



## Maestro Firmware V1.2

(Updated August 17, 2021)

## Introduction

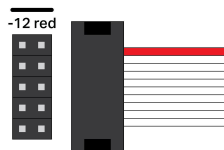
Maestro is a 6 channel clocked modulation controller inspired by the automation lanes found in digital audio workstation software, brought into eurorack and made playable and performable. Maestro will push and pull the parameters of your other modules with rapid or slowly evolving voltages, always in perfect sync with each other and the rest of your system.

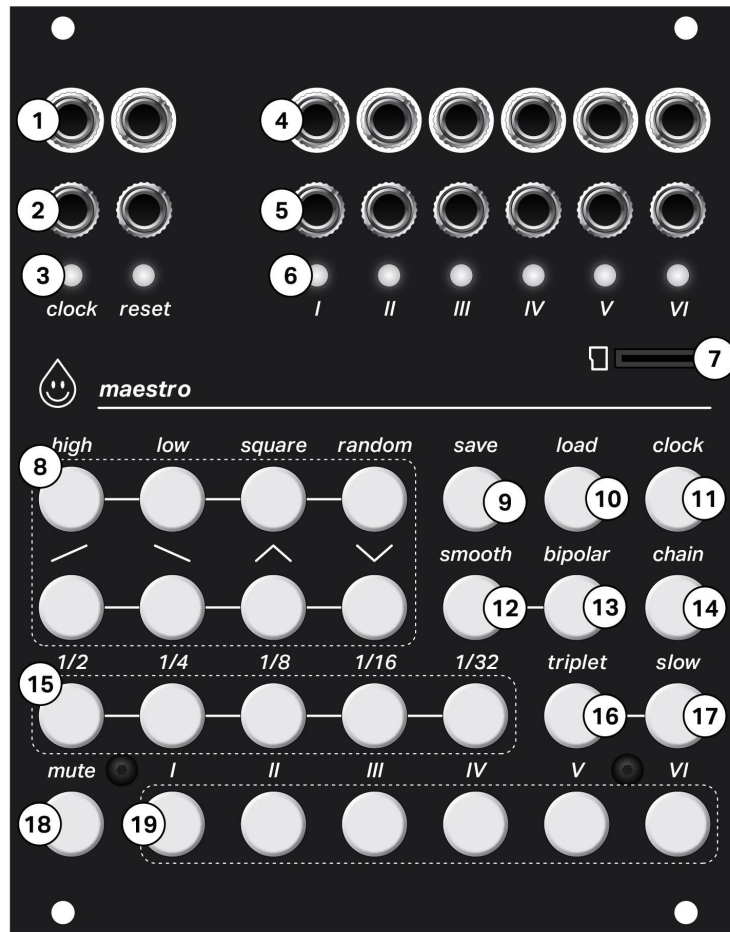
## Maestro Features

- 6 channels of live switchable looping/one shot waveforms
- A clock system that keeps all waveforms in sync, even when switching them manually in a live performance setting. Maestro keeps track of the number of clock pulses elapsed since the last reset and synchronizes the phase of all channel waveform outputs together
- Internal or external clocking to sync with any modular gear
- A "Chain" function that allows different waveforms to be sequentially played to form complex, evolving streams of control voltage
- A "One Shot" function that turns any channel of Maestro into a complex CV generator, following the rhythm of an external gate or trigger
- Instantly recallable save and load slots from the uSD card cached in internal memory. You can save and recall entire module state or individual channel settings to perform dramatic changes to Maestro's output without missing a beat

## Module Installation

- Maestro requires 20hp of space in a eurorack case, and the module is 25mm deep with the power header connected - easily compatible with slim/shallow cases
- Maestro requires 65mA of current on the +12V rail and 18mA on the -12V rail of a eurorack power supply. Please ensure you have enough power available in your case before installing Maestro.
- The red line on the edge of the included eurorack power ribbon cable should be aligned with the "-12v" text on the back of Maestro, and with the -12v rail of your power supply bus board. Maestro is protected from plugging the power cable in backwards (the unit will not power on) however we encourage you to take care in making sure Maestro is plugged in correctly before powering on your case.





## Hardware Overview

Along the top of the module you will find the inputs (2) and outputs (1) for the clock and reset, and channel trigger inputs (5) and channel signal outputs (4). Each channel also has an LED indicating the signal at its output (6) and Maestro's clock and reset are shown on LEDs (3). Maestro uses a micro SD card (7) to store channel data for saving and loading, as well as firmware updates and other settings.

