

ECE 301 Digital Electronics  
**Counter Design**  
Revised Fall 2013  
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**OBJECTIVE**

Understand the design and operation of clocked sequential circuits to implement a 3-bit counter from discrete logic.

**PREPARATION**

Design and construct the circuits.

**PROCEDURE**

Design, build, and verify the operation of a three-bit counter utilizing 74LS73 J-K FF's. Design your circuit such that it counts up when the control variable  $U / \overline{D} = 1$ , and counts down when  $U / \overline{D} = 0$ .

Hint: Use a logic switch to clock the flip-flops, and the LED displays to indicate the count of the system. (Or use the 74LS47 and seven segment display to display the count.) Make sure to set  $\overline{Clear} = 1$  (note the inverting bubble on the CLR input of the connection diagram) and set inputs of the flip-flops high when counting. Use the clear inputs of the flip-flops to initialize the counter to zero. Check your design against the following excitation equations before assembling it.

$$J_0 = K_0 = 1$$

$$J_1 = K_1 = \overline{Q_0} \cdot \overline{U} + Q_0 \cdot U$$

$$J_2 = K_2 = \overline{Q_1} \cdot \overline{Q_0} \cdot \overline{U} + Q_1 \cdot Q_0 \cdot U$$