GATE DR. MANUAL

v1.0

LESSTHANTHREE <3

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Installation

- Confirm the Eurorack system is turned off
- Connect the 10-pin side of the included ribbon cable to the module- the connector is keyed and should only fit one way, with the red stripe (-12V) on the bottom
- Connect the 16-pin side of the included ribbon cable to the power supply (bus board or flying ribbon cable) of your Eurorack system and confirm that the red stripe is connected to -12V. Please check your case or power supply manual if you are unsure of the orientation
- Mount the Gate Dr. to your Eurorack system using the included M3 screws (or some knurlies or something if you're real fancy)
- Turn on the power to your Eurorack system
- Enjoy!

NOTE: The Gate Dr. includes reverse power protection to prevent damage to the module in case of an improper power connection.

Overview

The Gate Dr. is a versatile utility module based around extracting, combining, and further modulating gate signals from your Eurorack system. It can be a simple comparator, logic module, clock divider, probability generator, gate delay (plus plenty of other features/modulation options), or any combination of those at once!

The Gate Dr. features 2 channels, each with 2 inputs and 2 outputs. Each channel contains the following:

- 2 comparators with adjustable threshold, hysteresis, and ability to invert the signal.
- 2 separate logical operations on the 2 inputs, including combinational logic (AND, NAND, OR, NOR, XOR, XNOR), sequential logic (S-R latch, D-latch), and a BYPASS operation which ignores the 'operation' processing.
- Output processing blocks that include various gate-related utilities, including a clock divider, a gate start-delay, a probability control, and a robust gate-to-trigger converter.
- 2 globally assignable CV signals, with CV control available for the vast majority of parameters.

The Gate Dr. also has the following features:

- OLED screen, pushbutton encoder, and two Channel buttons for easy access to any parameter.
- Simple, easy to understand menu interface with shortcuts to menus on the panel.
- Automatic saving of all settings parameters.
- Reverse power protection.
- Super slim skiff-friendly design.
- USB-Micro Type B connection for easy drag-and-drop firmware updates.

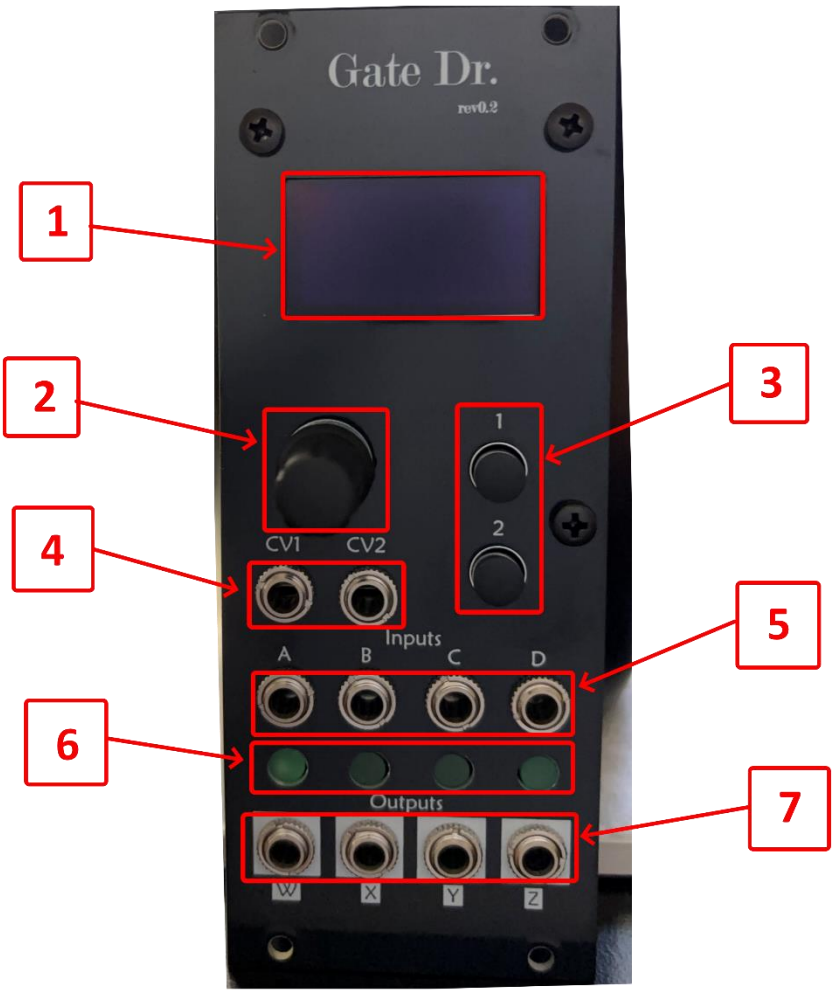
Technical Specs

- Size – 10 HP
- Depth – 22mm
- Power – 65mA max (45mA typical) @ +12V

  9mA max (8mA typical) @ -12V
- Inputs – 4x inputs (2 inputs per channel), range: -8V to +8V

