DrumKid manual

Introduction

Welcome to the DrumKid manual! DrumKid is a musical instrument that creates rhythms using random numbers. To get started with DrumKid, unscrew the six screws on the back of the unit (you should be able to do this by hand), and carefully remove the back plate. Insert three AA batteries (you can use rechargeable or single-use), replace the back plate, and tighten the screws. Slide the power switch to "on" - you should see the lights flash briefly. After this, DrumKid is ready to use. Plug some headphones or a 3.5mm stereo aux cable into the socket (mono won't work), and start playing. If you would prefer not to use batteries, you can also power DrumKid by connecting a USB mini cable to the socket recessed on the right hand side of the device.

Philosophy

DrumKid is designed around a very basic computer chip with limited memory and processing power. My idea was to squeeze as much cool sound out of this chip as possible, but it has its limits. Rather than try and hide from these limits, I decided to embrace them. This means that it is absolutely possible to make horrible, distorted, broken noises using DrumKid. Some of these horrible noises will sound cool, others will not. DrumKid is a playable instrument like any other - experiment with it and see what happens.

Demo videos and resources

You can find demo videos and other resources at [https://www.mattbradshawdesign.com/projects/drumkid (https://www.mattbradshawdesign.com/projects/drumkid)](https://www.mattbradshawdesign.com/projects/drumkid), or more technical info (source code, schematics, etc) at [https://github.com/mattybrad/drumkid (https://github.com/mattybrad/drumkid)](https://github.com/mattybrad/drumkid).

Basics

DrumKid has six buttons and four knobs. The basic functions are as follows:

- Press the start/stop button to start or stop the rhythm
- Press buttons A/B/C/D to select different knob functions (see table below)
- Turn any of the four knobs to alter the parameters in the current selected group (see table below)
- Tap the tap tempo button repeatedly to set the tempo
- Press buttons A+B together to load a session, then choose which session to load by

pressing any of the buttons
- Press buttons C+D together to save a session, then choose which slot to save your session in by pressing any of the buttons
- Press buttons B+C together to change the current active memory bank, then choose a specific memory bank by pressing any of the buttons

Presets

In the aleatoric spirit of DrumKid, all 36 sessions stored when you first use the instrument are randomly generated when DrumKid is built. Try loading a few of them to get a feel for what DrumKid can do.

Parameters

There are 16 different parameters which can be adjusted on DrumKid, split into four groups, with each group's four parameters controlled by the four knobs. The parameters are grouped as follows:

Group A (randomness)

1. Chance
2. Zoom
3. Range
4. Midpoint

Group B (effects)

1. Pitch
2. Crush
3. Crop
4. Drop

Group C (drone)

1. Drone
2. Modulate
3. Tuning
4. Note

Group D (rhythm)

1. Beat
2. Beats/bar (time signature)

3. Swing
4. Tempo

You can try out each parameter by starting a rhythm (using the start/stop button), then selecting a group and turning the different knobs. For example, try selecting group B (by pressing the B button) then turning the first knob, which will now control "pitch". You should hear the sound change. Below are descriptions of exactly what each parameter does, and how it can be used.

Chance - The probability of extra drum hits being generated. At zero, the beat will be completely unchanged, while for higher values there will be lots of extra events, usually creating a busier, messier beat. This can be used in conjunction with zoom, midpoint, and range to create drum fills that transition organically from a simple beat.

Zoom - Chooses which subdivision of the beat should be affected by the randomly generated extra hits. When zoom is at zero, beats will only be generated for "whole notes" (i.e. the first beat of the bar). Higher values will affect half notes, quarter notes, eighth notes, and so on. A medium value is a good place to start for zoom, but turning it up can make a beat or fill sound more "urgent". Some of the smaller subdivisions will vary depending on the current "swing" setting.

Range - This is the range of velocities which will be assigned to the random hits, and works in conjunction with "midpoint" (see below). For all the random hits to have the same velocity as each other, keep this value at zero. For a wide range of velocities, turn this up high.

Midpoint - This is the average velocity of the randomly generated hits, and works in conjunction with "range". Note that this control does allow negative values (below halfway). If you set the midpoint to maximum and have range set at zero, all the randomly generated hits will be at max velocity. Conversely, if you set it at zero, some hits will be muted. Setting it somewhere in the middle (with non-zero range) will add some random hits while reducing the volume of others. Try keeping midpoint at a three-quarters setting to add a bustling undercurrent to your beat, or turn it up briefly to create a drum fill.

