

MAINFRAME-B (&B+)

REFERENCE GUIDE

v1.1

CHANGELOG

Version	Date	Changes
v1.0	Nov 2022	Initial guide creation.
v1.1	Apr 2025	Visual instrument -related additions, number of LEDs updated from 320 to 480, animation mode #1 changed, improved troubleshooting, improved formatting & readability.

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MAINFRAME-B INTRODUCTION

MAINFRAME-B (B standing for "Base") is the very first product in the MAINFRAME product line of portable, real-time visual instruments.

MAINFRAME-B has the following features:

- Real-time MIDI patterns displayed on WS2812b (Neopixel) LEDs.
- USB-MIDI through a USB-C connector, with both B and B+. Perfect for DAW users. No special drivers, plugins or external interfaces needed.
- 5pin MIDI through 3.5mm TRS jack (Type A) with B+.
- Highly customizable - MAINFRAME-B displays animations based on 10 individual parameters across three zones (MIDI channels). All parameters can be remotely set and automated through MIDI CC.
- Modulation options, for expressive patterns based on MIDI pitch, velocity, or random.
- 8 presets per zone, for a total of 24.
- Supports up to 480 LEDs.
- 33 fps.

This product is a beta. It is in a finished state but it is in beta because it requires users and feedback to fully develop into future versions.

NOTE: Throughout this document, both B and B+ variants will be referred to as just "B". Distinctions will be noted where applicable.

WARNINGS

Just a few warnings that are worth mentioning:

- Don't plug in more than 5V to MAINFRAME. The controller board will be fine, but the LED strip will burn out because they are designed only for 5V. If in doubt, check your power supply voltage or only get supplies from Synthetic State.
- Best to not overpower the LEDs through MAINFRAME, use more power supplies instead. Connectors and cables start to get warm with more than 5A.

- MAINFRAME-B features an exposed circuit board, so you must be careful. Avoid spilling anything on it or shorting out traces by dropping metal objects on it.
- MAINFRAME-B can potentially trigger seizures for individuals with photosensitive epilepsy - please do not use this product if this applies to you!

COMPONENTS

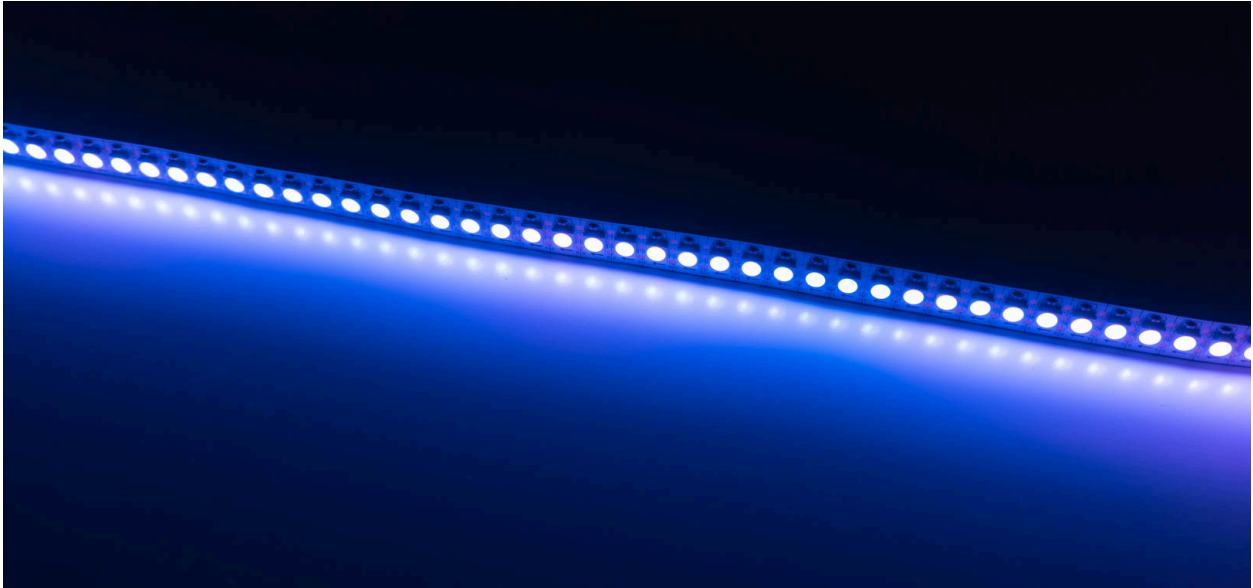
There are at least five components to the basic MAINFRAME-B setup. It can get more complicated beyond this if you have really long LED strips, mirror multiple strips or have multiple MAINFRAME controllers. For now, this section will focus on the setup of all starter kits regardless of type of LED.

