

8.3 Procedure / Summary Sheet

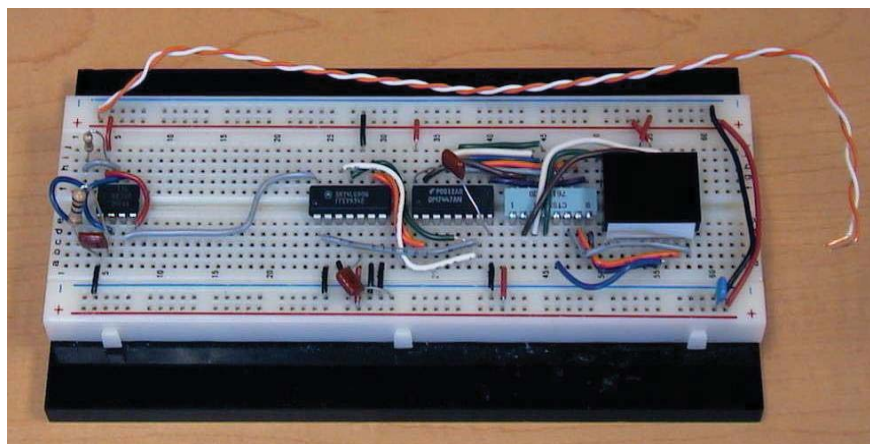


Figure 8.6 Example of Breadboard Wiring

- (1) Construct the 555 timer circuit shown in Figure 8.7 on the left side of your breadboard (see Figure 8.6). Figure 8.8 shows useful information from the 555 datasheet. Using the resistor and capacitor values shown in Figure 8.7, the output of the circuit will be a pulse train with a frequency of approximately 0.7 Hz, corresponding to a period of approximately 1.4 sec (see Section 6.12.3 in the textbook for more information).

