Function Generator: Wavetek model 81

Waveforms:
- Sine wave
- Triangular wave
- Rectangular wave
- Positive pulses
- Negative pulses
- Positive ramp

Frequency range: 10mHz ÷ 50MHz
Output voltage: up to 16V (amplitude)
“Introduction to Oscilloscope, Function Generator, DMM”

The goal of the Lab is to get familiar with these laboratory tools.

Function Generator

Wave Function Generator; generates time dependent voltages $V(t)$ as input for the study of electrical circuits or can be used as signal source in scientific experiment.
DMM – digital multimeter. (Agilent 34401A)

You can use DMM to measure:
- AC/DC voltage
- AC/DC current
- Resistance
- Frequency
- Period

All DMM’s measure AC signals (voltage or current) in rms (root mean square) units. For periodic signal:

\[ V_{rms} = \sqrt{\frac{1}{T} \int_{0}^{T} [V(t)]^2 dt} \]

In case of sine wave

\[ V_{rms} = \frac{V_{amp}}{\sqrt{2}} \approx 0.707V_{amp} \]
“Introduction to Oscilloscope, Function Generator, DMM”

Digital Oscilloscope Tektronix TDS3012b

The things you have learn and know about the scope:

- Inputs characteristics of the channels (input resistance, gain, bandwidth)
- Time base range
- Triggering
- Measurements of signal parameters
- Using cursors
- Averaging
- Using Math options
- Computer access to the image and data
- And much more ....

Higher Speeds Demand Greater Bandwidth

The TDS3000B DPOs offer bandwidths from 100 to 500 MHz to best suit the needs of your most demanding projects, so you can complete your tasks efficiently and confidently.

<table>
<thead>
<tr>
<th>Model</th>
<th>Bandwidth</th>
<th>Channels</th>
<th>Sample Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>TDS3054B</td>
<td>500 MHz</td>
<td>4 Ch</td>
<td>5 Gs/s</td>
</tr>
<tr>
<td>TDS3052B</td>
<td>500 MHz</td>
<td>2 Ch</td>
<td>5 Gs/s</td>
</tr>
<tr>
<td>TDS3044B</td>
<td>400 MHz</td>
<td>4 Ch</td>
<td>5 Gs/s</td>
</tr>
<tr>
<td>TDS3034B</td>
<td>300 MHz</td>
<td>4 Ch</td>
<td>2.5 Gs/s</td>
</tr>
<tr>
<td>TDS3024B</td>
<td>300 MHz</td>
<td>2 Ch</td>
<td>2.5 Gs/s</td>
</tr>
<tr>
<td>TDS3014B</td>
<td>200 MHz</td>
<td>4 Ch</td>
<td>2.5 Gs/s</td>
</tr>
<tr>
<td>TDS3012B</td>
<td>100 MHz</td>
<td>2 Ch</td>
<td>1.25 Gs/s</td>
</tr>
</tbody>
</table>

Physics 401 Spring 2016
Digital Oscilloscope Tektronix TDS3012b

Simplified block diagram of two channels digital oscilloscope
Digital Oscilloscope Tektronix TDS3012b - Triggering

- Triggering level: 4.44 V
- Triggering source: -2.88 V
- Triggering delay: 132 µs
- Triggering delay: -72.0 µs

Vertical scale (V/div)
Horizontal scale (s/div)

Triggering level
Triggering source
Triggering delay
Digital Oscilloscope Tektronix TDS3012b - Triggering

This data was taken from scope in ASCII format and plotted using Origin. Color arrows indicate the triggering levels for each trace.
Digital Oscilloscope Tektronix TDS3012b – Averaging

Mixing the signal with noise

Wavetek 81

Analog HP

Noise

Signal

TDS3012b
"Introduction to Oscilloscope, Function Generator, DMM"

Digital Oscilloscope Tektronix TDS3012b – Averaging

Noisy signal

Numbers of averaging

- 4
- 16
- 256
- 512
“Introduction to Oscilloscope, Function Generator, DMM”

Digital Oscilloscope Tektronix TDS3012b – Math
“Introduction to Oscilloscope, Function Generator, DMM”

Retrieving the data from scope. All scopes in the Lab are connected to network.

Find IP address of the scope on the top of its case and type it in the browser window.

You will have access to the scope screen image and data stored in scope memory from computer.
Retrieving the data from scope.

To get the data from scope – click on data button in Tektronix window.

In data window choose the proper channel and format and click “Get”. Spreadsheet format corresponds to ASCII

Downloading the data
This program will help you to take data much faster than using Tektronix site.
“Introduction to Oscilloscope, Function Generator, DMM”

Retrieving the data from scope.

Now we import the data in Origin, Excel

The first column represent time in sec accounted from triggering event. The second – voltage applied to corresponding channel.
“Introduction to Oscilloscope, Function Generator, DMM”

The most important things which you have learn from Lab1:

- **Function generator.** Manipulating with wave form, frequency, amplitude of the signal. What is the output resistance of the generator.

- **DMM.** Input resistance of DMM. Measuring AC signals. What is rms and how to calculate it.


- **General.** Access to the Lab portal. Create a personal folder in “Students” area.