MAINFRAME-B Controller



This is the main brain of the MAINFRAME system, responsible for processing all incoming MIDI data, handling user-defined parameters, rendering animations, storing presets and serving the user interface. The controller has all the connections necessary for the system to function (USB-MIDI, power and LED).

LEDs

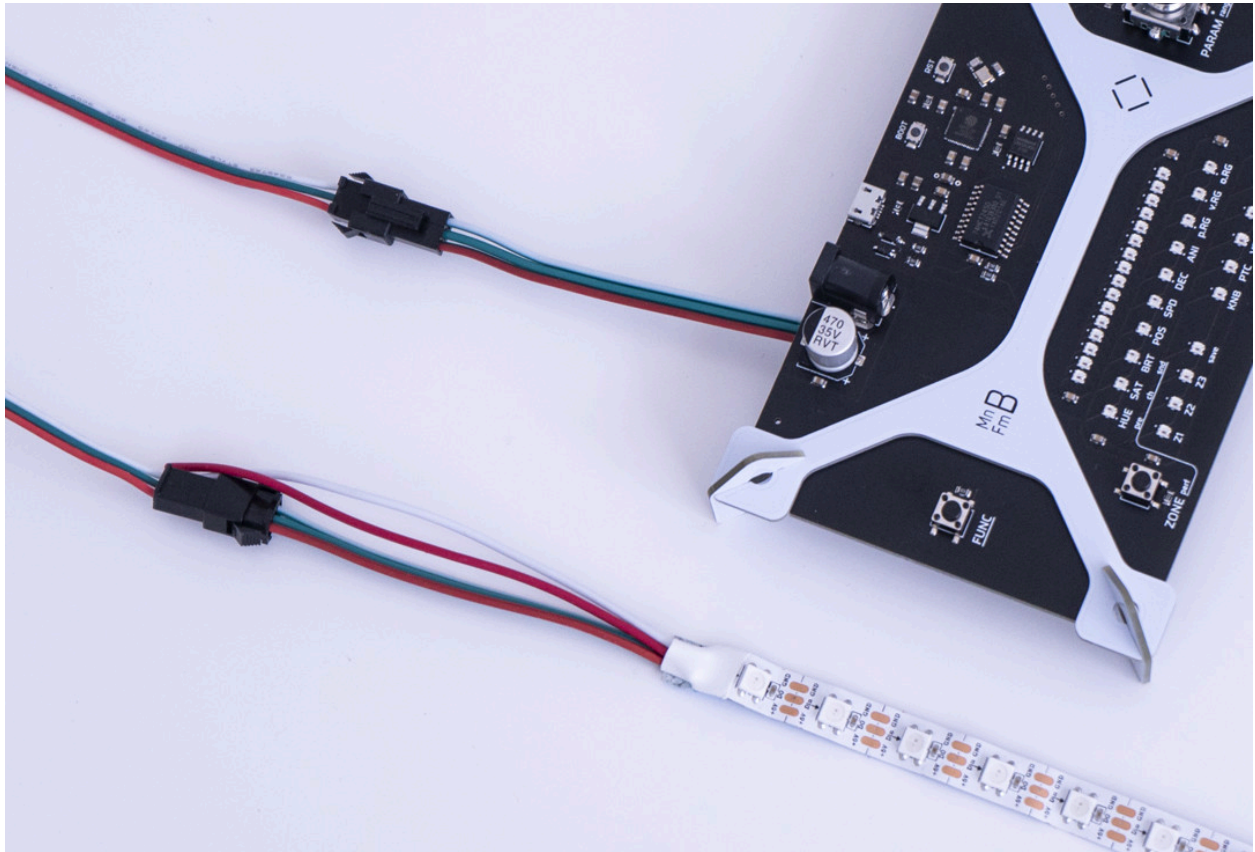


MAINFRAME-B is compatible with individually addressable LEDs using the WS2812b chipset, which are also known as “Neopixels”. These LEDs can come in many different forms, such as strips (with different densities), grids, christmas lights, rings and are often used in custom visual installations too. It doesn’t matter what form factor the LEDs come in, it’s all the same to MAINFRAME. To the system it’ll see all the LEDs as a long, continuous sequence.

MAINFRAME-B is also compatible with the WS2815 as it uses the same protocol, however, these LEDs are powered via 12V so require a slightly different power setup.

These LEDs typically use a 3-pin JST cable that is red, green and white.

LED cable



This cable is an extension cable to connect the LEDs to MAINFRAME, and will give you more flexibility where you can place the controller and LEDs. Connection is simple, there are male and female sides to the cable so it only fits one way.

Note: The LEDs can get a little glitchy when this cable is longer than 5 meters.

Power supply



This power supply is used to give power to the LEDs that are connected to MAINFRAME.

The LEDs are 5V and can draw a lot of power, so each starter kit comes with a power supply that is 5V and 5A, which should be able to power smaller strips but not enough for very long, or many strips. This also depends on the brightness - full brightness means fewer LEDs, but dim means many more LEDs with a given power supply. You might have power supplies lying around at home, but you have to double check their amperage.

Connecting power is also fairly simple, one end goes into your power socket, and the other end plugs into MAINFRAME. You'll see this LED turn on when power is on, so look out for that in case you run into problems later with LEDs not turning on.

Barrel connector size: 5.5mm Outer, 2.5mm Inner

