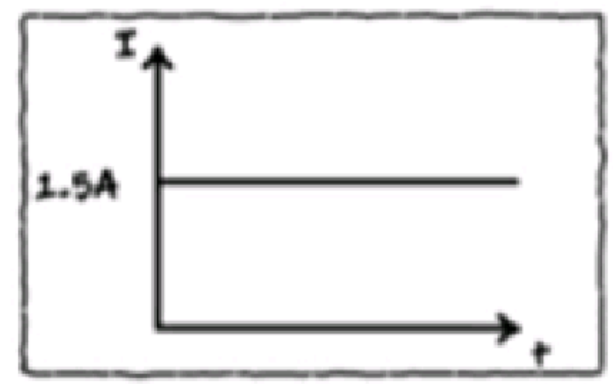
Introduction

Test Point 1 :

- Voltage = 10 V



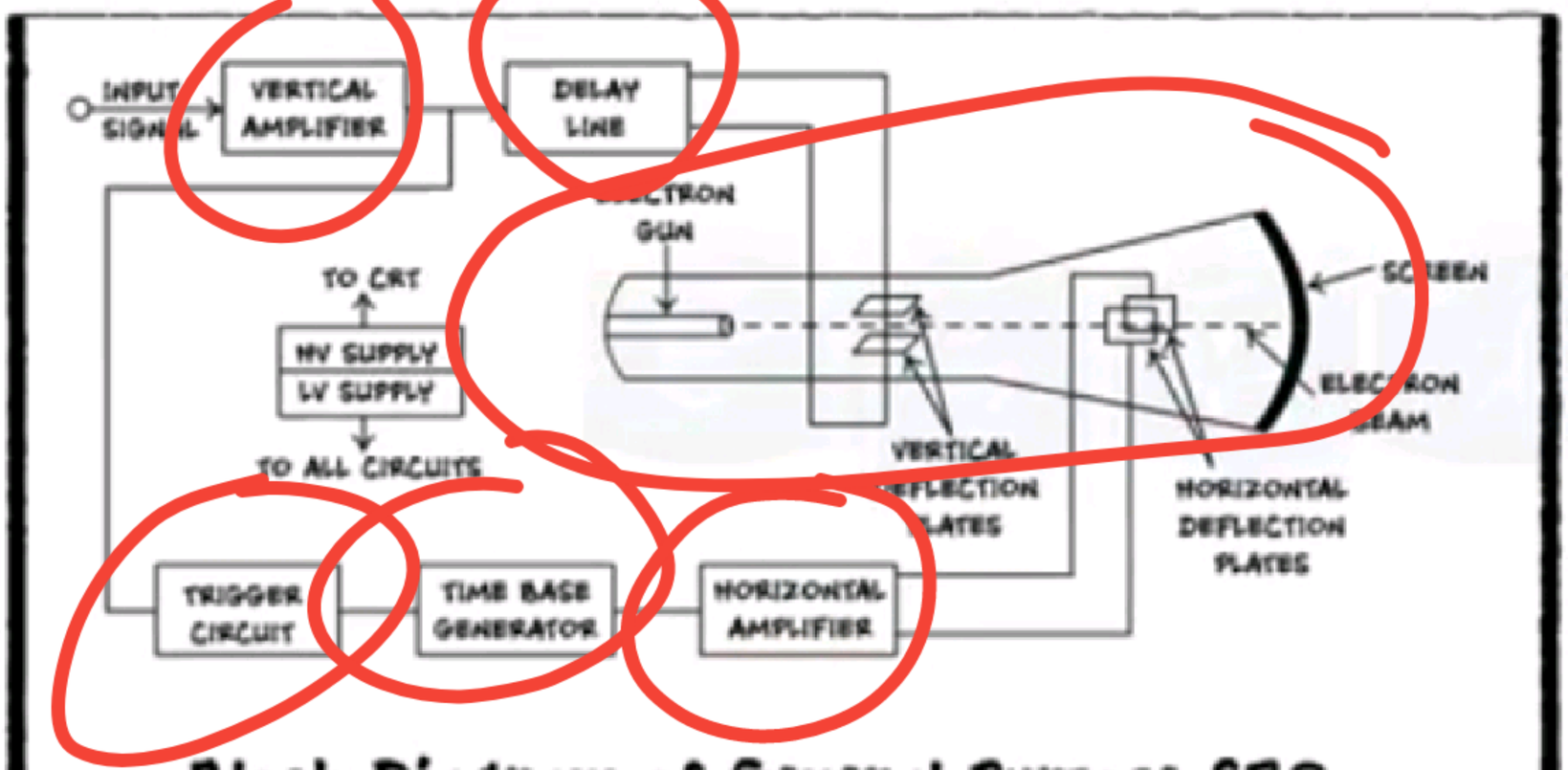
- Current = 1.5 A



- Power = 2W

Note : CRO gives variation of a signal wrt time where Digital Multimeter only gives digital value of that parameter

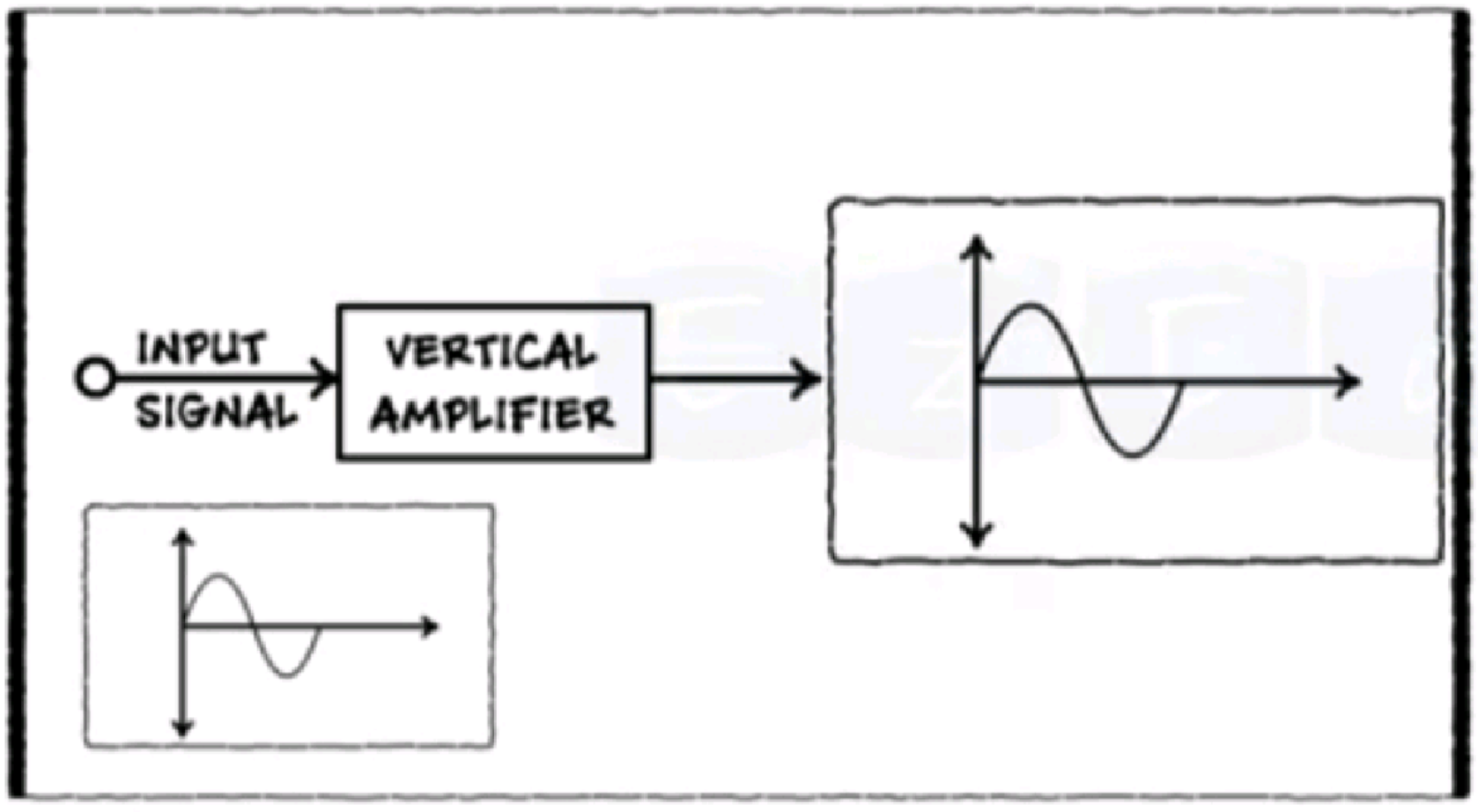
Block Diagram of CRO



Block Diagram of General Purpose CRO

- Vertical Amplifier
- Delay Line
- Trigger Circuit
- Time Base Generator
- Horizontal Amplifier
- Cathode Ray Tube (CRT)