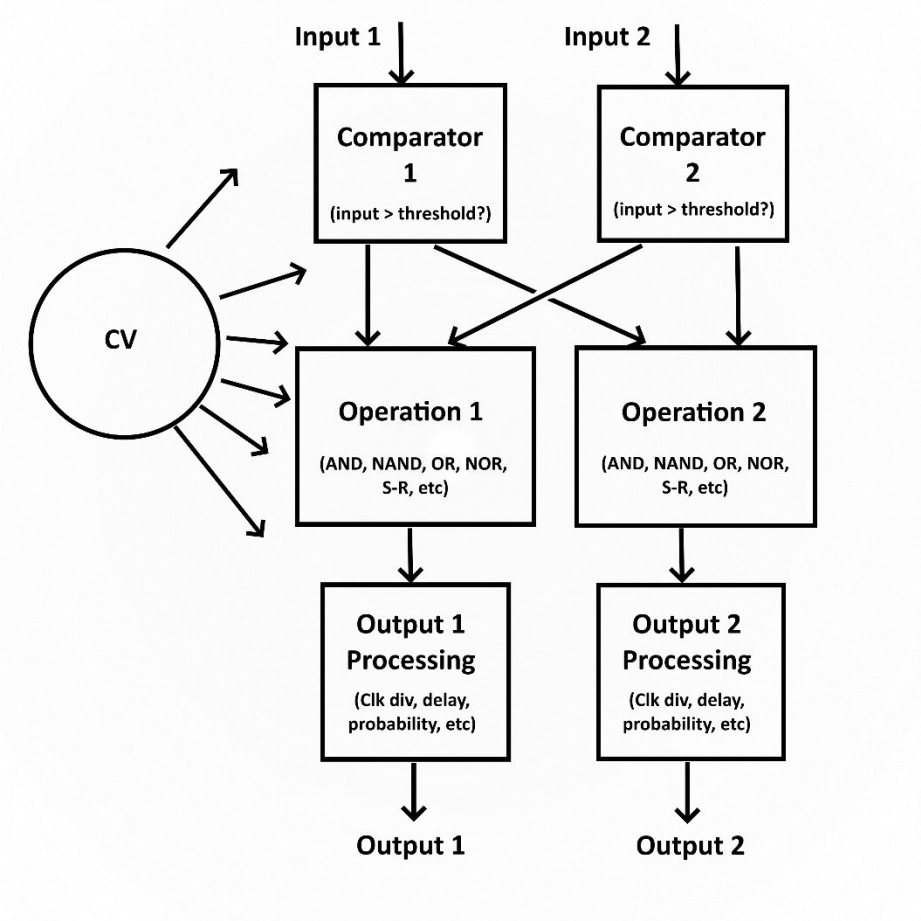
  2x CV inputs, range: -8V to +8V
- Outputs – 4x outputs (2 outputs per channel), range 0V to +8V gates

Ins & Outs



1) A lovely OLED screen
2) Encoder/pushbutton, used for navigating the Gate Dr.'s menus
3) 2 Channel pushbuttons, used for navigating the Gate Dr.'s menus
4) 2 CV inputs, input range -8V to +8V
5) 4 channel inputs, input range -8V to +8V
6) 4 output indicator LEDs, which will display the current state of the output below
7) 4 channel outputs, output range 0V to +8V

Basic Operation (per channel)



