lumatone™

ISOMORPHIC KEYBOARD

User's Guide

Version 1.0

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Version 1.0

February 2021

Lumatone Inc.

#207, 61 Elm Grove Ave

Toronto, ON

Canada M6K 2J2

www.lumatone.io

Only use the approved power supply.
GlobeTek PN: TR9CE5000YL4CIMR6B

POWER SUPPLY SPECIFICATIONS:
NAMEPLATE RATED INPUT: *100-240V~, 50-60Hz, 1.5A*
INPUT CONFIG: *IEC 60320/C14*
WATTS: *60.0*
VOLTS OUT: *12.0*
CURRENT OUT (Amps): *5.0*

Tested to Comply
With FCC Standards
FOR HOME OR OFFICE USE

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference and (2) this device must accept any interference received, including interference that may cause undesired operation.

This Class B digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations.

Cet appareil numerique de la classe B respectee toutes les exigences du Reglement sur le materiel brouilleur du Canada.

For Technical Support, email: **support@lumatone.io**

Table of Contents

IN MEMORIUM:
We would like to acknowledge the support of the late Bent Schmidt-Nielsen and George Secor, two early Lumatone backers who did not get the chance to play the Lumatone with our community.

SPECIAL THANKS:
To Hans Straub and Vincenzo Sicurella for their hard work on the *Lumatone Editor* software, and to Mike Battaglia, Dolores Catherino, Benton Roark, and Cam Taylor for their contributions and guidance in the creation of this manual.

WE ARE FOREVER GRATEFUL TO OUR ORIGINAL CROWDFUNDING BACKERS AND INVESTORS:
Kalle Aho, Michael Battaglia, Kurt Bigler, Graham Breed, Dolores Catherino, Zac Cogswell, Bo Constantinsen, Wil Gravlev, Vilhelm Gustafsson, Georg Hajdu, Gareth Hearne, Rachel Horvath, Douglas Keislar, Ere Lievonen, Carl Lumma, Joel Mandelbaum, Juhani Nuorvala, Robin Pitre, Dustin Schallert, Ryan Schroeder, William Sethares, Hans-André Stamm, Will Stewart, Hans Straub, David Stützel, Yosef Tamim, Cam Taylor, Siemen Terpstra, Roberto Trevisan, Michael Vannice, The Canada Council for the Arts, and The Maldeb Foundation.

THE LUMATONE TEAM:
Matthew Angus, Bo Constantinsen, Lauren D'Souza, Art De Guzman, David Dempster, Leith-Fleming Smith, Dylan Horvath, Parth Jain, Andrew Lowe, Charlie Man, Matthew Mak, Aidan Muller, Johnny Reinhard, Benton Roark, Vincenzo Sicurella, Hans Straub, Siemen Terpstra, and Garnet Willis.

Welcome to Lumatone

Congratulations! You've joined a growing community of musical pioneers. You are an exclusive member of a forward-thinking group of composers, performers, and producers who want to create and explore music and sound in new, inspiring ways. Welcome to Lumatone.

A Brief History

I met Garnet Willis in 2003, when I was using his wood studio on a design project. One day Garnet brought in a cardboard model of a theoretical generalized keyboard designed by Siemen Terpstra in the Netherlands in 1996. A friend of Garnet's, Johnny Reinhard, had met Siemen, who had designed this concept for a unique keyboard based on centuries-old hexagonal layouts. Not only did it enable you to play all of the microtonal "notes between the notes", but it enabled any player to think intuitively and differently about the intervals between notes, no matter what the scale or tuning. As an engineer and a designer, I was hooked by the opportunity to create a new tool for musical expression for these artists. Before long, we were on a journey to create a full-sized prototype, funded by a grant from the Canada Council for the Arts and Joel Mandelbaum's Maldeb Foundation.

The first Lumatone was called the *Terpstra* in honour of Siemen Terpstra's brilliant original design. We made two. There were no LEDs, but you could map it using coloured keycaps. It was generalized, but it was tedious to change the mapping manually with those keycaps. We knew to make it really versatile, those changes would need to be at the touch of a button.

Fast forward to 2021, and the Lumatone in front of you is the result of years of hard work by over a dozen passionate, creative people. It was also made possible by the financial support of over thirty early believers who backed a crowdfunding campaign and made the development of this project possible. You're one of the very first people on the planet to own a Lumatone. We hope your adventuring spirit is as inspired by this instrument in playing it as we were in building it. We can't wait to see what you create with it, and we're thrilled to welcome you to the Lumatone family!

Cheers,

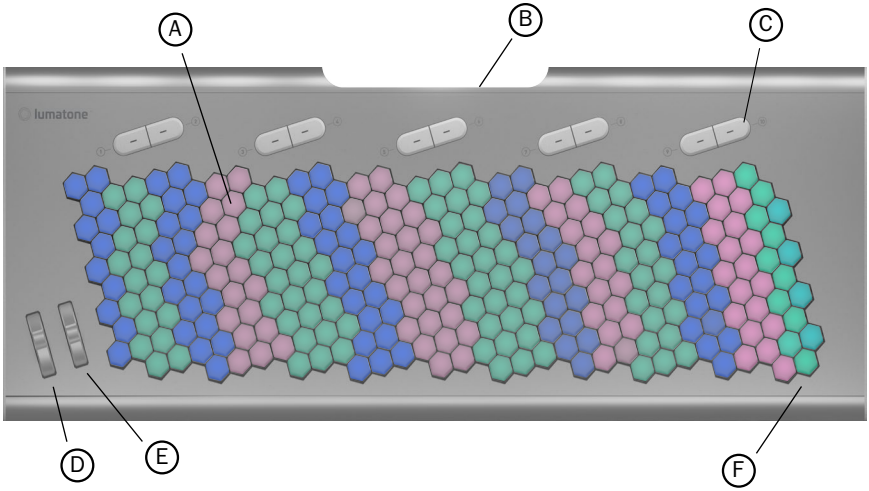
Chapter 1: General Overview

Lumatone is a generalized keyboard controller with 280 colour-changing keys, arranged in a hexagonal grid. The keys – hexagons themselves – are arranged in a unique pattern in three-dimensional space for maximum reach and playability. Lumatone makes no sounds of its own, and instead is meant to control any *sound-generating device* that receives MIDI. For example, DAW-based virtual instruments or analog synthesizers.

The hexagonal grid is what makes Lumatone so powerful for playing in multiple tunings, and enabling the creation of virtually unlimited layouts, which we call *mappings*. Lumatone's unique design also makes it ideal for the creation of *isomorphic* keyboard layouts, which we will discuss later.

All 280 keys are velocity-sensitive, capable of acting in either note on/off mode or as continuous controllers. Every key is also able to transmit polyphonic aftertouch (poly pressure) over MIDI. Unlike many modern controllers with shallow action, Lumatone's keys are designed to be familiar to a traditional keyboard player, with key travel similar to synthesizers and other non-weighted keybeds.

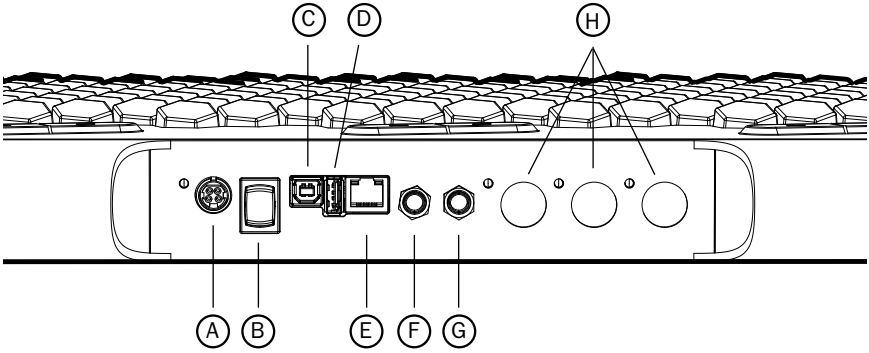
The Instrument



- (A) Rising Hexagonal Keybed
- (B) Rear Panel / Ports
- (C) 10 Preset Buttons
- (D) Pitch Wheel
- (E) Modulation Wheel
- (F) Anodized Aluminum Case

The Rear Panel

Lumatone's rear panel is outfitted with connectors for MIDI, USB, Power, and Ethernet. There are also 1/4" pedal jacks for both sustain and expression pedals.



Ⓐ **DC Power Connector**
For use only with the included Lumatone power adapter.

Ⓑ **Power On/Off**
This rocker switch powers Lumatone on and off.

Ⓒ **USB Type-B**
USB port to be used for MIDI-Over-USB

Ⓓ **USB Type-A**
For diagnostic / manufacturer use only.

Ⓔ **RJ45 Port**
For diagnostic / manufacturer use only.

Ⓕ **Expression Pedal Jack**
Accepts a 1/4" TRS phone plug for expression pedals.

Ⓖ **Sustain Pedal Jack**
Accepts a 1/4" TRS phone plug for sustain pedals.

Ⓗ **MIDI IN/OUT/THRU**
Standard 5-pin MIDI DIN connectors for communicating with MIDI-equipped devices.

MIDI Connectivity

Lumatone was built to control virtually any MIDI-capable device on the planet. While it is designed primarily as a musical instrument, people in non-musical fields such as lighting design and live video have also found power in the simplicity of Lumatone's MIDI-centric, colour-oriented design.

Lumatone can transmit bidirectional MIDI signals via its USB Type-B port when connected to a computer. It can also be connected to computers and other devices via 5-pin MIDI DIN connectors (via separate In/Out/Thru connectors).

Lumatone is only capable of one MIDI connection at a time, and if a USB cable is plugged in and active, Lumatone will send and receive MIDI via USB and ignore anything plugged into the DIN ports. Therefore, if you wish to use 5-pin MIDI DIN connectors with Lumatone, ensure you do not have anything plugged into the USB port.

MIDI-Over-USB

Connecting Lumatone to a computer using its USB Type-B port enables bidirectional MIDI communication with a computer. As a Class Compliant USB device, Lumatone does not require any additional drivers or software, and will be recognized as a MIDI device by both Mac and Windows computers upon connection.

On Mac OS, your Lumatone will appear as "Lumatone" automatically as a MIDI device in any MIDI capable software, including in Mac OS's "Audio Media Setup" utility.

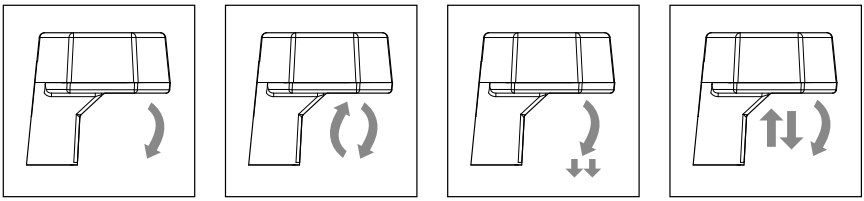
In most recent versions of Windows, Lumatone should also automatically be available. However, if actively connected to Lumatone over MIDI using a windows application, disconnecting the USB cable and reconnecting it may result in the need to resync the device. Selecting Lumatone in the "Windows Device Manager" under "Sound, video, and game controllers" going into the "Properties" window, and simply clicking OK usually results in a resync.

If Windows isn't detecting Lumatone after a disconnection has occurred turn off Lumatone, reconnect the USB cable, and turn Lumatone back on.

Chapter 2: How Lumatone Works

Lumatone offers a vastly larger number of keys than virtually any other keyboard instrument on the market, but does so in a similar form factor to a traditional keyboard. It does this by packing 280 hexagon-shaped keys into a unique grid.

Each key is a highly expressive continuous controller with velocity sensitivity, deep travel, and extended travel at the end for polyphonic aftertouch.



Note On/Off *Continuous Controller* *Polyphonic Aftertouch* *Lumatouch*

This means that each key can be set to provide expression in a multitude of ways:

1. **Note On/Off** – Functions as a regular keyboard key with full velocity sensitivity, and familiar / responsive action.
2. **Continuous Controller** – Continuously reads the position of the key like a bidirectional fader, allowing the control of MIDI CC parameters such as volume, filter cutoff, expression, and countless others, and can also control custom parameters via any MIDI channel and note.
3. **Polyphonic Aftertouch** – When enabled, polyphonic aftertouch (also called poly pressure) takes traditional aftertouch a step further, allowing each key to send it's own aftertouch information. This allows a performer to affect the aftertouch parameter on a per-key basis simultaneously with other keys.
4. ***Lumatouch*** – *Lumatouch* is an experimental mode that can be assigned to any key, which combines all three of above forms of expression. The key behaves like any other note on/off key, but upon pressing into aftertouch, the key converts to a continuous controller, allowing the performer to control their chosen aftertouch parameter with the full range of key travel. We'll discuss potential applications for this mode in more detail later.

Every key can be uniquely set to Note On/Off, Continuous Controller, or *Lumatouch*. Polyphonic Aftertouch is a mapping-wide feature that can be turned on or off, and it must also be enabled if you wish to use *Lumatouch*. Any keys set to *Lumatouch* in a mapping without Polyphonic Aftertouch enabled will revert back to being standard note on/off keys.

