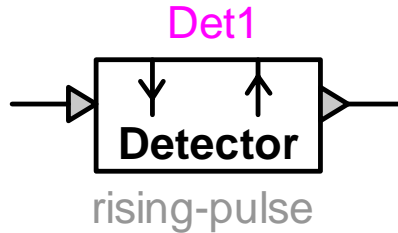


Control device : detector



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1 Description

This device detects the rising-from-zero and/or falling-to-zero pulse edges of the input signal. Three types of events can be detected:

- zero-crossing
- rising from zero
- falling to zero

1.1 Pins

This device has two signal pins:

<i>pin</i>	<i>description</i>	<i>value when unconnected</i>
in	input	0
out	output	as calculated

1.2 Detection

Selection options for the type of detection:

<i>type</i>	<i>output value</i>
zero crossing	1 when detected, otherwise 0
rising from zero	1 when detected, otherwise 0
falling to zero	1 when detected, otherwise 0

1.3 History

Selection options for the history value of the output signal:

<i>option</i>	<i>value</i>	<i>rules</i>
zero	history(t) = zero	
constant value	history(t) = user-defined value	any value
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:

<i>mode</i>	<i>output value between $t - \Delta t$ and t^-</i>	<i>value at t^-</i>	<i>value at t</i>
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:

- zero-crossing detection:
 - when $in(t - \Delta t) < 0$ and $in(t) \geq 0$
 - or $in(t - \Delta t) > 0$ and $in(t) \leq 0$
 - or $in(t - \Delta t) = 0$ and $in(t) \neq 0$ and $out(t - \Delta t) = 0$
$$\text{then } out(t) = 1 \tag{1}$$
 - else $out(t) = 0$
- rising-edge detection, rising from zero:
 - when $in(t - \Delta t) \leq 0$ and $in(t) > 0$, then $out(t) = 1$
$$\text{else } out(t) = 0 \tag{2}$$
- falling-edge detection, falling to zero
 - when $in(t - \Delta t) > 0$ and $in(t) \leq 0$, then $out(t) = 1$
$$\text{else } out(t) = 0 \tag{3}$$

3 Steady-state representation

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

if history is defined, out(0) = history(0)
 else out(0) uses detection logic as above

(4)

4 Netlist

4.1 Netlist format for zero crossing

Netlist format:

```
_c_detc;name;2;2;out,in,
history,step/ramp,scope,
history function expression
```

<i>field</i>	<i>description</i>	<i>value</i>
c_detc	part name	
name	instance name	
2	pin count	
2	pin count	
out	signal name of the output	
in	signal name of the input	
history	history	constant value or "H" for function
step/ramp	calculation mode	"S1" for stepped "S0" for ramped
scope	monitoring, optional	"?s" for enabled
history function expression	optional, required when history field is "H"	

The comma separated data is saved into the ParamsA attribute of this device. The **history function expression** is saved into the ModelData attribute.

4.2 Netlist format for rising from zero

Netlist format:

```
_c_detr;name;2;2;out,in,
history,step/ramp,scope,
history function expression
```

<i>field</i>	<i>description</i>	<i>value</i>
c_detr	part name	
name	instance name	
2	pin count	
2	pin count	
out	signal name of the output	
in	signal name of the input	
history	history	constant value or "H" for function
step/ramp	calculation mode	"S1" for stepped "S0" for ramped
scope	monitoring, optional	"?s" for enabled
history function expression	optional, required when history field is "H"	

The comma separated data is saved into the ParamsA attribute of this device. The **history function expression** is saved into the ModelData attribute.

4.3 Netlist format for falling to zero

Netlist format:

```
_c_def;name;2;2;out,in,
history,step/ramp,scope,
history function expression
```

<i>field</i>	<i>description</i>	<i>value</i>
c_def	part name	
name	instance name	
2	pin count	
2	pin count	
out	signal name of the output	
in	signal name of the input	
history	history	constant value or "H" for function
step/ramp	calculation mode	"S1" for stepped "S0" for ramped
scope	monitoring, optional	"?s" for enabled
history function expression	optional, required when history field is "H"	

The comma separated data is saved into the ParamsA attribute of this device. The **history function expression** is saved into the ModelData attribute.