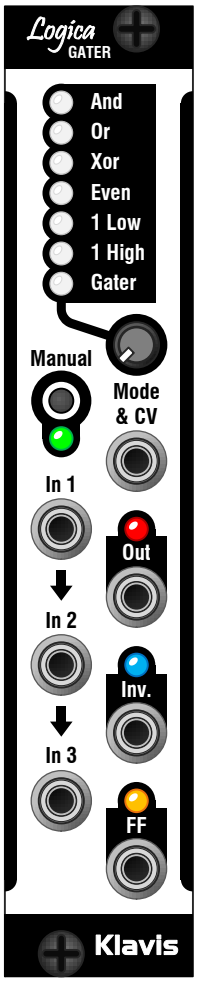
Logica Gater

Voltage-controlled multiple-input logic and gate processor

Introduction

Logic functions are a longtime ally in the modular toolbox. In the typical Klavis' approach, we had to bring something extra to the party. First, we made the selection of the logic function controllable by a voltage; this way creative dynamics can be put in place; secondly, we have our unique Gater function which combines gates in a way no traditional logic function does: it creates as many individual gate triggers on the output jack as are arriving on the various inputs.



Features at a glance

- 9 modes of operation: 7 logic functions + forcing to 1 or 0
- Unique Gater function to add-up multiple gate signals while maintaining each triggering.
- 3 normalized input jacks + manual button for quad signal handling
- Simultaneously normal and inverted outputs (e.g. And & Nand)
- Dedicated Flip-Flop output (divider by two)
- Continuous manual + Bipolar CV control of the 9 logic options
- LEDs on all outputs
- LED on manual button indicating its default status
- Skiff-friendly & compact module

Installation and security

Purpose

This module is meant for installation in a Eurorack-compliant chassis.
It adheres to Eurorack Doepfer mechanical and electrical specifications.

Do not attempt using this module in other mechanical or electrical contexts.

Installation

Before the installation, disconnect the mains supply from your modular system. Some supplies are not safely isolated; there is a risk of injury!

See in the specifications if this module requires 5V from the supply rails. If 5V is needed and your rack is not providing 5V, do not attempt connection!

Check that the current consumption requirements of this module, when added to your installed set of modules do not exceed the available current of your supply. This is done by adding up the current draw of all modules (mA) separately for each of 5V, 12V and -12V rails. If any of these 3 sums exceeds the available current of your supply for that voltage, do not connect the module to your system; you need a stronger supply.

The provided supply flat cable can only be inserted in the appropriate orientation at the back of the module, so there is no risk of error on that end. However, you should care about the orientation of the cable in the socket of the supply PCB inside your chassis. Cheap sockets without shrouding allow you plugging the connector the wrong way!

The red stripe on the cable should match a stripe printed on the supply board. The stripe also indicates the -12V side. In case there is no stripe, a -12V marking is a safe indication of the orientation.

Double check that the connectors are fully inserted and adequately oriented before switching on the supply. In case of anomaly, switch off the supply immediately and check everything again.

LEDs

All outputs have LEDs that indicate a logic level 1 when on.

The manual button LED tells the default setting of the button according to the logic function.

Inputs & outputs

Input jacks 1, 2 and 3

These are working all the same. Any signal can be brought to any jack.

Normalization

The input jacks are internally chained so that it is not needed to replicate a signal if less than 3 inputs are needed. Chained jacks are called "normalized".

In a logic module, this allows having a logic condition being realized with fewer signals than inputs offered. For example, a 2-input AND function would not work if the unused jack(s) were not normalized: the condition where all inputs go on would not be possible without patching (duplicating) one of the signals to the remaining inputs.

The arrows between the input jacks indicate where the signal is replicated.

Main output (Out)

This output provides the logic result of the operation currently selected.

Inverted output (Inv)

This output provides the opposite state of the main out (Out) jack. It therefore represents the negative logic of the currently selected option. (see table further)

Flip-Flop output (FF)

This output changes its state every time the main output transitions from off to on. It provides a division by two of the main output and can be used for clocking purposes or sub-octave creation when handling audio signals.

CV control input

This input works jointly with the Mode potentiometer. Their settings are summed to select one of the logic functions.

Controls

Mode potentiometer

It selects one of the logic options or a forcing to one or zero when set full up or full down respectively.

Manual input button

This button acts as a fourth input.

The manual button is low by default (LED off) except with the "And" and "1 Low" functions where it defaults to high (LED on).

Logic

There is a correspondence between various terms used when dealing with logic.

Logic	1	0
State and LED	On	Off
Voltage presence	Yes	No (zero)
Level	High	Low

Logic voltages

Logic signals are represented by a voltage or lack of it. In the modular world, any gate, trigger, clock and even square output from an LFO or VCO can be considered a logic signal.

