ROHINI
COLLEGE OF ENGINEERING AND TECHNOLOGY
Approved by AICTE and affiliated to Anna University,(An ISO Certified Institution)
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DEPARTMENT OF BIOMEDICAL ENGINEERING

III Semester

BM3301 SENSORS AND MEASUREMENTS

UNIT – 5

5.2 DSO - Digital Storage Oscilloscope

The digital storage oscilloscope is an instrument which gives the storage of a digital waveform or the digital copy of the waveform. It allows us to store the signal or the waveform in the digital format, and in the digital memory also it allows us to do the digital signal processing techniques over that signal. The maximum frequency measured on the digital signal oscilloscope depends upon two things they are: sampling rate of the scope and the nature of the converter. The traces in DSO are bright, highly defined, and displayed within seconds.

5.2.1 Block Diagram of Digital Storage Oscilloscope:

The block diagram of the digital storage oscilloscope consists of an amplifier, digitizer, memory, analyzer circuitry. Waveform reconstruction, vertical plates, horizontal plates, cathode ray tube (CRT), horizontal amplifier, time base circuitry, trigger, and clock.

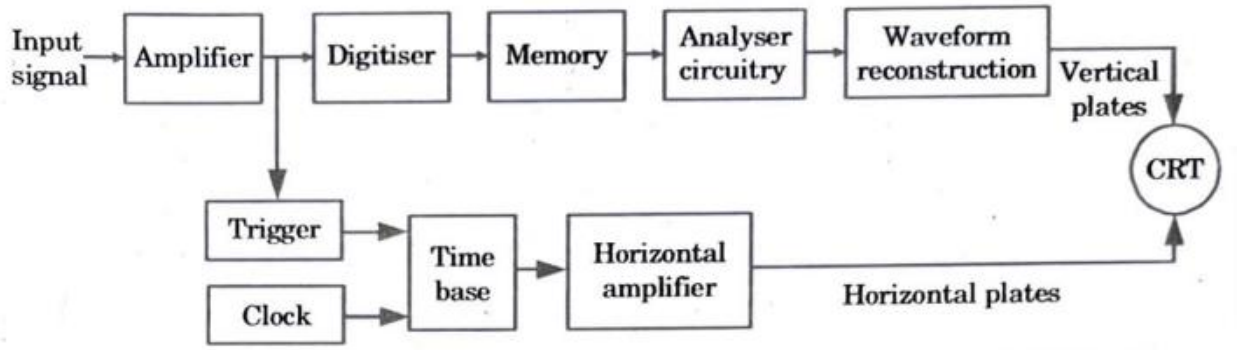

Fig 5.2.1 *The block diagram of the digital storage oscilloscope*

Construction and Working:

1. As seen in the above figure, at first digital storage oscilloscope digitizes the analog input signal.
2. Then the analog input signal is amplified by amplifier if it has any weak signal.
3. After amplification, the signal is digitized by the digitizer and that digitized signal stores in memory.
4. The analyzer circuit process the digital signal after that the waveform is reconstructed (again the digital signal is converted into an analog form) and then that signal is applied to vertical plates of the cathode ray tube (CRT).
5. The cathode ray tube has two inputs they are vertical input and horizontal input. The vertical input signal is the 'Y' axis and the horizontal input signal is the 'X' axis.
6. The time base circuit is triggered by the trigger and clock input signal, so it is going to generate the time base signal which is a ramp signal. Then the ramp signal is amplified by the horizontal amplifier, and this horizontal amplifier will provide input to the horizontal plate. On the CRT screen, we will get the waveform of the input signal versus time.
7. The digitizing occurs by taking a sample of the input waveform at periodic intervals. At the periodic time interval means, when half of the time cycle is completed then we are taking the samples of the signal. The process of digitizing or sampling should follow the sampling theorem. The sampling theorem says that the rate at which the samples are taken should be greater than twice the highest frequency present in the input signal. When the analog signal is not properly converted into digital then there occurs an aliasing effect.
8. When the analog signal is properly converted into digital then the resolution of the A/D converter will be decreased.
9. When the input signals stored in analog store registers can be read out at a much slower rate by the A/D converter, then the digital output of the A/D converter stored in the digital store, and it allows operation up to 100 mega samples per second.

This is the working principle of a digital storage oscilloscope.

5.2.2 Difference Between Digital Storage Oscilloscope and Conventional Storage Oscilloscope

The difference between DSO and the conventional storage oscilloscope or analog storage oscilloscope (ASO) is shown in the below table.

S.NO	Digital Storage Oscilloscope	Conventional Storage Oscilloscope
1	The digital storage oscilloscope collects data always	After triggering only, the conventional storage oscilloscope collects data
2	The cost of the tube is cheap	The cost of the tube is costlier
3	For higher frequency signals the DSO produce bright images	For higher frequency signals the ASO cannot produce bright images
4	The resolution is higher in digital storage oscilloscope	The resolution is lower in conventional storage oscilloscope
5	In DSO an operating speed is less	In ASO an operating speed is less

Advantages:

The advantages of the DSO are

1. Portable
2. Have the highest bandwidth
3. The user interface is simple
4. Speed is high

Disadvantages:

The disadvantages of the DSO are

1. Complex
2. High cost

Applications of DSO:

The applications of the DSO are

1. It checks faulty components in circuits
2. Used in the medical field
3. Used to measure capacitor, inductance, time interval between signals, frequency and time period
4. Used to observe transistors and diodes V-I characteristics
5. Used to analyze TV waveforms
6. Used in video and audio recording equipments
7. In ECG measurements, DSOs help visualize and diagnose abnormalities in the heart's electrical activity.
8. Used in the Biomedical research field
9. Used in patient Monitoring Systems

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