For detailed instructions on how to create and edit mappings using the *Lumatone Editor* software, see ***Chapter 3: Designing Mappings.***

The Many Personalities of Lumatone

Lumatone by its very nature allows you to create a musical instrument with virtually unlimited visual appearances, behaviours, and modes. It all depends on how you map its 280 keys, and on what kind of *sound-generating device* you choose to control with it. Infinitely customizable, Lumatone can shape-shift into thousands of different instruments with the push of a button simply by changing *mappings*.

A *mapping* defines the characteristics of each key on Lumatone. At the heart of Lumatone's power is that each key can be set to a different colour, allowing for visual patterns to be created that help to reinforce the intervals between notes. Each key can then be set to transmit any MIDI channel/note, and set to various expression modes (*ie. note on/off or continuous controller*). MIDI notes are assigned to particular pitches or parameters within a sound-generating device, allowing the performer to visually map the playing surface with colour in a way that makes playing even complex tunings, intervals, or scales intuitive and easy to understand.

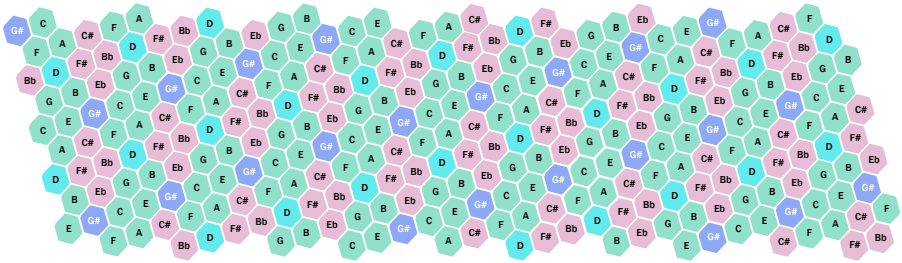
Because there are so many approaches to customizing Lumatone, this manual is meant to describe the basic features and functions of the instrument. We also encourage the exploration of existing mappings, some of which were preloaded on your Lumatone. Ultimately, we hope to inspire you to think outside of the box, create your own mappings, and maybe even share them with the wider community.

As the Lumatone community grows, you'll be able to find an ever-expanding library of mappings designed by respected composers, performers, and producers, along with descriptions of how best to use them, and the intent behind their creation.

While it wouldn't be possible to go through the myriad of mapping types within this manual, let's explore a few broad and common types of mappings that inspired the creation of Lumatone.

Isomorphic Keyboard Layouts

One of the most exciting ways to use Lumatone is to create and perform using Isomorphic mappings. While the word Isomorphic sounds like something straight out of Star Trek, it's actually all about simplicity. Isomorphic layouts have been around since the mid-1800's, and are an approach to laying out notes on a grid that in many ways makes music theory *less* complex.



The "Harmonic Table" isomorphic layout, popularized by the C-Thru Music Axis 64, adapted to a Lumatone.

An isomorphic layout is any grid of notes on which any given interval retains the same *shape* on the keyboard wherever it occurs. This phenomenon can occur within a key, across different keys, across octaves, and even across different tunings. Play a major chord shape with a root of C, and move the same shape to start on an E, and you'll have an E major shape. Though quite different, this is in a lot of ways far more intuitive and easy to understand than the traditional piano.

For more than a century now, many different styles of isomorphic layouts have been developed. Some of the more common and practical layouts are: *Bosanquet, Janko*, *Wicki-Hayden*, *Gerhard*, *Park*, *Wesley,* and the *Harmonic Table,* the latter of which was popularized by the C-Thru Music Axis 64 keyboard. While that layout focused on the playing of chords and harmonic elements, other isomorphic layouts prioritize scales, note repetition, or microtonality.

Isomorphic layouts enable a vastly different way of thinking about the intervals between notes, but the uniformity involved also creates a

very favourable environment for playing in non-standard and microtonal tunings, especially on keyboards with multiple rows of keys like Lumatone.

Universally, an isomorphic layout provides the benefit of *invariance*, meaning the intervals between notes never change from key to key. Isomorphic layouts are highly favourable for musical exploration, based more in intuition than overthinking. It's also suggested that isomorphic tunings are a powerful environment for teaching and learning music.

Whatever your reason for wanting to play or design isomorphic layouts, Lumatone is the perfect instrument upon which to do it. Many (if not most) Lumatone mappings we have seen so far are either exact copies of existing isomorphic layouts, or variations on them.

Microtonal/Polychromatic Music

Microtonal music has been around since music began. Put most simply, it is a catchall term for any tuning system with notes other than the usual 12 equal divisions of the octave, or 12-tone equal temperament (12-ET). While popular western music rallied around 12-ET and it became the the most common tuning system, countless other approaches to communicating and performing music have persisted. Various cultures around the world have embraced microtonality in music, but in reality, microtonality is present in all music in the form of subtle deviations in pitch on countless instruments, such as bending guitar strings, wavering voices, and winding violins.

Also commonly called Xenharmonic music, Microtonal music has many disciplines, and there are many schools of thought about which tunings are most ideal, and how intervals best relate to each other.

The idea of creating an instrument to best help performers visualize the *"notes between the notes"* was the driving force that inspired Lumatone's creators from day one. Lumatone is by far the most powerful instrument on the market for performing and composing microtonal music, largely because of it's full customizability. While isomorphic layouts are especially powerful for microtonal layouts, any non-isomorphic layout can be custom mapped to Lumatone as well, along with any corresponding tuning.

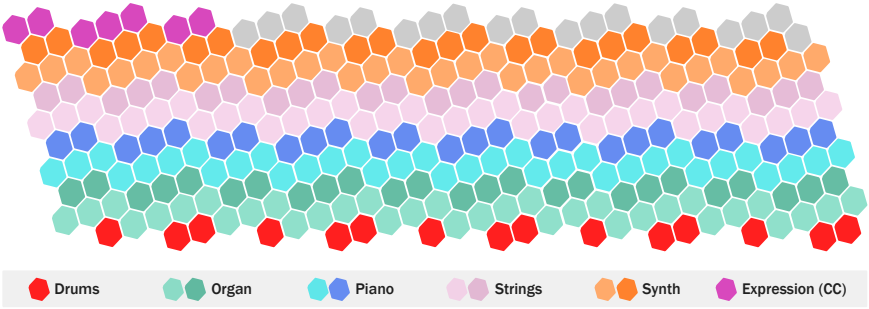
We've worked with dozens of microtonal musicians over the course of designing and producing Lumatone to ensure that the instrument provides the optimal number of keys in the optimal places. The excitement around

Lumatone for performance and composition throughout the microtonal community has been inspiring and exciting!

While this manual can't be an education in microtonal music, there are several excellent resources listed in ***Appendix A*** that we encourage Lumatone owners to review if they are interested in pursuing this exciting way of thinking about music. ***Appendix B*** also discusses microtonal concepts in more detail.

Multi-Instrumental Layouts, Splits, Zones

A truly powerful use for Lumatone is in performance scenarios where you wish to play a number of instruments at the same time. Splits denote vertical or horizontal segmentation of the key layout, whereas zones can be any shape, fully customizable within the Lumatone editor. Lumatone excels beyond other surfaces due to the sheer number of keys available. By creating custom areas of a mapping identified with colour, you can route different MIDI channels and notes to any number of virtual instruments, synthesizers, drum machines, sequencers, and more.

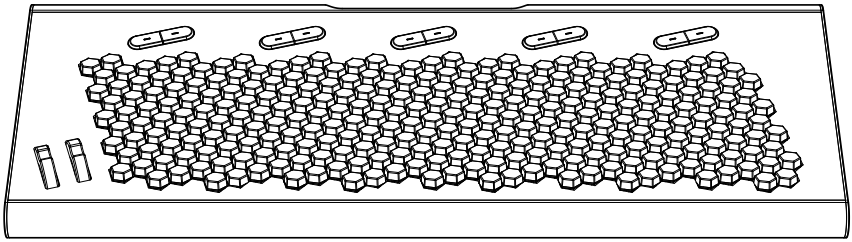


This packs any number of instruments in one large expressive playing surface, subdivided by MIDI channel and by using colour and position in just about any way you can dream up. Certain keys along the top are reserved as continuous controllers, allowing you to control any number of parameters on any instrument on the surface, easily switchable simply by changing their channel and note.

Multi-Instrumental layouts are not only a powerful solution live, but also as a centrepiece in the studio for producers, beatmakers, film scorers, and more.

Chapter 3: Getting Started

Lumatone is plug and play! The easiest, most familiar way to get started is to use the 12-et Isomorphic mapping preloaded to Preset 1. This mapping controls any 12-et tuned sound-generating device, such as a virtual instrument in your DAW, or an external sound module like a synthesizer or drum machine.



Getting started quickly with Lumatone is easy:

1. **Connect to Power and Pedals** – Connect your Lumatone to a power source using the included power supply. Do not use third party power adapters. If you wish to use a sustain or expression pedal, connect Lumatone to the 1/4" jacks on the rear panel.
2. **Connect a MIDI Device** – Using either USB Type-B or the MIDI 5-Pin DIN ports, connect your Lumatone to a computer, to a synthesizer, or to any other external sound-generating device.
3. **Power up the Lumatone** – Switch on the power rocker. The Lumatone will go through a colourful boot-up sequence. When the colours of all 280 keys stop moving, you're ready to go.
4. **Select a Preset Mapping** – Using one of the ten preset buttons, select the mapping you wish to use with Lumatone. We recommend staring with *Preset 1* to get a feel for the instrument, as it will interface naturally with all standard-tuning musical instruments in standard 12-et tuning.
5. **Enable Your Sound Generating Device** – On a computer, open your DAW and/or enable a virtual instrument. Or, if you're using an external sound module such as a synthesizer or a sampler, switch it on and ensure it is enabled and ready to make sounds.
6. **Play Your Lumatone** – Start exploring!

Preloaded Preset Mappings

Lumatone comes preloaded with ten unique mappings onboard, which vary from traditional 12-et Isomorphic layouts to a selection of microtonally tuned mappings. A Lumatone mapping can be stored as an .LTN file and easily saved on your computer or shared online. You can download more from our growing online library at:

- ***www.lumatone.io/community/mappings/***

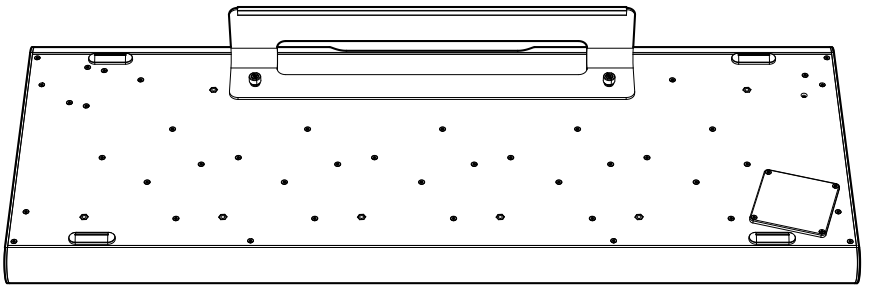
For a breakdown of the mappings that shipped preloaded to each of the ten onboard *preset buttons on Lumatone, refer to* ***Appendix A****. Note: from time to time, we'll change the presets we preload onto Lumatone, and this manual may no longer be accurate. Our online mapping library at the URL above will always contain the most recent collection of available presets – including many created by the wider community – along with more information about how to set them up.*

Positioning Your Lumatone

Lumatone was designed with maximum playability in mind. Every row of keys rises subtly to create a cascading effect, and the included kickstand puts Lumatone at what we consider to be an optimal 15 degrees. The stand works best when placed on a flat surface.

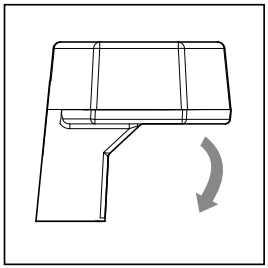
Some players have found they prefer the angle of Lumatone without the kickstand. There really is no wrong way to position Lumatone, but we suggest starting with the stand attached on a flat surface to begin with.

To attach the included kickstand, gently place your Lumatone face down on highly cushioned surface to avoid putting pressure on the pitch and mod wheels. Position the stand over the screw holes on the underside of the Lumatone, and screw the two attached screws in tightly.



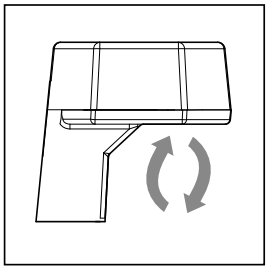
Chapter 4: Features and Functions

Later in this manual in ***Chapter 4***, we will discuss creating and editing mappings using the *Lumatone Editor* software. But first, we'd like to familiarize you with some of Lumatone's primary features, functionality, and terminology.



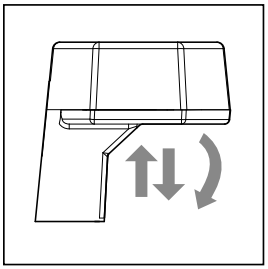
Note On/Off Keys

In their natural state, Lumatone's 280 keys behave in classic *note on/off* mode, like most other keyboard-driven MIDI controllers. Striking a key will send the related MIDI note to your connected sound module, along with the associated velocity information.



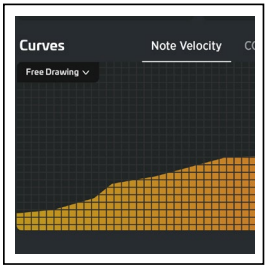
Continuous Controller Keys

A key set to continuous controller (CC), operates bidirectionally as a fader. Setting the MIDI note of a CC key to a corresponding parameter on your sound-generating device provides control of things like attack, filter cutoff, expression, volume, and many more.



