Counter

This block is listed in the following Xilinx Blockset libraries: Basic Elements, Control Logic, Math, and Index.

The Xilinx Counter block implements a free-running or count-limited type of an up, down, or up/down counter. The counter output can be specified as a signed or unsigned fixed-point number.

Free-running counters are the least expensive in FPGA hardware. The free-running up, down, or up/down counter can also be configured to load the output of the counter with a value on the input din port by selecting the **Provide Load Pin** option in the block's parameters.

$$out(n) = \begin{cases} InitialValue & if\ n = 0 \\ (out(n-1) + Step) \bmod 2^N & otherwise \end{cases}$$

The output for a free-running up counter is calculated as follows:

$$out(n) = \begin{cases} InitialValue & if\ n = 0 \\ din(n-1) & if\ load(n-1) = 1 \\ (out(n-1) + Step) \bmod 2^N & otherwise \end{cases}$$

Here N denotes the number of bits in the counter. The free-running down counter calculations replace addition with subtraction.

For the free-running up/down counter, the counter performs addition when input up port is 1or subtraction when the input up port is 0.

A count-limited counter is implemented by combining a free-running counter with a comparator. Count limited counters are limited to only 64 bits of output precision. Count limited types of a counter can be configured to step between the initial and ending values, provided the step value evenly divides the difference between the initial and ending values.

The output for a count limited up counter is calculated as follows:

$$out(n) - \begin{cases} InitialValue & if\ n = 0\ or\ out(n-1) = CountLimit \\ (out(n-1) + Step) \bmod 2^N & otherwise \end{cases}$$

The count-limited down counter calculation replaces addition with subtraction. For the count limited up/down counter, the counter performs addition when input up port is 1 or subtraction when input up port is 0.

The output for a free-running up counter with load capability is calculated as follows:

$$out(n) = \begin{cases} StartCount & if\ n = 0\ or\ rst(n) = 1 \\ din & if\ rst(n) = 0\ and\ load\ (n) = 1 \\ (out(n-1) + CountByValue) \bmod 2^N & otherwise \end{cases}$$

Here N denotes the number of bits in the counter. The down counter calculations replace addition by subtraction.

Block Parameters

The block parameters dialog box can be invoked by double-clicking the icon in your Simulink model.

Basic tab

Parameters specific to the Basic tab are as follows:

- **Counter type**: specifies the counter to be a count-limited or free-running counter.
- **Number of bits**: specifies the number of bits in the block output.
- **Binary point**: specifies the location of the binary point in the block output.
- **Output type**: specifies the block output to be either Signed or Unsigned.
- **Initial value**: specifies the initial value to be the output of the counter.
- **Count to value**: specifies the ending value, the number at which the count limited counter resets. A value of Inf denotes the largest representable output in the specified precision. This cannot be the same as the initial value.
- **Step**: specifies the increment or decrement value.
- **Count direction**: specifies the direction of the count (up or down) or provides an optional input port up (when up/down is selected) for specifying the direction of the counter.
- **Provide load Port**: when checked, the block operates as a free-running load counter with explicit load and din port. The load capability is available only for the free-running counter.

Implementation tab

Parameters specific to the Implementation tab are as follows:

Implementation Details

Use behavioral HDL (otherwise use core): The block is implemented using behavioral HDL. This gives the downstream logic synthesis tool maximum freedom to optimize for performance or area.Core Parameters

- **Implement using**: Core logic can be implemented in **Fabric** or in a **DSP48**, if a DSP48 is available in the target device. The default is **Fabric**.

Other parameters used by this block are explained in the topic Common Options in Block Parameter Dialog Boxes.

LogiCORE™ Documentation

LogiCORE IP Binary Counter v12.0