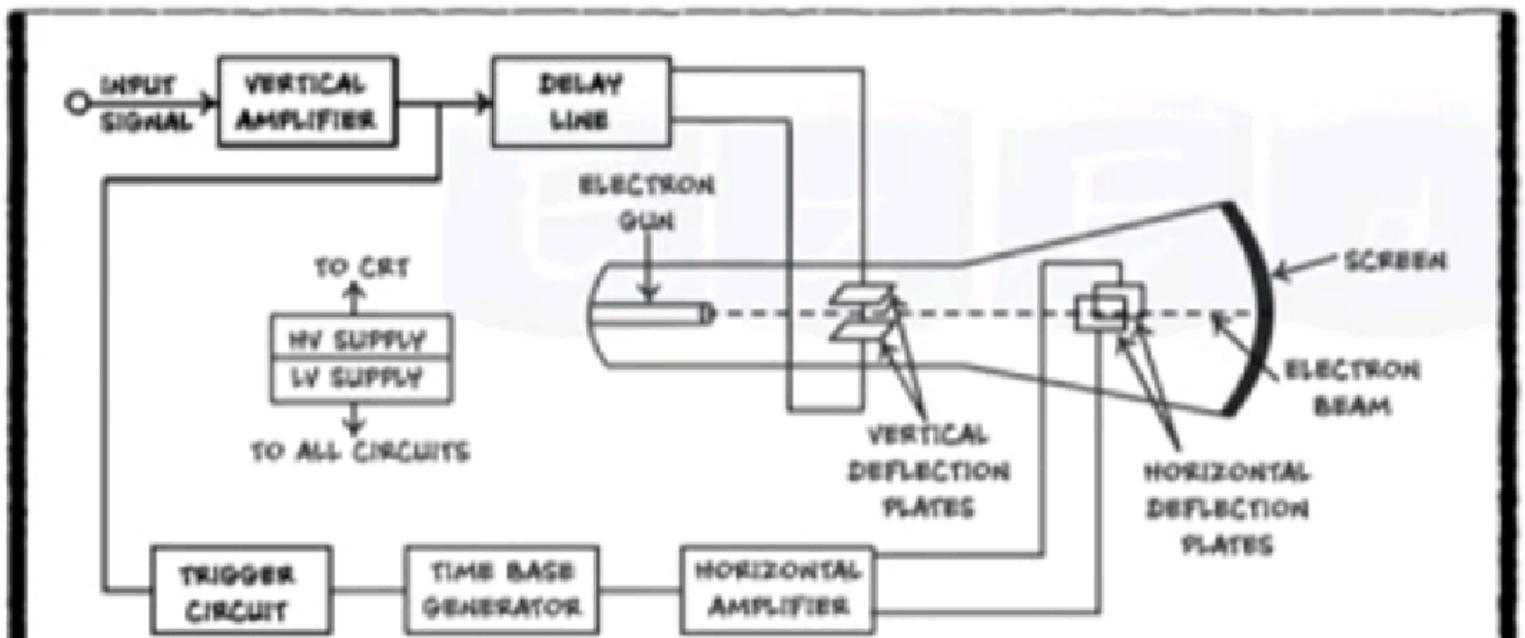
Vertical Amplifier



- Amplifies weak signals

Cathode Ray Oscilloscope

Delay Line



Block Diagram of General Purpose CRO

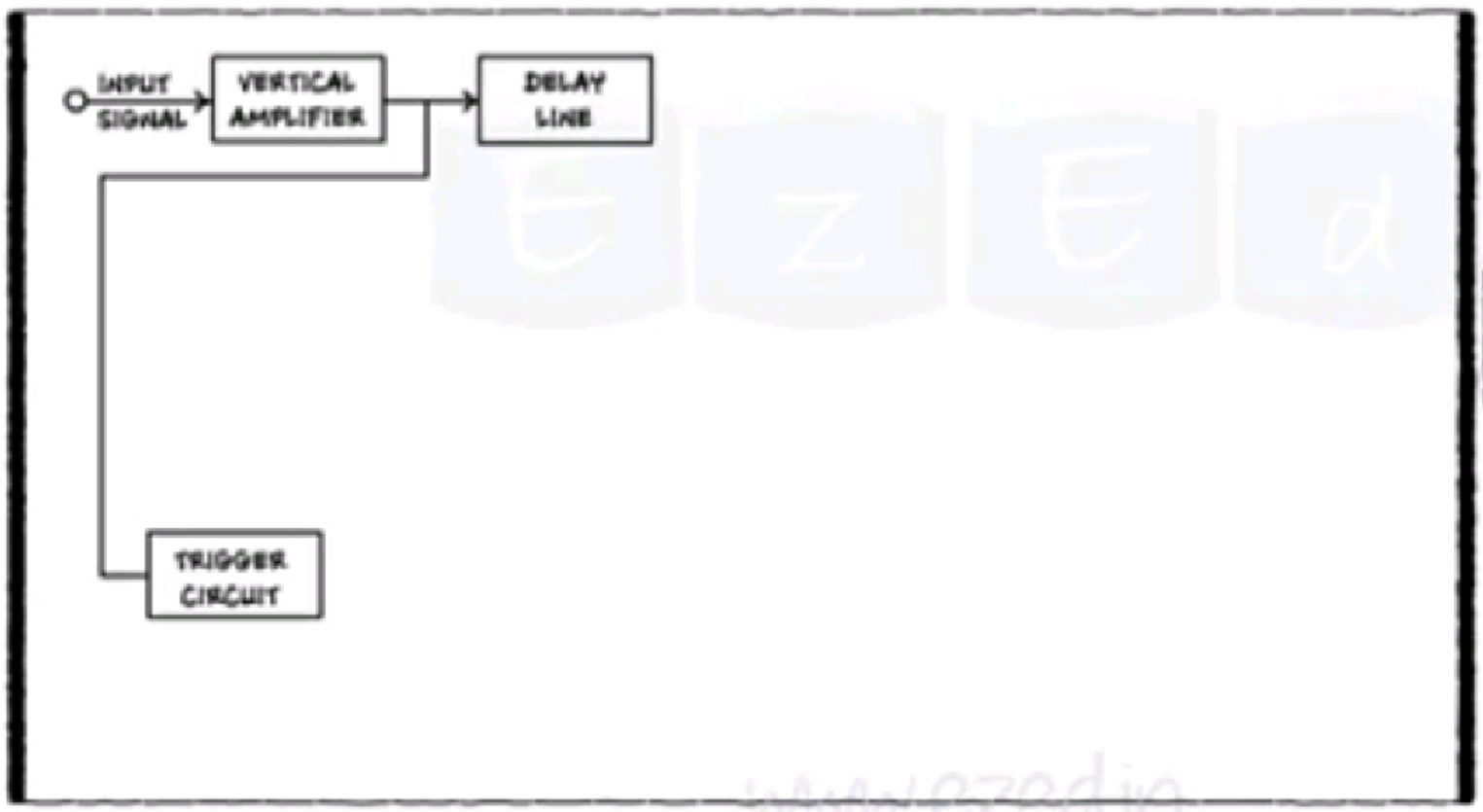
- Small Delay Occurs
- Signal reaches Vertical Deflection Plates early
- Causes distortion

Delay Line :

