Physics Experiment 03

Lab Report

Experiment Title:	The Oscilloscope
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Date Performed:	2018.06.22
Final Mark:	

Score

Abstract (About 100 words, 10 points)

The purpose of this experiment is to familiarize with the oscilloscope and basic types of measurement which can be made with it. We measured the peak-to-peak voltage and period of a sine wave. Then we used several kinds of Lissajous patterns which had been shown in experiment book to measure the frequency and analyzed the frequency read from generator and calculated value. Not only did I become more skillful to operate the oscilloscope, but also I digested the fundamental principles of generating all kinds of waveforms by testing signals.

Score

Calculations and Results (Calculations, data tables and figures; 15 points)

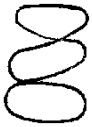
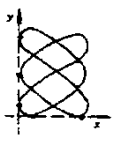
Data Tables

DATA TABLE 3-1(*purpose*: To measure the peak-to peak voltage and period of a sine wave)

Peak-to-peak voltage, V_{pp}		Period, T	
Vertical sensitivity, V	10mV/cm	Horizontal sensitivity, t	1ms/cm
Height, H	1.8cm	Length, L	6cm
$V_{pp} = V \cdot H$	18mV	$T = t \cdot L$	6ms

(*Don't forget UNITS*)

DATA TABLE 3-2(*purpose*: To measure the frequency using Lissajous pattern)

Known frequency f_y / Hz	Lissajous Patterns					
	N_x	1	1	1	2	2
	N_y	1	2	3	3	1
	$f_y : f_x$	1：1	1：2	1：3	2：3	2：1
50.00 (CH2)	f_x' / Hz (read from generator)	42	95	155	70	22
	$f_x = \frac{N_y}{N_x} f_y$ / Hz (calculate)	50	100	150	75	25

Calculations

(1) The sample calculation of peak-to-peak voltage of the sine wave:

$$V_{pp} = H \times V = 1.8\text{cm} \times 10\text{mV/cm} = 2\text{V}$$

(2) The sample calculation of the period of the sine wave:

$$T = L \times t = 6\text{cm} \times 1\text{ms/cm} = 6\text{ms}$$

(3) The sample calculation of the unknown frequency f_x:

When it becomes to the first Lissajous Pattern(it looks like: ), we can get:

$$\frac{N_x}{N_y} = \frac{f_x}{f_y} = 1$$

Thus, $f_x = f_y = 50\text{Hz}$

Score

Conclusions (About 100 words, 5 points)

We finished this experiment by using a dual trace oscilloscope and two kinds of function generators to create several waveforms. After operating the oscilloscope with some special controls, we analyzed the waveforms, including the peak-to-peak voltage input and the input period with read data and simple calculation. To measure the frequency, Lissajous patterns were used, and the key is about analyzing the ratio of the number of N_x tangential points in X-direction and N_y tangential points in Y-direction. However, there exist errors between read value and calculated value.

Score

Answers to Questions (10 points)

(1) The trigging function makes an AC wave form appear to stand when two sine waves with the same integral rate are added to the horizontal X deflection and the vertical Y deflection, that is, are connected to CH1 and CH2, respectively. A stable closed pattern can be shown on the screen by using X-Y mode.

(2) Since $T = L \times t = 4.2\text{cm} \times 4\text{ms/cm} = 16.8\text{ms}$, $f = \frac{1}{T} = \frac{1}{1.68\text{s}} = 0.595\text{Hz}$.

Thus, the input frequency of the signal is 0.595Hz.

(3) We are supposed to adjust the display knobs so that change the horizontal and vertical sensitivity, which means fewer cycles with a greater height of the signal can be seen on the screen.

Appendix

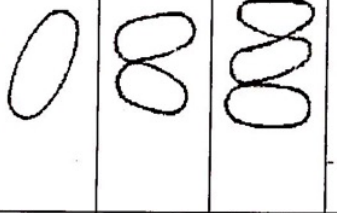
(Scanned data sheets)

Data Table 3.3-1 ***Purpose*: To measure the peak-to peak voltage and period of a sine wave**

Peak-to-peak voltage, V_{pp}		Period, T	
Vertical sensitivity, V	10 mV/cm	Horizontal sensitivity, t	1 ms/cm
Height, H	1.8 cm	Length, L	6 cm
$V_{pp} = V \cdot H$	18 mV	$T = t \cdot L$	6 ms

(Don't forget UNITS)

Data Table 3.3-2 ***Purpose*: To measure the frequency using Lissajous pattern**

Known frequency f_y / Hz	Lissajous Patterns					
	N_x	1	1	1	2	2
	N_y	1	2	3	3	1
	$f_y : f_x$	1 : 1	1 : 2	1 : 3	2 : 3	2 : 1
50.00 (CH2)	f_x' / Hz (read from generator)	42	95	155	70	22
	$f_x = \frac{N_y}{N_x} f_y$ / Hz (calculate)	50	100	150	75	25

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