Electromagnetics

Objective

Verify characteristics and performance of transformer.

Equipment List

- Computer running Windows (NI ELVIS installed)
- National Instruments DAQ board (inside computer).
- Transformer A -2700.
- Wires for connecting the previous equipment together.

Introduction

A single-phase transformer consists of two (or more) coils of copper wire wound on an iron framework, as shown in Figure 1. The primary winding is connected to the AC source V_p, while the secondary supplies power to a load at a voltage V_s. The number of turns in the primary winding is N_1, and N_2 in the secondary. If N_2 is greater than N_1, then V_s is greater than V_p, and we call the transformer a *step-up* transformer. The turns ratio is defined as

$$a = \frac{N_1}{N_2} \quad \text{.....(1)}$$

If the transformer is ideal, then the voltages are directly proportional to the number of turns, and the currents are inversely proportional to the number of turns.

$$\frac{V_p}{V_s} = \frac{N_1}{N_2} \quad \text{.....(2)}$$

$$\frac{I_p}{I_s} = \frac{N_2}{N_1} \quad \text{.....(3)}$$

The transformer schematic is shown in figure 1.

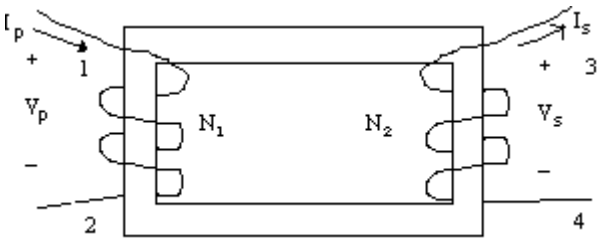

Figure 1. Transformer Schematic

In this lab, we will observe the voltage change of the secondary compared with the primary.

Procedure

1. Construct the circuit as shown in figure 2 on the NI ELVIS Prototyping board. Connect pin 1 of the primary to **FUNC OUT**; connect pin 3 of the secondary to **ACH5+**; connect pin 2 and pin 4 of transformer to **AIGND**.

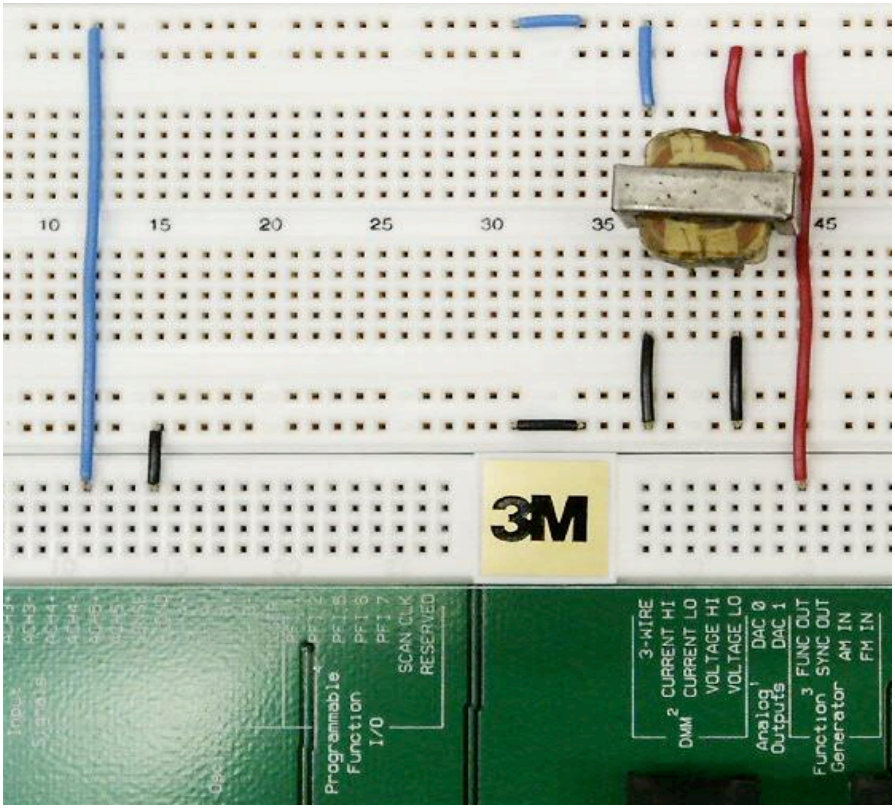

Figure 2. Component Layout for transformor circuit

2. Turn on the NI ELVIS Benchtop Workstation, select Start»Programs»National Instruments»NI ELVIS 1.0»NI ELVIS, or select NI ELVIS on the desktop. Turn on the Prototyping Board Power.