## Button Overview

- Channel (19) and mute (18) buttons
- Timing (15) buttons and triplet (16) and slow (17) modifier buttons
- Waveform (8) buttons and smooth (12) and bipolar (13) modifier buttons
  - Save (9) and load (10) buttons
  - Chain menu button (14)
  - Clock menu button (11)

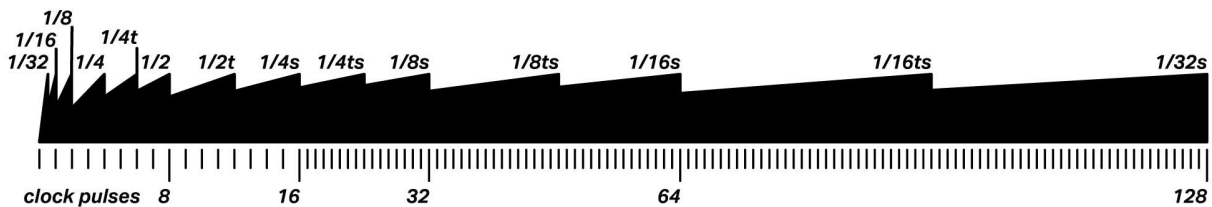
## Channel and Mute Buttons

- Each channel button corresponds to the input and output jacks labeled the same at the top of the module. Any operation within Maestro can be applied to one or more channels by selecting them together. This can allow you to make broad changes quickly in your patch by setting multiple channels to change at once.
- “Mute” will mute the output of any channel buttons already selected, or a single channel selected after pressing “mute”. If a channel is already muted, these operations will unmute the channel. This allows multiple channels to be muted or unmuted in a performance setting with a single press of the mute button by selecting the channel buttons first.
- If you press and hold a channel button, the timing, waveform and modifier buttons will illuminate for that channel’s current settings. Different timing and waveform buttons can be selected while a channel button is held down to live-change the settings for that channel. This will not disrupt the tempo synchronization of Maestro, and is intended as a physical performance tool to jam with in real time

## Timing and Modifier Buttons

- The timing buttons determine the multiplication or division of the clock tempo for a given channel. A timing can be applied to a channel by selecting the timing button before or after the channel button, or changed on the fly by holding down the channel button and jamming through different timings.
- The tempo is displayed on the clock LED. The timing buttons range from  $\frac{1}{2}$  note to a  $\frac{1}{32}$  note multiplication (see table below)
- The number of clock pulses Maestro uses to define a quarter note can be set by the user in the clock menu (see page 6)
- “Slow” turns the timing buttons into divisions -  $\frac{1}{2}$  is two beats all the way to 32 beats at  $\frac{1}{32}$ .
- “Triplet” makes all multiplications  $\frac{2}{3}$  as long and divisions  $1\frac{1}{2}$  times longer for a triplet feel
- Maestro is always counting the number of clock pulses since the last module reset, and when a channel’s timing setting is changed, the new phase of the waveform will remain such that it always originates back at the reset. This keeps maestro’s waves in sync no matter how you change timing settings live. Please consult the following table and graphic representation of timing button and modifier combinations. The following table shows the number of clock pulses per waveform at a given setting with the clock PPQN set to 4:

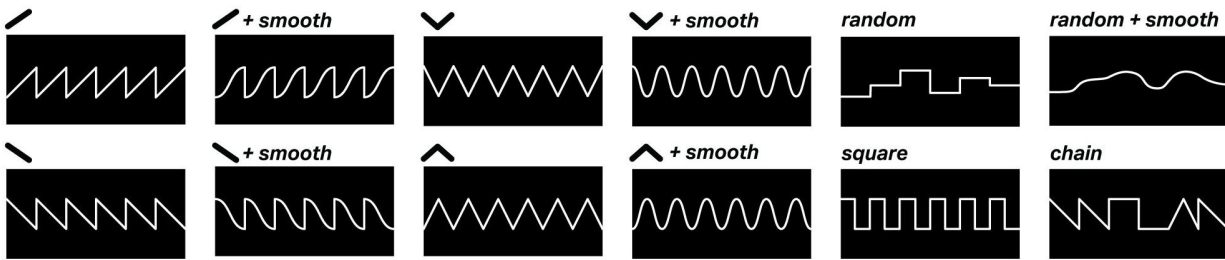
	1/2	1/4	1/8	1/16	1/32
No modifier	8	4	2	1	1/2
Triplet	12	6	3	1 1/2	3/4
Slow	8	16	32	64	128
Triplet & slow	12	24	48	96	192