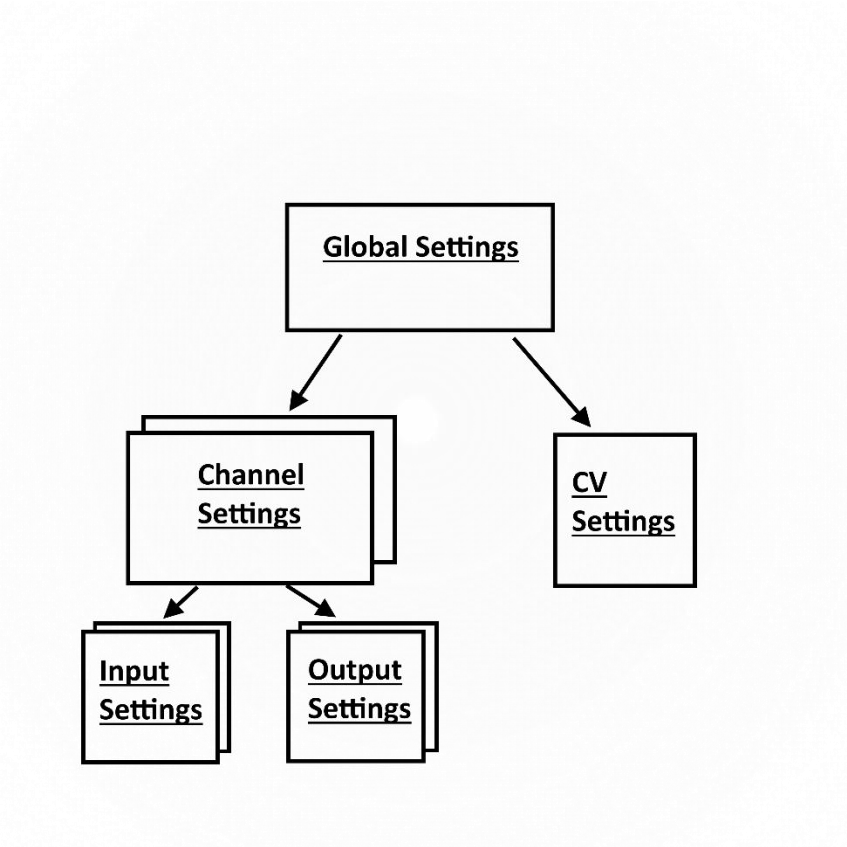
The Gate Dr. consists of 2 channels, each with 2 inputs and 2 outputs. Each channel will process the input signals using 3 processing blocks: a comparator per input, a pair of logical operations for combining your input signals, and an output processing block with a variety of functions (clock divider, probability, etc).

Each input is first fed through a comparator which will take any input signal and output a gate when the signal is above/below a certain voltage threshold, as per the Input menu settings.

Each pair of inputs in a channel are then fed into 2 operations, where they are combined using a logical operator (or passed directly to the output below if BYPASS is the chosen operation).

Finally, the result of the operation is fed through a processing block that has a few handy functions to further spice up your gates before they get sent out to the rest of your modular system. These include a clock divider, a gate start-time delay, a probability selection, and a feature-packed gate-to-trigger converter.

Menu Structure



The Gate Dr. menu structure is very simple and just contains 3 levels. At the highest level is the Global menu, which contains global module settings, reset options for both channels, and submenus to the next level down, the Channel menus. The Global menu can be quickly accessed with a long press of the CH1 button. The Channel menus contain the 2 Operations as well as submenus for the Inputs and Outputs settings menus. The Channel menus can be quickly accessed with a short press of

either the CH1 or CH2 button. Finally, there are the Input and Output settings menus, which contain parameters for the Input and Output processing blocks for each channel.

Detailed Controls

Inputs Menu

The Inputs menu contains parameters related to the comparators that each input is fed through before being further processed by the module. The comparator will take any analog input signal and output a related gate signal, whose output will be high any time the signal is above (or below, depending on settings) a certain threshold.

For each input you can adjust the following parameters:

- Threshold (thrsh) – The comparator threshold controls the level that the input signal needs to be above (or below, see the 'Invert' parameter) to output a high gate signal.
    - Range – -8V to +8V or CV control; default 1V
    - NOTE – When threshold is assigned to CV control, the input voltage will be compared directly to the value at the CV input selected, ignoring the 'CV Range' parameter found in the CV menu.

- Hysteresis (hys) – The comparator hysteresis controls how far above/below the threshold the input signal needs to be to change the output state. This helps keep a steady signal if your input voltage is hovering around the threshold you've set, preventing the output from switching rapidly.
    - Range – 0V to 0.5V or CV control; default 100mV

- Invert (inv) – The comparator invert setting will flip the logical state of your comparator output. When the invert is set to 'false' your comparator will output a high signal when your input is ABOVE the threshold, and when set to 'true' it will output a high signal when your input is BELOW the threshold.
    - Range – True/false or CV control; default false

- Copy Input 1 (copy in1) – This parameter is only available for the second input in each channel (inputs B & D). When set to 'Yes' the input will ignore the signal at the second channel input and instead use the first channel input, processed with the second input's settings. This makes it very easy to set up a simple window comparator patch.
    - Range – Yes/no; default no

Operations

The Operations are found on the main Channel menus, sandwiched between the Inputs and Outputs menus. Once processed, the output of operation 1 will feed into the channel's first output (outputs W & Y), and operation 2 will feed into the channel's second output (outputs X & Z). The Channel menus can be quickly accessed with a long press of either the CH1 or CH2 buttons.