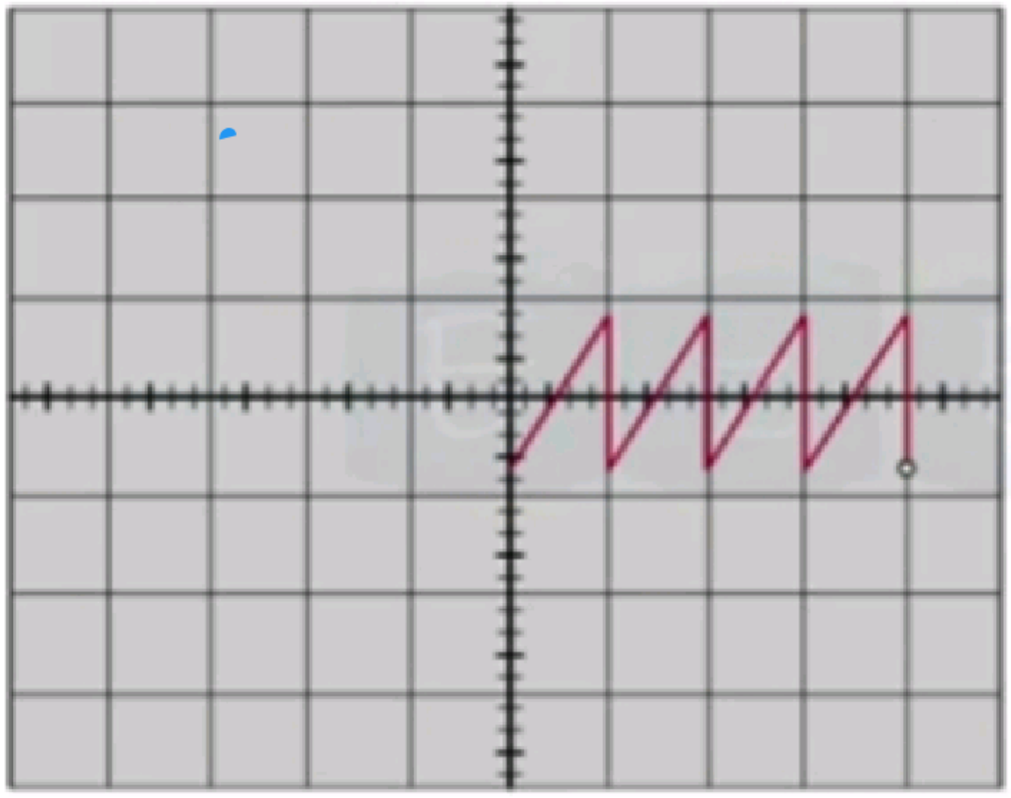
- Adds Delay to the signal

Cathode Ray Oscilloscope

Trigger Circuit

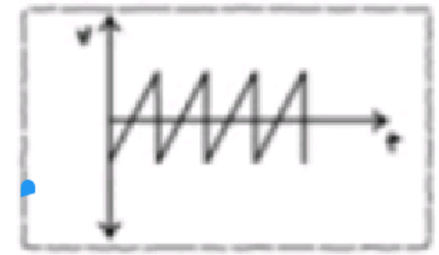


Time Base Generator



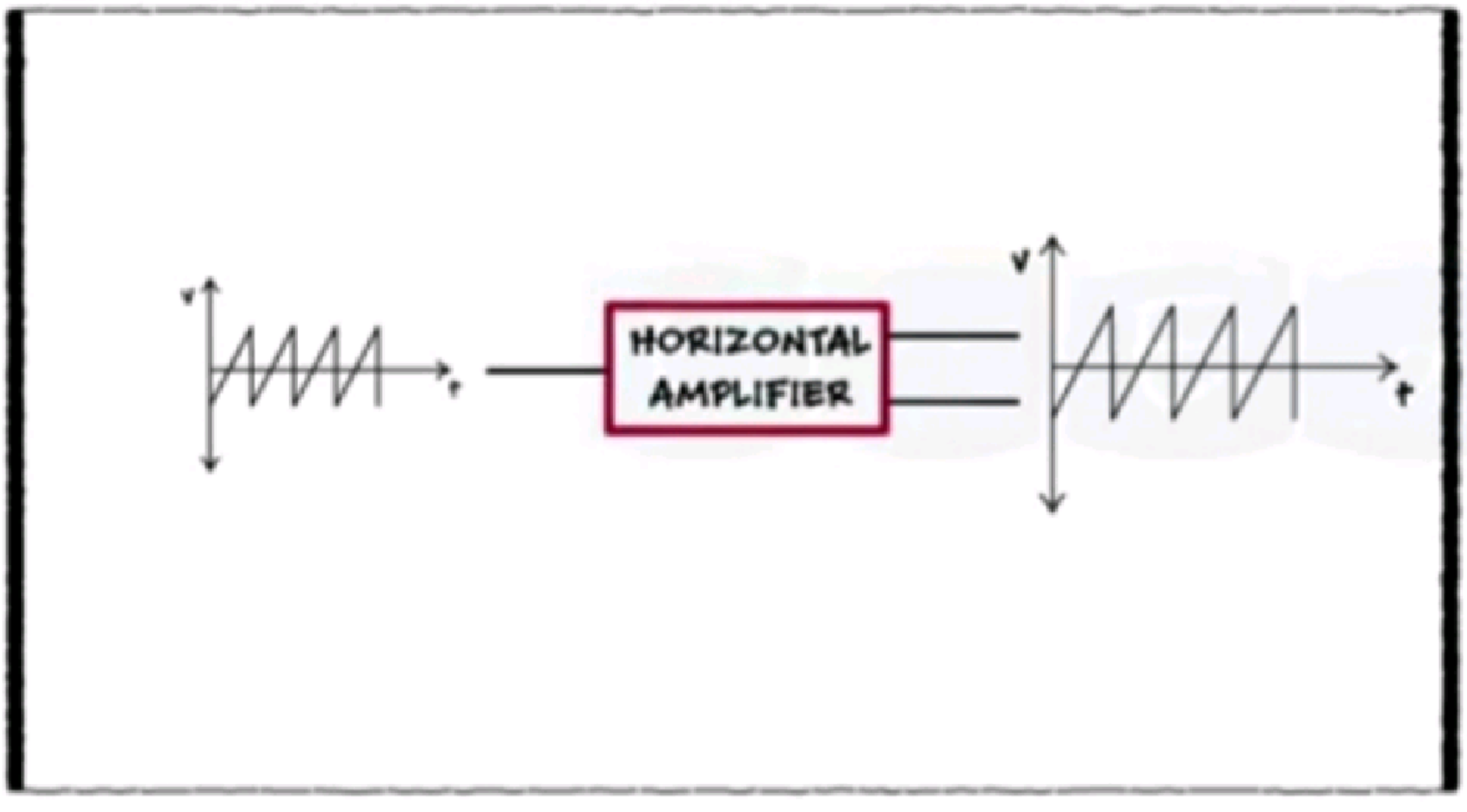
CRO Screen

- Generates Sawtooth Waveforms



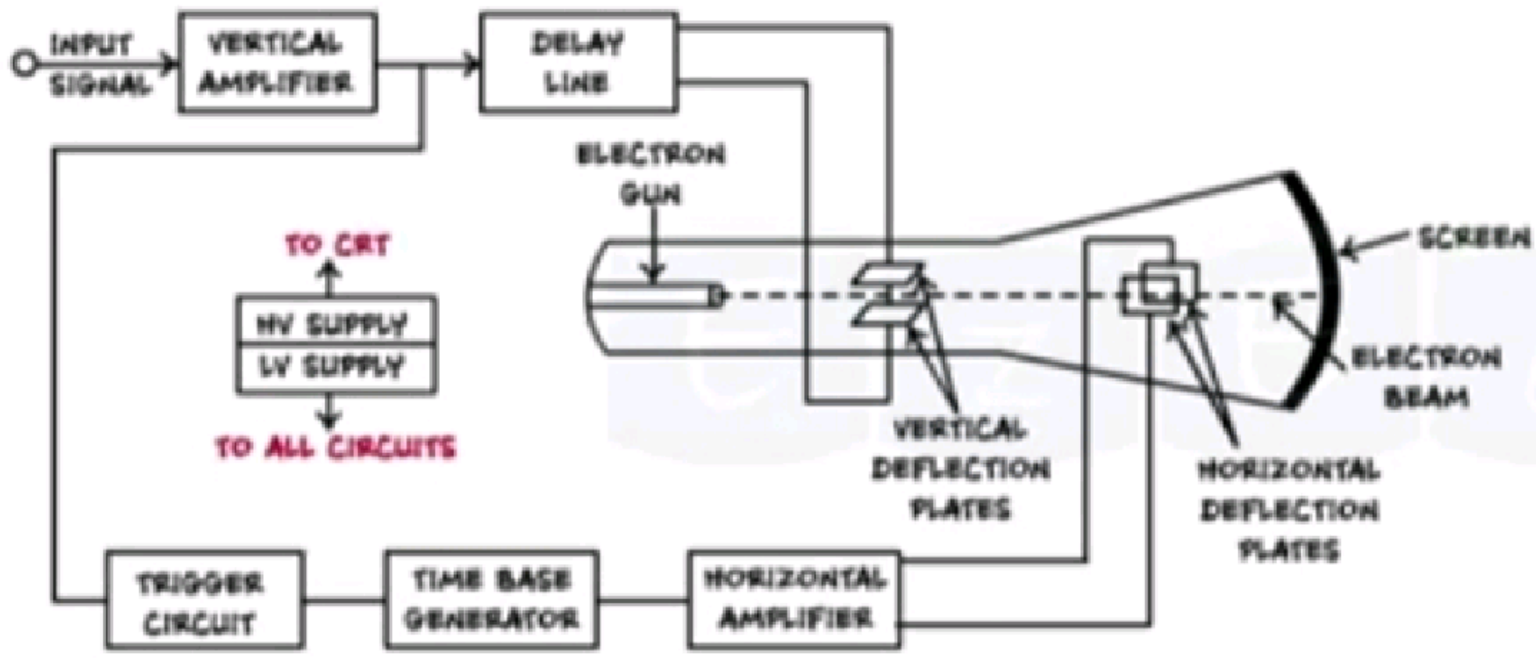
- Applied to Horizontal Deflection Plates
- Electron beam varies at constant velocity
- X axis of CRO is calibrated
- Input is displayed with respect to time

Horizontal Amplifier



- Strength of a sawtooth signal is not sufficient

Power Supply



Block Diagram of General Purpose CRO

Low Voltage :

- Used for working of Electronic Circuits

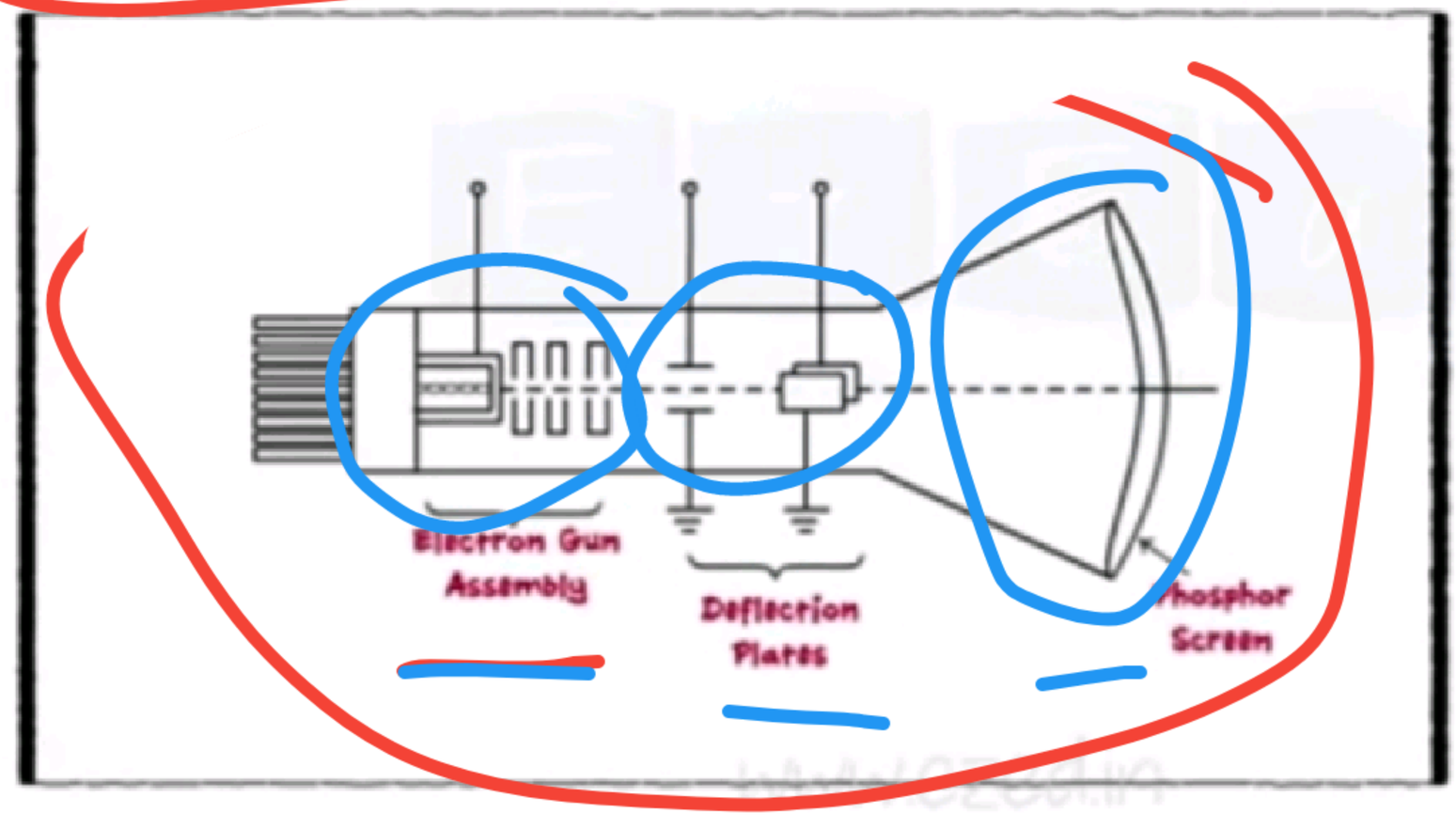
High Voltage :