Note: Do not plug in anything more than 5V into MAINFRAME!

USB cable



MAINFRAME-B has a USB-C connector, which is used to transmit MIDI data from your DAW, and is also used to power the controller. USB does not power the LEDs!

Note: MAINFRAME-B has a USB-C connector, but not the chipset, therefore, will not work if plugged into USB-C on the other end - it must be USB-A. We will incorporate proper USB-C to C connection capability in a future version.

3.5mm TRS to 5pin MIDI Dongle



For B+ only. This dongle is necessary to connect any 5pin MIDI cable to your MAINFRAME controller.

MAINFRAME-B+ uses the **Type A** dongle.

GETTING STARTED

You now have your MAINFRAME starter kit or already have all the necessary cables and such. Let's get everything connected!

Now the order of connection doesn't matter much, but there is a cool startup animation so let's get the power and LEDs connected first.

- Power the controller with the external power supply. You should see the little PWR green LED turn on.
- Connect the LED strip to MAINFRAME through the extension cable.
- Connect the USB Cable. Something to keep in mind is that MAINFRAME-B grabs power because of the onboard LEDs. If you're using multiple or have other things connected to the same hub, try to use a powered hub.
- If needed, connect the 3.5mm TRS to 5pin MIDI Dongle between your MIDI input cable and the 3.5mm jack on the MAINFRAME controller.

And that's it! Pretty simple.

MAINFRAME-B BASIC PRINCIPLES

Light Output Factors

The character of the lights from MAINFRAME is based on a few factors:

- Notes activate lights: Each "note on" triggers the beginning of an animation. The note length has an impact for most animation modes, either modifying the length of the animation or the amount of light. No notes, no lights.
- Parameter values: Each parameter changes the lights in different ways, either the hue, saturation, brightness, decay time, speed and mode of animations, etc.
- Note pitch and velocity: When a parameter is modulated, the incoming MIDI note's pitch and/or velocity will make it take on a parameter value based on the selected range for that parameter, as well as the range for either the input pitch or velocity.

