Title: **N-valued switches**

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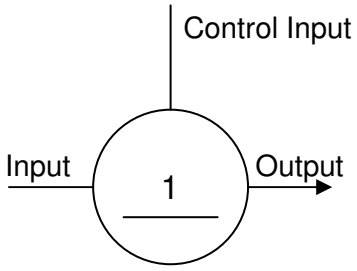
Binary switches

Switches are used in binary logic circuits for realizing binary logic functions. In electronic circuits such switches may pull for instance an output to ground to create a state 0, and make a switch conducting to put an output in a state 1. This is important in situations wherein a 0 may be represented as absence of signal. Because true absence of signal may leave an output floating and indefinite, it is usually not a good idea to present a binary switch or a gate as a spigot that can be turned on or off.

For symbolic reasons how one represents a switch or a gate does not really matter. It may create a wrong impression of what is physically happening, but it is not wrong. It is in that context important to be reminded of electro-mechanical switches, where a spigot model may be closer to physical reality.

For personal comfort one may consider a binary or n-valued switch as being a switch that stops or passes an optical signal. When the switch or gate is conducting the gate may pass light. It may also pass 'darkness' or absence of signal. When the gate is non-conducting, the output of the switch is dark in the optical case.

A model of a binary gate is shown in the following diagram.



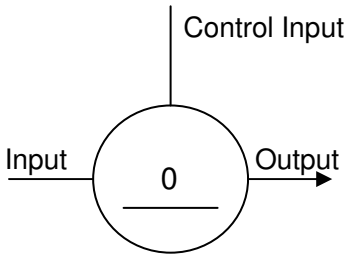
A binary switch has an Input, an Output and a Control Input. The binary switch is conducting from Input to Output based on the state of the Control Input. The 1 in the circle of the switch with a horizontal line indicates that the switch is conducting from input to output when the Control Input is in state 1.

Assuming further that the Input can be in state 0 or in state 1 one can create a truth table for this switch.

		Control Input	
	Output	0	1
Input	0	**0**	**0**
	1	**0**	**1**

The truth table shows the relationship between the state of the Output in the blue part of the table as a function of the state of the Input and the state of the Control Input.

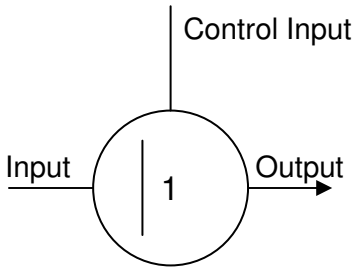
One may conclude that the switch realizes an AND function.
The following diagram shows a binary switch which is conducting when the Control Input is in state 0.



The truth table for this binary switch is provided in the following table.

		Control Input	
	Output	0	1
Input	0	**0**	**0**
	1	**1**	**0**

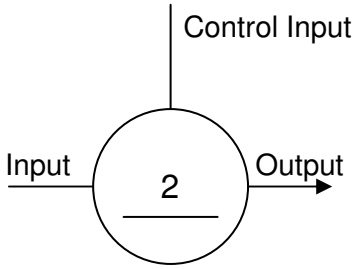
The following diagram shows a binary switch which is non-conducting from Input to Output when the Control Input is in state 1 and is conducting when the Control Input is in state 0.



One can easily check that the truth table for this switch is identical to the one that is conducting for Control Input has state 0.

The ternary switch

The same type of switch will be provided for the ternary or 3-valued case. Again keeping the optical type switch in mind one can have a ternary switch as shown in the following diagram.



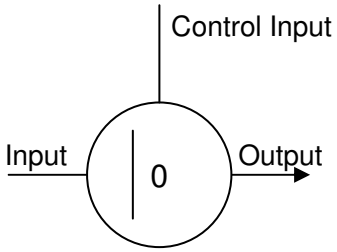
The ternary switch has an Input which can have one of the states (0, 1, 2) and an Output which can also have one of the states (0,1, 2) and a Control Input which also has one of the states (0,1, 2). The ternary switch as shown is conducting from Input to Output whenever the Control Input is in state 2. Absence of signal in this case is state 0.

A truth table for this switch is:

		Control Input		
	Output	0	1	2
Input	0	0	0	0
	1	0	0	1
	2	0	0	2

The same type of switch can be provided that is conducting when the Control Input is 0 or 1.

One can then also provide a switch that is non-conducting from Input to Output when for instance the Control Input is in state 0. This ternary switch is shown in the following figure. Again absence of signal represents state 0.



The truth table of this switch is:

		Control Input		
	Output	0	1	2
Input	0	0	0	0
	1	0	1	1
	2	0	2	2

The n-valued switch

One can thus provide any n-valued switch. Such a switch has an Input and Output and a Control Input. Based on the state of the Control Input and the type of switch (stop or pass), the switch conducts or isolates the Input from the Output.

About Ternarylogic LLC: Ternarylogic LLC is a New Jersey based R&D company. Its mission is to create novel MVL technology. The company owns a portfolio of inventions related to scramblers/descramblers, sequence generators and sequence detectors, sequence correlators, gates and inverters based circuitry, non-binary multipliers, latches and other non-volatile memory elements, optical disk applications and MC-DSSS technology.

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