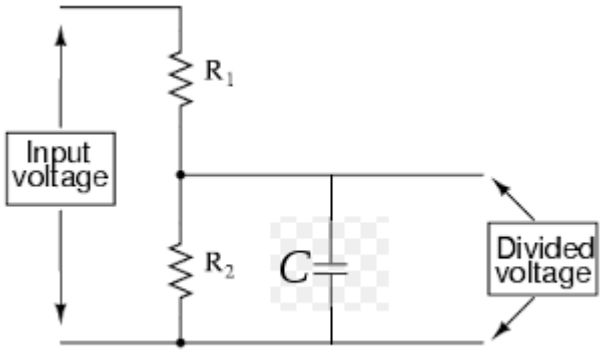
TECH 3821
End of Semester Project
Part 1

Objective	To calibrate the Feedback Educational Servo (ES151) Trainer to read Revolutions Per Minute (RPM).
Background	We will be using the Feedback Educational Servo (ES151) Trainer with the National Instruments PCI-6014 Data Acquisition Card. Since The ES151 uses voltage range of -15 to +15V and the NI PCI-6014 has a analog Voltage range of -10 to +10V we need to use some simple circuits to bridge the two devices. For the Tachometer, we will use a simple voltage divider circuit to bring the voltage down to an acceptable range for the Analog Input Channel:  Where: Input voltage is from the Velocity Output of the ES151 R1 = 2.2k R2 = 1K C = 499pF (used to filter noise) Input Voltage – Connect to ES151 Velocity Output Divider Voltage – Connected to CH3+ The output of the voltage divider will be an acceptable range for the PCI-6014 analog input channel. For the output to the ES151 Servo Amplifier input “T”, we will use an amplifier with a gain of 1.5 to step the Analog Output from -10 to + 10 to the -15 to +15 needed for the ES151. The circuit is as follows:

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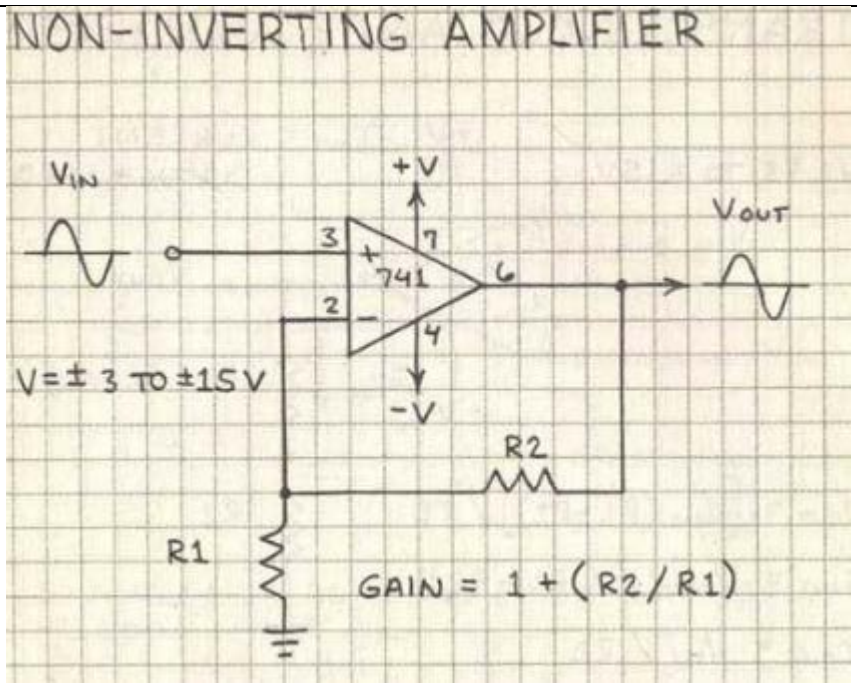

Where:
R1 = 2K
R2 = 1K
+V = 15V
-V = -15V

Vin – Connected to Analog Out CH0
Vout – Connected to point “T” on ES 151

Don’t forget a COMMON GROUND will be needed between the ES151 and the NIO PCI-6014.
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<td>Procedure

LabVIEW Code</td>
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Create a VI that will allow you to enter an output voltage (please keep the value between -2V and +2V (to keep the output speed “reasonable).

Use the procedure from Lab #2 (Relay Driver with Computer Control) except you will be using an Analog Read like we did in Lab #6 (Thermistor Calibration) and an Analog Write.

When you get to the Analog Input select the following options:

Acquire Signal | Analog In | Voltage | ai3
Max 10, Min -10
For “Terminal Configuration” set it to “NRSE”
For “Acquisition Mode” set it to “1 sample on demand”

For the Analog Output select the following options:

Generate Signal | Analog Out | Voltage ao0

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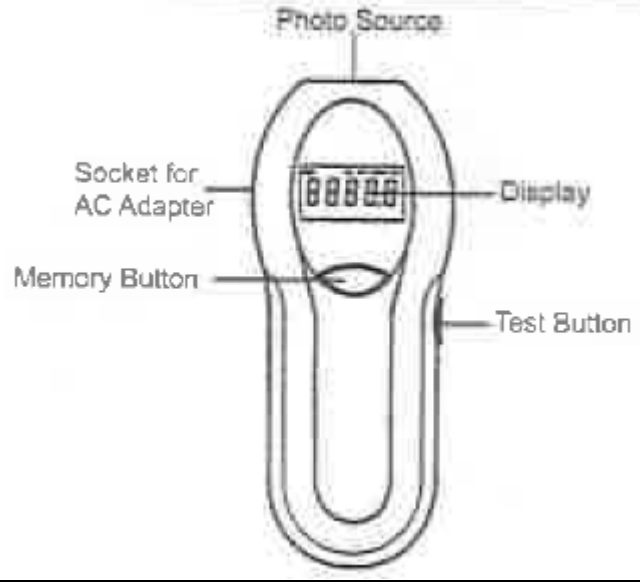
	• Max 10, Min -10 • For “Terminal Configuration” set it to “RSE” • For “Acquisition Mode” set it to “1 sample on demand” Use a CONTROL for the Analog Write Data input and an Indicator for the data coming out of the Analog Read. You might also want to take the same values to a Graph | Waveform Chart. Except for the IO names, the entire thing should be in a WHILE LOOP. Lastly, since we only have one working ES151 unit, you will need to be able to transport your Labview Code to the PC connected to the unit. To make this easier do the follow for the names of the IO points: • Right Click on the IO point (name) • Select GENERATE CODE | Configuration • This will replace the IO point (name) with a new block. This block is a SUB VI that contains the IO point configuration. Save this file to your USB for easy transport (and include this file with the ZIP file submitted at the end of the Lab) • Do this for both IO points
Procedure Calibrate Tach to RPM	Run your VI above. Set the Analog Output to 0V Turn on the ES151 unit. Adjust the “SET Zero” knob until the motor stops turning. Now collect the data necessary to calibrate the motor speed to RPMs. Use the provided Photo Sensor Tachometer. 

	To measure the RPM, hold the tachometer 2” to 8” away from the spinning disk as shown below:  Hold the Test Button in to obtain reading on LCD display. It is suggested you record the following in an Excel Spreadsheet: • Analog Output Value (going from -2V to 2V in reasonable increments) • Analog Input from Tach • RPM Graph RPM vs Analog Input From Tach and obtain the linear trend line equation and R^2 values. Use the above to display RPM on the LabVIEW VI (similar to Lab #6) Turn in a zip file containing your VI and Sub VI’s (for IO Points) as well as the Excel Spreadsheet via online submission.