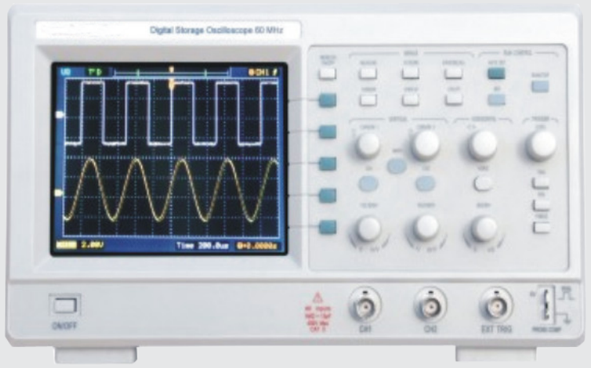
Tesca Technologies Pvt. Ltd.

Know Your Digital Storage Oscilloscope



DSO Definition

The Oscilloscope is an electronic measuring instrument which displays electrical signals in graphic form. Used for measuring voltage, Time, Phase angle, Frequency etc.

DSO performs waveform acquisition using high-speed sampling and digitizing rates. This allows the waveform to be digitized into a complete set of points from a single triggered acquisition.

DSO allows to capture and view transient events, and since the waveform information exists in digital form, it can be analyzed, archived, printed and otherwise processed.

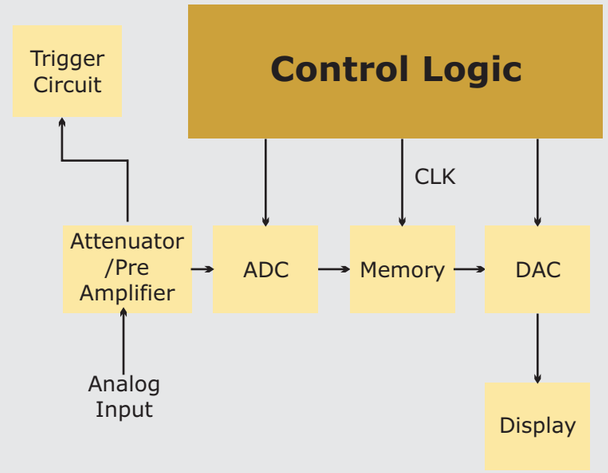
Advantage of Digital Storage Oscilloscope:

- One-shot measurement
- Pre Trigger Facility
- On screen measurements and analysis eg. FFT, correlation, Integration etc.
- Data Re0use
- Connectivity to computers for printing, sharing, remote control via Rs22 or GPIB etc.
- Vast storage capacity i.e. More than one image can be stored
- Non volatile memory is used for storing signals,
- Have the highest bandwidths
- Easy to use
- Are small and portable
- Can also be fully integrated into Automatic Test Equipment (ATE) systems. In addition, the DSO is often used as the

Limitations

1. Aliasing: If sampling rate is below the Nyquist limit, the signal appears to be of much lower frequency than it Actually is.
2. Effective Sampling rate varies with Time base: This is due to limited memory available to store the sampled points. This causes aliasing at lower time base settings.

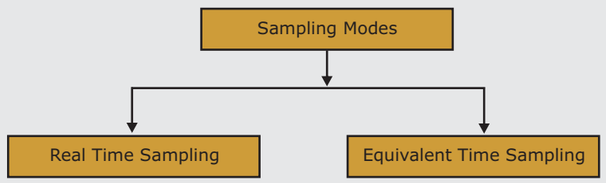
Block Diagram of DSO



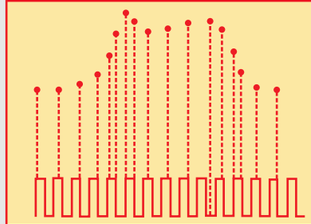
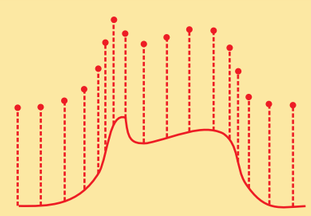
Key Specifications

Vertical Resolution: Determined by the resolution of the A/D converter. On DSO this range covers the whole vertical area.