Logic functions are the interaction of logic signals. They do not respond to nuances in the way analog signals do. Nevertheless they obey to ranges and levels. Logic signals are normally positive only; negative voltages are ignored and interpreted as zero. Typically, a voltage close to zero volts will be considered logic 0 (off) and a voltage of at least a few volts will be seen as logic 1 (on). Incoming voltages can go beyond or below what are valid one and zero without any problem. In other words, you can't go beyond 1 when it's already 1 !

Therefore, it is perfectly valid to drive this module with almost anything, logic or analog signals from any source. You are not limited to "squary" type signals, any wave shape can be used as a source logic signal. For example, passing the saw wave output of an oscillator through an OR function will create pulses since only the positive half of the wave will be accepted, and within that half, only levels high enough will produce a logic one on the output. Just for fun, changing the amplitude of the saw will change the PWM ratio of the resulting pulse.

Logic functions

Forced On & OFF states

When the potentiometer (or CV in) pushes the setting out of the logic options offered in the LED column, the outputs are forced to a stable level: To one when pushed full up, to zero when pushed full down. In both cases, the column of LEDs will be off. However, the LEDs of the Out and Inv jack tell the current logic level as usual.

And & Nand

The main output goes on when all inputs plus the button are on. The push button defaults to ON. AND is somehow the logic equivalent of a VCA where one input has to be ON for the other to pass through. The difference being that, contrarily to a VCA, all inputs are simultaneously controlling and controlled.

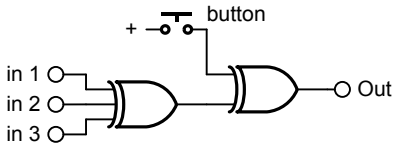
Or & Nor

The main output goes on when at least one input or the button is on. OR is the logic equivalent of a mixer: if there is something being on at any input there's something coming out.

Xor & Xnor

This logic option works like the OR, except that the main output goes off when all inputs are on.

Also, conversely to all other logic modes, the button is not equal to an input jack. Instead, it feeds a second Xor function. See the logical chain hereafter.



Xor can be used as a "digital ring modulator" such as implemented in the ARP Odyssey and KORG MS-20 synthesizers. Feed two inputs with two oscillators to get the effect.

Here is the detail of the Xor/Xnor function:

Button	released		pressed	
Input jacks	**Out jack = Xor**	**Inv jack = Xnor**	**Inv jack = Xnor**	**Out jack = Xor**
All low	low	high	high	low
One or more high, but not all	high	low	low	high
All high	low	high	high	low

Even & Odd

The main output goes on when an even number of inputs – including the button – are on. The inverted output works the same for an odd number.

1 Low

The main output goes on when only 1 input – including the button – is off. The button defaults to on.

1 High

The main output goes on when only one input – including the button – is on.

Gater

This unique function is not a logic-only function because there are timing aspects involved.

The Gater combines all inputs as an Or function does, but also retriggers the output every time a new gate starts while one or more are already active.

The output signal maintains the actual duration of the gate signals; this is not a gate to trigger function!

Summary

In the table, "inputs" include the manual button (except with Xor/Xnor)

White LED	Function	Out jack	Inv jack logic	Details
None - Above top	On	On	Off	Logic inputs and button are inoperative
Top	And	On when all inputs are on	Nand	Button defaults to ON
2nd	Or	On if at least 1 input is on	Nor	
3rd	Xor	On if 1 or more jacks are on, Off if all jacks are on Button inverts the final result	Xnor	
4th	Even	On if the number of inputs on is even	Odd	
5th	1 Low	On if only 1 input is low	Off with 1 low	Button defaults to ON
6th	1 High	On if only input is high	Off with 1 high	
Bottom	Gater	On if at least 1 input is on; retriggers with every new off to on input transition while out is on.	Inverted gate	
None – Below bottom	Off	Off	On	Logic inputs and button are inoperative

The Inv out is the opposite of Out; the FF out toggles when Out changes from low to high.

Specifications

Mechanical

Dimensions	mm	inches	Eurorack compliance
Height	128.40	5.06	3HE
Width	25.00	0.98	5HP
Depth behind panel (with supply cable inserted)	25.00	0.98	

Supply

The supply socket is protected against reverse insertion.

Supply rail	Current draw
+12V	0 mA
-12V	1 mA
+5V	16 mA

Input/output

All inputs and outputs can withstand signals between -12V and +12V without harm.

Jack	Effective voltage range received or generated
CV control input	-5V to +5V
All outputs	0 or 5V (logic levels)
Input low to high change	3.5V or higher
Input high to low change	2.8V or lower

Signals

Parameter	Values
Frequency range	DC to beyond audio

Packing list

The box contains:

- Logica module
- 2x M3 black mounting screws + washers
- Eurorack-compliant 16-pin supply cable
- Quick setup notice

Klavis products, including PCB and metalwork, are designed and manufactured in Europe.