# Incremental Encoder Lab

In this experiment, the performance of a rotary incremental encoder will be investigated. The encoder is already mounted to a bracket that also holds a DC motor which is linked to the encoder with a drive belt. The DC motor be used to drive the encoder at various speeds during the experiment.

The output signal of one channel of the encoder is measured with a USB data acquisition (DAQ) unit connected to a PC and controlled by LabVIEW software. The DAQ unit also provides power to the encoder via its 5V output. The system setup is shown below:

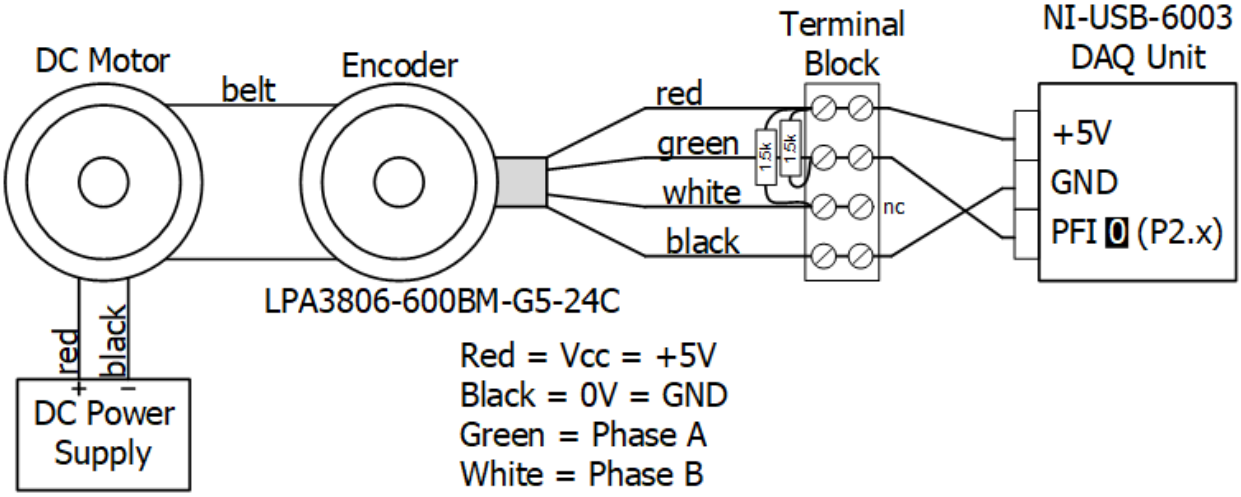


Figure 1. Rotary encoder, DC motor, and DAQ unit setup

The output pulses from one phase of the encoder can be counted during timed intervals (apertures) to determine the speed of the shaft rotation. Various speeds and aperture times will be investigated. The LabVIEW software applications (Vis) to perform these measurements must be downloaded from Canvas. The encoder speed will also be measured with an optical tachometer. The results can then be compared.

## Procedure

1. Connect/verify setup as shown in Figure 1.
2. Use a DMM to measure the voltage of the DC power supply. Record this value.
3. Connect the DAQ unit to the PC via a USB port.
4. Download the LabVIEW VI, "DAQ counter for incremental encoder.vi" from Canvas onto the lab PC desktop.
5. Double click the VI icon to launch LabVIEW and the VI.
6. Select the Devx/ctr0 counter from the pulldown menu. (The "x" will be a number)
7. Run the VI by clicking the "Run" arrow.

8. The aperture time can be adjusted by double-clicking on the value and typing the desired new value. (the values are in milliseconds)
9. Turn on the DC power supply and set it to about 5V (the exact value is not critical)
10. Measure and record the "Count Delta" values and the optical tachometer values for the aperture times shown in Table 1.
11. Calculate the rotational speed in RPM and the % Error to complete the table.
12. Adjust the DC Power Supply to 10V and repeat the previous two steps.
13. Set the DC Power Supply to 0V and turn it off.
14. Stop the VI by clicking the STOP button.
15. Turn the encoder pulley by hand to align the marks on the pulley and bracket.
16. Run the VI and observe the Total Count as the encoder is slowly rotated by hand through one complete revolution until the marks align again. Be careful to only rotate the encoder in one direction during this process. To reset the Total Count value, stop the VI by clicking the STOP button, then click the Run arrow to restart the VI. Record the Total Count value.

Table 1.

| DC Motor Voltage | Optical Tachometer Reading (RPM) | Aperture Time (ms) | Count Delta | Calculated RPM assuming 600 P/R | % Error (Calculated RPM vs. Measured RPM) |
|---|---|---|---|---|---|
| 5V | | 500 | | | |
| 5V | | 1000 | | | |
| 5V | | 2000 | | | |
| 10V | | 500 | | | |
| 10V | | 1000 | | | |
| 10V | | 2000 | | | |

## Homework Submission

Table 1 and the values recorded in steps 2 and 16.

Chinese symbols for various colors