The available operations to choose from are as follows:

- AND – The AND operation will give a high output only when both inputs are high, otherwise the output will be low.

- NAND – The NAND operation will give a low output only when both inputs are high, otherwise the output will be high.

- OR – The OR operation will give a high output when either input is high, or when both inputs are high.

- NOR – The NOR operation will give a high output only when both inputs are low.

- XOR – The XOR operation will give a high output when either input is high, but not when both are high.

- XNOR – The XNOR operation will give a high output when either both inputs are low or both inputs are high.

- Set-Reset Latch (S-R) – The S-R latch operation will be set high when the first input in the channel (Set) goes high, and will stay high until the second input in the channel (Reset) goes high, at which point it will go low again. If both inputs are active, there will be no change in the output.

- D Latch (D) – The D latch operation can be though of as a binary sample-and-hold, with the first channel input as the input signal to be sampled and the second channel input as the trigger for sampling. When the second channel input goes high the output will latch onto the state at the first channel input, and will stay at that level until the next time the second input goes high again.

- Bypass (BYP) – The Bypass operation will feed the processed input straight into the output processing block, skipping any combination with the other channel input. This allows you to use one half of a channel to independently

process a signal just using the Input and Output processing blocks. For example, if both OPs in a channel are set to bypass, the first channel input could be used as a simple comparator while the second channel input is used as a clock divider for a different input signal.

- CV1/CV2 – The CV1/CV2 operations will select the OP that corresponds to the signal seen at the CV input, according to the individual range parameter set in the CV menu.

AND

A	B	OUT
0	0	0
0	1	0
1	0	0
1	1	1

NAND

A	B	OUT
0	0	1
0	1	1
1	0	1
1	1	0

OR

A	B	OUT
0	0	0
0	1	1
1	0	1
1	1	1

NOR

A	B	OUT
0	0	1
0	1	0
1	0	0
1	1	0

XOR

A	B	OUT
0	0	0
0	1	1
1	0	1
1	1	0

XNOR

A	B	OUT
0	0	1
0	1	0
1	0	0
1	1	1

S-R

S	R	OUT
0	0	x (no change)
0	1	0
1	0	1
1	1	x (no change)

Outputs Menu

The Outputs menu contains parameters for further processing your gates after they've been through their operation. These include a clock divider, a gate start-time delay, a probability selection, and a feature-packed gate-to-trigger converter.

For each output you can adjust the following parameters:

- Clock division (div) – The clock division parameter will let every Nth gate signal through, where N is the current division setting. For example, if the divider is set to /4, the 1st, 5th, 9th, 13th, etc. gates will pass through to the output, and all others will not be passed to the output [1,0,0,0,1,0,0,0…].
    - Range – /1 to /32 or CV control; default /1

- Clock divider phase (div phase) – The clock divider phase parameter will shift the start-point of the divider. For example, when the clock divider is set to /4 and the phase is set to 3, the 3rd, 7th, 11th, 15th, etc. gates will pass through to the output, and all others will not be passed to the output [0,0,1,0,0,0,1,0…].
    - Range – 1 to 32 or CV control; default 1

- Clock divider reset (div reset) – The clock divider reset parameter will let you choose which input you would like to reset the clock divider function, if any. When the selected input sees a rising edge the clock divider will reset, and the next gate received will pass through to the output (if the phase is 1).
    - Range – none, CV1, CV2, In1, In2; default none

- Start-time delay (delay) – The delay parameter will delay the start of any incoming gate signals by the time set in milliseconds. If a gate signal is received that is shorter than the delay time, then it will not pass through to the output.
    - Range – 0ms to 1s or CV control; default 0ms

- Probability (prob) – The probability parameter will let a certain percent of random gates pass through to the output.
    - Range – 0% to 100% or CV control; default 100%

- Trig output mode (trig mode) – The trig mode parameter gives you a variety of options for using the gate-to-trig converter. The available options are as follows:
    - Off – The module will pass on your signal directly to the output, with no change.