From there, Zones/Channels blend together: MAINFRAME-B is designed to blend all notes and zones together, which opens possibilities for interesting patterns and

colors by assigning different MIDI channels to different zones with their own parameter values.

Focus vs. Ambiance

There are two ways to use MAINFRAME-B, either as something for you or your audience to focus on, or something to create ambiance within the room.

Focus:

MAINFRAME-B can be used as a focal element by:

- Using LED grids, rings and Christmas lights. LED strips can also be used though the effect is not as good.
- Facing the LEDs directly towards you or your audience.
- Turning down the brightness so the LEDs are not blinding, but instead form small dots. You can also set the “max brightness” low within the global configuration menu.
- Experiment with animation modes and layering zones. Adding one or more randomly-modulated parameters will keep the patterns interesting and non-repetitive.

Ambiance:

MAINFRAME-B can also be used to “paint the room” and create ambiance for live performances by:

- Using LED strips mostly, though 8x8 grids and christmas lights can also be used.
- Face LEDs towards the wall or another surface. A white surface is best so it takes on the color of the LEDs.
- Maximize brightness within the global configuration menu, and use higher values for the brightness parameter within each zone. If layering multiple zones, try lowering the brightness within each zone a bit so they can blend properly. If all zones are max brightness, the colors saturate to white easily.
- Use sweeping patterns from long notes because subtle patterns will not be visible as LEDs blend.
- Experiment with placement of LEDs and especially distance from the reflecting surface to get different looks.

OVERVIEW OF UI AND MODES

MAINFRAME-B's User Interface allows you to fully customize your controller and how it reacts to MIDI notes. The following sections of the User Interface informs the user of MAINFRAME-B's core functions: Zones, Parameters and Modulation. This is just an overview, each of these functions have dedicated sections within this guide.

Zones

At all times you have a particular zone selected, and it is highlighted. The selected parameter is the value of that parameter for the selected zone. Despite which zone is selected, all of them will display on the LED strip!

The zone LED also provides feedback in two ways:

- It blinks when it receives a MIDI note.
- It displays the color of that zone.

Parameters

The parameter knob can scroll through the parameters, and press to go in and out of edit mode.

By pressing FUNC and ZONE, you can enter and exit the Preset Menu. From here you can change the selected preset and MIDI channel for that zone.

Modulations

Shows you how the parameter is modulated, or if it's possible at all.

When a modulated parameter is selected, pressing MOD will cycle through the modulation options.

Pressing FUNC and MOD will have different behaviors depending on the mode. This will be explained in the relevant sections.

All of MAINFRAME's settings follows a typical format, which also describes how everything is nested:

ZONE | PARAMETER | MODULATION

And within PARAMETER: PRESET MENU | PARAMETER EDIT

Each zone has 8 presets, and each preset has 10 parameters. The parameters are the same, but unique values can be set for each preset for each zone.

GLOBAL CONFIGURATION MENU

The global configuration menu has two settings that will be applied to all patterns output by MAINFRAME: Max brightness and number of LEDs.

By setting these two parameters in this menu, the values will be saved between resets and all patterns (from all zones and presets) will be scaled automatically.

To enter the configuration menu:

- Hold down all three buttons for two seconds.
- By default you are editing brightness.
- Press FUNC to edit LED strip length, the white dot will be the max number of LEDs.
- Don't see the dot? Press zone and it will reset the value to one.
- At any time, press PARAM to exit and save both values.

ZONES

What is a zone? A zone is a bank of presets and parameters assigned to a MIDI channel, which is a fancy way of saying they're different "looks" or display options for their selected MIDI channel.

All zones are displayed simultaneously, but when a zone is selected on the UI it will display that zone's parameters and you can edit them.

Simultaneous display is how you get interesting color and pattern blending, because MAINFRAME is designed to mix the colors of all notes and zones together so you can layer different MIDI tracks and channels. You can also assign all zones to the same channel if you want.