- Used as Anode for CRT
- Generates voltage of 1000 Volts to 1500 Volts

Cathode Ray Oscilloscope

Cathode Ray Tube

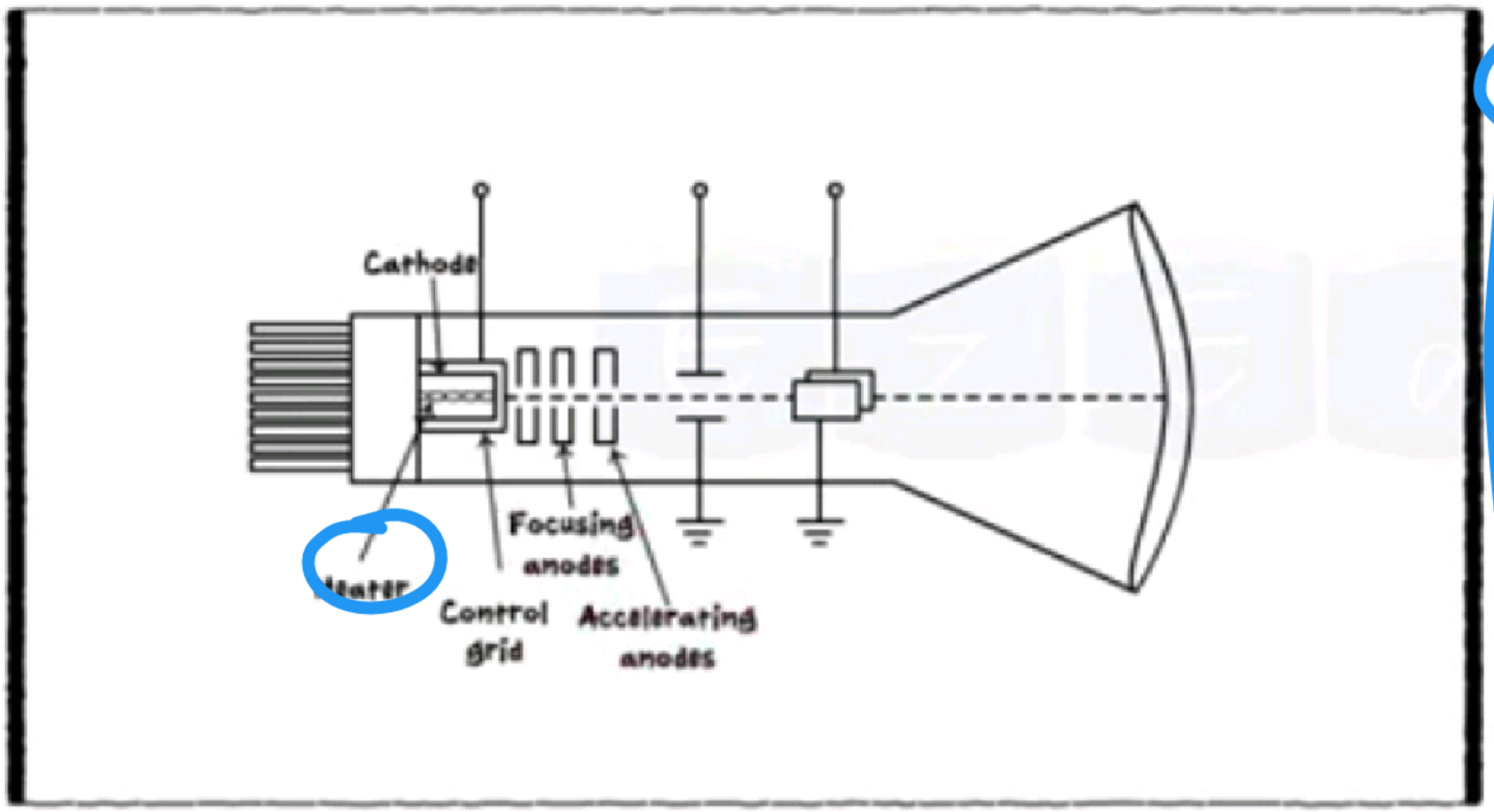
Heart



Sections of CRT

- Electron Gun Assembly
- Deflection Plates
- Phosphor Screen

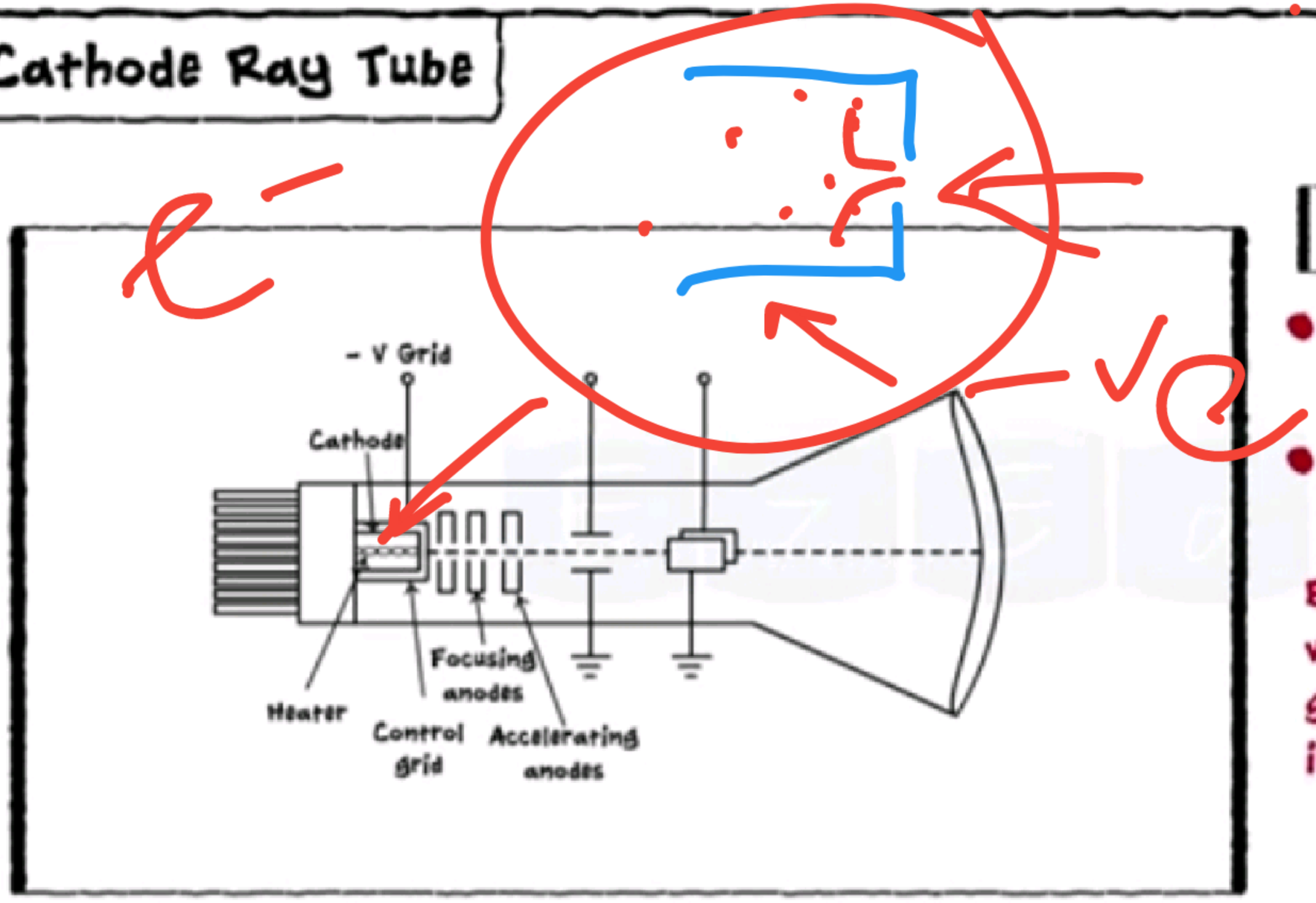
Cathode Ray Tube



Electron Gun Assembly

- Heater
- Cathode
- Control grid
- Accelerating anodes
- Focusing anodes

Cathode Ray Tube



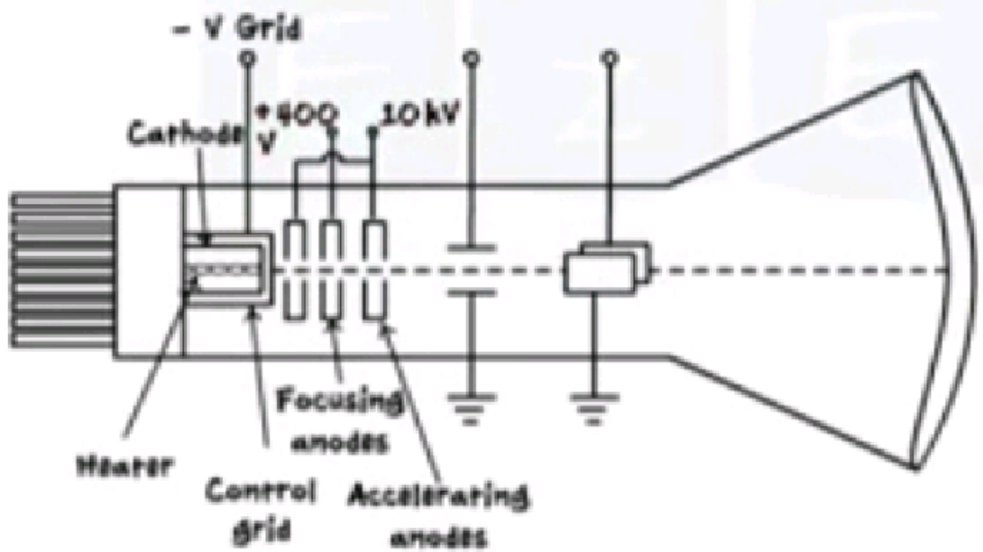
Control Grid

- Negative charge Repels electrons
- Generates a Narrow beam

By controlling the negative voltage applied to the control grid we can control the intensity of the beam