    - Rise – The rising-edge gate-to-trig converter will output a trigger whenever the signal goes from low to high, for the length specified by the 'trig length' parameter.

    - Fall – The falling-edge gate-to-trig converter will output a trigger whenever the signal goes from high to low, for the length specified by the 'trig length' parameter.

    - Change of Value (COV) – The change of value gate-to-trig converter will output a trigger whenever the signal goes from low to high, AND from high to low, for the length specified by the 'trig length' parameter.

- Toggle – The toggle mode will toggle the output from low to high whenever it receives a rising edge (low to high) signal. This mode ignores the 'trig length' parameter, as the output will stay low/high until the next rising edge.

- CV1/CV2 – The CV1/CV2 operations will select the trig mode that corresponds to the signal seen at the CV input, according to the individual range parameter set in the CV menu.

- Trig output length (trig len) – The trig length parameter will set the length of the trigger to be output when using the gate-to-trig converter. This parameter has no effect when in toggle mode (or OFF, for that matter).
  - Range – 20ms to 2s or CV control; default 200ms

- Output 2 mode (2-mode) – This parameter is only available for the second output in each channel (outputs X & Z). This parameter gives you a few options for easily configuring the second output in a channel without having to adjust many settings. The available options are as follows:
  - Separate (sep) – This is the default mode; the second output will use the settings for the second output as the user has set them.

  - Follow (foll) – The follow mode will use all the Output menu settings for output 1 to process both outputs, ignoring the settings for output 2.

  - Invert (inv) – The invert mode will always output the logical inverse of the final signal at output 1, ignoring all Input, OP, and Output menu settings for output 2.

- Bernoulli (bern) – The Bernoulli mode will allow output 2 of the channel to act as the second output of a Bernoulli gate, ignoring all Input, OP, and Output settings for output 2. A traditional Bernoulli gate can be created by adjusting the 'probability' parameter for output 1, and any time a gate is 'suppressed' it will show up on output 2. In addition, the Bernoulli mode will work when adjusting parameters other than probability on output 1. For example, if you are using the clock divider function to divide your first output by 4, the first gate will show up on output 1 and the next 3 gates will show up on output 2, followed by one gate on output 1, etc. This works for all output parameters, so get creative with it!

CV Settings

The CV menu contains parameters that tell the Gate Dr. how it should process your incoming signals at the 2 CV inputs, with options to make integrating signals from your rack as seamless as possible. The CV menu can be quickly accessed with a long press of the CH2 button.

- PRO TIP: For all continuous parameters in the Gate Dr. (probability, trig length, delay, etc.) using CV will allow you to pick individual values that may not be selectable due to the increment value for that parameter. For example, the trig length parameter will increment/decrement by 20ms when setting a static value using the encoder, but if finer control is needed you can set the parameter to CV and use a fixed voltage source to dial in the precise trig length time you need!

For each CV input, you can adjust the following parameters:

- CV range – The CV range parameter will set the voltage range that the CV input will need in order to span the range of any parameter it is assigned to (calculated per parameter). For example, if the range is set to bipolar +/- 5V and the output probability is set to CV control, a CV input of -5V will correspond to 0%, a CV input of 0V will correspond to 50%, and a CV input of +5V will correspond to 100%. The available options are as follows:
    - Unipolar 5V (+5V) – 0V to +5V
    - Bipolar 5V (+/-5V) – -5V to +5V
    - Unipolar 8V (+8V) – 0V to +8V
    - Bipolar 8V (+/-8V) – -8V to +8V

- Threshold (CV thresh) – The CV threshold parameter is used for any parameters that are binary (yes/no, true/false), such as the 'invert input' parameter.
    - Range – -8V to +8V; default +1V

Global Settings

The Global menu contains some miscellaneous parameters as well as the CH1, CH2, and CV submenus. The Global menu can be quickly accessed with a long press of the CH1 button.

The global parameters you can adjust are as follows:

- Reset – This option will reset all parameters in CH1, CH2, or both to their defaults. Scroll to your selected option and press enter (short press ENC) to reset. Select 'none' or press back (long press ENC) to cancel without resetting.

- Long-press time – This parameter selects how long you need to hold the ENC button down for it to count as a long press. The available options are short, medium, and long.

- Screen off time – This parameter selects how long the module will keep the screen on when no UI inputs are received (ENC, CH1/2 buttons). The available options are Off (not recommended), 5mins, and 15mins.