3. Open **Function Generator** and **Oscilloscope.** Set the parameters as shown in figure 3 and figure 4.

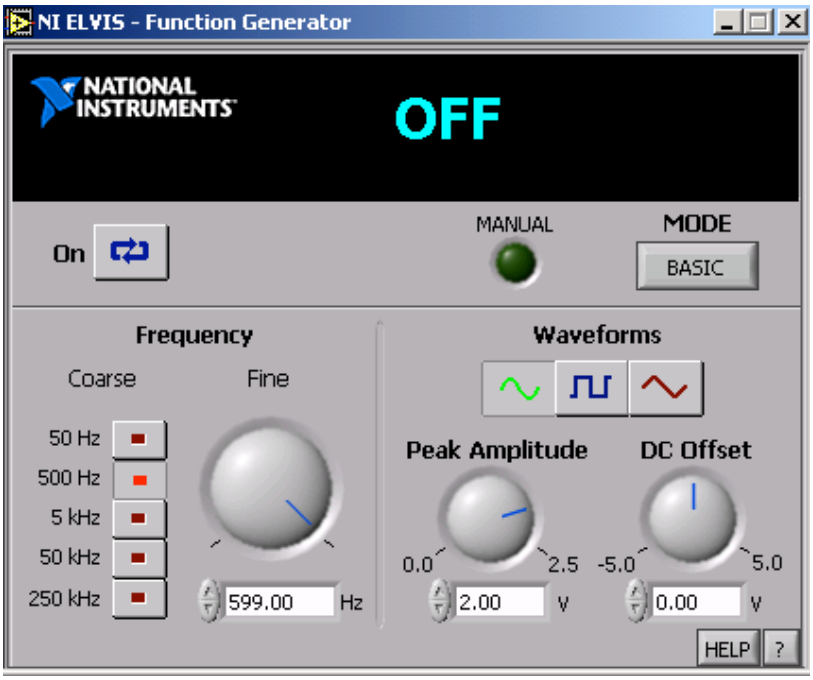

Figure 3. Function Generator

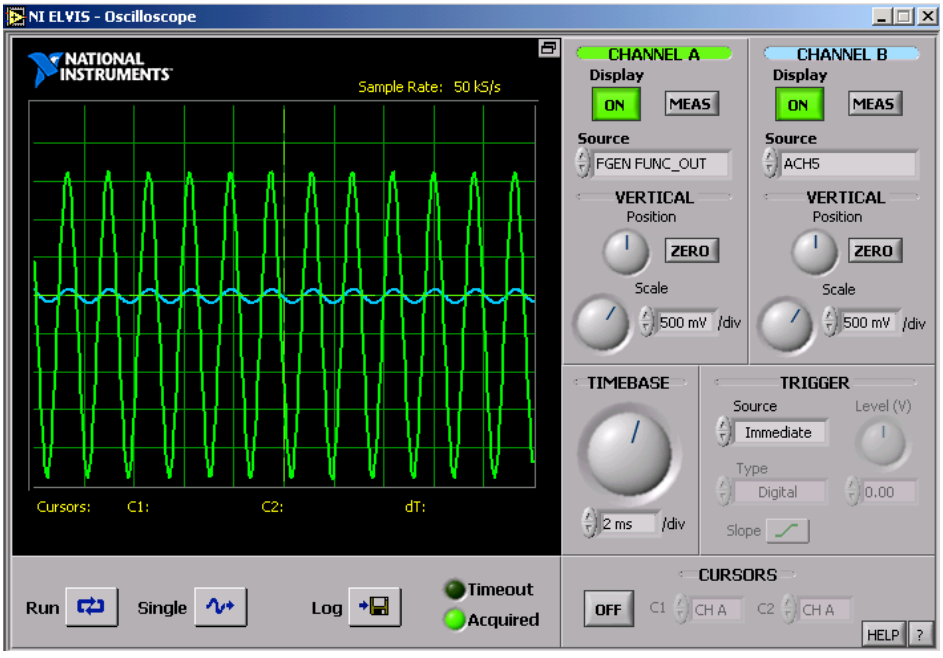

Figure 5. Oscilloscope

4. Select sine wave and click **On** at **Function Generator**; observe the waves on **Oscilloscope.**

5. Change the frequency and Amplitude from **Function Generator,** and observe the amplitude of **CHANNEL A and CHANNEL B** on **Oscilloscope.**