APh77 - Laboratory in Applied Physics
Analog Electronics Experiment
Supplemental Information

Brian Standley
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Contact information

Email: standley@caltech.edu
Cell phone: (626) 376-6004
Office phone: x4873
Office location: 272 Watson (building 95)

To contact me first try my cell phone. If that doesn't work try my office. Appropriate times to call: 9am to 1am on weekdays, 12pm to 3am on weekends. I read my email frequently, but I might not respond for a while if it isn't urgent.

Handout corrections

1. In the pre-lab the words "analog-to-digital converter" should read "digital-to-analog converter".
2. We will use a phototransistor instead of a photodiode to detect the light generated by the LED. The appropriate circuit to use is shown in Fig. 4.17.

Procedure for doing the experiment

1. Answer the pre-lab questions. Typed responses are not required as the questions involve circuit analysis. Hint: Slew rate is not the same thing as bandwidth / high frequency roll-off.
2. Briefly read the data sheets listed on http://standley.caltech.edu/aph77/.
3. Meet with the instructor (me) in the lab, located in 002 Thomas. At this point the instructor will go over the pre-lab questions, show you how to operate the equipment, and give a 20min talk on the relevant circuit theory.
4. Build and test the circuits up through the voltage controlled oscillator (VCO). Make notes as you go along which include (at least) circuit diagrams, component values, and measured waveforms. In addition, fully characterize the behavior of the circuits which will go into the FM modulator/demodulator circuit at the end. Specifically, measure I_{LED} vs. V_{OUT} when testing the photodetector circuit and V_{IN} vs. f_{OUT} when testing the VCO circuit.
5. Take a break to work out a block diagram of the FM modulator/demodulator circuit, then meet with the instructor to discuss it. At this meeting the instructor will help you fill in the details of the design and explain how to implement the phase locked loop.
6. Build and test the FM modulator/demodulator circuit.

7. Individually write a lab report following the course guidelines. Attach your pre-lab and experimental notes to the back and turn it in to the box outside Kate Finigan's office on the second floor of the Sloan Annex building.

Hints

1. The multimeter on the bench can measure capacitance using the current terminals, which is a handy way to find a particular value without decrypting the markings on the packages. Do not, however, try to measure a voltage with the leads connected to the current terminals, because doing so will blow the fuse and/or damage the meter.

2. The two types of breadboards found on the bench provide different internal connections. Specifically, the outer rails on the plain-white boards are split in the middle.

3. The scope has an X-Y mode which will allow you view the voltage transfer function of the Schmidt trigger directly.

4. The phase locked loop IC provides the VCO control value as a digital pulse width modulated (PWM) signal rather than an analog voltage as one might expect. Therefore, you will need to apply a low pass filter to this signal to recover the actual data signal.