ZONE UI OPTIONS

Press zone at any time to select the zone you are currently modifying

Pressing FUNC + ZONE to go into the preset menu for that zone. This is where you can select the currently active preset and the channel for that zone.

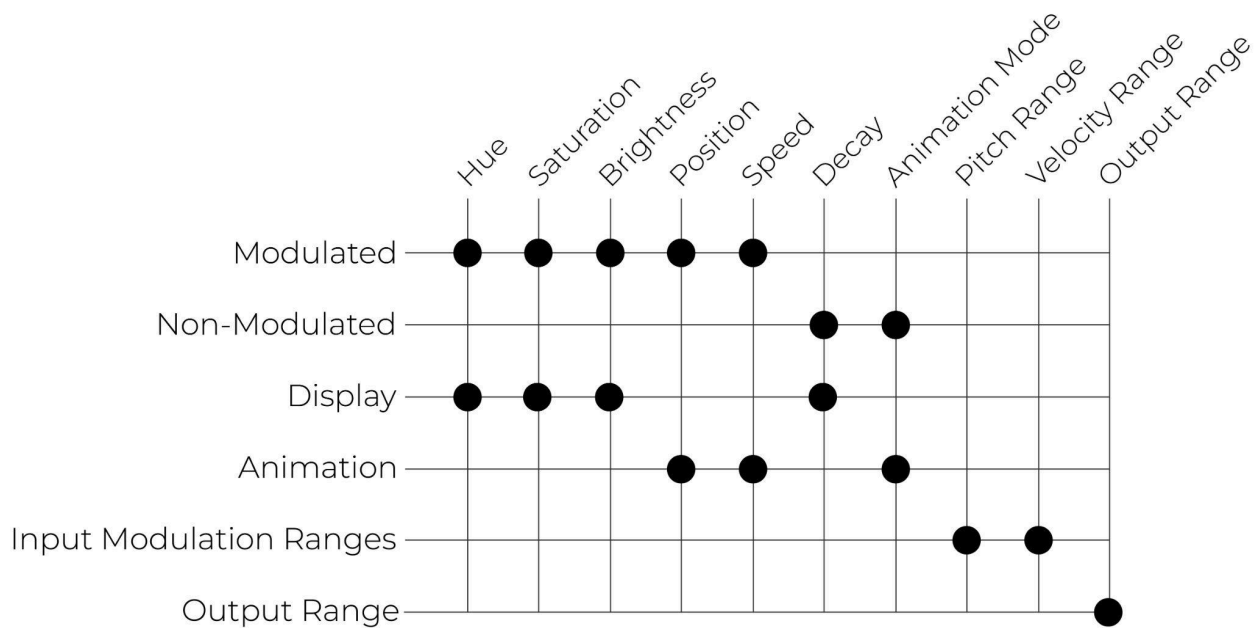
To reset all parameters for that zone to the default, hold down ZONE to reset. This is used as a last resort when you don't see lights displaying and want to refresh.

PARAMETERS

MAINFRAME expresses incoming MIDI data using parameters, which gives you the opportunity to finely tune what your lights will look like.

Parameters can be changed by the onboard knob, through MIDI CC or by modulation.

Parameter Categories



Modulated Parameters

These parameters can be modulated by pitch, velocity, or randomly if desired.

- Hue
- Saturation
- Brightness
- Position
- Speed

Non-modulated parameters

These parameters can only be changed by the onboard knob or MIDI CC.

- Decay
- Animation Mode

Display Parameters

These parameters are what impacts the color and brightness of the LEDs themselves.

- Hue
- Saturation
- Brightness
- Decay

Animation Parameters

These parameters alter the animations and patterns displayed by MAINFRAME.

- Position
- Speed
- Animation Mode

Input modulation ranges

These set the input pitch and velocity ranges used for modulation for ALL modulated parameters within that zone & preset. Explained more in the “Modulation” section.

- Pitch Range
- Velocity Range

Output range

Good for isolating zones to different parts on the strip, lights within that zone will not leave their part of the strip no matter what.