Pitch - Alters the playback speed of the samples. Will play samples backwards if you turn the knob below halfway.

Crush - Reduces the number of bits used to calculate the audio output, creating a digital distortion effect. Higher values are clean, lower values are more distorted (fewer bits).

Crop - Crops the end of the samples, creating a staccato effect. Lower values are more cropped.

Drop - This control mutes some or all of the drum channels, allowing you to quickly "drop" everything except the hi-hat and snare, for example, or only retain the kick drum. Broadly, this control has "treble-y" channels at one end and "bass-y" channels at the other. The setting corresponding to all the channels being audible is somewhere in the middle.

Drone - DrumKid generates a drone which can be mixed with the drum sounds. The "drone" parameter controls the amount of raw drone signal added to the mix. Turning to the left adds a single tone, while turning to the right adds two tones, a fifth apart. A halfway value mutes the drone.

Modulation - The drone can also used to modulate the audio signal from the drums, creating a robotic effect. When "modulation" is set at halfway, no effect is heard. Turning the knob to the left modulates the drums with a single drone, while turning it to the right modulates the drums with two tones, a fifth apart. Turning the knob all the way left or right creates an extreme effect, while values closer to halfway will be more subtle.

Tuning - Controls the overall tuning of the drones (both the single and fifth tones).

Note - Alter the root note of the drones, in semitone steps over an octave range.

Beat - Chooses between a series of basic underlying drum patterns.

Beats/bar - Alters the time signature of the beat, i.e. the number of steps in the pattern. The possible values are 4/4, 5/4, 6/4 and 7/4.

Swing - Creates a swing feel to a beat by altering the timing of certain hits. There are three settings: straight, partial swing, and full (triplet) swing.

Tempo - Alters the tempo (BPM) of the beat. Will override any tempo previously set using the tap tempo function.

MIDI

DrumKid has MIDI in and out ports. These can be used to connect DrumKid to other MIDI equipment.

Synchronisation

DrumKid sends and receives MIDI clock signals. A clock signal will be sent through the "MIDI out" socket whenever DrumKid is playing. If DrumKid detects a clock signal through the "MIDI in" socket, it will synchronise itself to this signal. Once a clock signal has been received, the tempo controls will stop having any effect (you can return to non-synchronised mode by turning DrumKid off and on again). In synchronised mode, the start/stop button acts slightly differently - it will still stop the beat as normal, but starting a beat will only work if there is an active clock signal. If you attempt to start the beat before a clock signal is present, DrumKid will wait for a clock signal before starting. This behaviour may change with future updates.

Note output

DrumKid outputs note data on channel 10 (the standard MIDI drum channel). The note numbers are as follows:

- Kick - C1 (36)
- Click - C#1 (37)
- Snare - D1 (38)
- Closed hi-hat - F#1 (42)
- Tom - G1 (43)

Other info

Because DrumKid uses a lo-fi method (known as pulse width modulation) to generate its audio signal, there is a trace, high-frequency noise present in the output. While this signal should be above the human range of hearing, you may want to filter it out if you are recording DrumKid in a studio, especially if you intend to pitch-shift the recording downwards (since this could bring the noise within human hearing range). To remove the noise, use a band-stop or low-pass filter (before any pitch-shifting) - the offending frequency should be at 32768Hz.

Hacking DrumKid

DrumKid is an open source project, based on the Arduino Uno, and is designed in such a way that it can be modified and repaired. The source files for DrumKid are available from https://github.com/mattybrad/drumkid/ (https://github.com/mattybrad/drumkid/) - you will find the schematics, CAD files, parts list, source code and more. I have also written a "hackers' manual" to assist with modifying DrumKid's electronics and software.

Preset beat list (X denotes LED)

1. You can leave your hat on (X----)
2. Johnny Two-Hats (-X---)
3. Drum lesson (--X--)
4. Half-time rock (---X-)
5. There there (----X)
6. Metal (X----)
7. Four to the floor (-X---)
8. "Dance" (--X--)
9. Blue Monday (---X-)
10. Chime (----X)
11. Funk Soul Brother (X----)
12. Amen I (-X---)
13. Amen II (--X--)
14. Superstition (---X-)
15. Derribar el muro (----X)

16. Hips don't lie (X----)
17. Videotape (-X---)
18. Videotape (Bonnaroo) (--X--)
19. Military (---X-)
20. Ballad (----X)
21. Waltz (X----)
22. Take Five (-X---)
23. Unsquare (--X--)
24. Nihil (---X-)