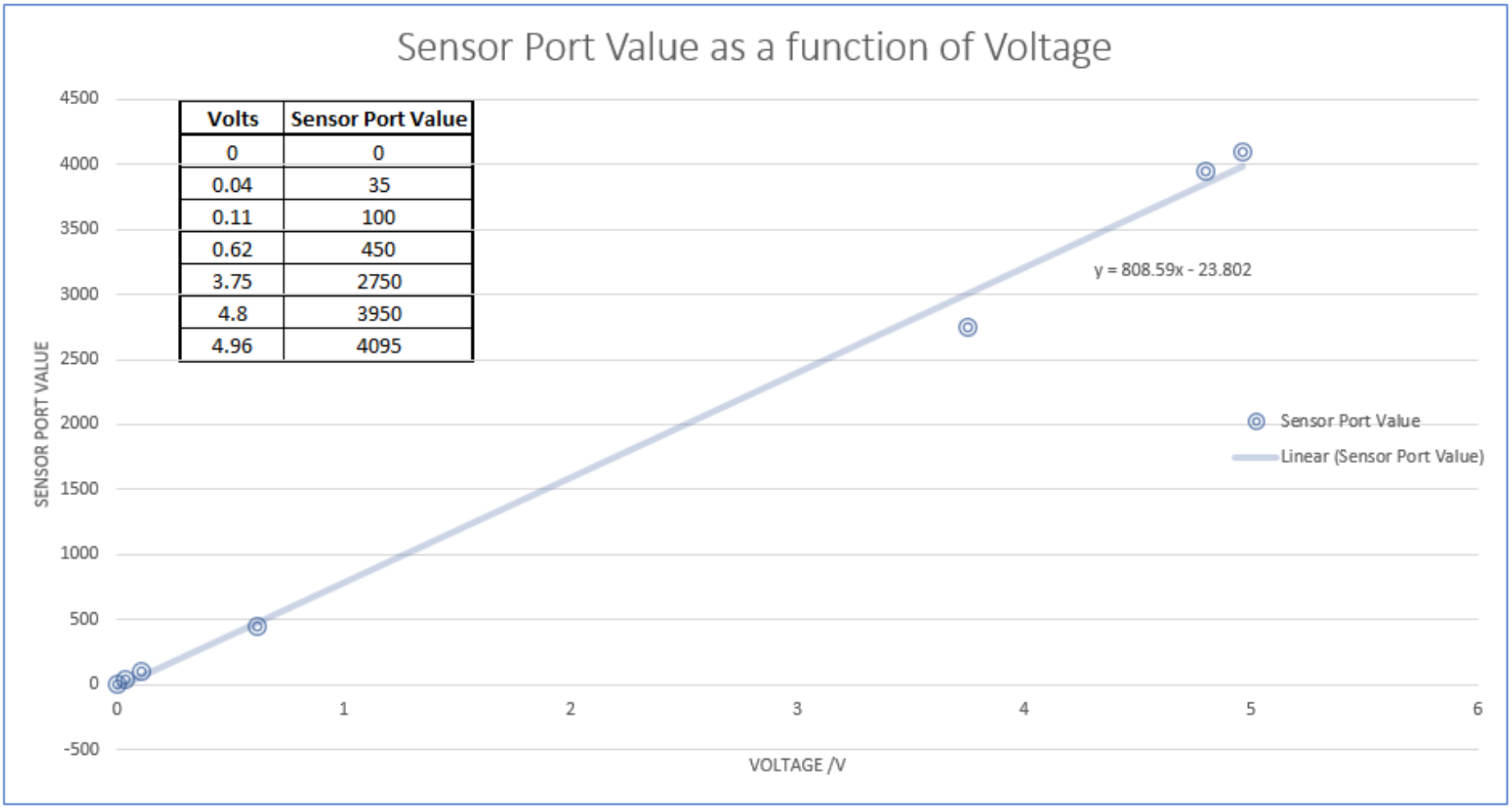
Group: 091

Lab: 3

Due: February 22nd, 2020



The y-intercept should be as close to zero as is possible. Given our value of 23.8, there may have been interference anomalies in the light pathway that gave rise to readings such as that located at 3.75V. The slope is linear, however, as would be expected if there were a direct relationship between voltage and infrared light sensitivity.

Questions

What is the purpose of the biasing resistor, Rlimit, in the LED circuit of Figure 2?
The biasing resistor acts to limit the current going through the LED to prevent it from damage through over voltage/current as I=V\R and V=IR.

How do you expect the brightness of the LED to change as the value of the resistor R_{limit} is lowered?
The brightness of the LED will increase as Rlimit is lowered.

What are the negative repercussions of using too low a value for the biasing resistor R_{limit}?
Using too low of a resistor may damage the LED.

You wish to use the IR phototransistor circuit described in this lab to detect IR light. If you were going to connect this circuit to an ANALOG port on a VEX kit, what would be the configuration port setting under the RobotC "Motors and Sensor Setup" options to obtain a value indicating the level of IR light incident on the phototransistor?
The ANALOG port values can be read as value between 0 and 4095 which maps to an input voltage from zero to five Volts. If the port is configured as a switch input, the port is configured as a 'Touch' switch, and the input voltage would be between 0.6 Volts and 2.5 Volts, the output value could be either zero or one. The port setting would therefore be selected as "Light Sensor".

If this port setting is used, what would be the value read by the VEX software if there is only a small amount of IR light at the phototransistor, and what would be the expected change in the value read from the sensor when the phototransistor is exposed to intense IR light as opposed to when it is not exposed to any light?
Below 0.6 Volts in this case being exposed to a small amount of light, provides a non-zero or 'active' output. Above 2.5V provides a zero output or an exposure to more infrared light.

How does the value of the resistance in series with the phototransistor change the variation of voltage from when there is IR light versus when there is no light on the phototransistor?
The output voltage changes with the reciprocal of the combined resistances (R(x) + R(1)) according the equation $V_1 = \frac{R_x}{R_1+R_x} V_{Source}$. When there is no light, the resistance approaches infinity. When there is more light, the resistance drops to almost zero.