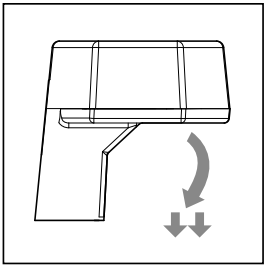
Lumatouch Keys

Lumatouch is an key mode that behaves like any other note on/off key, but upon engaging aftertouch, converts the key to a continuous controller, allowing the performer to control their chosen aftertouch parameter with the full range of key travel.



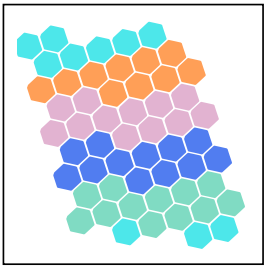
Velocity Sensitivity

Lumatone's keys are velocity sensitive, and while by default the velocity curves used to determine sensitivity are fairly standard, you have complete control over the curve in each mapping, editable via the curves editor in our *Lumatone Editor* software.



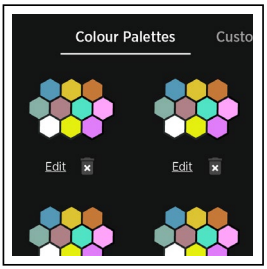
Polyphonic Aftertouch

While most modern keyboards are capable of aftertouch, Lumatone is able of *polyphonic aftertouch*, enabling each key to engage aftertouch independently from all other keys. This allows for a far more expressive instrument.



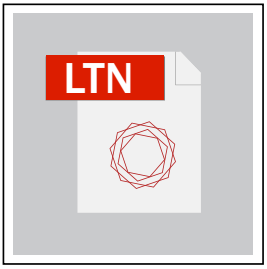
Sections

When we refer to a *section* of Lumatone in this manual, we are referring to one-of-five subsets of 56 keys. While sections don't limit how you can map Lumatone's keys, they are an important term we use to specify areas of the Lumatone when editing mappings.



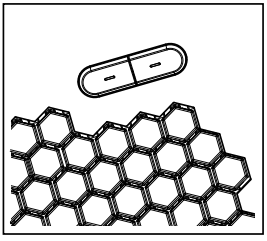
Key Colour

Lumatone's power is its ability to display colour *(any RGB hex value)* on each of its 280 keys. Colour combines with Lumatone's hexagonal grid to create recognizable patterns that guide you in performance. You define key colour using the *Lumatone Editor* software.



Mappings

Mappings are made up of midi notes, key colours, and mapping-specific settings like velocity curves and aftertouch that make up a layout on Lumatone. They can be created and edited using the *Lumatone Editor* software, and mappings can be saved or shared as .LTN files.



Preset Buttons

Ten preset buttons at the top of Lumatone offer fast access to different mappings. To save a mapping you have sent to your Lumatone, simply hold down the preset button you wish to write it to, just like a car stereo radio preset.

Chapter 5: Lumatone Editor Software

While the presets that come with your Lumatone are a great way to explore your instrument, real magic can happen when you start creating and editing your own mappings. There are thousands of potential instruments waiting to be unlocked inside Lumatone, simply by customizing the colours and MIDI assignments of its keys.

There are countless resources online for learning about various approaches to isomorphic layout design, as well as many schools of thought around non-isomorphic approaches to hexagonal grid keyboards. We encourage you to read as much as you can on the subject to inspire you in building Lumatone mappings of your own.

To create mappings you can then save to Lumatone and play, you use the companion *Lumatone Editor* software. In the pages that follow, we'll show you how to use the software to create, edit, load, and save mappings.

Installing the *Lumatone Editor* Software

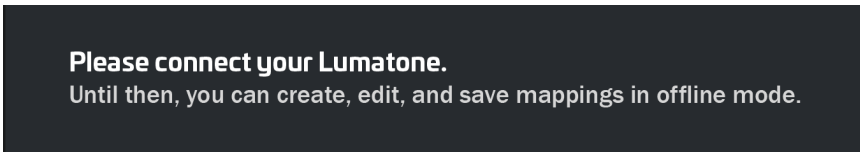
Lumatone Editor is compatible with both Mac and PC computers. To download and install the latest version of *Lumatone Editor,* head to the following URL, and follow the on-screen instructions to install:

- ***www.lumatone.io/support/downloads/lumatone-editor***

Once downloaded and installed, start the application to begin.

Offline Mode

Lumatone Editor allows for the creation and editing of mappings without a Lumatone present, and defaults to *offline mode* if a Lumatone is not detected. Mappings can be loaded from a file, and saved to a file, but you won't be able to send mappings to Lumatone until you connect it.



Working in *Live Mode*

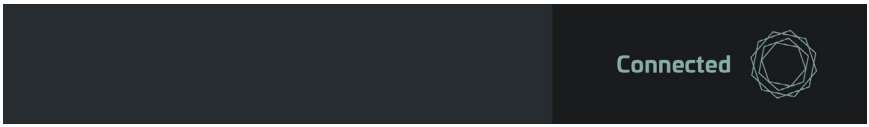
Lumatone Editor connects to your Lumatone via MIDI connection or MIDI-over-USB. Once connected, you can:

- **Import** the current Lumatone preset for editing
- **Display** the mapping you're editing in real time on Lumatone
- **Save** your current mapping to a preset button on Lumatone

Connecting Your Lumatone

Live Mode is *Lumatone Editor*'s default mode whenever your Lumatone is connected. After connecting your computer to Lumatone via USB or both MIDI IN and OUT connectors, open Lumatone Editor, and the software will automatically detect your Lumatone. Both MIDI IN and OUT must be connected to your computer.

Lumatone Editor will confirm it is connected by displaying a green *Connected* message at the top of the application:



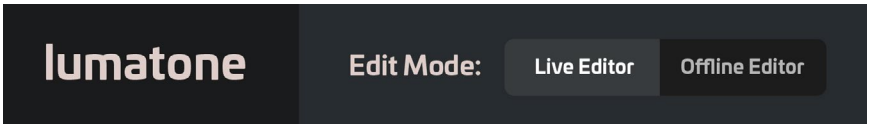
If the green *Connected* message does not appear, ensure that both IN and OUT cables are connected to the correct 5-pin MIDI ports, or that your USB cable is properly connected. You should also try restarting your computer and the application after connecting, but this should not be necessary, as Lumatone is plug and play.

Switching Between *Live* and *Offline* Mode

Whenever your Lumatone is connected, *Lumatone Editor* will default to *Live Mode.* In most cases, this is the most desirable way to work. You can see the result of your edits on your instrument in real time, test your mapping as you create, and save your mapping to a preset button on Lumatone when you're ready.

But there may be situations where you wish to work in *offline mode* even

when your Lumatone is connected. For example, you may wish to go offline to save and load various mappings from files on your computer, without altering your Lumatone's current state. To toggle between *live* and *offline* modes, simply use the switch at the top of the application:



Note: *When switching back to Live mode from Offline mode, Lumatone Editor will ask if you'd like to replace what you were working on with the current mapping displayed on Lumatone, or if you'd like to keep what you were working on in Offline mode and send that to Lumatone instead.*

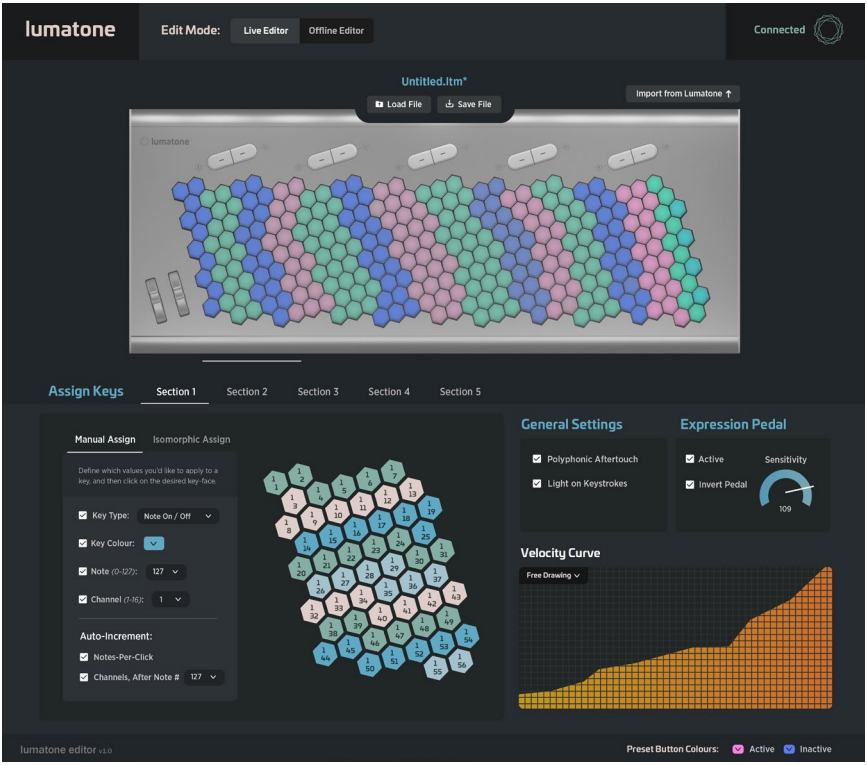
Mapping Files vs. Preset Buttons

You can create unlimited mappings for Lumatone, and save them as .LTN files on your computer, and share them with others. Saved with each mapping is the colour, MIDI channel and MIDI note of each key, along with the following mapping-specific preferences:

- Velocity Curves, CC Curves, Aftertouch Curves
- Polyphonic Aftertouch On/Off
- Expression pedal settings
- *Light on Keystrokes* Feature On/Off

While you can save any number of mappings to your computer in the form of .LTN files, you can also save up to 10 mappings to your Lumatone to the *preset buttons.* After loading and/or editing a mapping with *Lumatone Editor* and it is displaying on your Lumatone in *Live Mode,* saving a mapping to a preset button is as easy as holding your chosen preset button down for five seconds until it's LED blinks. Your preset mapping is now saved to a Lumatone preset button for fast recall without a computer.

Chapter 6: Creating Mappings



The Lumatone Editor Software

Lumatone Editor is a simple but powerful tool that allows you to quickly assign a key colour, MIDI channel, and MIDI note to each of Lumatone's 280 keys, customize settings like velocity curves and polyphonic aftertouch, and save it all to a shareable *.LTN* mapping file.

It also connects directly with your Lumatone as described in the previous chapter, enabling you to edit the surface of your Lumatone in real time, and save mappings to its 10 preset buttons.

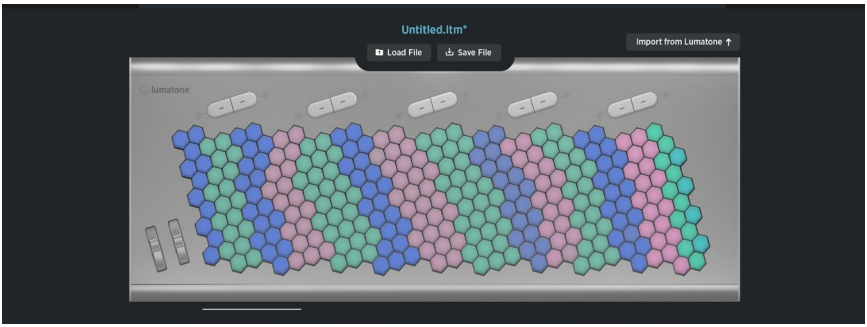
Mappings: MIDI Notes, Not Musical Notes!

Lumatone is built to interface with any sound-generating device that receives MIDI input. Because of that, Lumatone mappings are meant to remain "pitch agnostic." While you probably have specific pitches in mind when designing a mapping, a Lumatone mapping purposefully only

assigns *MIDI note numbers (0-127)* to keys. Mappings in traditional 12-ET tuning will work automatically, but microtonal mappings will then need to be interpreted properly by your sound generating device in order to play the right pitch. An understanding of how your sound-generating device interprets both default and customized MIDI notation is vital to the process of using microtonal mappings. Since every sound-generating device is different, we encourage you to learn using the many resources available online. Over time, however, we will be posting articles on our website ongoing highlighting different tips and techniques for integrating Lumatone with various virtual instruments, DAWs, and external sound modules. We discuss a few of these options in ***Appendix B***.

Getting Around *Lumatone Editor*

Let's briefly walk through the different components of *Lumatone Editor.* At the very top of the interface, you'll see a master visualization of your mapping on a Lumatone:



By default, *Lumatone Editor* will present the current mapping on your Lumatone when you open the application. The filename of the current mapping appears above it all. In the case of the above example, an asterisk denotes that the mapping has yet to be saved.

To save the current mapping, click *SAVE FILE* and select a location on your computer.