Cathode Ray Oscilloscope

Cathode Ray Tube

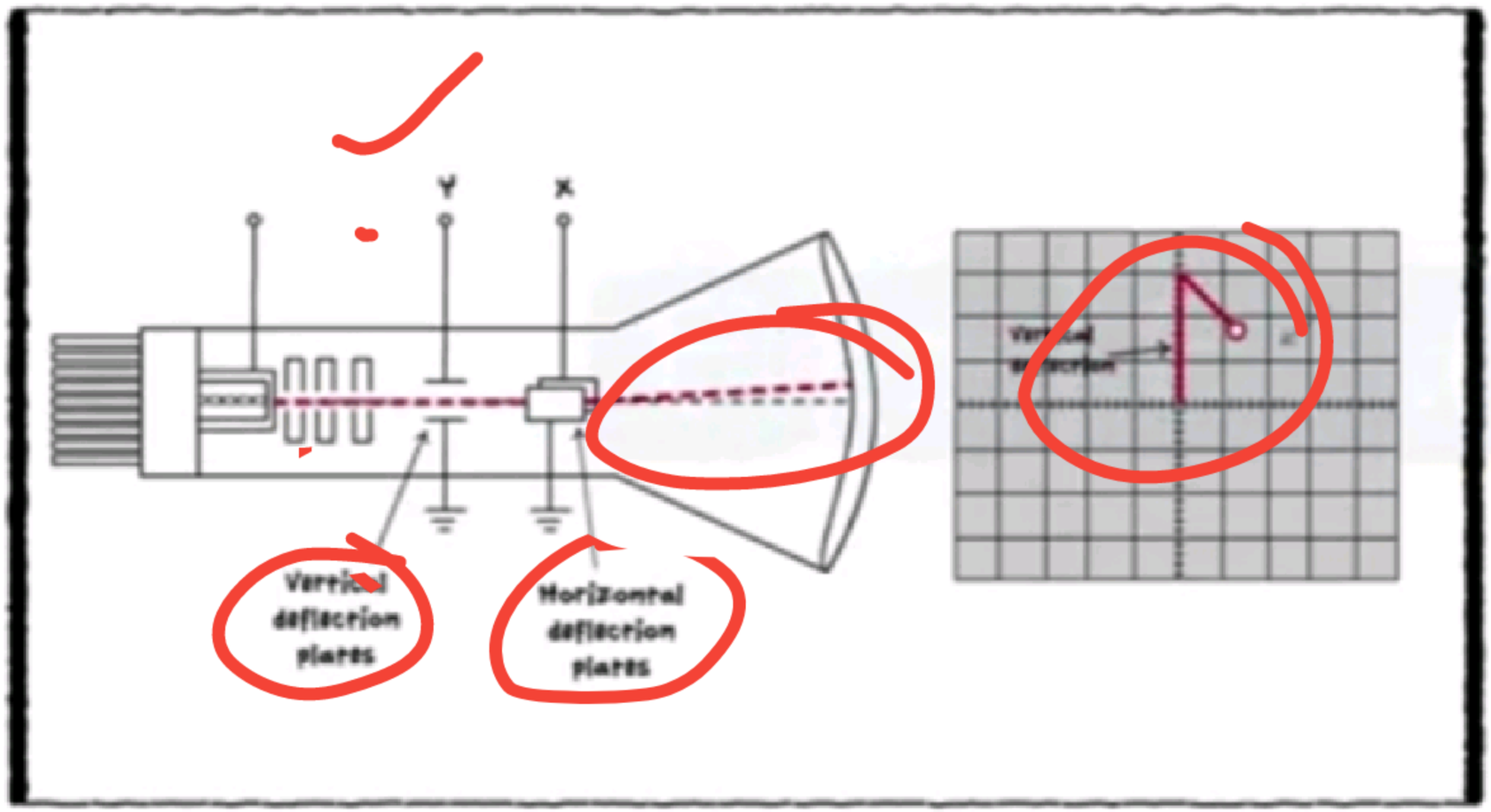


Accelerating and Focusing Anodes

- Increase the velocity of the beam
- Keep the beam focused

By controlling the positive voltage applied at anodes, the focus of the beam can be controlled

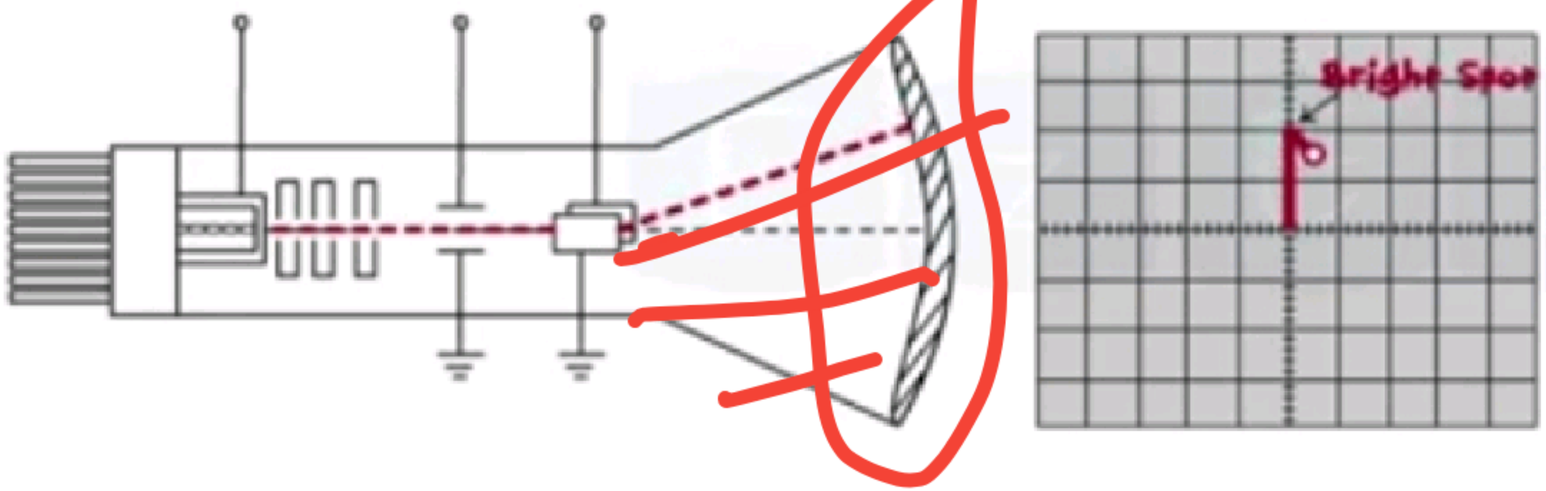
Cathode Ray Tube



Deflection Plates

- Horizontal deflection plates
- Vertical deflection plates

Cathode Ray Tube



Note : Signal also deflects horizontally.

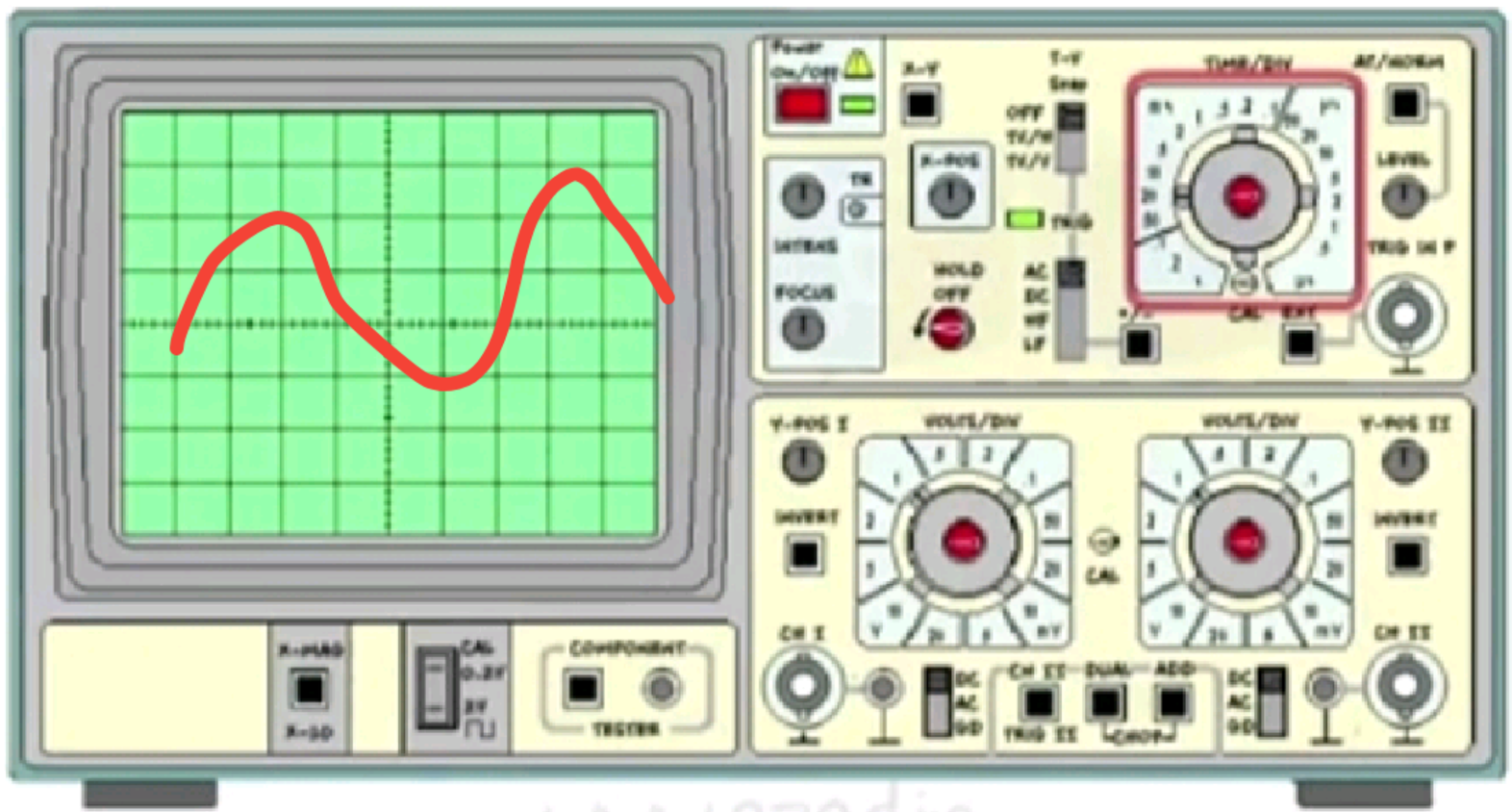
Phosphor Screen

- Electrons are made to strike the screen with **very high velocity**
- Inner side of screen : Phosphor

