CATHODE RAY OSCILLOSCOPE

A cathode-ray oscilloscope (CRO) is a standard laboratory instrument that measures accurate time and amplitude measurements of voltage signals over a wide range of frequencies. Its ease of operation makes it suitable as a general-purpose laboratory instrument. The heart of the CRO is a cathode-ray tube.

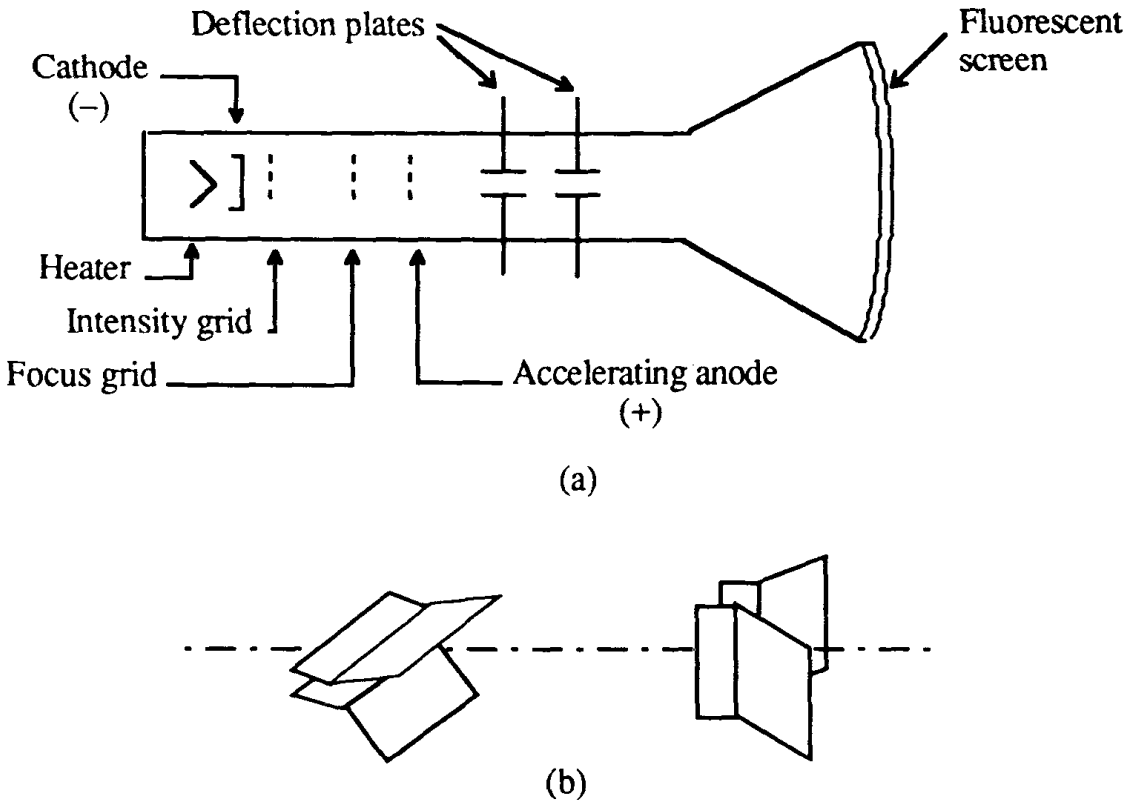
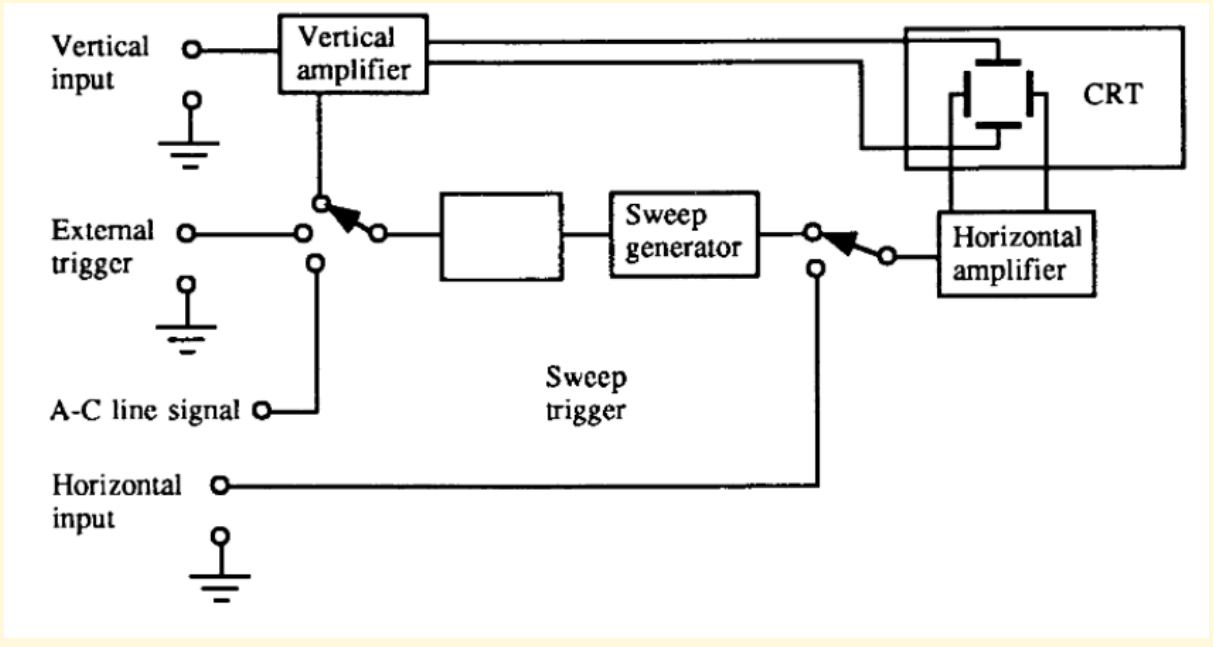