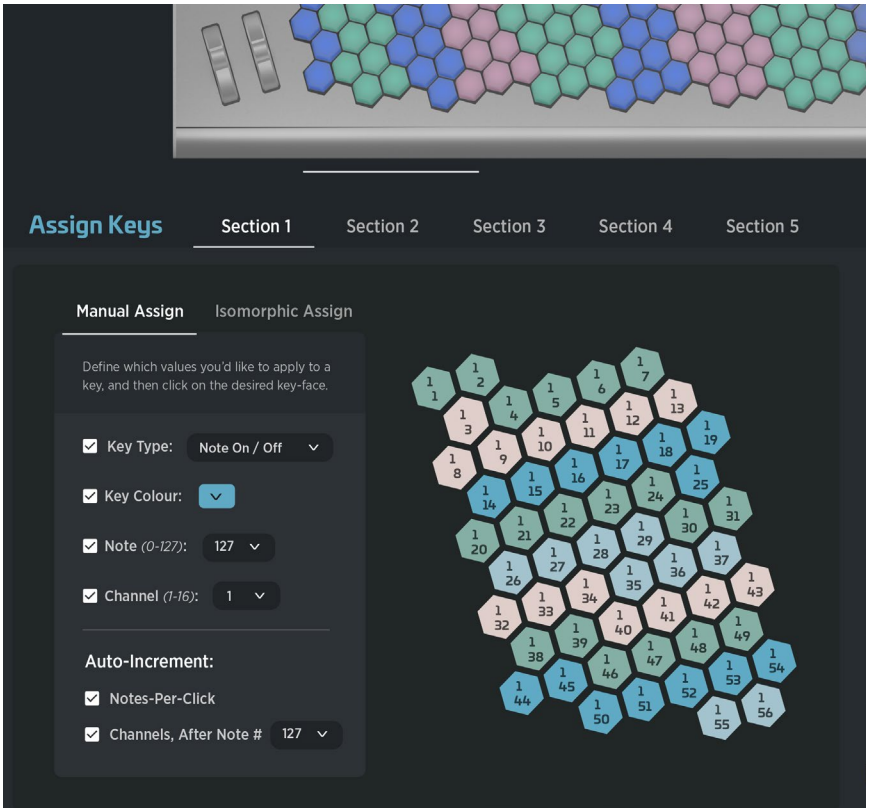
To load a mapping from a file, click *LOAD FILE* and browse your computer for the mapping you'd like to load. This file will replace whatever you're working on, and in *Live Mode*, will also display on your Lumatone in place of whatever was there previously.

To load a mapping from your Lumatone into *Lumatone Editor*, click the

IMPORT FROM LUMATONE button. You will be asked if you'd like to save your existing mapping, after which the mapping visible on your Lumatone will be loaded into *Lumatone Editor* for editing or saving. This is most useful if you'd like to load a preset that is already saved to your Lumatone. You can switch between preset buttons on your Lumatone to find a mapping you'd like to load before clicking the *IMPORT FROM LUMATONE* button.

Assign Keys

The *Assign Keys* section is the heart of it all, this is where you'll assign colours and MIDI note numbers to your Lumatone's keys. To manage the sheer number of keys on Lumatone, we've divided Lumatone into five *sections* of 56 keys each. While you can visualize the entire mapping using the Lumatone image at the top, or on your physical Lumatone, the *Assign Keys* section lets you focus in on one 56-key section at a time to make your key assignments.



It's in this section of *Lumatone Editor* that you'll assign colours and MIDI channels/notes to your keys. Let's walk through this process now.

Choosing Which Section To Work On

To select which of the five sections of Lumatone you'd like to edit, you can either:

- Click a section on the Lumatone image at the top of the app
- Select a section from the menu at the top of *Assign Keys*

In both cases, your current section will be denoted by highlighting the active section in white in the menu, as well as a white line underneath the image of Lumatone denoting the active section.

How To Assign Values to Keys

The most important thing to remember when defining key values is that you must select which settings you'd like to edit first, along with a chosen value. Then, whenever you click a key in the *Assign Keys* section, those values are immediately applied to that key.

This allows you to use Auto-Increment functions to rapidly apply values to multiple keys in sequence.

You can also decide *which* values you'd like to assign when clicking keys. If the checkbox next to a value (ie. Key type or Key Colour) is checked, that value will be assigned when clicking a key. If you uncheck a box, that value will not be applied.

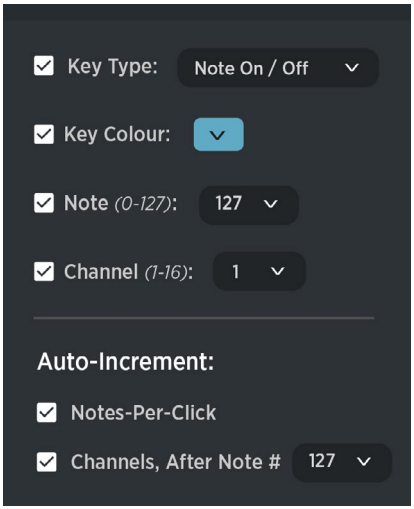
For example, you may want to define the patterns of colour on your entire Lumatone, along with the key's type, before assigning MIDI channels or notes. To accomplish this, You would check only the "Key Colour" and "Key Type" attributes, select a colour and type, and then click all the keys you wish to give those values. Then, you can do another pass focusing on assigning the right MIDI notes to your keys.

Each key's MIDI Channel (1-16) and Note # (0-127) will appear as text on each key, with the channel on top, and the note number underneath it.

Now, let's review each attribute you can assign to a key, and walk through how you can use *auto-increment* to assign MIDI notes quickly and easily.

The Attributes of a Key

Each key has four attributes you can define: key type, key colour, MIDI note, and MIDI channel.



- **Key Type** allows you to specify what the key's behaviour is. You have three key types to choose from: *Note On/Off, Continuous Controller,* and *Lumatouch*.
- **Key Colour** is the LED colour you'd like the key to be, selected from a colour picker or user defined colour palettes.
- **Note #** is a value *(0 to 127)* that represents the MIDI note number you'd like the key to send.
- **Channel** is a value *(1 to 16)* that represents the MIDI channel you'd like the key to send.

Auto-Incrementing Channels and Notes

When assigning MIDI channels and notes to Lumatone's keys, you can achieve quick results by using the auto-increment tools, pictured above.

- **Notes-Per-Click**: Check this option if you'd like to increment the MIDI note number by one with every key you click. For example, if your note value is set to *1*, this value will be assigned to the first key you click, *2* will be assigned to the next key, *3* the next, and so on.
- **Channels:** Check this option if you'd like to auto-increment to the next channel after a certain note has been assigned. For example, if you're assigning to MIDI channel 1, but you'd like to switch to channel 2 every 56 keys, input *"56"* in the *After Note #* field, and your the MIDI channel you assign will increment by one, every 56 keys. *(Tip: Incrementing the channel based on the size of your tuning, as opposed to using a channel's full 128 note range, might make tuning and mapping coordination easier for some tunings.)*

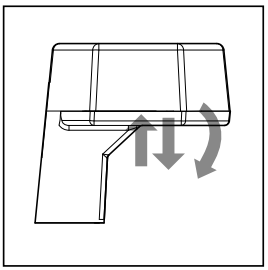
Key Types

When assigning attributes to keys, each key can be independently set to

to behave in one of three ways. Let's review the three different key types that can be assigned to keys on Lumatone.

1. **Note On/Off** – Keys set to this type function as a regular keyboard key. Pressing down on a key sends a "note on" signal over MIDI with the chosen channel and note information, along with velocity sensitivity. Velocity curves can be defined in software (we'll discuss this a bit later) and keys have a familiar responsive action.
2. **Continuous Controller** – Keys set to act as continuous controllers will continuously read the position of the key. This allows the key to act like a bidirectional fader, sending a value of 1 at it's topmost position, and sending a value of 127 when the key is fully depressed. By "fading" this key up and down, you're able to control any number of MIDI CC parameters available in many virtual instruments and sound modules such as volume, filter cutoff, expression, and countless others. With many sound-generating devices you can also set a CC to control a custom parameter via your chosen MIDI channel and note.
3. ***Lumatouch*** – *Lumatouch* is a mode developed specifically for Lumatone. Any key can be set to act as a Lumatouch key. The key behaves like any other note on/off key, but to engage Lumatouch, you press to the bottom of the aftertouch region. This converts the key to a continuous controller, allowing the performer to control their chosen aftertouch parameter across the full range of key travel. Polyphonic aftertouch must be enabled in your mapping for these keys to work properly, and if it isn't, keys set to Lumatouch will revert to being Note On/Off keys.

A Word About *Lumatouch*



Lumatouch was developed as a new way to express yourself with all of the power of a Lumatone key at once. We think this mode will be especially useful for the performance of expressive pads and drones, giving you more of a range of motion to modulate your sounds when compared with simply using traditional polyphonic aftertouch. However, it should only be used for certain kinds of playing, and will make many other performance styles difficult. We'd love feedback on the current implementation and will continue to tweak Lumatouch via firmware updates, and add further functionality based on your input!

Key Colour

You can apply a unique colour to every key on Lumatone, but in most cases you'll find that picking a limited number of colours and using them to convey *meaning* is what makes Lumatone powerful. Key colour can be used to visualize any relationship between notes that you can dream up, but the most common use for colour is to visually define patterns in notation and intervals.

Selecting a Key Colour

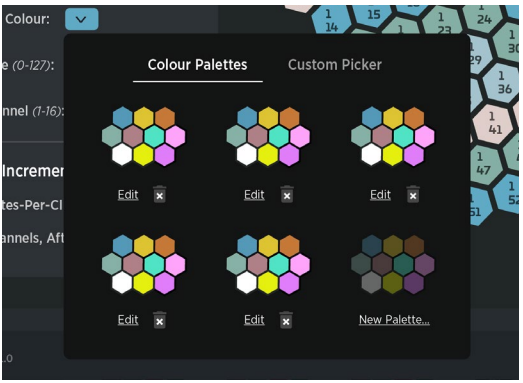
You can select a colour by clicking the square swatch next to "Key Colour," which will open the colour picker.

You can pick any colour using the *Custom Colour* tab using a standard colour picker or by entering an RGB hex code. But we recommend building Lumatone *Colour Palettes* in order to keep your colours uniform across the entire keyboard, and make saving and recalling colours easy.

Using Colour Palettes

Lumatone Editor allows for the creation of colour palettes containing up to ten colours each, that you can easily refer back to when assigning colour to your keys.

The *Colour Palettes* tab appears whenever you pull down a colour swatch in the editor. We've included five designer colour palettes that already look great on Lumatone, but you're also able to edit them to your liking, or add your own palettes from scratch.

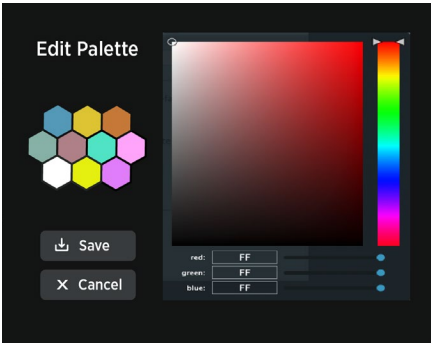


To select a colour from an existing colour palette when picking colours, simply click on a hexagon of colour.

To edit an existing colour palette, click the *Edit* link under the palette.

To create a new colour palette, click the *New Palette* button.

Creating and Editing Colour Palettes



Editing an existing palette or creating a new one can be done using the *Edit Palette* window.

When you click to create or edit a colour palette, this window appears. Palettes are made up of ten hexagonal swatches of colour. To edit each colour in your palette, simply click each hexagon, adjust each colour to your liking, and when you are happy with your palette, click *Save.* Your new or edited colour palette will now appear every time you're looking for a colour.

Selecting a Key Colour

You can select a colour by clicking the square swatch next to "Key Colour," which will open the colour picker.

You can pick any colour using the *Custom Colour* tab using a standard colour picker or by entering an RGB hex code. But we recommend building Lumatone *Colour Palettes* in order to keep your colours uniform across the entire keyboard, and make saving and recalling colours easy.

How to Choose the Best Colours

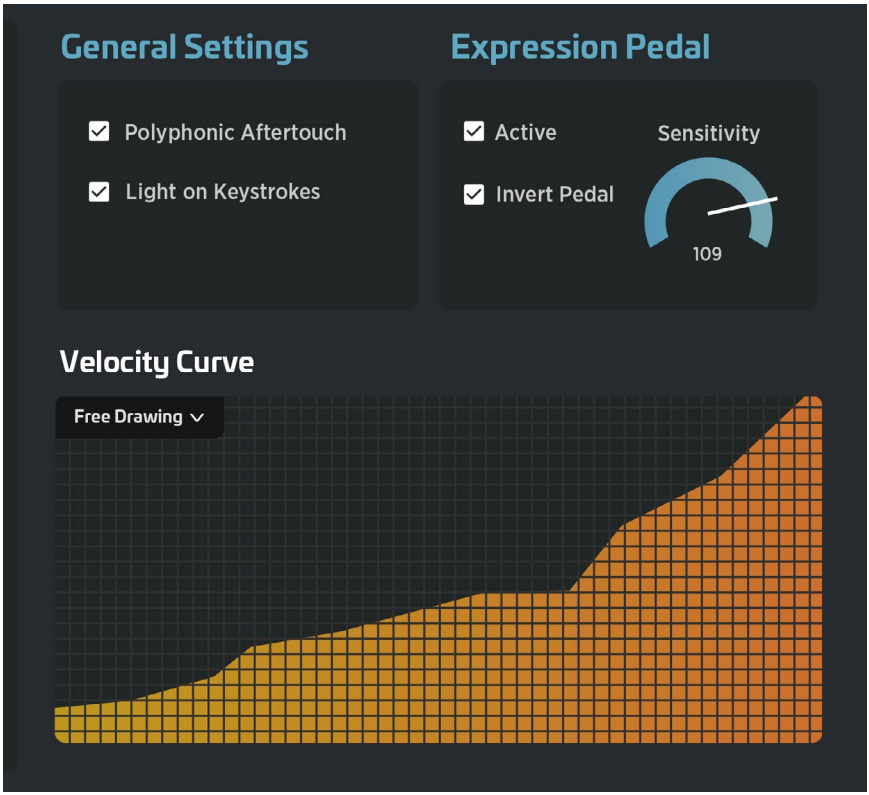
Although you can assign any colour you'd like to Lumatone's keys, it's best to remember that the physical keys of the instrument are a special LED key designed to use colour in combination with light.

