LAB 2

HALF WAVE RECTIFIERS

OBJECTIVE
To study the characteristics and operation of half wave rectifiers and filter circuits.

READING
Graymark Manual pages 22-36

PROCEDURE

1) CONSTRUCTION - Perform Steps 1-3 on page 23 of your Graymark manual. Pay careful attention to Figure 40 on hold to solder diodes to a printed circuit board. As shown in Figure 40 using an alligator as a heat sink during soldering is an excellent idea.

2) DIODE - Perform Steps 1-4 DIODE EXPERIENCE on page 24. **Remember to record the forward and reverse resistance readings.**

HINT: Check ALL diodes for different forward and reverse readings before you solder them to your circuit board. This will save a lot of trouble later.

If you prefer you can quickly test your diodes with the Radio Shack transistor testor in the instrument room. Connect a diode between the rd and black test leads and press DIODE. If the diode is good one of the ANODE LEDs should light up. A BAD light indicates that your diode is bad.

3) HALF-WAVE RECTIFIER – If you have already assembled your Graymark kit you should construct the circuit shown in Figure 1. You may use either the transformer in your Graymark kit, or the Triad F91X transformer available in the instrument room. Use voltage windings which approximate those measured from your transformer in Lab 1.

The lab is written assuming you are working from your Graymark.

Perform steps 1-8 HALF_WAVE RECTIFIER EXPERIENCE on page 24 of the Graymark manual. This will give you the same circuit as that shown in Figure 1. Trigger the scope on external, at a sweep speed of 2 msec/division, so as to observe slightly more than one cycle. Set both channels at 5 volts/division, DC, and place both probes on the input (TP1 on your printed circuit board). Then, leave one probe on the input, (TP1) and observe the output (TP17) with the other probe. **Record these waveforms.**

When the input is at Vpeak volts, the output will also be at Vpeak volts, or, more exactly at Vpeak-0.7 volts, allowing for the 0.7 volt drop across the diode. When the input is at –Vpeak, the output will be at 0 volts, since the diode is reverse biased and does not conduct. The circuit is called a "half wave rectifier" since only one half, in this case the positive half, of the input appears at the output. Note that R11=1.5k in our Graymark power supply.

4) CAPACITIVE FILTER

Now connect the circuit in Fig. 2, using a 10 µf capacitor from your Graymark kit. A procedure for doing this is described in steps 3 and 4 on page 30 where you are asked to solder the positive lead of a 10 and a 1000 µf capacitor to TP17. This may be a little

difficult since you also need to make sure that the red wire from TP8 remains soldered to TP17. Continue with steps 4-8 by soldering one of the leads of a 10Ω resistor to TP7. Use a scope to observe the waveform at TP17. **Record this waveform.** Connect the negative lead of the 10μf capacitor to the free lead of the 10Ω resistor with a clip lead. Note that you want to be very careful that nothing shorts together while making this connection. **Record the power supply output waveform at TP17 being sure that you have values for the peak AC voltage and the peak-peak ripple voltage.** Turn off the power supply, disconnect the clip lead from the 10μf capacitor and connect it to the 1000μf capacitor. Turn the power supply back on and **repeat your waveform measurements of ripple**.

For the 1000μf capacitor setting only use the second channel of your scope to measure the voltage across the 10Ω resistor. This is the current through the capacitor. It should look like Figure 60 of the Graymark manual. **Record this waveform. Using this measurement calculate the peak current through the capacitor in your writeup.**

Question: Basedupon your observations with these capacitors, how big a capacitor would be required to reduce the ripple to 0.1 volt?

(5) FULL WAVE BRIDGE

Remove the 10Ω resistor from TP7.

Perform steps 1-7 FULL-WAVE BRIDGE RECTIFIER EXPERIENCE at the bottom of page 26. **Record the full wave rectifier output waveform at TP9.**

Mount diodes D2, D3 and D4 to the printed circuit board (steps 1-3 at the top of page 27). Remove the capacitors from TP17 but keep the wire jumper from TP17 to TP8. Perform steps 1-9 on pages 27 and 28. **Record the full wave bridge output waveforms at TP17 and TP18 on the same display. Are these waveforms in phase with each other?**

(6) COMPLETING THE POWER SUPPLY

Follow steps 1-8 on page 36. At the end of these steps you should have these components directly mounted to the printed circuit board, i.e., diodes D1 to D12, capacitors, capacitors C1, C2, C3, C7 and C8; and resistors R1, R2, R4 and R6. Be sure to insert wire jumpers W1 and W2 as described in step 7.

You should have only the following jumpers and resistors soldered to the various test points (TP):

- a 1.5kΩ resistor between TP7 and TP9.
- a wire jumper from TP10 to TP17.
- a wire jumper from TP12 to TP 18.

The effect of these wire jumpers is to convert your Graymark into a fully functional (but not electronically regulated) power supply.

Perform steps 1-6 (PCB TEST) on page 36 to make sure that your circuit works. Record the DC voltages at TP9 (positive output), TP10 (positive output), and TP12 (negative output) with respect to ground (TP7). If these do not agree with the Graymark manual then there is something wrong with your circuit which should be fixed now.

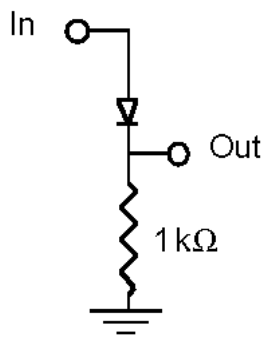
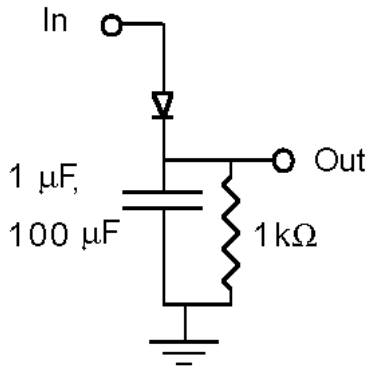


Figure 1



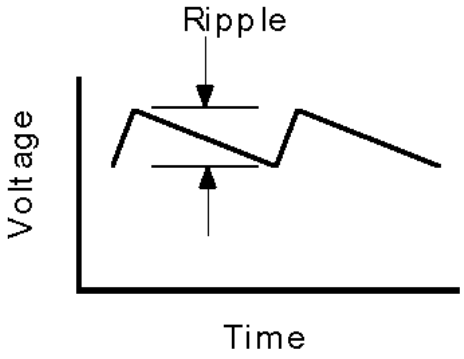


Figure 2