Figure 1. Cathode-ray tube: (a) schematic, (b) detail of the deflection plates.



The main parts of the cathode ray oscilloscope are as follows.

1. Cathode Ray Tube
2. Electronic Gun Assembly
3. Deflecting Plate
4. Fluorescent Screen For CRT
5. Glass Envelop

1. Cathode Ray Tube

The cathode ray tube is the vacuum tube that converts the electrical signal into a visual signal. The cathode ray tube mainly consists of the electron gun and the electrostatic deflection plates (vertical and horizontal). The electron gun produces a focused beam of the electron, which is accelerated to high frequency.

The vertical deflection plate moves the beams up and down, and the horizontal beam moves the electron beams left to the right. These movements are independent of each other, and hence the shaft may be positioned anywhere on the screen.

2. Electronic Gun Assembly

The electron gun emits the electrons and forms them into a beam. The electron gun mainly consists of a heater, cathode, a grid, a pre-accelerating anode, a focusing anode, and an accelerating anode. For gaining the high emission of electrons at moderate temperature, the layers of barium and strontium are deposited on the end of the cathode.

After the emission of an electron from the cathode grid, it passes through the control grid. The control grid is usually a nickel cylinder with a centrally located co-axial with the CRT axis. It controls the intensity of the emitted electron from the cathode.

The electron passing through the control grid is accelerated by a high positive potential applied to the pre-accelerating or accelerating nodes.

The electron beam is focused on focusing electrodes and then passes through the vertical and horizontal deflection plates and then goes on to the fluorescent lamp. The pre-accelerating and accelerating anode are connected to 1500v, and the focusing electrode is connected to 500 v. There are two methods of focusing on the electron beam. These methods are

- Electrostatic focusing
- Electromagnetic focusing.

The CRO uses an electrostatic focusing tube.

3. Deflecting Plate

After leaving the electron gun, the electron beam passes through the two pairs of deflecting plates. The plate producing the vertical

deflection is called a vertical deflecting plate or Y plate. A pair of the plate used for horizontal deflection is called horizontal deflection plate or X plates.

4. Fluorescent Screen for CRT

The front of the CRT is called the face plate. It is flat for screen size plates the electron beam After up to about 100mm×100mm. The screen of the CRT is slightly curved for larger displays. The face plate is formed by pressing the molten glass into a mold and then annealing it.

The inside surface of the faceplate is coated with phosphor crystal. The phosphor converts electrical energy into light energy. When an electronics beam strikes phosphor crystals, it raises their energy level, and hence light is emitted during phosphorous crystallization. This phenomenon is called fluorescence.

5. Glass Envelope

It is a highly evacuated conical shape structure. The inner surface of the CRT between the neck and the screen is coated with the aquadag. The aquadag is a conducting material and acts as a high-voltage electrode. The coating surface is electrically connected to the accelerating anode and hence helps the electron focus.