It's best to experiment with programming colours into your Lumatone to get the hang of what this means, but in basic terms, this means that **brighter colours will translate better than darker colours**. Colours with too little brightness/lightness will appear very dim and at times seem almost completely unlit, and the colour black will display with no light at all, rather than appearing "black."

We've included some great colour palettes to get you started that look fantastic on Lumatone, but when choosing your own, remember to keep it bright!

Mapping-Specific Settings

A mapping contains information about key types, colours, notes, and channels. But it also lets you specify certain settings about how you'd like your Lumatone to behave when a certain mapping is in use. In *Lumatone Editor,* while your key assignments are made on the left side of the application, you can set mapping-specific settings on the right side.



Polyphonic Aftertouch – This checkbox enables polyphonic aftertouch for your mapping. When selected, engaging aftertouch on keys will send polyphonic key pressure data over MIDI. When not selected, no aftertouch data will be sent.

Light on Keystrokes – A visual effect. When selected, every key on Lumatone will light to a bright white when struck.

Expression Pedal – In this section, you can enable/disable the expression pedal input using the *active* checkbox, invert your expression pedal's polarity by checking *Invert Pedal,* and use the *Sensitivity* control to

scale the data the expression pedal sends over its range of motion.

Velocity Curve

The *Velocity Curve* section of the mapping-specific settings panel allows you to edit the velocity response of Lumatone's keys by mapping it on a graph.

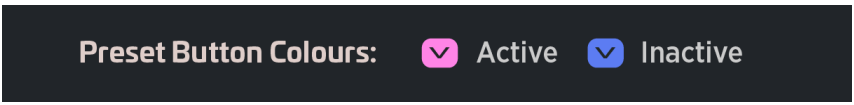
The graph maps key pressure on the X-axis against the transmitted velocity value on the Y-axis. In other words, the X-Axis represents how hard you strike a key, while the Y-Axis represents the corresponding velocity value that will be sent over MIDI.

You can draw curves using one of three drawing methods by pulling down the small menu in the top left of the graph. *Free Drawing* allows you to simply drag your mouse across the graph and draw the curve. *Linear* allows you to set and drag linear points along the graph. And *Quadratic* allows you to set and drag points that result in a smoothed, bezier graph curve.

Preset Button LED Colour

While most settings are mapping-specific, you can only adjust the LED colour of the preset buttons at the top of your Lumatone globally (ie. these will not change from mapping to mapping.)

To edit these colours, you can select them by pulling down the colour swatches at the bottom of *Lumatone Editor.*



Chapter 7: Loading/Saving Mappings

Once you have created or edited a mapping, you'll want to save it! A mapping can be saved in .LTN format to your computer using the *Save Mapping* button at the top of *Lumatone Editor.*

Once saved, the filename you've chosen will appear at the top of the mapping. An asterisk next to the filename indicates if any changes are unsaved.

By the same token, you load a mapping from a file in the same way. Click the *Load File* button at the top of *Lumatone Editor*, browse for your .LTN file, and select it. If you have unsaved work, the application will ask you if you'd like to save it before loading the new mapping in its place.

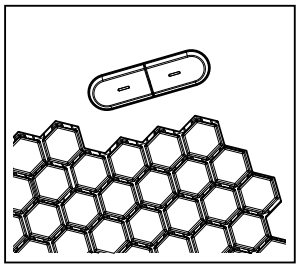
Import a Mapping From Your Lumatone

While we recommend saving all of your mappings to files, a need may arise to import a mapping from your Lumatone. Once your Lumatone is connected to *Lumatone Editor*, hit the preset button on your Lumatone to enable the mapping you'd like to load into *Lumatone Editor.*

Once it is active on your Lumatone, click the *Import from Lumatone* Button at the top right of *Lumatone Editor.*

If your currently loaded mapping has unsaved changes, you will be asked to save your work, and then the Lumatone's active mapping will be loaded into *Lumatone Editor*. From here you can edit it in *Live Mode*, or save it to a file.

Saving a Mapping to Your Lumatone



You can save up to 10 mappings to your Lumatone as presets that can be recalled without connecting a computer.

Once connected to *Lumatone Editor,* make sure you are editing in *Live Mode.* Your current mapping will display on Lumatone. When your mapping is ready to save to Lumatone, simply hold down the preset button location you'd like to save the mapping to for 5 seconds. The preset button's LED will blink briefly to indicate your save is complete. **Any previous mapping will be overwritten with your new mapping**, so be sure of your decision before doing this!

Chapter 8: Troubleshooting / Support

Lumatone is designed to operate smoothly and simply. It has undergone extensive testing, and we expect your instrument to bring you years and years of joy without interruption.

In very rare cases, your Lumatone may not behave as expected. In 95% of all cases, this can be resolved by simply turning Lumatone off, waiting at least five seconds, and turning it back on.

How to Calibrate Your Keys

Rarely – due to issues in transport or extreme temperature or force – Lumatone's keys may become uncalibrated. If you're experiencing any issues related to uneven response with keys, keys that are unresponsive, or issues with aftertouch responsiveness, the first solution to try is to calibrate the keys on your Lumatone.

To calibrate your key response, start *Lumatone Editor* and connect your Lumatone using the usual process. Once connected, click the *Calibrate Keys* button in the bottom right of the application. Follow the video instructions provided in the window that appears, and move through the process.

After key calibration is complete, we also recommend calibrating aftertouch response using the same window, to ensure aftertouch is responding to your freshly calibrated keys.

Contacting Support

We are building an ever-growing collection of support materials online at ***www.lumatone.io/support*.**

If your issue persists after reading the above, please contact our support team by emailing ***support@lumatone.io*.** This will open a support ticket, and we will respond within one business day to help you further.

Appendix A: Resources

Isomorphic keyboards and microtonality are an exciting new world enabled by Lumatone, and there are a variety of excellent resources to explore online. We've collected some of our favourite links and resources below. This list will likely change as time goes on, so we recommend doing further research online.

Websites

WWW.LUMATONE.IO

Naturally, we recommend our own website! We're building a growing support resource as well as a community section for sharing mappings, tips, and experiences.

WWW.ALTKEYBOARDS.COM

A website devoted to the exploration of the variety of alternative keyboards developed throughout history, and the various layouts and mappings that have become popular over the centuries.

WWW.MUSICNOTATION.ORG/WIKI

The Wiki at *musicnotation.org* contains several excellent articles exploring isomorphism and various layouts and tuning systems.

WWW.TONALSOFT.COM/ENC/ENCYCLOPEDIA.ASPX

An large collection of articles on microtonal music theory.

HPI.ZENTRAL.ZONE/UTE

Home of the Universal Tuning Editor (UTE) – software that allows users to map any pitch to any key of any arbitrary geometry of any MIDI keyboard instrument imaginable, including Lumatone.

ANAPHORIA.COM/WILSON.HTML

The authorized archives of Erv Wilson's microtonal and just intonation theories.

WWW.SIEMENTERPSTRA.COM
The website of the original designer of what became Lumatone. Many great articles and ideas collected here from an amazing musical mind!

WWW.TALLKITE.COM
Kite Giedraitis's website, a home for all of his writings on microtonality in various instruments, including instruments and software he has created.

WWW.LUMMA.ORG/TUNING/ERLICH/
Posted on original Lumatone backer Carl Lumma's website, these papers from Paul Erlich dive into some of the more complex theory around microtonality and tuning systems.

Microtonal Facebook Groups

There are many Facebook groups you can join that bring together microtonal composers and performers sharing ideas, theories, content, questions and answers on the topic of microtonality.

WWW.FACEBOOK.COM/GROUPS/XENHARMONIC2

WWW.FACEBOOK.COM/GROUPS/497105067092502

WWW.FACEBOOK.COM/GROUPS/239947772713025

WWW.FACEBOOK.COM/GROUPS/12468854691

WWW.FACEBOOK.COM/GROUPS/421996207912134

WWW.FACEBOOK.COM/GROUPS/SMALL.XEN.ETS

Books

We're always on the look out for interesting books on isomorphic or generalized keyboards and microtonality. Here's a few we've found in our travels. Please write us with any others you think are worthy of inclusion and we will add to the next revision of this manual!

"MICROTONALITY IN 55 KEYS"

CAM TAYLOR

https://cametaylor.wixsite.com/home/post/microtonality-in-55-keys-the-first-book

"MICROTONALITY AND THE TUNING SYSTEMS OF ERV WILSON"

TERUMI NARUSHIMA

https://www.amazon.ca/dp/0367872404/ref=cm_sw_em_r_mt_dp_YGR2FbCZ833V9

"TEMPERAMENT; OR, THE DIVISION OF THE OCTAVE"

R. H. M. BOSANQUET

http://www.anaphoria.com/Bosanquet-TemperamentOrtheDivisionoftheOctave.pdf

Appendix B: Microtonal Compatibility

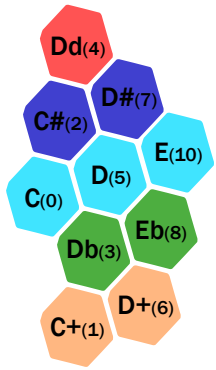
Creating and playing microtonal mappings is one of the most powerful features on Lumatone. As you dive deeper into the possibiliites now open to you in playing microtonally, you'll need to learn more about the myriad of options available to you in controlling sound generating devices with microtonal mappings.

There are too many approaches to this to list in this manual. We encourage further research online as well as experimentation of your own, but we thought it would be helpful to describe a few of these approaches in this appendix.

Sequential Mappings

One of the most intuitive ways to create microtonal mappings is to assign MIDI notes to keys sequentially. This method works great when using a sound generating device that allows you to set the number of notes per octave, which is becoming quite common. Native Instruments' Kontakt, Omnisphere, and several hardware synthesizers such as the Sequential Prophet 12 allow for this. If mapped correctly, you simply set your destination instrument to play the correct number of notes per octave, and with many tunings, everything is taken care of. Larger tunings may need to use multiple channels in order to achieve this.

Take for example the selection of notes to the right, sampled from a 31-ET Bosanquet mapping. The number in brackets is the MIDI note assigned to each key. Notice that it starts at MIDI note 0 and sequentially increases from the lowest note to the highest note in the tuning. If your destination device (Kontakt, Synthesizer, virtual instrument, etc) is set to play 31 notes per octave, every note will map out perfectly automatically.



USED IN OUR PRESETS: *Presets 4 through 9 included by default on your Lumatone all use sequential mapping by default. Selecting a sound modules or virtual instruments like* ***Kontakt*** *that allow for the defining of "notes-per-octave" can be quickly to set up to work with these mappings without any additional modifications.*

Using UTE (Universal Tuning Editor)

The Universal Tuning Editor software (UTE) is third party software developed by sofware company ***H-Pi*** that enables you to map any pitch to any key of the Lumatone. H-Pi has developed direct integration with Lumatone and makes it very easy to take keys in a mapping you've built with *Lumatone Editor* and assign the desired pitch to that key. The resulting XML file is used in your DAW or virtual instrument in order to act as a *translator* of sorts between Lumatone and the sound generating device you are looking to control. **More info:** ▸ ***hpi.zentral.zone/ute***

> ***USED IN OUR PRESETS:*** *Preset 10 included by default on your Lumatone – Dolores Catherino's polychromatic 56-ET mapping – serves as an excellent example of how to use UTE. In addition to the mapping, you'll need the UTE file associated with the mapping, which can be found in our online mapping community:*
> ▸ ***www.lumatone.io/community/mappings/***

Tubbutec µTune for Hardware Synths

Tubbutec µTune is an excellent hardware device with more features than we can list here, but most exciting is that you can convert MIDI notes into CV/Gate signals. The powerful scale editor lets you easily create and modify scales. For each note of a scale you can edit the pitch in cents, fractions or select from a list of common intervals. Scales not based on the octave are possible and up to 128 notes per scale are supported. This allows you to control any hardware synthesizer or module that accepts CV/Gate, transforming Lumatone into the ultimate microtonal controller for hardware synths! **More info:** ▸ ***tubbutec.de/µtune/***

Midi 2.0 and Other Approaches

There are more approaches you can research online, such as using *Scala / Tun / Script* files, or assigning preassigned pitch-bend values to MIDI notes. Midi 2.0 is also bringing many new opportunities for directly assigning microtonal pitches, and we plan to offer MIDI 2.0 for Lumatone the moment we're able.

Appendix C: Default Presets

Your Lumatone is designed to be customized. Virtually any layout and mapping you can dream up – for any purpose – can be built and switched between in the heat of a performance, composition, or production.