Electrical Energy → Light Energy

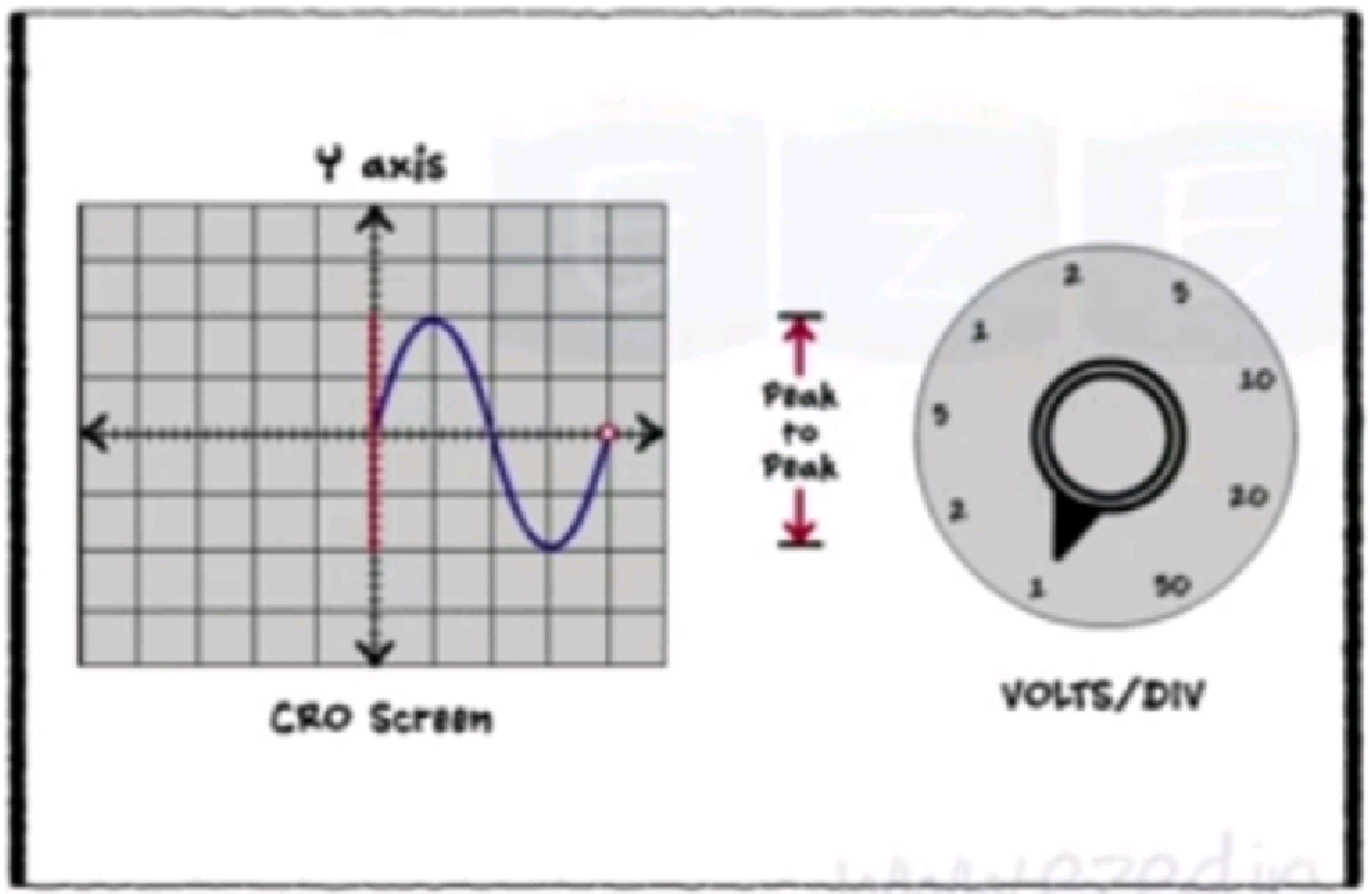
Cathode Ray Oscilloscope

Measurement of Voltage and Frequency



Cathode Ray Oscilloscope

Measurement of Voltage



To Measure the Voltage

- Count number of divisions
  No.of div = 4
- Note the position of VOLT/DIV knob
  Volt/Div = 1
- Calculate peak to peak voltage

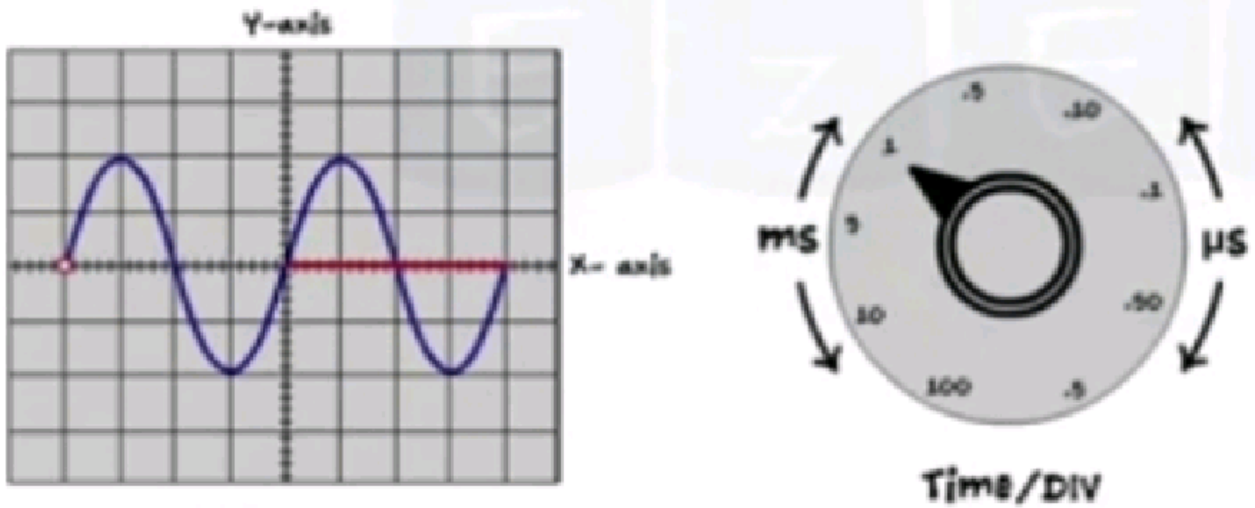
Peak to Peak voltage = No. Of Divisions * Volts/Div value

= 4 * 1 = 4 Volts

V_{p-p} = 4 Volts

Cathode Ray Oscilloscope

Measurement of Time Period and Frequency



CRO Screen

- Calculate the time period :

$$\text{Time period} = \frac{\text{No.of}}{\text{Div.}} * \text{Time Div}$$

$$= 4 * 1 \text{ ms} = 4 \text{ ms}$$

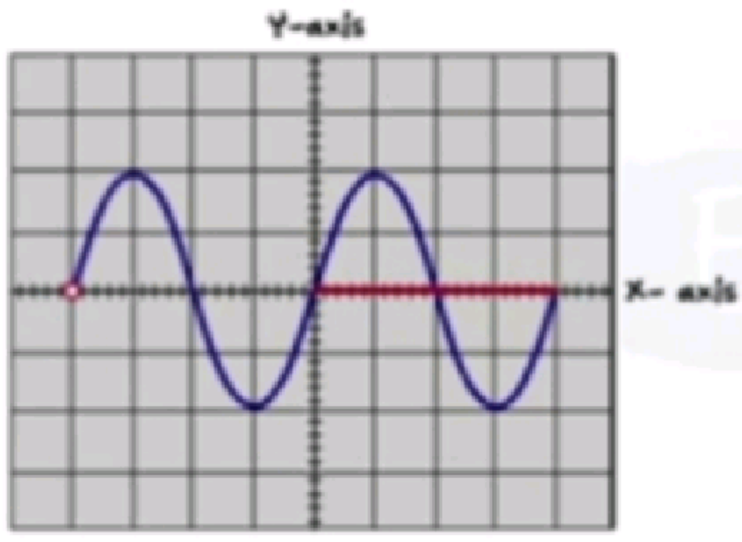
Frequency and Time Period are inverse to each other