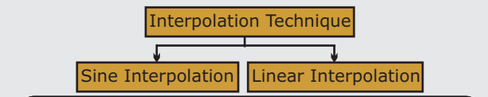
Sample Rate: In DSO sampling rate determines its effectiveness unlike analog oscilloscope where Bandwidth is of prime importance. The faster the Digital Storage Oscilloscope samples the input signal the greater the resolution and detail realized on the displayed waveform.



Comparison of Equivalent time and Real time Sampling

Equivalent Time Sampling	Real Time Sampling
A sampling technique in which a representative waveform is created with a series of samples taken from identical repetitive.	A sampling technique in which all samples are taken in a single cycle of the digitizing system, capturing and displaying the event in the same time frame in which it occurs.
Allows the oscilloscope to accurately capture signals whose frequency components are higher than the oscilloscope's sample rate: however the signal must be	Input signal need not be repetitive.
Requires multiple triggering events.	Samples are equally spaced in time and acquired in a single
Cannot create meaningful display from a single shot	Treats both repetitive and single shot waveforms as one time.
	
In equivalent time sampling successive samples of the signal to captured are taken over many stable waveform repetitions and the signal is reconstructed from them.	In real time sampling, each point is displayed as it really occurs in time. Only one complete sweep is needed to

Horizontal Resolution/Memory Length: Horizontal resolution is determined by the memory length. This is the number of samples which are stored for a displayed trace.
This allows expansion horizontally which is helpful in observing details of transient signals. Larger memory will give more resolution and so allow more expansion.
Single shot mode: DSO's are capable of capturing signals that happen only once in time eg. Transients.
Pretrigger: Helps to see the events occurring before the trigger. Useful when the trigger event occurs after the events of interest.
Waveform Reconstruction: To avoid visual aliasing, scopes use interpolation techniques which fill in the missing samples between actual samples and display a continuous waveform.

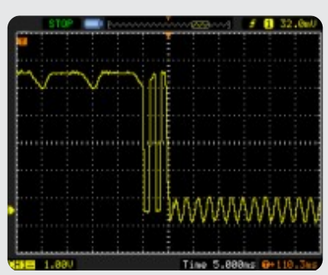


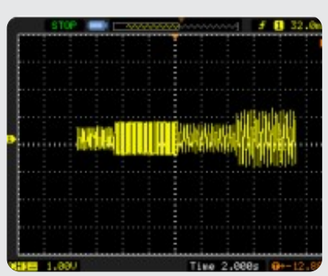
Interpolation Techniques Resulting Accuracy

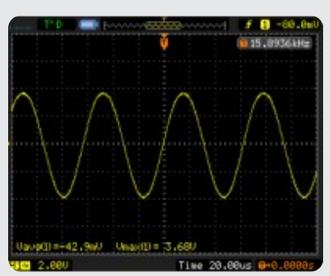
Samples/Cycle	Amplitude Error	
	Linear	Sin (×)/ X
2.5	40%	14%
4	28%	2%
5	12%	<2%
8	8%	<2%
10	5%	<2%
20	<2%	<2%

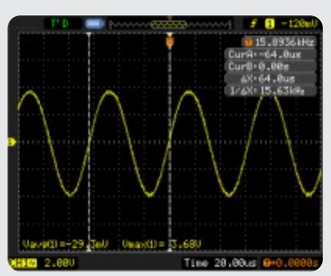
Glitch Detection: The scope will look for any occurrence of glitches and records them. It has 3 options viz 'min' and 'min-max'. Min mode is used to detect negative glitches, Max to detect positive glitches and Min-Max mode is used to detect aliasing.
Roll Mode: This mode helps to display a stable clear picture of very slow signals, as the display continuously scans the memory which is being updated slowly.

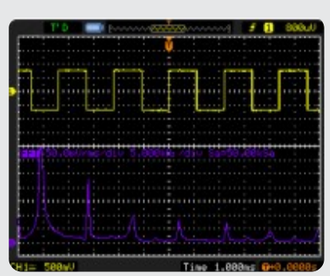
Popular Measurements on DSO


Transient Capture


Roll Mode


Average Mode


Cursor Measurement


FFT Analysis


10926
DSO Demonstrator Trainer


16961 - 16962
½ Dgt. 2000 Count Multimeter


16990
DC Voltage Supply Unit


17023
Function generator


17043
DC Power Supply


17090
Digital Storage Oscilloscope


17131
DC Power Supply


17703A - 17704F
Digital Clampmeters

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