Lab #3: Regulated DC Power Supply Using the LM317
(Supplemental Information on Preparation of Results Tables)

For the post-lab meetings, you will need to prepare two professional-quality tables that summarize the results of your measurements and the performance metrics that you calculate based on those measurements. The tables must be prepared using software. For detailed instructions on preparing tables, read "Formatting Guidelines for Figures, Tables, and Captions," which is available at the Laboratory web page at the course web site. Part of your group lab score will be determined specifically by the quality, organization, and clarity of the two tables.

Details on the two tables that you must produce are given below.

Line Regulation Table

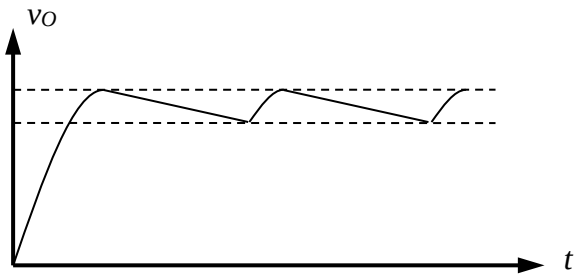
Important: It will be very difficult to complete this part of the assignment if you do not read the "Line Regulation" and "Measuring Load and Line Regulation" sections of the supplemental reading "Three-Terminal Linear Voltage Regulators."

With the load drawing the maximum specified current (~150 mA) from the power supply, you will need to measure the capacitor voltage ripple and the output voltage ripple and then use those measurements to calculate the line regulation of the LM317 regulator. You are asked to compare the value that you calculate to the value given on the datasheet. The latter value is expressed in the %/V unit, so you will need to convert it to the mV/V unit.

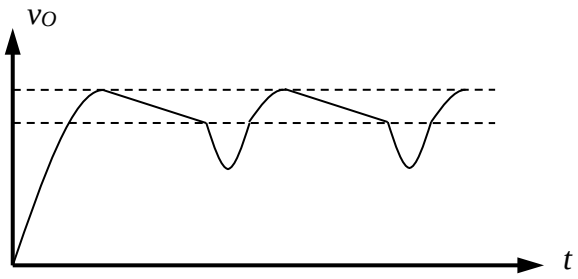
Your data table must therefore list the following:

- Measured capacitor ripple voltage
- Measured output ripple voltage
- Measured line regulation value (in mV/V); that is, the value calculated from the capacitor and output voltage measurements
- Line regulation given in datasheet (converted to mV/V)

The expected shape of the output waveform for maximum rated load is shown in Figure (a) on the next page. The ripple consists of a brief charging period during which the output voltage rises with the sinusoidal AC waveform followed by a gradual, almost linear decay. The oscilloscope trace is likely to be much noisier (fuzzier) than the one depicted in the figures, but the ripple should be clearly evident. The waveform in Figure (a) is a greatly attenuated version of the ripple across the filter capacitor on the input side of the voltage regulator. Occasionally, there will be a distinct dip in the output voltage waveform as shown in Figure (b). The dip is not part of the expected ripple. It is usually caused by the voltage $v_I - v_O$ between the regulator's input and output terminals falling below the drop-out voltage. If you cannot eliminate the dip by modifying your circuit, then base your output ripple voltage measurement on the linearly decaying portion of the waveform, the extent of which is indicated by the dashed horizontal lines. That part of the waveform is the ripple, which happens with normal operation. The dip is not normal.



(a)



(b)

Load Regulation Table

Important: It will be very difficult to complete this part of the assignment if you do not read the "Load Regulation" and "Measuring Load and Line Regulation" sections of the supplemental reading "Three-Terminal Linear Voltage Regulators."

You are asked to measure and record the DC output voltage obtained when the supply provides 0%, 25%, 50%, 75%, and 100% of the maximum rated load current. Given that there is a small amount of ripple in the output voltage waveform, if you use the oscilloscope to make the measurements, then there is some ambiguity about what the output voltage is at each output current level. Moreover, the amount of ripple changes as the load current changes; there is very little ripple at low load currents and the maximum amount of ripple at maximum load current. Consequently, the changes in the peak value of the output waveform with load current best represent the load regulation. The output ripple is primarily related to the line regulation. The handout recommends the use of the bench-top voltmeter instead of the oscilloscope to help remove this ambiguity. The voltmeter also provides readings with several digits of accuracy, which makes it easier to see the voltage dropping with increasing load.

The load regulation table must list the measured values obtained for each load current level along with the corresponding load currents and load resistances. It should also list the load regulation value (in mV/mA) calculated from the measured data and the value given on the datasheet (converted to mV/mA).