

Experiment 1

Lab Activity

Pre-Lab Activity

Read and summarize the material in this Oscilloscope Unit and the [Probe Calibration Unit](#) before coming to the Laboratory; Watching YouTube Channel Teaching video to familiarize yourself with the basic operation of the scope. Submit your summary to the Lab instructor. Read the laboratory activity and the post-lab activity.

Laboratory Activity

All the waveform operations are based on the waveform generated by step 4.

1. Turn on the Rigol MSO1104 oscilloscope.
2. Attach the 10:1 test probe to Channel 1.
3. Attach the probe's tip to the **Probe Comp** connector, as shown in the figure 1. The shown probe's black clip connection to ground is not necessary, since all of the scope BNC connectors have their outer shields already grounded.



Figure 1 Probe Connection

4. Press the corresponding Channel key (in this case, the **CH1** key). By pressing the same channel key for the second time, this channel will be turned off
5. If the displayed attenuation factor is different from that of the test probe (normally 10:1), adjust the attenuation factor
 - 1) Press the corresponding Channel key (in this case, the CH1 key)
 - 2) Press the corresponding Softkey on the right of the screen (in this case, the third Softkey)
 - 3) Turn the Intensity knob to select a desired attenuation factor
 - 4) Press the Intensity knob
6. Press the **AUTO** key in order to display the acquired signal on Channel 1. Adjust the Intensity knob so that you get a clear view of all edges of the waveform.
7. Inspect the displayed waveform. [Calibrate the probe](#) if you do not see a perfect square wave.
8. Apply amplitude scaling, vertical shift and horizontal shift to the displayed waveform so that it looks like the signal in the following figure.
 - 1) If amplitude scale needs to be adjusted, turn the Scale knob in the Vertical section
 - 2) If vertical shift needs to be adjusted, turn the Position knob in the Vertical section
 - 3) If horizontal scale needs to be adjusted, turn the Scale knob in the Horizontal section
 - 4) If horizontal shift needs to be adjusted, turn the Position knob in the Horizontal section
9. Save the display by following ways:
 - 1) Saving the display onto a flash drive
 - 2) Recording the display by taking photo
 - 3) Using Workstation software to save the display.

10. To display average signal waveforms
 - 1) Press the Acquire key
 - 2) Press the corresponding Softkey on the right of the screen (in this case, the first softkey)
 - 3) Turn the Intensity knob to change mode to Average
 - 4) Press the Intensity knob
 - 5) Turn the intensity knob again, to change the average #
11. Turn the **Trigger Level** knob and study its effect on the displayed waveform. What is the range of trigger levels that leads to a stable signal?
12. Turn the **Scale** knob in the Horizontal section. Make note of the effects it has on the displayed waveform.
13. Press the **Measure** key. Using the proper softkeys, perform frequency, period and peak-to-peak measurements. Corresponding keys are on the left of the screen.
14. Save the display.
15. Employ cursor measurements to determine the period and peak-to-peak voltage of the waveform.(Set the averaging back to # **Avg**s = 8.)
 - 1) Press the Cursor key
 - 2) Press the first Softkey on the right of the screen
 - 3) Turn the Intensity knob to select Manual, then press the intensity knob
 - 4) Turn the Intensity knob to determine the position of the first line, then press the intensity knob
 - 5) Turn the Intensity knob to determine the position of the second line, then press the intensity knob
 - 6) Press the second Softkey on the right of the screen to toggle between vertical and horizontal
 - 7) Turn the Intensity knob to determine the position of the first line, then press the intensity knob
 - 8) Turn the Intensity knob to determine the position of the second line
16. Press the scope's **Math** key, set the function to the **Integral** to display the integral of the square wave. And save the display
17. Employ cursor measurement to determine the slope of the integral waveform in the neighborhood of $t = 200\mu\text{sec}$

18. Save the current scope's display
19. Sort all components and give them back to your instructor.

Post-Lab Activity

Write a [technical report \(Post Lab report\)](#) that discusses your observations and analysis of all steps in this activity. Make sure to include (your own) captured display images. More specifically, your report should address the following:

- The significance of the scope's ground connection.
- The significance of using a 10x probe.
- Why do we need to calibrate the probe.
- The effect of signal averaging on the displayed waveform.
- The effect of triggering level on the displayed waveform.
- The effect of vertical and horizontal scaling on the waveform.
- Compare the automatic measurements of the peak-to-peak value and period (of the test square wave) to those obtained manually employing the scope's cursor system.
- Include all captured display images in your report.