### Waveform and Modifier Buttons

- Maestro has 8 waveform options, and two waveform modifier options to apply to any channel. Each waveform will be generated with a full cycle equal to the channel's timing button setting as described above. A waveform can be applied to a channel by selecting the waveform button before or after the channel button, or changed on the fly by holding down the channel button and jamming through different waveforms.
- Bipolar modifies the waveform output of a channel to output between -5V to 5V instead of 0V to 5V giving each waveform a bipolar, 10V amplitude
- "High" is a fixed 5V signal
- "Low" is a fixed 0V signal (-5V with bipolar applied)
- "Square" is a 50% duty cycle square wave with an amplitude of 5V (10V with bipolar applied)
- "Random" is a stepped random voltage between 0V and 5V (-5V to +5V with bipolar applied)
- "Ramp up" is a rising sawtooth wave with an amplitude of 5V (10V with bipolar applied)
- "Ramp down" is a falling sawtooth wave with an amplitude of 5V (10V with bipolar applied)
- "Triangle" is a triangle wave with an amplitude of 5V (10V with bipolar applied)
- "Inverted triangle" is an inverted triangle wave from 5V to 0V back to 5V (10V from +5V to -5V and back to +5V with bipolar applied)
- "Smooth" modifies the random, ramp up, ramp down, triangle and inverted triangle waveforms to be smooth, continuous sinusoid segments. Smooth does not affect high, low or square waveforms. Smooth random in particular adds a sinusoidal interpolation between each random value generated, producing a smooth, wandering random voltage.

Here is a visual reference for Maestro’s waveform and modifier combinations:



### Clock Menu

- With no external clock patched in, pressing “clock” brings you into the internal clock menu with options for adjusting Maestro’s internal clock settings. By default the internal clock tempo is set to 120 beats per minute (bpm) at 4 pulses per quarter note.
- “High” is a manual reset button for the whole module
- “Low” resets the internal clock to 120 bpm
- “Triangle” increases the bpm of the internal clock by 5 bpm (the button looks like an “up” arrow in this use case)
- “Inverted triangle” decreases the bpm of the internal clock by 5 bpm (the button looks like a “down” arrow here)
- Holding “smooth” while manually increasing or decreasing the internal clock will move in increments of 1 bpm
- “Ramp up” is simple tap tempo, where the bpm determined by space between last 2 taps on the ramp up button
- “Random” sets a random internal clock tempo between 60 and 180 bpm
- “Mute” stops the internal clock when no external clock is patched into Maestro

### Clock PPQN Setting

- In the clock menu, the timing and timing modifier buttons can be used to adjust the number of clock pulses equal to a quarter note or “PPQN” setting of the clock as described in the following table. This setting persists between power cycles and save and load of channel data from the micro SD card.

	1/2	1/4	1/8	1/16	1/32
No modifier	½ ppqn	1 ppqn	2 ppqn	4 ppqn	8 ppqn
Slow	½ ppqn	¼ ppqn	⅛ ppqn	⅙ ppqn	⅓₂ ppqn
Triplet	16 ppqn	24 ppqn	48 ppqn	64 ppqn	96 ppqn

## External Clocking

- Maestro has clock and reset inputs at the top left of the module. Plugging a cable into the clock input will automatically bypass the internal clock. Maestro will wait for a clock signal to begin running.
- Maestro can follow both straight and swung clock signals, but will not function well with uneven trigger or gate patterns on the external clock input.
- When a clock signal is patched into the external clock input, the clock menu offers only global reset with the “high” button” and the PPQN setting options on the timing buttons

## Save Menu

- The “save” button brings you into the save menu where you can store the current state of the module in one of 14 save slots on the micro SD card. Saving is processed separately and will not interrupt the operation of Maestro while running
- Pressing one of the 14 pulsing save slot buttons (middle two rows of buttons on Maestro) will save the current state of the module including all clock tempo settings and individual channel settings to that save slot
- Pressing one or more channel buttons in the save menu before selecting a save slot will save only the individual channel settings for those channels in the selected slot. This will overwrite any channel settings on those selected channels in that slot. Any settings for other channels in that save slot will remain untouched.
- Pressing the “clock” button inside the save menu will allow you to save the internal clock tempo to a save slot in addition to any selected channel’s data
- Pressing save again without selecting a save slot will exit the save menu without saving

## Load Menu

- Pressing “load” brings you into the load menu where you can recall module settings from any of the 14 save slots in Maestro. On power up, all save slot data is loaded into internal memory on Maestro, allowing near instant recall of the saved data - save slots can be loaded mid performance without disrupting the tempo of Maestro’s operation. We designed the save data in Maestro to be loaded, changed, saved and loaded again in real time during a live modular performance - offering a huge variation of CV output to keep a patch interesting for a long extended jam!
- On power up, save slot 1 (ramp up waveform button) is loaded by default
- Selecting channels in the load menu before selecting a load slot will recall only the individual channel settings for those channels in the selected slot. All other channels will remain as they were before entering the load menu.
- Pressing the “clock” button inside the load menu will allow you to load an internal clock tempo setting in addition to any selected channel’s data
- Pressing load again without selecting a save slot will exit the load menu without loading