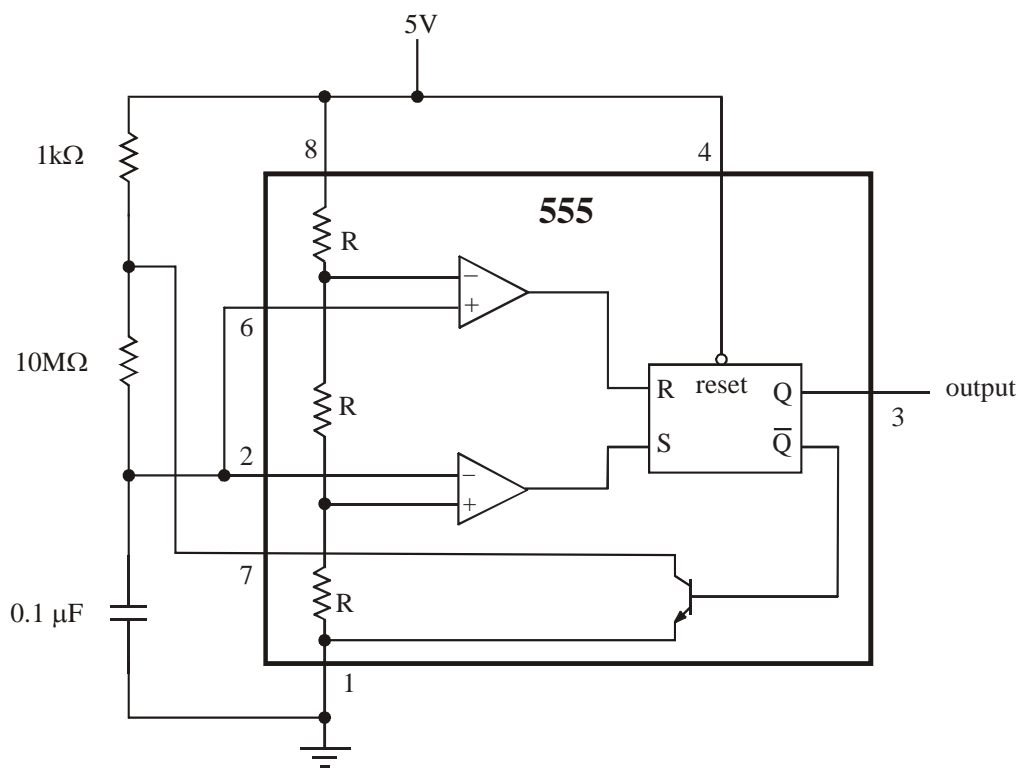


Figure 8.7 555 Timer Circuit

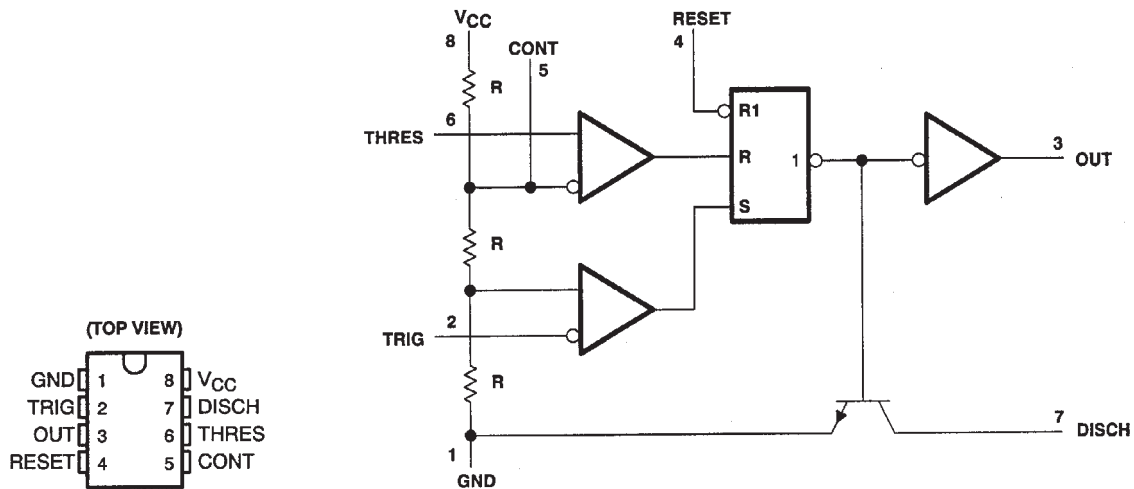
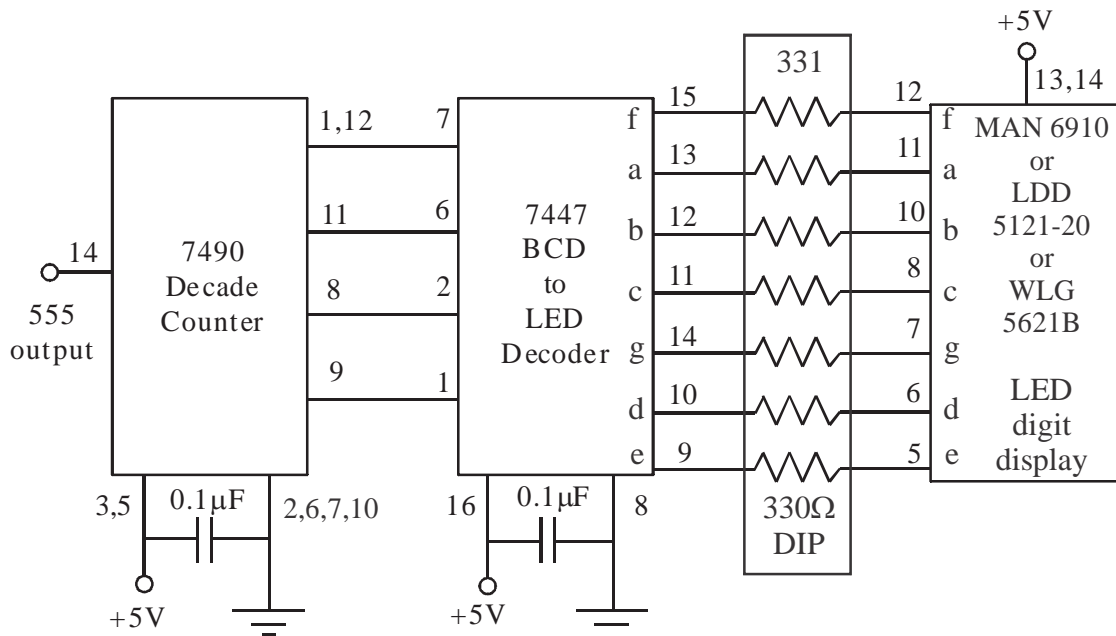


