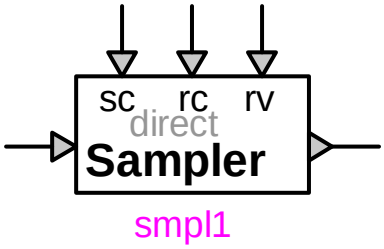
Control device : sampler



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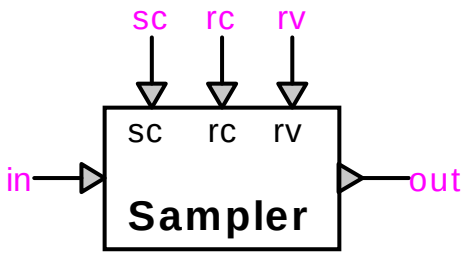
1 Description

This device, when not sampling, maintains the previous value of the output signal.
When the sample control sc is >0, the output performs the selected type of sampling.
When the reset control rc is >0, the output takes the reset value rv.
If the reset value signal rv is unconnected, the reset value is zero.

1.1 Pins



This device has five signal pins:

pin	*description*	*value when unconnected*
in	input	0
sc	sample control	1
rc	reset control	0
rv	reset value	0
out	output	as calculated

1.2 Sampling type

Selection options for the type of sampling:

option	*value*
direct sampling	output = value of input signal
accumulating sampling	output = accumulated value of input signal
minimum sampling	output = tracked minimum value of input signal
maximum sampling	output = tracked maximum value of input signal

1.3 History

Selection options for the history value of the output signal:

option	*value*	*rules*
zero	history(t) = zero, inherit from input when sc>0	
constant value	history(t) = user-defined value	any value, 0 is as selecting zero, use 0.0 to get actual 0.
function value	history(t) = user-defined function	constant or f(t)

1.4 Scopes

Setting the scope flag enables monitoring of the output signal during the simulation.

1.5 Output signal interpolation

During the simulation, the output value of this device is calculated at successive instants t at intervals Δt. Between these simulation instants, the output value can be set to vary in one of two modes, ramped or stepped:

mode	*output value between* $t - \Delta t$ *and* t^-	*value at* t^-	*value at* t
ramped	interpolated linearly between values out($t - \Delta t$) and out(t^-)	calculated at t^-	calculated at t
stepped	remains at out($t - \Delta t$)	remains at out($t - \Delta t$)	calculated at t

2 Time-domain representation

In the time-domain calculation at t>0, the output value is calculated as follows:

$$\begin{aligned} &\text{when } rc(t) > 0, && out(t) = rv(t) \\ \text{else}\quad &\text{when } sc(t) > 0, && out(t) = sampling(t) \\ \text{else}\quad & && out(t) = out(t - \Delta t) \end{aligned} \qquad (1)$$

where sampling(t) is one of the following:

option	*sampling(t)*
direct sampling	$sampling(t) = in(t)$
accumulating sampling	$sampling(t) = out(t - \Delta t) + in(t)$
minimum sampling	$sampling(t) = \min(out(t - \Delta t), in(t))$
maximum sampling	$sampling(t) = \max(out(t - \Delta t), in(t))$

3 Steady-state representation

In the steady-state calculation at t=0, the output value is calculated as follows:

$$\begin{aligned} &\text{if history is defined,} && out(0) = history(0) \\ \text{else}\quad &\text{if } rc(0) > 0, && out(0) = rv(0) \\ \text{else}\quad & && out(0) = in(0) \end{aligned} \qquad (2)$$

4 Netlist

4.1 Netlist format for direct sampling

Netlist format:

```
_c_smpd;name;5;5;out,in,sc,rc,rv,
history,step/ramp,scope,
history function expression
```

field	*description*	*value*
c_smpd name 5 5	part name instance name pin count pin count	
out in sc rc rv	signal name of the output signal name of the input signal name of the sample control signal name of the reset control signal name of the reset value	
history	history	constant value or "H" for function
step/ramp	output interpolation	"S1" for stepped "S0" for ramped
scope	monitoring, optional	"?s" for enabled
history function expression	optional, required when history field is "H"	

4.2 Netlist format for accumulating sampling

The format is the same as the “direct sampling” case, but the part name is now c_smpa.

4.3 Netlist format for minimum sampling

The format is the same as the “direct sampling” case, but the part name is now c_smpn.

4.4 Netlist format for maximum sampling

The format is the same as the “direct sampling” case, but the part name is now c_smpx.