But we thought it would be helpful to preload the 10 hardware preset buttons on every Lumatone with a variety of mappings to demonstrate a cross-section of those possibilities.

On the pages that follow, we'll describe those ten presets. Remember that as time goes on we may change the presets that come default, and that the ones that shipped with your Lumatone may not match what follows on these pages. Every preset we've ever preloaded on a Lumatone – as well as many more contribued by the community – can be found online at our always growing online mapping community:

- ***www.lumatone.io/community/mappings/***

We'd like to send special thanks to **Cam Taylor** not only for contributing several of these mappings, but for his assistance in crafting the excellent descriptions that accompany each one. Cam's book *"Microtonality in 55 keys"* is a must read. We'd also like to thank **Mike Battaglia**, **Dolores Catherino**, and **Benton Roark** for their contributions to these mappings, and for their advice and wisdom throughout the creation of this manual. All four are brilliant members of the Lumatone community whose work is worth checking out!

Traditional Tunings (12-ET)

When we refer to "traditional" tuning, we are referring the common tuning of 12-ET (12 Notes Per Octave). The first few presets are all 12-ET, and this means that you don't need any special third party translator or scripting in order to control sound generating devices with Lumatone.

These examples represent only a few of a multitude of layout approaches for performing 12-ET music. More will be available online at our mapping community, and we encourage you to create your own. 12-ET mappings are easy to create, since default MIDI notes are already defined in the MIDI specification and if used, these mappings "just work."

Microtonal Tunings

There are literally thousands of potential mappings for each of the dozens upon dozens of popular microtonal tunings in use around the world. The microtonal community is vast and there are many differing opinions about which tunings are best for which application, and what kind of layout is optimal for use on instruments like Lumatone. This diversity is what makes the microtonal community so creatively vibrant!

Please remember that the microtonal tunings we've included are just a tiny sampling of the many approaches that are out there. We ask that those of you who are well-versed in microtonality to create your own mappings and share them with our mapping commnunity online. Your contributions will help to spread awareness and knowledge and in turn will lead to more amazing musical work.

Microtonal Nomenclature

For those of you with an interest in learning about microtonality, we thought it might be helpful for you to read about the nomenclature used in various microtonal mappings before viewing the presets that follow in this appendix. There are many schools of thought about how to spell the accidentals in microtonal music. We've used multiple approaches in the pages that follow.

Certain tunings can be notated only using standard accidentals (#, b) in a single chain of fifths (12, 17, 19-ET). Some have an extended chain of fifths that goes into double or even triple accidentals (31, 41-ET), however this gets quite difficult to read and relate to pitch-class, as, for example, in tunings with fifths wider than 700c, ascending pitch order around D goes Fbbb-Ebb-D-Cx-B#x.

To help with readability and relating to pitch class, half-sharps (+) and half-flats (d) can be very helpful in any tuning which splits the sharp/flat into two equal or nearly-equal parts, e.g. 17, 24, 31, 41-ET. These are also tunings which can be generated by a chain of neutral thirds. Thus we can also create a neutral triad on D, D-F+-A.

However we still have the same problem in larger systems, which can be remedied by another symbol pair, comma-up, or simply “up” (/) and comma-down, or “down” (\), for small alterations of a “comma”, which for most listeners stay within the same pitch class, but change the intonation, so, e.g. different flavours of minor and major can be compared, e.g. filling in the third between D-A we might have \F, F, /F, \F#, F# or /F#.

To demonstrate different approaches to spelling pitches with different sets of accidentals, here are three ways to describe the same 25 pitches between the perfect fifth from C-G in 41-et:

Standard fifth-chain accidentals:
C B# Ebbb Db C# Bx Ebb D Cx Fbb Eb D# Gbbb Fb E Dx Gbb F E# Abbb Gb F# Ex Abb G

Half-accidentals:
C B# C+ Db C# Dd Ebb D Cx Fbb Eb D# Ed Fb E Dx Gbb F E# F+ Gb F# Gd Abb G

Comma accidentals:
C /C C+ Db /Db Dd \D D /D \Eb Eb /Eb Ed \E E /E \F F /F F+ \F# F# Gd \G G

While this can all seem complicated if you’re just starting out with microtonality, stick with it and it really will become second nature. And if you’d rather try something more colour-driven, we encourage you to check out **preset 10** – Dolores Catherino’s *polychromatic* layout – which enables you to use *“pitch colour”* to understand the intervals between notes instead of thinking of it in terms of accidentals.

Thank-you, and Enjoy!

This manual is only the beginning, and is a first revision. Our online resources will also be updated constantly. We’d love your feedback on what we’ve included, as well as any contributions you’d be willing to make to the community. Contribute online at our website or write us via email!

- ***www.lumatone.io/community/***
- ***support@lumatone.io***

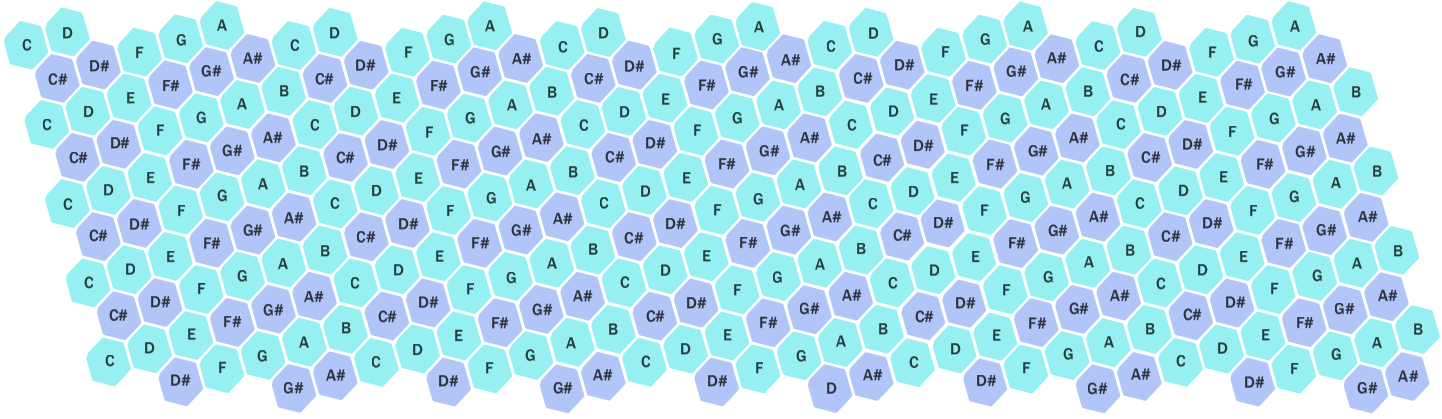
Microtonal Nomenclature Table

	Name	Function	Rules, examples
#	sharp	Raises pitch by a chromatic semitone	F# always a perfect fifth above B
b	flat	Lowers pitch by a chromatic semitone	Bb always a perfect fifth below F
x	double-sharp	Raises pitch by two chromatic semitones	Fx always a perfect fifth above B#
bb	double-flat	Lowers pitch by two chromatic semitones	Bbb always a perfect fifth below Fb
+	half-sharp	Raises pitch by half a chromatic semitone	F+ always a neutral third above D and a perfect fifth above Bd
d	half-flat	Lowers pitch by half a chromatic semitone	Bd always a neutral third below D and a perfect fifth below F+
#+	sesqui-sharp	Raises pitch by one and a half chromatic semitones	F#+ always a neutral third above D# and a perfect fifth above B+
db	sesqui-flat	Lowers pitch by one and a half chromatic semitones	Bdb always a neutral third below Db and a perfect fifth below Fd
/	(comma) up	Raises pitch by a comma (less than a chromatic semitone)	/F always a large minor third above D
****	(comma) down	Lowers pitch by a comma (less than a chromatic semitone)	\B always a large minor third below D

Preset 1 – 12-ET / 4 Manuals

Mapped by Benton Roark (www.bentonroark.com)

All of our included 12-ET layouts are automatically compatible with any virtual or hardware instrument without any extra work necessary. This is because they use default MIDI values, just like any other MIDI controller. This 12-ET mapping – like many Lumatone mappings – is based on the Bosanquet-Wilson layout. It displays its isomorphism in semitones on the vertical axis and whole tones on the horizontal axis. It also features ample note doublings, enabling you to reach the same note in a number of different hand positions. An extra bonus: This mapping includes 4 full manuals and 2 more partial manuals. This means that as you move up and down vertically, the same notes are assigned to different channels, allowing you to split across multiple instruments if you wish! However, many players also find it useful to still only target one instrument with this mapping, in order to achieve a high amount of useful vertical note repetition.

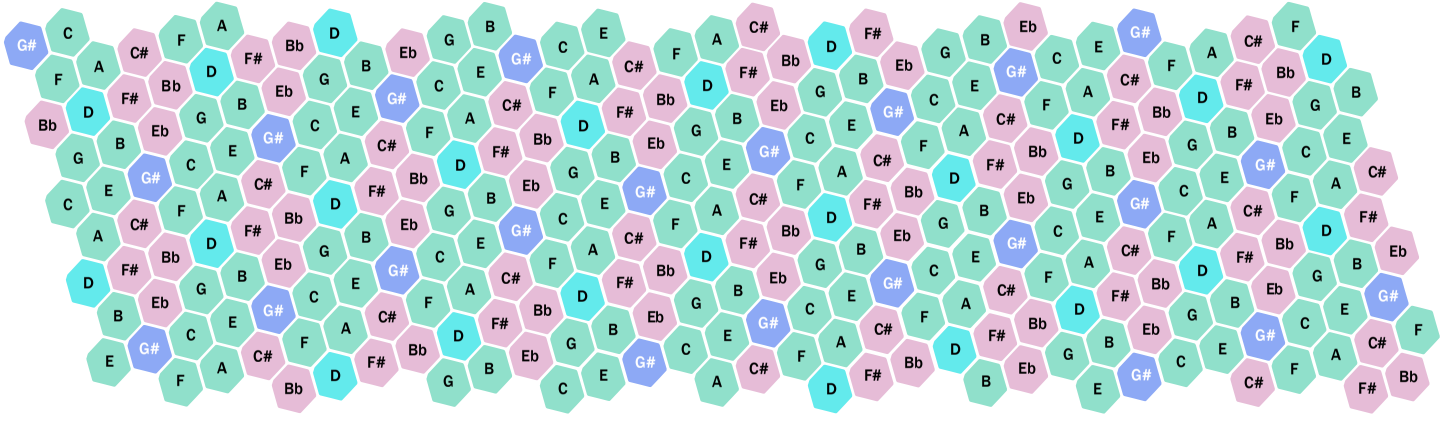


Programming notes: The 4 full manuals can be found on channels 1, 2, 3, and 5. Partial manuals are found at the top and bottom of the layout on channels 4 and 6. Set the MIDI instrument/device you are controlling to OMNI to control one instrument with all keys.

Preset 2 – 12-ET / Harmonic Table

Mapped by Matthew Angus

The concept behind the Harmonic Table has been around since the 18th century, recently popularized via the now-defunct C-Thru Axis-64 keyboard, which delivered the harmonic table as a fixed layout. Ergonomically, the harmonic table format is exceptionally compact, and offers some very unique and powerful properties. Note-values ascend by the musical interval of a perfect fifth along the vertical axis. On one diagonal axis, notes ascend by four semitones (a major third or diminished fourth). On the remaining diagonal axis, notes ascend by three semitones (a minor third or augmented second). The notes of commonly played chords (except the octave) are clustered close together, and well-practiced players will find that any major triad and minor triad – in root position – can be played with a single finger.

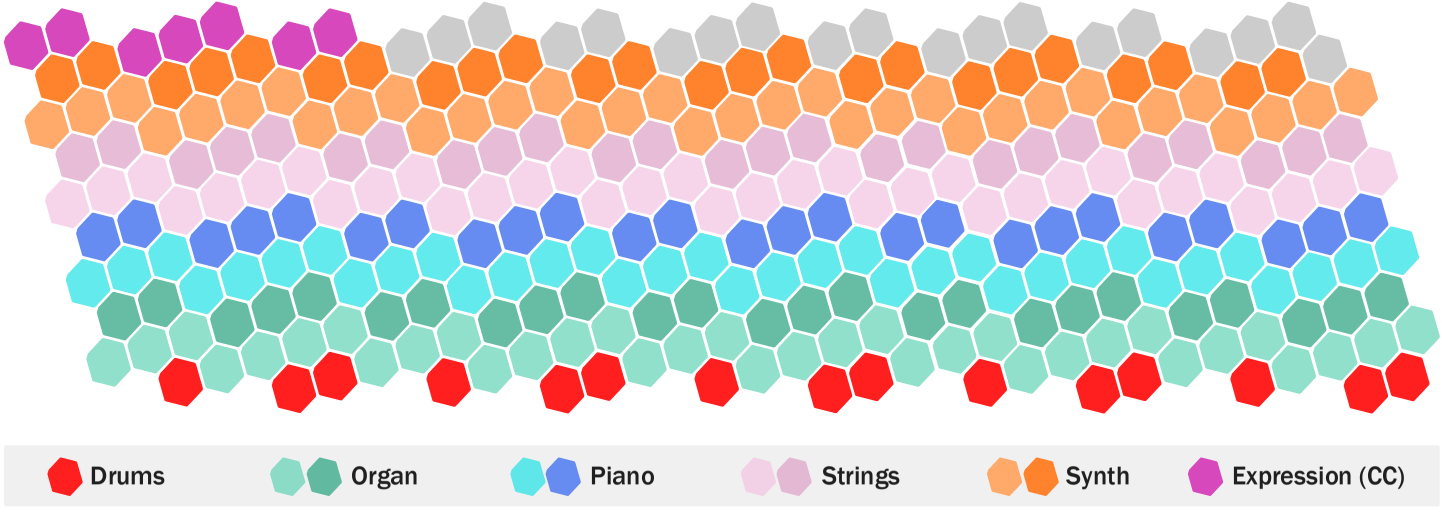


Programming notes: Like our other 12-ET mappings, this mapping will automatically be compatible with all virtual / hardware sound generating devices. All notes are sent via MIDI channel 1, so set your device to MIDI channel 1 or OMNI.