Figure 8.8 555 Pin-out and Circuit Diagram

- (2) Verify that your timer circuit is working properly by displaying the output on the oscilloscope **and** by driving an LED. Show the result to your TA before continuing. Leave this circuit on your protoboard as it will be used later.
- (3) In the steps that follow, you will construct the one-decade digital display shown on the right side of Figure 8.6. The detailed wiring diagram is shown in Figure 8.9. **Don't start building the circuit yet!** Read the information below and then follow the steps in the remainder of the procedure (starting on the next page). Each group should have a 7-segment LED display (e.g., MAN6910 or LTD482EC), a 7447, a 7490, and a 555.

When making connections, trim wires to appropriate lengths so they will lay flat against the board when inserted. A “rat’s nest” will not be acceptable. Also, if multiple wire colors are available, be purposeful with your selections (e.g., red for power, green for ground, and other colors for different signal types). Please see the TA’s board and Figure 8.6 as model examples.

Figure 8.10 includes useful reference information from the MAN6910 datasheet. If your display is not one of the model numbers listed in Figure 8.9, you might need to look up the spec sheet for your display to see which circuit in Figure 8.9 to use (by comparing the spec sheet to Figure 8.10 if necessary).



or

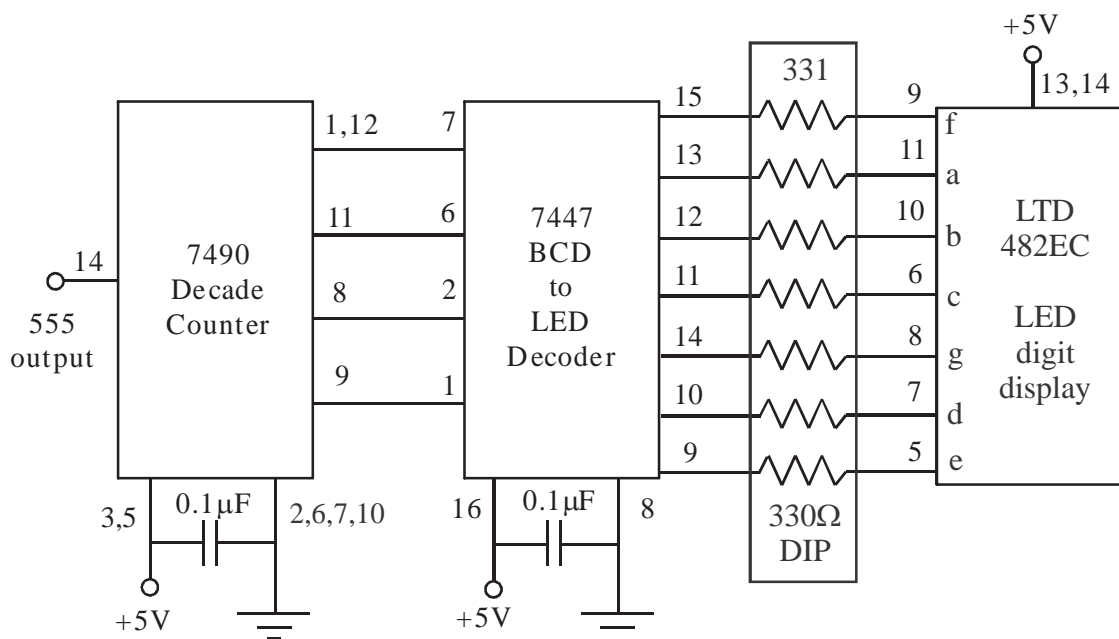


Figure 8.9 Decade Counter Wiring Diagrams

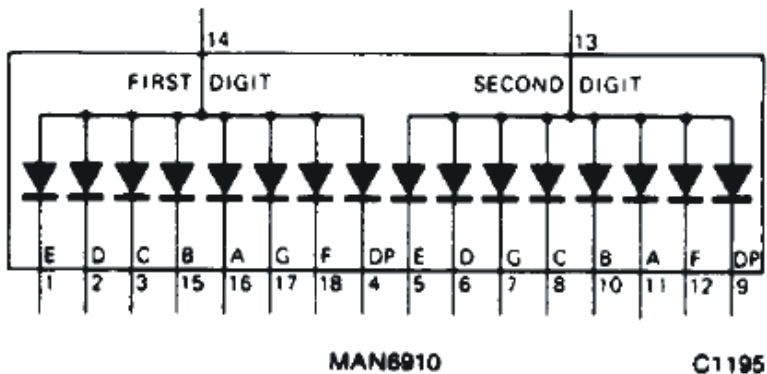
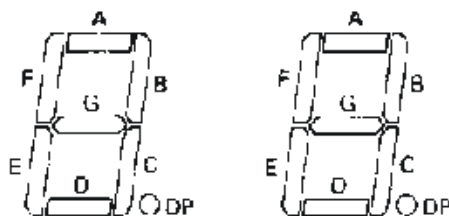
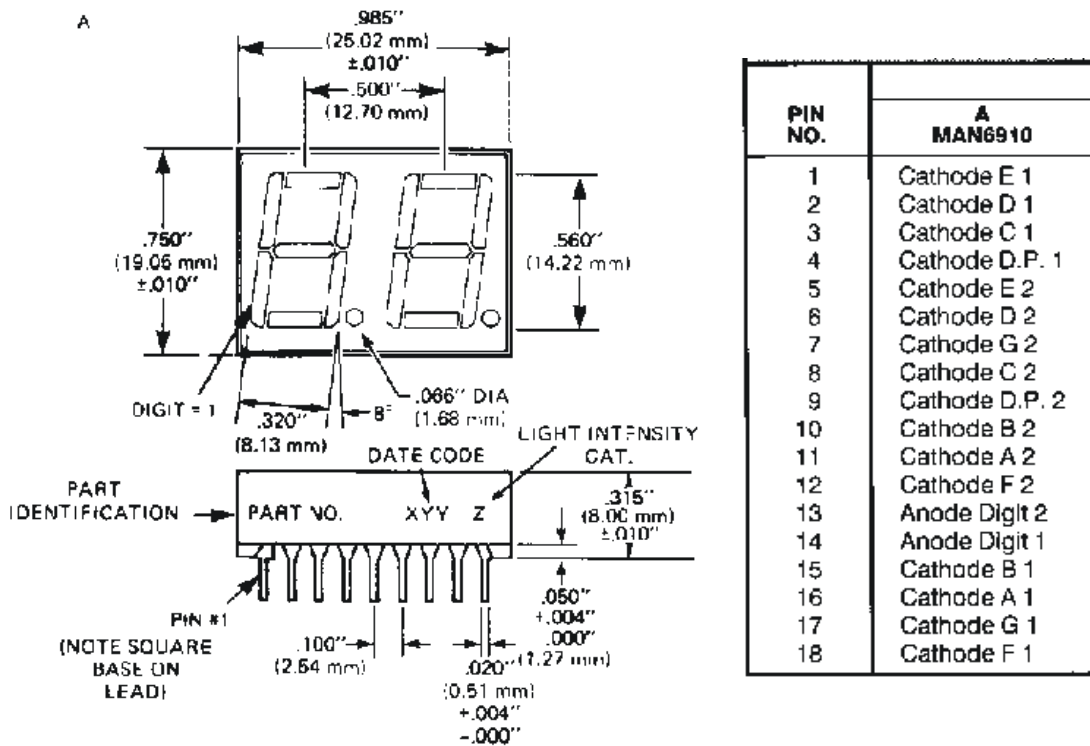


