Make Noise Maths — Function Module

Maths is an analog computer designed for musical purposes. Amongst other things, it can: 1. Generate a variety of linear, logarithmic, or exponential triggered or continuous functions 2. Integrate an incoming signal 3. Amplify, attenuate and Invert an incoming signal 4. Add, subtract and OR up to 4 signals 5. Generate analog signals from digital information (Gate/ Clock) 6. Generate digital information (Gate/ Clock) from analog signals 7. Delay digital (Gate/ Clock) information.

If the above list reads like science rather than music, here is the translation: 1. Voltage Controlled Envelope or LFO as slow as 25 minutes and as fast as 1khz 2. Apply Lag, Slew or Portamento to control voltages 3. Change the depth of modulation and modulate backwards! 4. Combine up to 4 control signals to create more complex modulations 5. Musical Events such as Ramping up or Down in Tempo, on command 6. Initiating Musical events upon sensing motion in the system 7. Musical note division and/ or Flam.

CHANNEL 1 IN: DC input to circuit. Use for lag, portamento, or ASR envelopes. Also input to **SUM**/**OR** bus. Range: +/-10V.

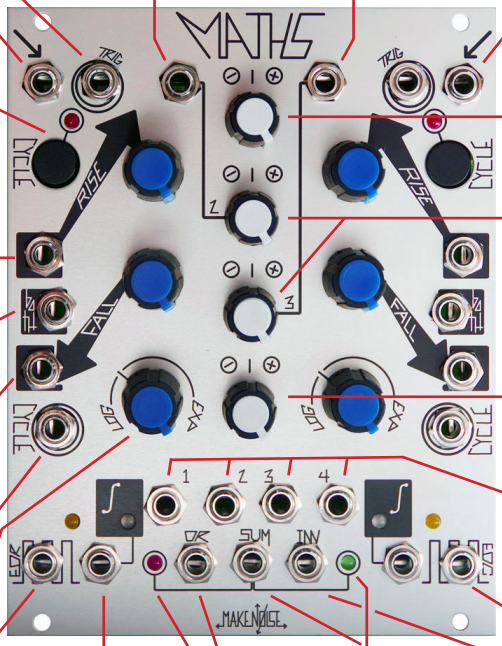
TRIG IN: Gate or pulse at input triggers the circuit regardless of Signal In activity. Result is a 0V - 10V function (envelope), whose characteristics are defined by the **Rise**, **Fall**, and **Vari-Response** parameters. Use for envelope, pulse delay, clock division, LFO Reset (only during falling portion).

CHANNEL NOTE: Channel 1 & 4 are identical, except for **EOR** / **EOC**. So only Channel 1 (in Green), and any differences, are explained below. Channel 4 Input is shown below, for reference.

CHANNEL 2 IN: DC input to attenuvertor and **SUM**/**OR** bus. Normalized to a +10V reference for generation of voltage offsets. Input Range: +/-10V.

CHANNEL 3 IN: DC input to attenuvertor and **SUM**/**OR** bus. Normalized to a +5V reference for generation of voltage offsets. Input Range: +/-10V.

CHANNEL 4 IN: DC input to circuit. Use for lag, portamento, or ASR envelopes. Also input to **SUM**/**OR** bus. Range: +/-10V.



CYCLE BUTTON & LED: Causes the circuit to self cycle, generating a repeating voltage function, aka LFO. Use for LFO, clock, or VCO. The associated LED displays red when the cycle is enabled.

RISE ROTARY & CV IN: The rotary sets the time it takes for the voltage function to ramp up. CCW roation decreases rise time, while CW rotation increases rise time. CV In is the linear CV input for the **Rise** parameter. Positive CV signals increase rise time, negative CV signals decrease rise time, with respect to the **Rise** rotary setting. Range: +/-8V.

BOTH CV IN: Bi-Polar Exponential CV signal input for entire function. Positive CV signals decrease total time while negative CV signals increase total time. Range: +/-8V.

FALL ROTARY & CV IN: The rotary Sets the time it takes for the voltage function to ramp down. CCW rotation decreases fall time, while CW rotation increases fall time. CV In is the linear CV signal input for the **Fall** parameter. Positive CV signals increase fall time, while negative CV signals decrease fall time, with respect to the **Fall** rotary setting. Range: +/-8V.