Preset 3 – 12-ET / Multi-Manual

Mapped by Matthew Angus

Our 12-ET Multi-Manual is very similar to our 12-ET 4-Manual, but with one important difference... *colour*! It still follows the Bosanquet layout, but each channel is repped by its own colour family. This allows you to better visualize each manual as a different instrument, transforming your Lumatone into a performance or production powerhouse! The below legend shows one of many multi-instrumental approaches, but the creative possibilities are endless, so plan to modify it to match your needs! And remember, save some keys for "expression" keys (set to act as continuous controllers), allowing you to manipulate any number of parameters for each instrument.

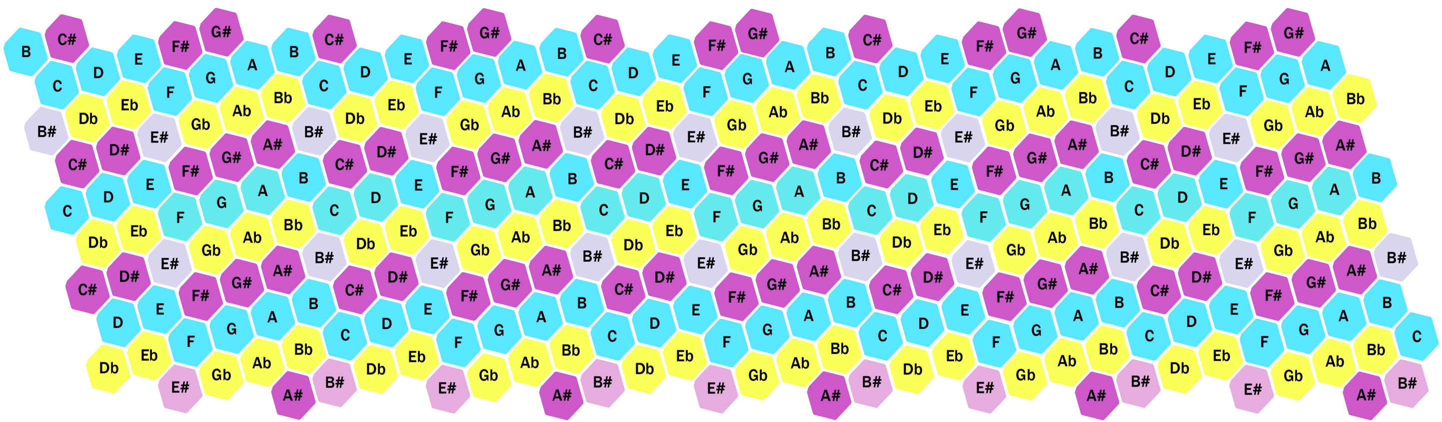


Programming notes: The 4 full manuals can be found on channels 1, 2, 3, and 5. Partial manuals at the top and bottom of the layout on channels 4 and 6, which work best for controlling non-chromatic entities like drums, continuous controllers, etc.

Preset 4 – 19-ET Bosanquet

Mapped by Mike Battaglia and Cam Taylor

19-ET is the first equal temperament after 12-ET in which it is possible to play much of Western music. It is essentially 1/3-comma meantone, with virtually pure 5:6 minor thirds and 3:5 major sixths, circulating in 19 tones, and was made popular by Costeley and Salinas in the 16th century. 19-ET splits the whole step into three equal tones. Chromatic semitones like C-C# are 1/3-tone, while diatonic semitones like C-Db are 2/3-tone, so it helps to not get them mixed up. At first they may sound a little "lumpy" and may warrant different treatment compared to in 12-ET, but can also successfully function melodically as "half steps" in the proper musical setting. While usual enharmonic pairs like C# and Db are distinct, our new equivalences are E#=Fb and B#=Cb, which also means Cx=Db, etc. Here we have naturals as usual in light blue, sharps marked in dark purple, flats in dark yellow, and the enharmonic E#=Fb in light purple. 5-limit harmonies sound warm and rich, and while higher limit harmonies can be approximated, they are not nearly as clear. 19-ET lends itself well to the music of the Renaissance, but the vast majority of modern rock, R&B, country, folk, and blues is easily playable in 19-ET, if some care is taken, although more modern classical repertoire can sound a little warped.

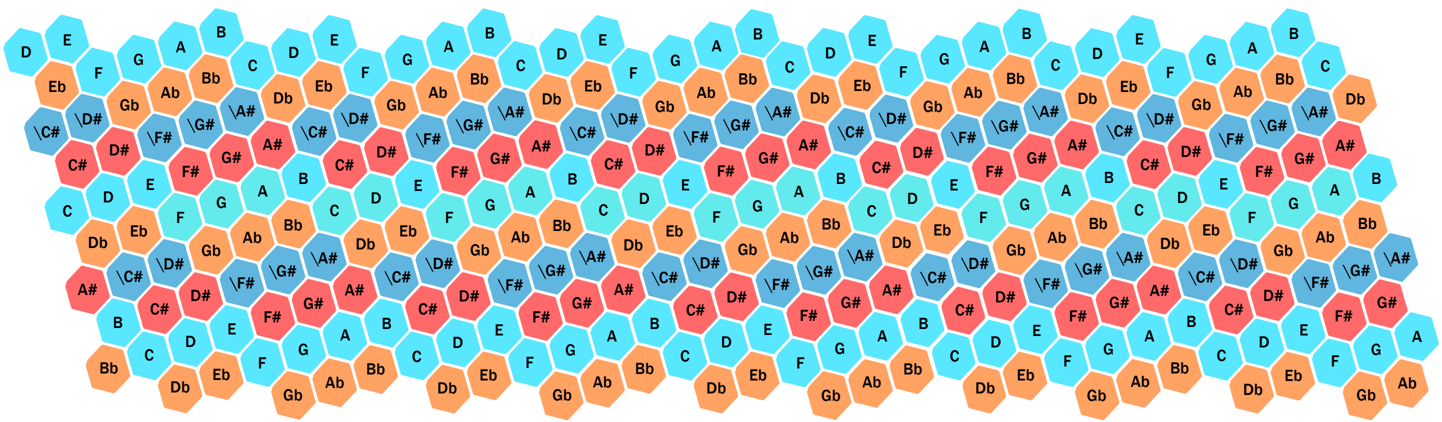


Programming notes: There are many ways to program MIDI notes/channels for microtonal mappings, depending on what you're controlling. Please see ***Appendix B*** for more information on our default programming approach for Microtonal layouts, as well as information on other approaches.

Preset 5 – 22-ET Bosanquet

Mapped by Cam Taylor (cametaylor.wixsite.com/home)

22-tone equal temperament (22-ET) features perfect fifths wide enough to support superpyth temperament, which provides a "septimal" take on the diatonic scale. The "major third" is now an approximate 9/7, and the "minor third" is now an approximate 7/6, rather than the "classic" 5/4 and 6/5 from meantone temperament. Although the diatonic scale no longer has these classic "4:5:6" and "10:12:15" major and minor triads, it instead has septimal chords such as 4:6:7, 4:6:7:9, and 6:7:9, leading to a new way to tonicize this familiar scale. Major intervals tend to sound brightly "supermajor," and minor intervals darkly "subminor," with the subminor triad of 6:7:9 notably being very smooth. 22-ET represents the 11-prime limit or 2.3.5.7.11.17 group very well, and its quarter-tone and three-quarter-tone step sizes allow some rather unique harmonies, melodies and modulations. Classic harmonies are also accessible in new ways, with the classic small major third of 5/4 represented by the diatonic augmented second, e.g. from Eb-F#. Most intervals come in four flavours: subminor, classic minor, classic major, and supermajor. However, many conventional progressions are bent into rather novel shapes! As a result, 22-TET represents somewhat of a departure from the standard tonal structure of Western music. It remains one of the most popular tunings, with a relatively large body of theoretical writing, of which Paul Erlich's "Tuning, Tonality, and Twenty-Two Tone Equal Temperament" is a particularly well-developed highlight.

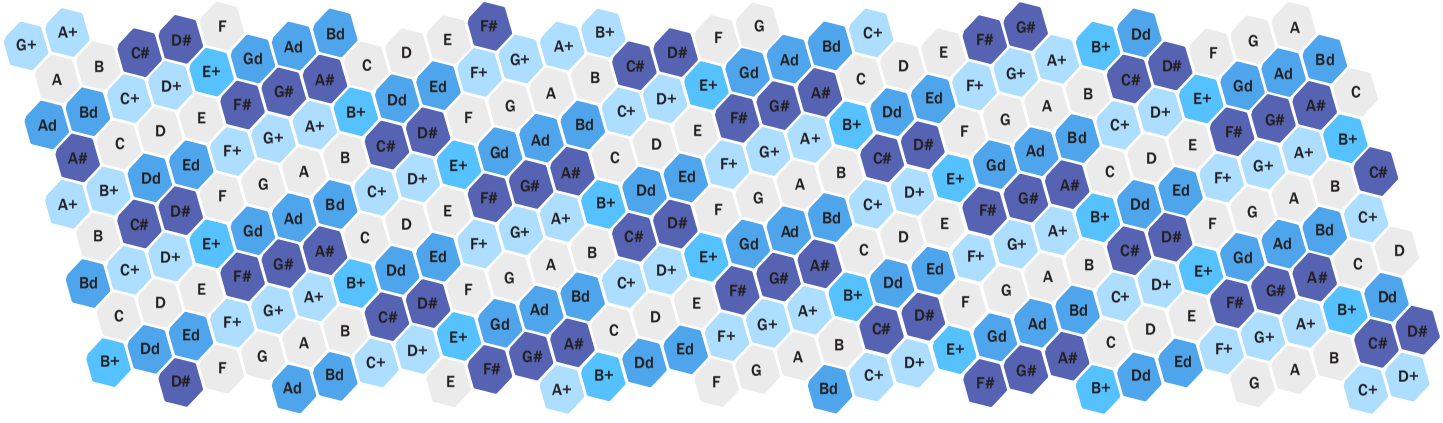


Programming notes: There are many ways to program MIDI notes/channels for microtonal mappings, depending on what you're controlling. Please see ***Appendix B*** for more information on our default programming approach for Microtonal layouts, as well as information on other approaches.

Preset 6 – 24-ET Isomorphic

Mapped by Mike Battaglia

24-ET, often referred to as the “quarter tone scale,” is what you get if you simply divide 12-ET in half. In modern times, it is most famous for its association with Arabic maqam music, although this is somewhat of a Western-oriented simplification. It has new intervals, called “neutral” or “middle” intervals, that are right between major and minor, some of which (such as the neutral third) are particularly reminiscent of the microtonal inflections used in the blues. This 24-ET mapping can be thought of as a “stretched” version of the familiar Bosanquet-Wilson layout, in which the chromatic half steps are split into two to make room for the new quarter tone intervals. The familiar “white notes” of the diatonic scale are in white, and the “black notes” are in the purple. The new quarter tones are in three shades of blue - “half-sharps” are a light blue, “half-flats” are a dark blue, and the two notes B+ = Cd and E+ = Fd, being both half-sharps and half-flats, are a medium blue. The layout remains isomorphic - going to the right, you have the diatonic scale whole step, and going diagonally down and to the right, you have the “neutral second.” Since some notes are repeated vertically in this layout, which can be quite useful for reach and playing, you may also find it useful as a double manual layout. You can also use this approach to assign each half to different octaves of the same instrument, enabling you to reach combinations of notes not usually possible with just one hand.