Figure 8.10 MAN6910 Datasheet Information

- (4) Wire the top and bottom two rows of the breadboard together as shown in Figure 8.6 so both power (+5V) and ground will be accessible on both sides of the board. This makes it convenient to connect to +5V and ground on either side of a component. It is good practice to leave the power supply off and disconnected while working on the circuits. Only when you are ready for a test should you turn on the power supply, check to make sure the voltage is set to +5V, and then connect to your board.
- (5) Before inserting any components in the board, be sure to lay them all out first to make sure everything will fit. Figure 8.6 shows a suggested board layout.
- (6) Insert the MAN6910 2-digit display on the right side of the board, with the corner labeled MAN6910 at the lower-left side. This label marks pin 1 on the MAN6910.
- (7) Insert the 330 Ω DIP resistor IC next to the display. Connect pins 13 and 14 of the MAN6910 to +5 V (see Figure 8.10 for MAN6910 pin-out information). Nothing more for now! As a test, connect three of the 330 Ω DIP resistors to pins 3, 15, and 16 of the MAN6910, grounding the other ends of the resistors. Double-check your circuit, and then turn on and connect the power supply. Is the displayed digit what you expected? If not, consult with your TA. When you are done with this test, turn off and disconnect the power supply until you are ready for the next test. Also remove all of the resistor connections.
- (8) Insert the 7447 IC next to the 330 Ω DIP resistor IC. Per Figure 8.9, connect the MAN6910 one's (right) digit to the 7447 and connect +5V and ground as shown.
- (9) Activate the 7447 lamp test by attaching 0V to pin 3 and 5 V to pin 4. Turn on and attach the power supply to see if all LED segments come on, as they should.
- (10) Remove the wire from pin 3 and apply +5V to pins 1, 2, 7 and ground to pin 6 of the 7447. Does the display show what you think it should? Turn off and disconnect the power supply before continuing.
- (11) Finish wiring the 7447 and 7490 as shown in Figure 8.9. Refer to the 7490 Reset/Count Truth Table and the description of the reset inputs in Section 8.2. In Figure 8.9, pins 2, 6 and 7 (R0(1), R9(1) and R9(2)) are grounded and pin 3 (R0(2)) is held high, putting the 7490 in count mode. To be able to reset the counter, wire up a normally-open (NO) button to pin 2 (R0(1)) so the signal is low when the button is not pressed (see Question 2 below). When R0(1)=L, the counter will be in count mode, and when R0(1)=H (when the button is pressed), the counter will reset to 0.
- (12) Attach the output of your 555 to the input of the 7490. Double-check your entire circuit! Then turn on and attach the power supply to see if your circuit is working properly. If not, see Section 7.4 in the previous Lab for debugging advice.
- (13) Demonstrate to the TA that your display can increment properly from 0 to 9. At the same time, also demonstrate that you can reset the counter to 0.
- (14) Now disconnect the 555 circuit and wire up a button with a pull-up resistor to the 7490 input instead. Press the button a few times and describe what happens and why in Question 3 below.

8.4 Troubleshooting Advice

Often, when assembling complicated circuits like those in this Lab and in your Project, things rarely work the first time because you will often make mistakes. Also, sometimes your connections won't be reliable. When this happens, try to remain calm and logically "debug" or troubleshoot the problem.

Any time you have any problem with any circuit, especially with your Project, carefully follow all of the troubleshooting advice outlines in Section 2.3 in Lab 2, Section 7.4 in Lab 7, and Section 15.5 in Lab 15.

