

Experiments for the

Lab9500

Experiment 215 - Up/Down Counter -

Introduction: In a complete if simple traffic light program, it is desirable that the time duration for the main green light and the side green light be programmable in use. The timing for the traffic light is generated by a down counter that is loaded with the number of seconds to be timed. The numbers for the amber times and overlapping red times can be fixed. The numbers for the green times can come from registers that can hold any number, and that can be changed in some way.

One idea would be to make the register loadable from DIPswitches. The register for the long green time is suggested to be five bits, which would give a maximum time of thirty-two seconds. For bits for the short green will give a max time of sixteen seconds. This would take a pushbutton to clock the data in, and nine DIPswitch positions. A more efficient way would be to use five DIP switches for either the long or short green time, and a sixth switch to determine which of the two registers gets clocked with a pushbutton.

Another idea would be to make the register a counter. Then all that is necessary to change the number is a simple pushbutton. One depression of the pushbutton could increment the counter by one count. If a counter is used, it is necessary to show the contents of the counter so that you know what the count is. This is done by using the bank of LEDs to show the contents of the counter. A single DIPswitch could be used to select which of the two counter/register banks is being displayed and clocked.

Suppose you use an up-counter and the current value is eighteen. Suppose that you want to increase the time to 24 seconds. You would select the counter and pulse it six times and watch the count on the LED display increase from 18 to 24. Now suppose that the time is 24 seconds and you want to reduce it to 18. Seven pulses will give a full count of 31. The next pulse will overflow to a count of zero. Now 18 more pulses will bring the count up to 18. If you start out higher than the desired count, or you go past it, you simple step around through zero.

A final approach is to make the counter up/down. A switch can determine the direction, and a debounced pushbutton can provide the counts. Pushbutton PB3 could be used to determine the direction. For example with PB3 unpressed, the counter could count up. With PB3 pressed, the counter could count down.

Experimentation

1. Make two up/down counters with T-type flip-flops. One will be five bits to hold the number of seconds for the long green time. The other will be four bits to hold the short green time. Let PB2 be the count pulse. Let DIP switch S0 when one select the long green register for display on the LEDs, and let S1 when one select the short green register for display. When both are one, neither should be displayed and PB2 should not affect the count.
2. Upon power up, the long register will be all zeros corresponding to the maximum time of thirty-two seconds, and the short register will correspond to sixteen seconds. Use the Xilinx Property function of ABEL to preset on power up one or more bits of both registers so that the power-up register values are not maximum.