$$F = \frac{1}{T}$$

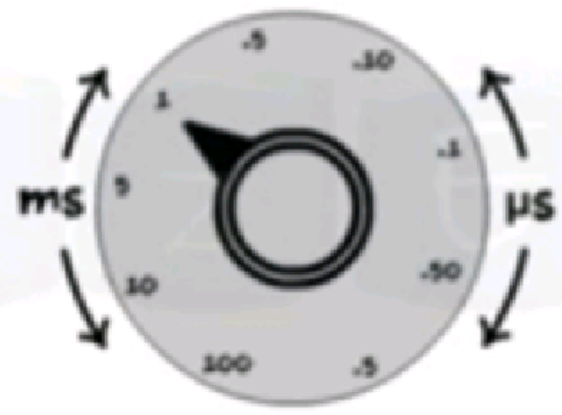
$$F = \frac{1}{4}$$

$$F = 250 \text{ Hz}$$

Measurement of Time Period and Frequency



CRO Screen



Time/DIV

- Count the number of divisions for one complete cycle

  No. Of Div = 4

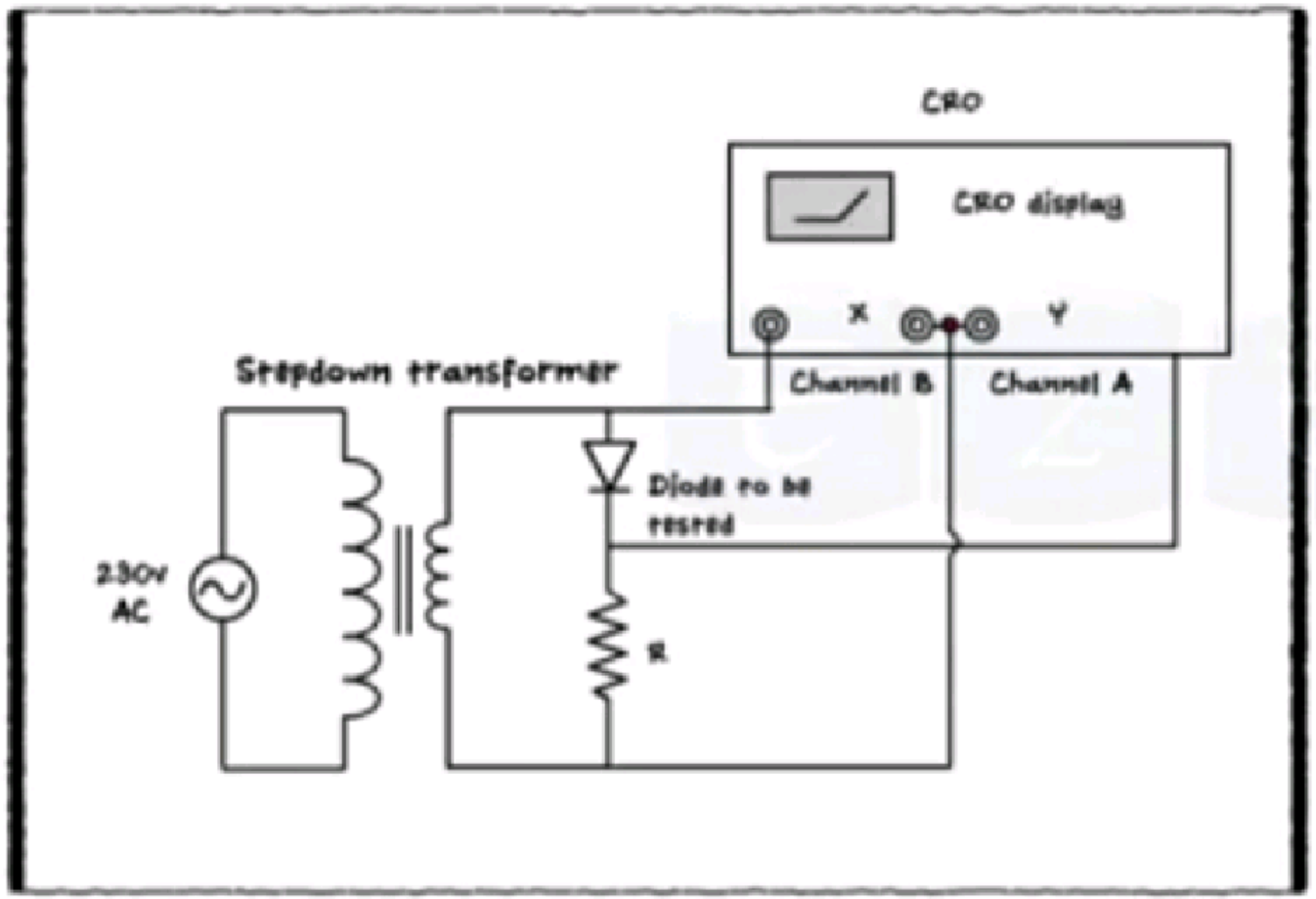
- Note the position of TIME per DIVISION knob

  Time Div = 1ms

$T = 4 \times 1$

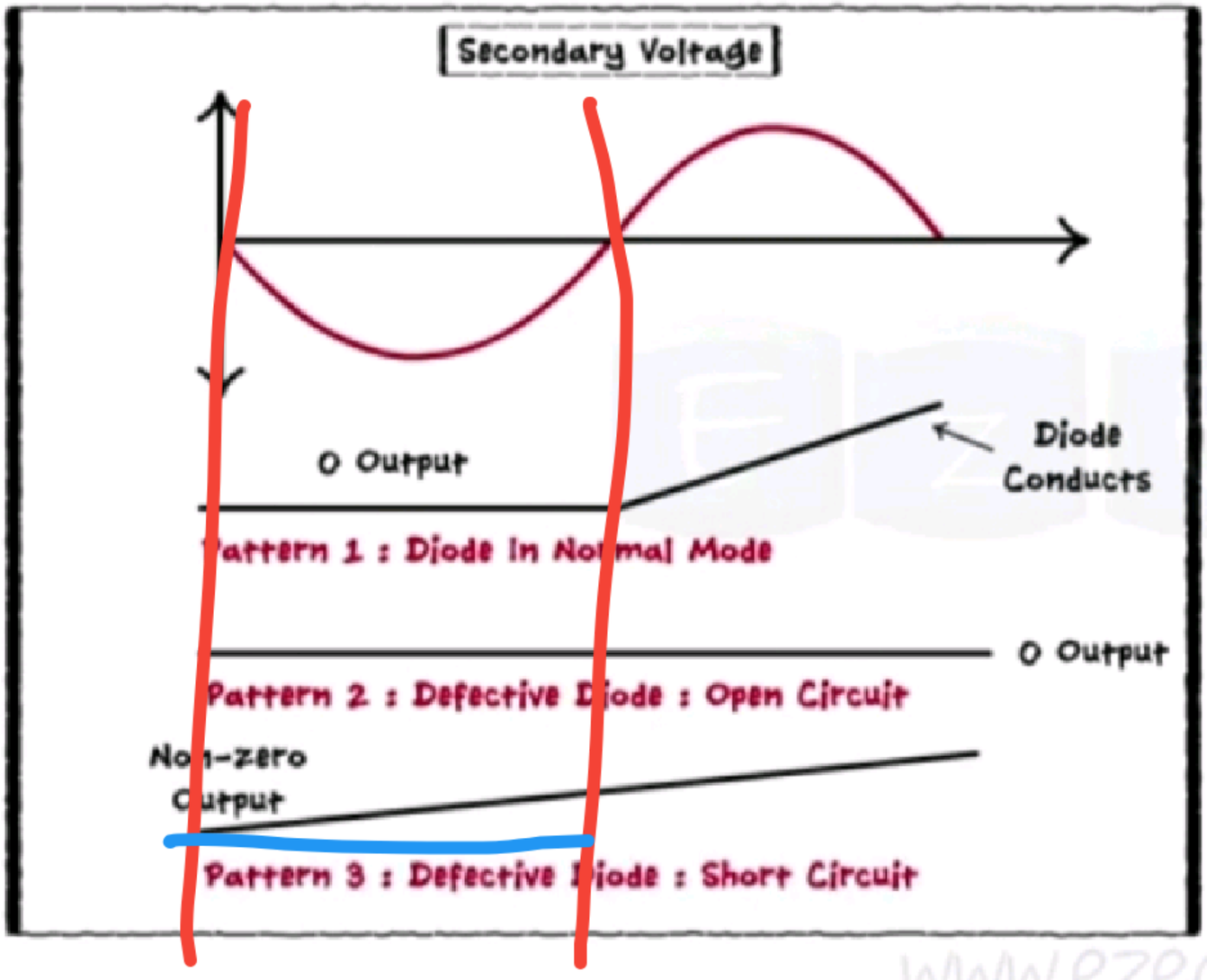
$f = \frac{1}{T}$

Testing of Diode



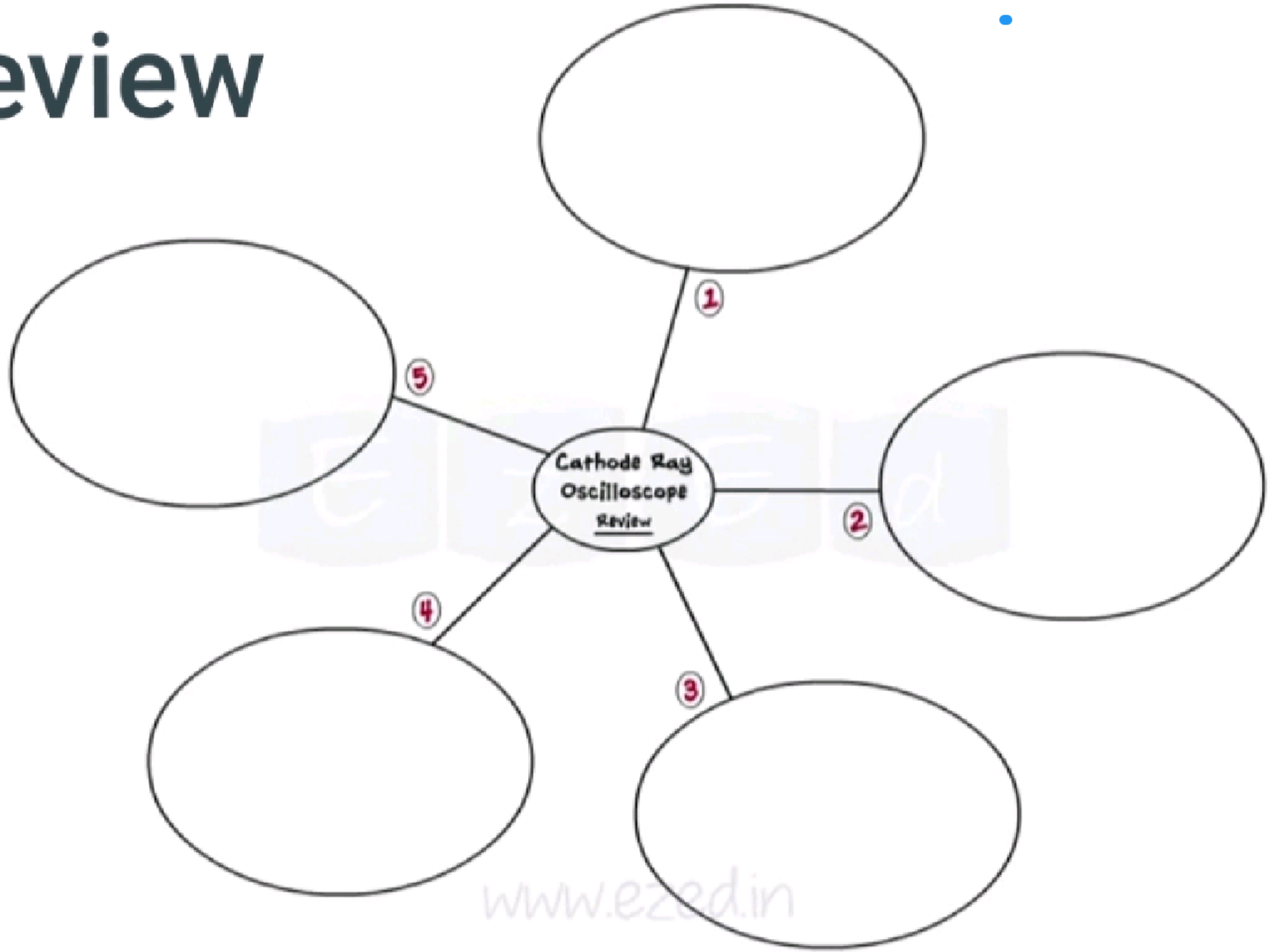
- Voltage across R_A depends on Diode Current