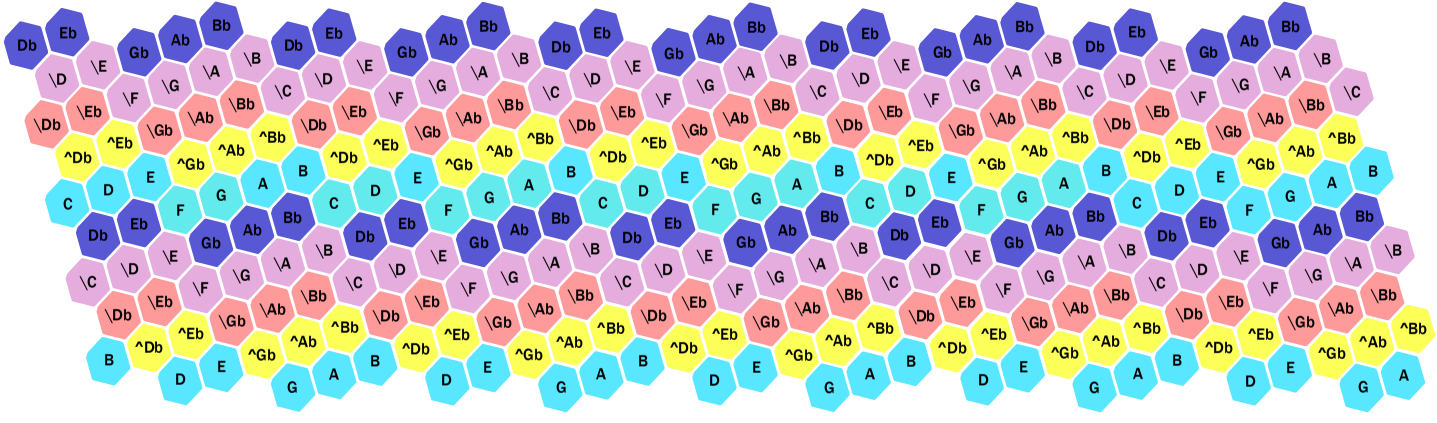


Programming notes: The 2 manuals can be found on MIDI channels 1 (lower) and 2 (upper). There are many ways to program MIDI for microtonal mappings, depending on what you’re controlling. Please see ***Appendix B*** for more info on our default programming approach for Microtonal layouts.

Preset 7 – 29-HTT Bosanquet

Mapped by Cam Taylor (cametaylor.wixsite.com/home)

This 29-tone High Tolerance Temperament (29-HTT) was designed in 1975 by George Secor, one of the original Terpstra backers who passed away in 2020. It brings together many of the most popular resources of just intonation with a little more versatility, but without much noticeable mistuning. In George's own words: *"a middle-ground alternative to 15-limit JI ... [F]or your enlightenment: 29-HTT consists (except for one filler tone) of 3 chains of fifths of ~703.5787c, or exactly (504/13)^ (1/9). The 3 chains of fifths contain tones 1/1, 5/4, and 7/4, respectively, and the tones in each chain are taken to as many places as are required to result in otonal ogdoads on roots Bb, F, C, G, D, and A. This also gives very-near-just diatonic (5-limit) scales in 5 different keys."* In slightly more common language, the fifths are mostly gently wider than pure, and we have the first 16 harmonics of Bb, F, C, G, D and A with minimal error. Several meantone-like narrower fifths are used to optimise these keys, and while the remaining fifth is very wide, the whole tuning is able to circulate in a way through 29 keys, and provides a whopping 220 interval sizes.

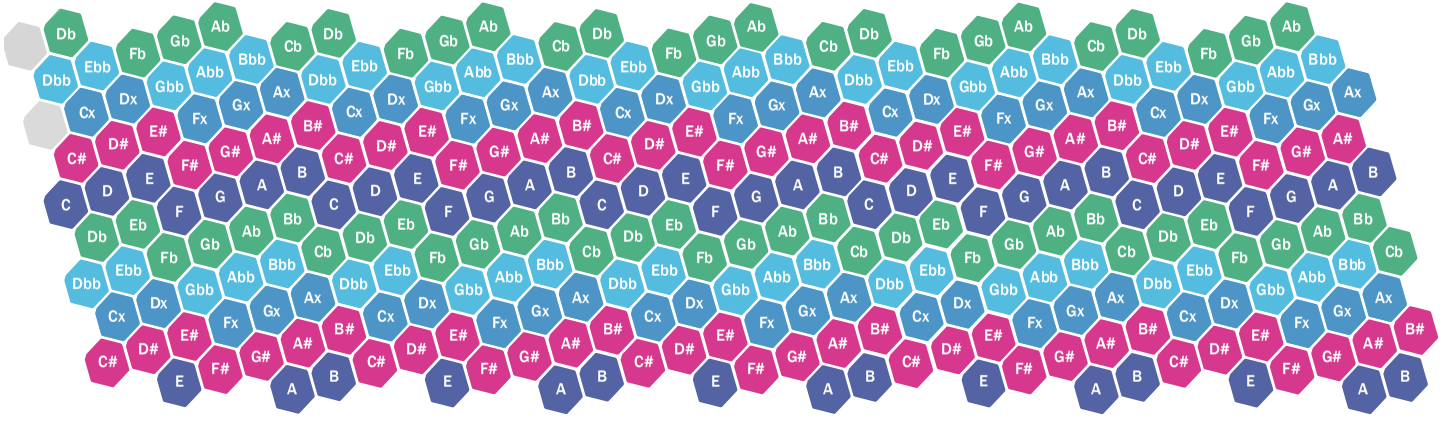


Programming notes: There are many ways to program MIDI notes/channels for microtonal mappings, depending on what you're controlling. Please see ***Appendix B*** for more information on our default programming approach for Microtonal layouts, as well as information on other approaches.

Preset 8 – 31-ET Bosanquet

Mapped by Benton Roark (www.bentonroark.com)

31-ET is the next equal temperament, after 12-ET and 19-ET, in which it is possible to play much of Western music. It has received widespread attention for being essentially equivalent to the historical “1/4-comma meantone” tuning, used in Europe for several centuries, but in an “equalized” form and with additional higher-limit harmonies. 31-ET was first developed during the Renaissance, and has near-just 4:5 major thirds and 5:8 minor sixths. It also has near-just septimal harmonies, 11-limit intervals, and many “neutral” intervals reminiscent of Arabic Maqam music, including a neutral third very close to 9:11. Subminor, minor, neutral, major, and supermajor (as well as the rather extreme diminished and augmented) are all unique flavours of thirds. 31-ET splits the whole step into five equal tones, and the 1/5-tone diesis, e.g. between C#-Db, can be quite striking as a melodic step or change in harmony, while the usual chromatic and diatonic semitones are actually 2/5- and 3/5-tones. Its layout is similar to both 12 and 19-ET, with the central zone of up to 5 flats and sharps surrounded by a row of half-flats (enharmonic double sharps) above and half-sharps (double flats) below. 31-ET is fairly adaptable to many styles of music, from the Renaissance to 20th century popular music, and most listeners will notice a subtle difference with 12-ET that usually includes a sweetening of almost all of the conchords. It sounds closer to 12-ET than 19-ET does, and has much better support for higher-limit intervals, at the cost of requiring more notes. One of Siemen Terpstra’s most deeply explored tunings, and featured in much of the original Terpstra’s marketing.

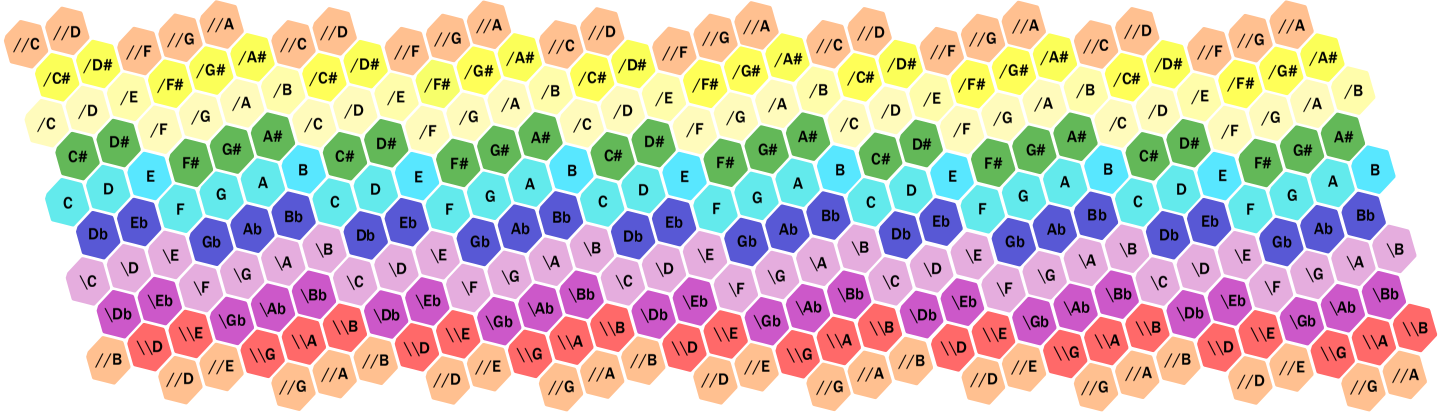


Programming notes: There are many ways to program MIDI notes/channels for microtonal mappings, depending on what you’re controlling. Please see *Appendix B* for more information on our default programming approach for Microtonal layouts, as well as information on other approaches.

Preset 9 – 53-ET Bosanquet

Mapped by Cam Taylor (*cametaylor.wixsite.com/home*)

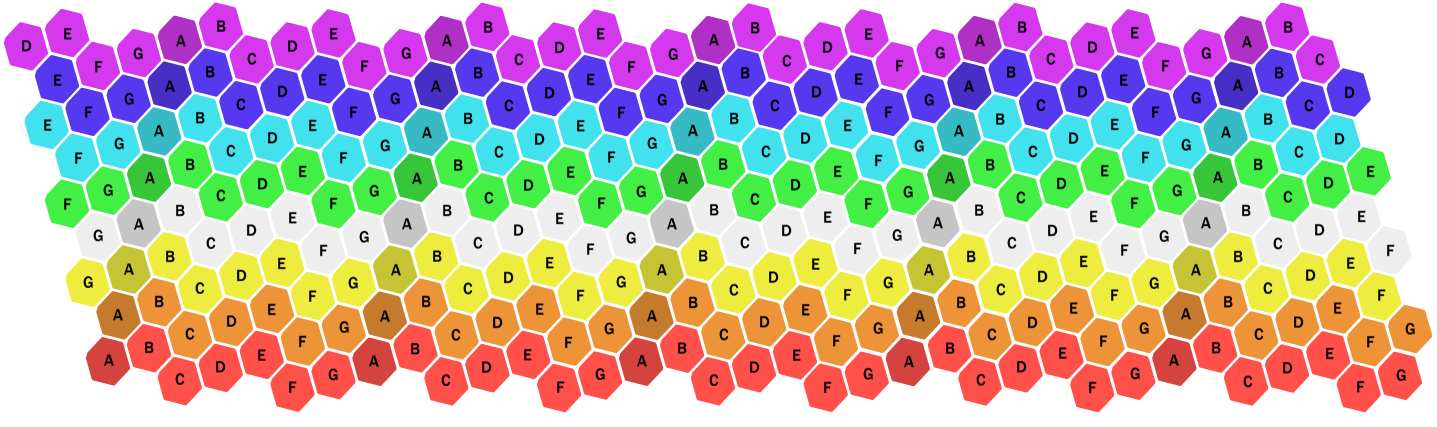
53-ET has become somewhat of a master tuning at several times and places throughout history. In modern times, it is one of the main tuning systems taught in Turkey, as the basis for Turkish makam music. It is still a good basic model for the intonation of Ottoman and Hindustani classical musics, where raising or lowering by a single comma (1/9-tone) is still rather significant, approximating at once the syntonic, pythagorean and septimal commas amongst others. While this was another of Siemen Terpstra's favourite tunings, it is even more significant as the tuning which Bosanquet built his generalised organs for. The tuning is a 53-tone cycle of virtually pure fifths, giving us a practically perfect approximation to the famous Pythagorean tuning, however it also features great schismatic thirds. 4:5 is mapped as a diminished fourth and 5:6 is mapped as an augmented second, so Eb-F#-Bb and F#-Bb-C# are examples of classic triads, much closer to just even than the meantone tunings (note since the fifth is wider than 700c, C# is higher than Db, not lower as in the meantone tunings). 53-ET approximates not only the 5-limit, but also extends well to primes 7, 13, and 19 also. Flavours of thirds run inframinor, subminor, minor, classic minor, supraminor (lesser neutral), submajor (greater neutral), classic major, major, supermajor, ultramajor. One can think of the keyboard in ranks of 7 naturals and 5 accidentals, with each rank up ascending a comma, and each rank down descending a comma. We get really interesting possibilities for modulation, chord and tonality flavours, approximations to different forms of just intonation, and also the ability to work alongside natural open string tunings from around the world.



Programming notes: There are many ways to program MIDI notes/channels for microtonal mappings, depending on what you're controlling. Please see ***Appendix B*** for more information on our default programming approach for Microtonal layouts, as well as information on other approaches.

Preset 10 – 56-ET Polychromatic Created by Dolores Catherino (www.dolorescatherino.com)

This polychromatic layout was created for Lumatone by polychromatic composer Dolores Catherino. While it is not isomorphic, it represents a different approach to representing pitch using colour. In her words, “It uses the diatonic notes of the octave (A, B, C, D, E, F, G) and replaces all chromatic accidental symbols with pitch colors. Each diatonic note (A-G) has 8 color variations, allowing for a maximum pitch resolution of 56 equal divisions of the octave (EDO). The ‘white’ colored notes represent the ‘home row’, like the white keys of the piano. ‘A’ notes are highlighted in gray for visual orientation within the isomorphic keyboard design.”



Pitch colors symbolize degrees of flatness and sharpness of each diatonic pitch (A-G):

Natural b bb bbb

Programming notes: Dolores Catherino’s approach to mapping uses third party software called UTE. You can download the required UTE file necessary to use this preset at ***www.lumatone.io/community/mappings/A10***. Please see ***Appendix B*** for more information on how to use UTE with Lumatone.