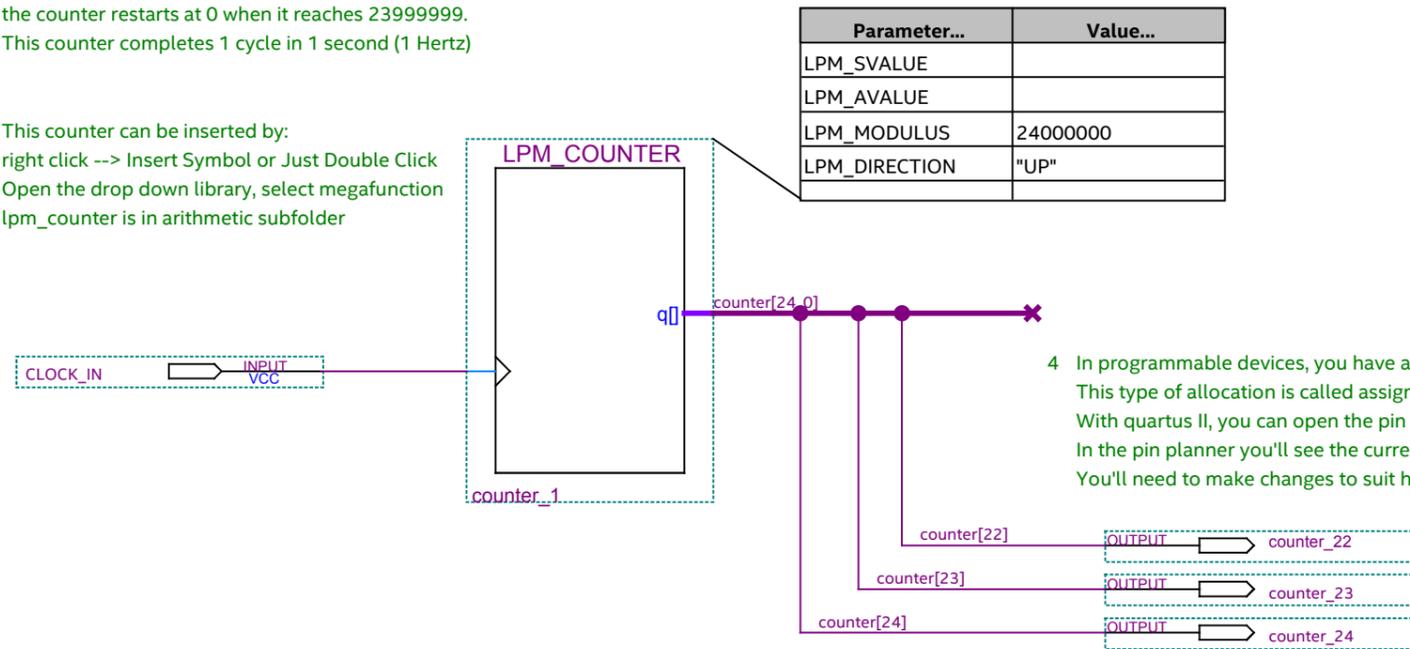


Part 1: Basic counter to blink an LED at 1Hz

- 1 a counter increments 1 unit every clock cycle, and is often used to keep track of time
In this example, we set the "Modulus" to be 24000000. That means the counter restarts at 0 when it reaches 23999999. This counter completes 1 cycle in 1 second (1 Hertz)

- 2 This counter can be inserted by:
right click --> Insert Symbol or Just Double Click
Open the drop down library, select megafunction
lpm_counter is in arithmetic subfolder



- 4 In programmable devices, you have a fair bit of freedom of where you want to allocate your output pins
This type of allocation is called assignments or pin constraints
With quartus II, you can open the pin assignment by (Assignments --> Pin Planner)
In the pin planner you'll see the current assignments of CLOCK pins, and the outputs.
You'll need to make changes to suit how you plug in your LEDs (drag the signal and drop it to the pin map or type in the sheet)

- 3 This is a 25-bit counter, the signals are indexed from 0 to 24.
One bit can represent 0 and 1 (2 to the power of 0)
Two bits b_1b_0 can represent 0, 1, 2 and 3 ($b_1 \times 2^1 + b_0 \times 2^0$).
bit 24 is 1 when the number is larger or equal to $2^{24} = 16 \times 1024 \times 1024$.
That means this bit is LOW for 0.699 second ($16 \times 1024 \times 1024 \times (1/24000000)$) and HIGH for 0.301 second

- 5 After making changes to the pin assignments, you can run full compilation
Press Ctrl-L.
Full compilation completes with pof file in the output_files folder. This is the binary file that you'll use to configure the CPLD
- 6 Open the programmer (Tools --> Programmer)
Select Hardware setup to detect your USB blaster
Then click "Auto Detect". You should see your device listed.
If your device is listed, then this is where you need to tell the tool what is your programming file. Use "Change file", don't use "Add file".
After change programming file from "none" to your led_blink.pof. Tick the program/configure box, then click start. Your device will now be configured
- 7 If you see the LED blinks, then congratulations, you've completed one whole cycle of programming a PLD (Programmable Logic Device).
Else, check your Pin assignment, check voltage rails on the bread board, make sure you've done the correct connection following the design
- 8 Before completing the first part of this lab, have a look at the report (Tool --> Compilation Report). Look at the Fitter Summary section and note the number of Logic Element that this design used.
Then, you can move on to part 2 of Lab 1. In the "Project Navigator" pane, select "Files" view, select "led_blink_adv.bdf" and Right-click --> "Set As Top level Entity"
(Or you can go to Assignments --> Settings --> General --> Top-level entity, and select led_blink_adv)