Experiment 1:

Introduction and Acquaintance with Digital Storage Oscilloscope (DSO)

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Aim: To learn about Digital Storage Oscilloscope (DSO) and its functionality in observing various Signal properties
Learning Activity: Carefully watch the video (provided by the Communications System Lab).

1. What is a Digital Storage Oscilloscope (DSO)? Read and learn about it on where / how can it be used? You may search web for this.
Ans: A Digital Storage Oscilloscope (DSO) is used to measure and analyse electrical input signal(s). It is an oscilloscope that stores and analyses a signal in 1s and 0s (digitally). It can measure the input signal parameters like amplitude, phase, frequency, mean, etc., of the given signal.
The word “Digital Storage” in the device’s name indicates that the Analog Input Signal is Sampled and Stored Digitally in the digital memory available (64 GB flash memory) also it allows us to do the digital signal processing techniques over that signal. The frequency of DSO depends on the sampling rate and the nature of the converter. It is used in various fields like Measurement of electrical signals, verifying waveforms of the signals, Medicine etc.

2. Note the model number and manufacturer name of the DSO in the video.
Ans: Model Number: **TDS 2012C**
Manufacturer: **Tektronix**

3. What are the functions of horizontal controls?
Ans:
The Horizontal panel consists of two knobs: Position and Scale knobs, Set to Zero button, Horizontal Menu

Position Knob: The ‘POSITION’ knob allows users to move all displayed signals left and right on display without changing the time scale. The white arrow on the top of the screen points to the mean position of the Signal on the screen. It moves along with the signal when it is moved left or right.
Scale Knob: The ‘Scale’ knob Use this knob to adjust the horizontal or time scale of the display (same for both channels) is for scaling the signal. It does not change any of the parameters but zooms the signal in and out. It can be used when very small or large signals are given as input.
Set to Zero Button: The ‘SET TO ZERO’ button resets the horizontal position of the signal back to zero, thus centring the signal horizontally. It is present to bring the signal back to its original position before moving it horizontally.
Horiz Menu: The ‘HORIZ MENU’ button activates a softkey menu that allows access to several other means of focusing on a specific section of a waveform.

4. What are the functions of vertical controls?

Ans:

The display in the DSO can show two signals (represented by yellow and blue colours).
The vertical panel contains four knobs (two on the top and two on the bottom) and three buttons: one for yellow signal and the other for blue, and the final one for the different types of “math functions”.

Position Knob: The Position Knobs(upper knobs with continuous rotation) each for each channel can adjust the position of the signal over the vertical axis.
Scale Knob: The Scale Knob(lower knobs), which can be stepwise rotated, is used for the signal’s amplification or attenuation.
Channels (1 and 2): The two buttons are for two signals represented on display. Using these buttons, we can select which signals to be displayed on the Display.
Math Menu: The button representing the “math” is used for different functions performed over the signal (or signals).

5. What is the purpose of a trigger in a DSO?

Ans: Trigger is useful for a stable visualisation of the input signal.

The trigger plays a crucial role in capturing the signal and seeing them as stable pictures on the screen. The trigger panel on the DSO consists of a trigger level (knob) and some buttons. When clicked on the trigger menu, components of the signal appear on the screen (type, source, slope, mode, coupling).
The cursor pointing in the horizontal direction on the right of the screen can be moved using the knob (trigger level). The signal is stable only until the cursor is in the range of the signal, overshooting that the signal becomes unstable. The signal can be reverted stable back by bringing the cursor back into the range of Signal.

6. What are the range of amplitudes and frequencies that the DSO can display?

Ans: Maximum Amplitude = ± 45V (for >200mV/div to 5V/div setting)
±1.8V (for 2 mV/div to 200 mV/div setting)
Maximum Frequency = 100MHz

7. What is the DC coupling & AC coupling functionalities?

Ans:

DC coupling functionality: The DC component (or DC Offset) of the input signal is allowed to pass and gets displayed.
AC coupling functionality: The DC component (or DC Offset) of the input signal is removed, and only the AC signal gets displayed.

8. In what way the cursors of DSO help in measurements?

Ans:

Cursors in DSO help measure the time of the Signal and the amplitude of the Signal. The cursors are present as vertical lines parallel to the y-axis and horizontal lines parallel to the x-axis.
In the oscilloscope, the horizontal cursors enclose the signal and can calculate the Signal amplitude.
The vertical cursors can be used for defining the user-chosen time segment of the signal. It can also be used for measuring the time period and, in turn, frequency of the signal.
These cursors can easily be moved and turned ON/OFF.

9. What is the use of “AUTO SET” functionality of DSO?

Ans:

Pushing the AUTO SET option, the oscilloscope automatically analyses/identifies the type of waveform and adjusts controls to produce a usable display of what it believes is the dominant signal. This adjusts the horizontal, vertical and trigger settings.

10. Where do you think the probe attenuation helps?

Ans:

Probe attenuation helps in the visualisation of input signals with large amplitude. This also helps in measuring high frequencies.
When a signal with very high amplitude is given as an input, the reduction of the amplitude is made by using this attenuation property of the oscilloscope probe command.

Mind Gym Exercise:

WHY are the different features of the DSO needed in the context of communication systems?

Ans:

The Different features on DSO are useful for monitoring any change in parameters of transmitted and received signals, like behaviour and shape of the signal, amplitude, noise part in signal, etc.