CYCLE IN: On gate high, circuit will cycle. On gate low, the circuit will not cycle (unless the **CYCLE button** is engaged). Requires minimum +2.5V for high.

VARI-RESPONSE ROTARY: Sets the response curve of the voltage function. Response is continuously variable from Logarithmic through Linear to Exponential to Hyper-Exponential. The tick mark shows the Linear setting.

EOR (END OF RISE OUT) & LED: Goes high at the end of the rise portion of the function. 0V or 10V. The associated LED indicates the states of the EOR output. Lights when EOR is high.

UNITY SIGNAL OUT & LED: Signal from the Channel 1 circuit. 8V peak to peak when cycling. Otherwise, the output follows the amplitude of the input. The associated LED indicates activity within the circuit. Positive voltages display green, while negative voltages display red.

OR BUS OUT: Result of the Analog Logic OR function with respect to the settings of the **Attenuvertor rotaries** for channels 1, 2, 3 and 4. Range: 0V to 10V.

SUM BUS OUT: Sum of the applied voltages with respect to the settings of the **Attenuvertor rotaries** for channels 1, 2, 3 and 4. Range: +/-10V.

SUM BUS LEDS: Indicates voltage activity in the **SUM** bus (and therefore the **INVerted SUM** as well). A red LED indicates negative voltages. A green LED indicates positive voltages.

CHANNEL 1 ATTENUVERTOR ROTARY: Provides for scaling, attenuation and inversion of the signal being processed or generated by channel 1. Connected to **Channel 1 Variable Out** and **SUM**/**OR** bus.

CHANNEL 2 & 3 ATTENUVERTOR ROTARIES: Provides for scaling, attenuation, amplification, and inversion of the signal patched into Channel 2 or 3. Connected to **Channel 2/3 Variable Out** and **SUM**/**OR** bus.

CHANNEL 4 ATTENUVERTOR ROTARY: Provides for scaling, attenuation and inversion of the signal being processed or generated by channel 4. Connected to **Channel 4 Variable Out** and **SUM**/**OR** bus.

VARIABLE OUTS: The applied signal, as processed by channels 1, 2, 3, or 4 controls. Normalized to the **SUM** and **OR** busses. Inserting a patch cable will remove the signal from the **SUM** and **OR** busses. Output range: +/-10V.

EOC (END OF CYCLE OUT) & LED: Goes high at the end of the fall portion of the function. 0V or 10V. The associated LED indicates the states of the EOC output. Lights when EOC is high.

INV BUS OUT: Signal from **SUM Out** turned upside down. Range: +/-10V.

MATHS is laid out top to bottom, with symmetrical features between Channel 1 and Channel 4.

The signal inputs are at the top, followed by the panel controls and control signal inputs at the middle.

The signal outputs are at the bottom of the module. LEDs are placed near the signal they are indicating.

Maths Tips & Tricks

- Longer cycles are achieved with more Log. response curves. The fastest, sharpest functions are achieved with extreme Exp. response curves.
- Adjustment to the response curve will affect **Rise** and **Fall** times.
- To achieve longer or shorter **Rise** & **Fall** times than available from the Rotaries, apply a voltage offset to the CV Signal Inputs. Use Ch.2 or 3 for this.
- Use the **INV SUM Out** where you require reversed modulation but don't have means for inversion at the CV destination (ex.: Mix CV In on Echophon).
- An **INV** signal from Maths back into the Maths at any CV input is useful for creating responses not covered by the **Vari-Response rotaries** alone.
- When utilizing the **SUM** and **OR** outputs, set any unused Ch. 2 or 3 **Attenuvertor Rotaries** to Noon, or insert a dummy patch cable into the associated channel Input. This will avoid unwanted offsets.
- The **OR** output will not respond to, or generate, negative voltages.
- The **EOR** and **EOC** are useful for generating complex CV functions where Ch. 1 and Ch. 4 trigger from each other. Patch to each other's **Trigger**, **Signal**, and **CYCLE** inputs.