

Department of Computer and Electronics Engineering Technology
CEET 1140
Lab 11

Title: Dependent Sources.

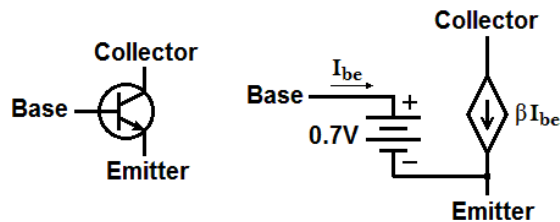
Objective: The student will be able to construct a simple circuit to measure a transistor's β value (the ratio of the transistor's collector current to its base current).

Equipment: DC Power Supply
Multimeters (2)
Proto Board

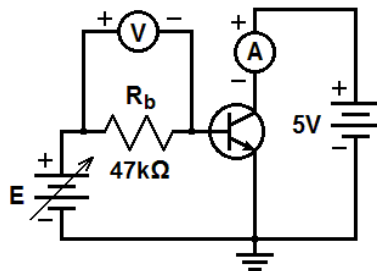
Parts: 1 47k Ω Resistor, 1/4 watt
1 NPN Transistor (2N3904 or 2N2222)

Preparation: Write the title and a short description of this lab in your lab book. Make sure the page is numbered and make an entry in the table of contents for this lab.

The simplest model for a silicon NPN transistor is a 0.7V voltage source and a dependent current source, as shown below:



The value of β depends on the transistor. We can measure β by measuring the collector current and dividing it by the base current. To measure these values, we will insert an ammeter in series with the collector and measure the voltage across the base resistor, R_b , as we vary voltage source E . (See schematic below.)



Be prepared to make these measurements and bring your lab book, along with the parts, above, to your lab period.

Set up: Turn on the power supply and adjust both supplies to 5V. One at a time, turn the current down to 0, short the supply and adjust the current to 0.05A. (This reduces the chance of damaging your transistor or the ammeter). Turn the power supply off.

Configure one multimeter to measure voltage (20V range) and one multimeter to measure current (200mA range).

Construct the circuit shown on the previous page using the power supplies and the multimeters you have configured.

Caveat: Be very careful with the base terminal of the transistor. If you accidentally touch it directly to a voltage source, your transistor will be instantly destroyed.

Procedure: Turn on the power supply and adjust the voltage across R_b to approximately 1.0V. Calculate the base current $I_b = V_{Rb}/R_b$ and measure the collector current, I_c , using the ammeter.

Perform this procedure for $V_{Rb} \approx 1V, 2V, 3V, \dots 10V$ and record V_{Rb} , I_b and I_c in a table in your lab book.

Plot I_c against I_b . Approximate the curve with a straight line. Find the value of β by computing the slope of that line.

Cleanup: Configure the multimeters to measure voltage, then turn off the power to all the equipment.

Conclusions: In the conclusion section, write a short summary of what you did and what you learned. Make sure your conclusion answers the following question(s):

Was the I_c vs. I_b curve perfectly straight? If not, why might that be?