

OBJECTIVE

Become familiar with basic and more in-depth operation of the oscilloscope and function generator while observing characteristics of an ac RC circuit.

MATERIALS

1. (1) Function Generator Lead
2. (2) Oscilloscope Probes
3. Function Generator/Oscilloscope
4. 4.7 k Ω Resistor
5. 0.05 μ F Capacitor 42.3

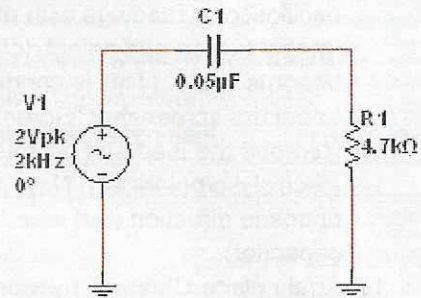


Figure 2-1

PROCEDURE

1. Turn on the computer.
2. Place the (2) electronic components seen in Figure 2-1 above on your bread board connecting them in series.
3. Attach Function Generator Lead to the 'Gen Out' Terminal and 1 Oscilloscope Probe to the Channel '1' terminal and the other to the Channel '2' terminal on the combined Function Generator/Oscilloscope device. Turn the device on.
4. When all the lights have stopped blinking and the device appears to be ready hit the 'Default Setup' button located near the top right of the control panel of the oscilloscope.
5. Turn on the Function Generator by pressing the 'Wave Gen' button located under the 'Trigger' buttons on the left of the control panel. You will see other menus located at the bottom of the screen indicating the waveform parameters that can be controlled.
6. Attach the function generator lead to the Channel 1 oscilloscope probe (black to black and red to probe)
7. Create a sine wave with a frequency of 2 kHz and an amplitude of 2 V peak. Be sure to keep the DC offset at 0.0 V. To adjust the horizontal and vertical settings use the knobs labeled 'Horizontal' and 'Vertical'. Adjust the horizontal (time) settings for 200 μ s/division and adjust the vertical settings to 1.00 V/division. These values are located at the top right and left on the screen.
8. Take the function generator lead and now attach it as the power supply to the circuit on your breadboard. Take the Channel 1 Probe and place it across the source.
9. Turn the Channel 2 probe on by pressing the number '2' button at the bottom middle of the control panel. You will see a green trace appear on the screen. Set the vertical scale of Channel 2 at 1.00 V/division. Apply Channel 2 to the circuit to measure the voltage across the resistor.
10. Measure the RMS and peak to peak values of each trace. Hit the 'Meas' button under the Measure menu on the control panel. You will see a 'Measurements' section appear in the middle right of the screen and different menus appearing at the bottom of the screen. On the right of the screen, press the 'Clear Meas' button and then 'Clear All'. On the left of these menus is 'Source'. First choose 'Source' 1 which is Channel 1. Under 'Type' find 'AC RMS - N Cycles' and 'Add Measurement'. Go back to 'Type' and find

1,39

~~1,39~~

4.02V
'Peak-Peak' and 'Add Measurement'. Repeat this for Source 2 (Channel 2) in the same order.

11. On the computer, open up the 'Keysight BenchVue' software on the desktop. Double click on the oscilloscope icon on the bottom right of the screen. At the top of the screen (left) under 'Bench Layout:' select the fourth full-screen icon. You should see your oscilloscope readings with measurements appear on the screen. Click on the 'Screen Image' button and select 'Invert Colors'. The background of the screenshot should become white. (This is conducive for printing). Copy and paste into a Word document. Label the screenshot "Screenshot 2-1: Voltage across the resistor".
12. Remove the lead and probes from your circuit. (Reverse the direction of the capacitor if electrolytic/polarized). Now place the function generator leads across the circuit in the opposite direction (red lead to the resistor and black lead on the negative side of the capacitor).
13. Again place Channel 1 probe across the supply, but place Channel 2 probe across the capacitor. Adjust the vertical scale of Channel 2 to 500 mV/division. Your waveform may appear very fuzzy. To see it more clearly, press the 'Acquire' button in the middle of the control panel. The menu on the far left at the bottom of the screen says 'Acq Mode' - 'Normal'. Press the corresponding button beneath and choose 'High Res' or 'Averaging'. Your waveform should become very clear. (Observe the phase shift)
14. Go to 'Measure' again and 'Clear Meas' and 'Clear All'. Add measurements of 'Max' voltage for Channel 1 then Channel 2. Under 'Settings' make sure the far left button is set at Source 1 and the middle button is set at Source 2. Go back to Measure menu and under 'Type' select 'Phase' at the bottom of the menu and hit 'Add Measurement'. Two cross-hairs will appear and you will see the phase difference measured on the screen. Decrease the horizontal scale to 100 μ s so approximately 2 full cycles are visible on the screen. Hit the 'Run/Stop' button so the oscilloscope displays a screen at an instant in time. Hit the 'Zoom' button (top middle of the control panel - looks like a magnifying glass). The screen will split into 2 shots one of which is zoomed in. Using the 'Horizontal' knob (width of the window) and the 'Zoom' knob (location of the window in time), adjust the zoom window to see the peaks of both waveforms.
15. Go back to 'Keysight BenchVue' software and acquire the screenshot. Copy and paste into the Word document created in step 11 above. Label the screenshot "Screenshot 2-2: Voltage across the capacitor".
16. Beneath the second image, write a statement indicating the lead / lag relationship and phase angle between the input and output.
17. Size the images such that all of the information in the document fits on one page. Save this document.

ch. 1

1.93 V

ch. 2

693 mV

from 2 to 2

700 ~~69.7~~
700 mV 69.7

input lead
output

SUBMITTAL: Make sure all submitted work is clearly your own. DO NOT USE MY WORDS, and DO NOT USE MY DATA/ILLUSTRATIONS. DO NOT USE ANY OTHER STUDENTS WORK. ALWAYS WRITE TECHNICAL PAPERS IN THE 3RD PERSON!!!! Your submittal will include the following report sections:

LAB COVER SHEET

TITLE PAGE

OBJECTIVE - using complete sentences, describe your thoughts on what you think the objectives of the exercise were.

PROCEDURE – using numbered steps, summarize the procedure performed in this lab

DATA – This section will include data created by you: A circuit schematic (using Multisim), Calculations (peak-peak current – use voltage measured in Step 10 and measured resistance), 2 screenshots

DISCUSSION – using complete sentences, compare the theoretical (calculated) time constants with measured values.

CONCLUSION – using complete sentences, state the success of this experiment (how well your measured data compared to theoretical values). State how this is known. State significant observations. Conclusively state what was learned in performing this experiment.