Testing of Diode



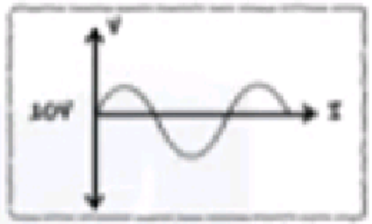
- Voltage across R_A depends on Diode Current
- If diode is in good condition :
- It will **Conduct** for +ve half
- It will act as **Open Circuit** for -ve half

Review



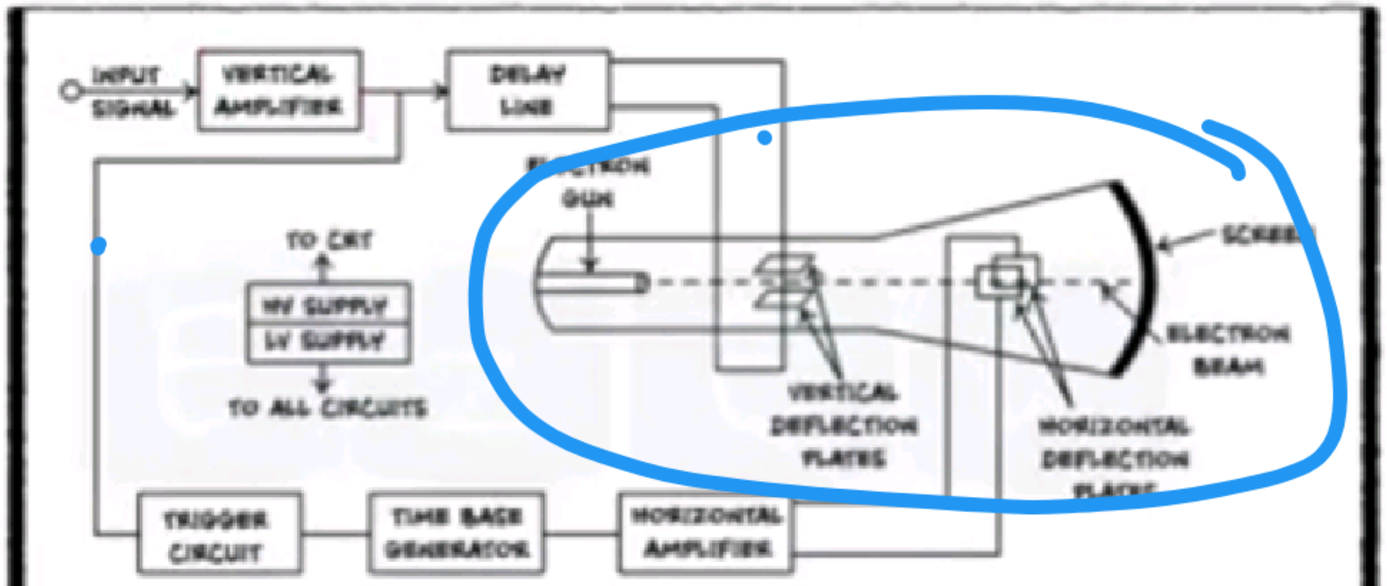
Cathode Ray Oscilloscope

- Used in College laboratories and Industries



1

Block Diagram of CRO

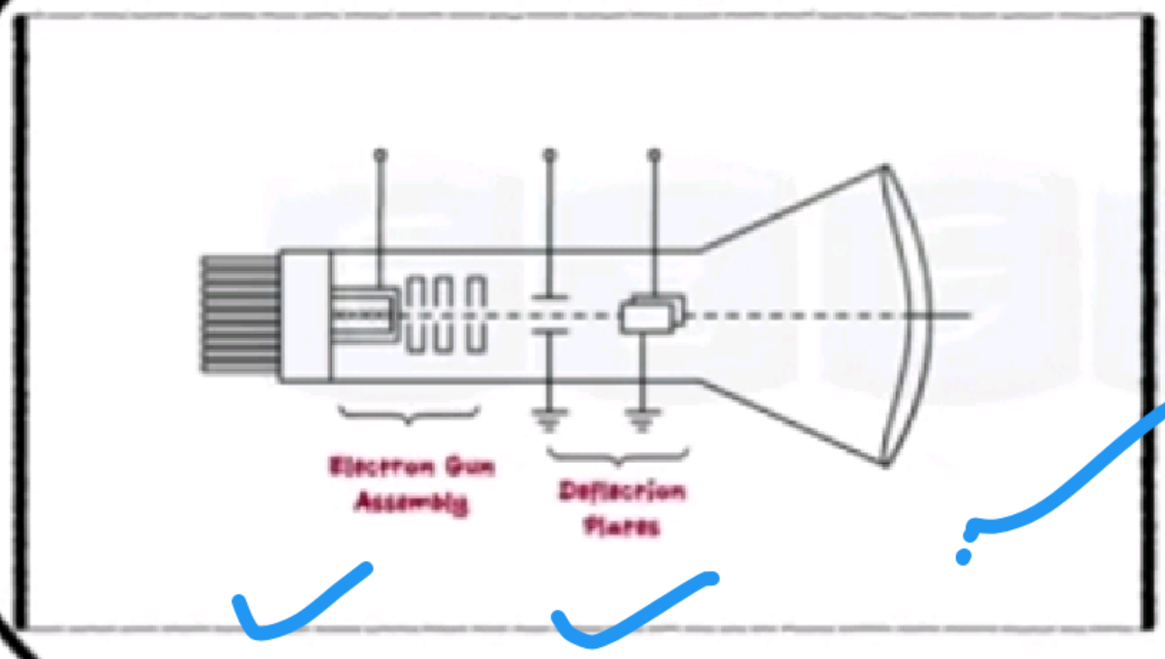


Block Diagram of General Purpose CRO

2

3

Cathode Ray Tube (CRT)

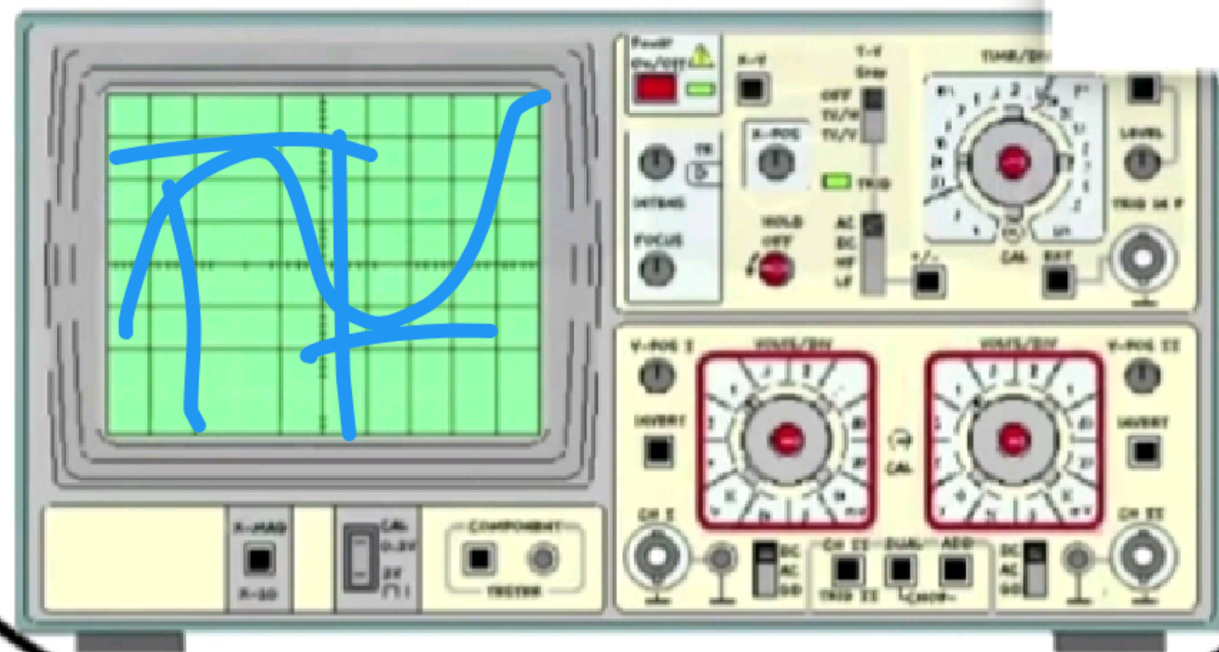


Sections of CRT

- Electron Gun Assembly
- Deflection Plates

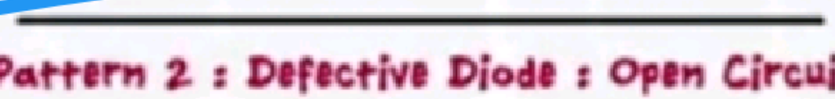
4

Measurement of Voltage And Fre



Component Testing of CRO

Pattern 1 : Diode In Normal Mode



Pattern 2 : Defective Diode : Open Circuit

Pattern 3 : Defective Diode : Short Circuit