## Chain Menu

- The “chain” button opens up the chain menu. This allows you to enter a sequence of waveforms that will play in a row at the given timing option selected for a channel. You can think of this as “assembling” your own waveform from the waveform components offered by the waveform buttons.
- A specific timing button may be selected before pressing a waveform button while building a chain. This will force that waveform to always play at a specific timing, regardless of the channel’s overall timing selection. After applying the chain, changing the channel timing setting can create some interesting polyrhythmic results with one or more waveforms in the chain locked to a specific timing.
- Smooth and/or bipolar waveform modifiers can be selected before pressing a waveform button while building a chain. This will apply the modifier to the specific waveform in the chain regardless of channel settings.
- Any channel selected before entering, or while inside the chain menu will receive the chain built after pressing the chain button at the end of building the chain. If no channel button is selected, pressing “chain” will illuminate the channel buttons once more to prompt you to apply the chain, and pressing “chain” a final time without selecting a channel button will simply exit the chain menu without applying the chain.
- Holding down the “random” button before pressing chain will generate a random chain, and illuminate the channel buttons to prompt you to apply the chain
- A chain may be a maximum of 32 waveforms long

## Channel Inputs / One Shot Mode

- Each channel has an input jack located below the channel output. When a cable is inserted into this input, the channel automatically enters “one shot” mode.
- Each time the rising edge of a trigger or gate is detected on the channel input, a single cycle of the waveform at the timing selected for the channel will be generated
- At the end of the waveform cycle the channel output will hold at the final voltage of the cycle until another trigger or gate is present at the channel input. This voltage is either high, low or random for the random waveform
- If a chain is assigned to the channel, a trigger or gate at the channel input will step through the waveforms in the chain on each rising edge. After triggering the final waveform in the chain, the chain will repeat.
- This functionality can turn Maestro into an unusual envelope generator, and opens interesting self patching opportunities, particularly by patching a chain with square and high / low waveforms into the channel input of another channel.



### Internal Attenuation Menu

- Pressing the “high” and “mute” buttons together will open up the internal output attenuation menu. Here the timing buttons can be used to reduce the voltage range of a channel’s output.
- The high and mute buttons can be tapped at the same time to stay inside the internal attenuation menu for a bit, or held down together to momentarily access the menu
- Select a channel button to display attenuation options for that channel. Each timing button name refers to the fraction of the default 0V to +5V (-5V to +5V bipolar) range according to the following table:

	<b>1/2</b>	<b>1/4</b>	<b>1/8</b>	<b>1/16</b>	<b>1/32</b>
<b>% of range</b>	50%	25%	12.5%	6.25%	3.125%
<b>Unipolar</b>	0 to 2.5V	0 to 1.25V	0 to 0.625V	0 to 0.313V	0 to 0.156V
<b>Bipolar</b>	-2.5V to +2.5V	-1.25V to +1.25V	-0.625V to +0.625V	-0.313V to +0.313V	-0.156V to +0.156V

- The attenuated output state of a channel is displayed accordingly on the channel’s LED
- To exit the internal attenuation menu, press the “high” or “mute” button again
- Channel attenuation settings are saved and loaded with channel data

## **Firmware Update Procedure**

- Power off case and remove micro SD card from Maestro
- Insert micro SD card into computer with a card reader (not included)
- Go to [acidraintechology.com](http://acidraintechology.com) and navigate to the Maestro page
- Download maestro\_1.1.zip and unzip the folder
- Inside you will find a FW.BIN file - move this onto the root directory of the micro SD card
- Eject micro SD card safely from your computer and insert it back into the Maestro with the your case power off
- Power up your case and watch Maestro run through the firmware update animation (buttons will slowly illuminate in rows from the bottom left to top right)
- Once the animation is complete your maestro is updated and ready for use

## **Firmware Update Changelog**

### **V1.1 - March 15, 2021**

ADDED: PPQN Settings in clock menu

ADDED: Internal attenuation menu

ADDED: Internal clock BPM separately selectable in save and load menu

FIXED: Clock output inverted when internally clocked

FIXED: No more minimum external clock tempo after clock engine rebuild

### **V1.2 - August 17, 2021**

FIXED: rare bug that causes Maestro to freeze the user interface in attenuation menu state