ANIMATION MODES

There are 7 animation modes:

Full strip

There will be a simple, full-length bar. Animation parameters have no effect, only display parameters. Great for adding background color.

Burst out

LEDs will burst out from a central point (determined by the POSITION parameter). LEDs will continue movement while the note is active, at the rate determined by the SPEED parameter. Movement stops and LEDs decay once the note off is received.

Burst in

Same as burst out, but instead the LEDs will burst in towards a central point also determined by the POSITION parameter. LEDs will continue to display once it reaches the center as long as the note is active.

Burst out with fill

Similar to Burst In, but the LEDs will continue to render from the center point as long as the note is active. This means the “width” of the resulting LED bar will be determined by the note length. Even if the note is inactive before the LEDs have reached the end of the strip, it will continue until it reaches the ends of the strip.

Burst in with fill

Similar to Burst out with fill, but instead the LEDs burst in towards a central point.

Full textured strip

A static pattern is rendered on the entire LED strip (or a subsection if an OUTPUT RANGE is set), with gaps determined by the SPEED parameter. Not particularly

interesting on an LED strip, but creates cool patterns on grids. Add a time-varying MIDI CC envelope to position and/or speed to create a dynamic pattern.

Strobe

The entire strip (or a subsection if an OUTPUT RANGE is set) strobes without any gaps. Note On triggers the strobe and it starts to decay before Note Off is received, meaning the note length does not matter.

PARAMETER CC CONTROL

You can automate every UI interaction with MIDI CC.

What is MIDI CC? CC are values between 0 and 127, sent from your DAW or MIDI controllers either as envelopes or mapped to a knob on a controller.

PARAMETER	VALUE TYPE	CC #
Hue	Value/Offset	1
	Range	22
	Modulation Mode	23
	Modulation Modifier	24
Saturation	Value/Offset	3
	Range	25
	Modulation Mode	26
	Modulation Modifier	27
Brightness	Value/Offset	9
	Range	28

	Modulation Mode	29
	Modulation Modifier	30
Position	Value/Offset	12
	Range	85
	Modulation Mode	86
	Modulation Modifier	87
Speed	Value/Offset	13
	Range	88
	Modulation Mode	89
	Modulation Modifier	90
Decay	Value	14
Animation Mode	Value	15
Pitch Range	Offset	16
	Range	17
	Cutoff	102
Velocity Range	Offset	18
	Range	19
	Cutoff	103
Output Range	Offset	20

	Range	21
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Hue is intentionally mapped to CC #1 so typical Mod wheels changes hue

When a parameter or value has been changed by MIDI CC, you will see a blue LED corresponding to that parameter and/or value.

When in the Parameter menu, FUNC and PARAM press will set a “MIDI Block” on that parameter, which means any MIDI CC values that change the value, range, modulation and modulation modifier will be ignored.

MIDI Block is perfect for “locking” certain parameters you don’t want to change through MIDI CC, which comes useful when syncing multiple MAINFRAME’s together. For example, you have one MAINFRAME displaying on LED strips facing a wall and another MAINFRAME with a grid that is facing you. Both MAINFRAME’s should have synchronized parameters, including brightness. However, you want the brightness on the grid to remain static and not synchronized with the strips (it’d be too bright) so you can turn on MIDI Block on brightness.

MODULATION

Modulation is another way of automating parameter changes, where this time the input MIDI notes pitch or velocity can “modulate” the output lights by taking on a different parameter value based on the pitch or velocity of that note. Without modulation the output lights will always be a single value, but with modulation you can now get variation based on the input.

Variation in the light’s parameters can be done by drawing a bunch of CC envelopes, but this is far from practical for many users. Automatic modulation is perfect for keyboardists and performers, people who can’t fiddle with knobs, MIDI CC envelopes, or MAINFRAME’s UI, but still want some variation in the lighting.

“Modulated Parameters” can be modulated by either:

- Pitch
- Velocity
- Random. This one is cool. To avoid things looking too static, you can slightly randomize different parameters. I like to add at least one slightly randomized parameter so the lights stay fresh.

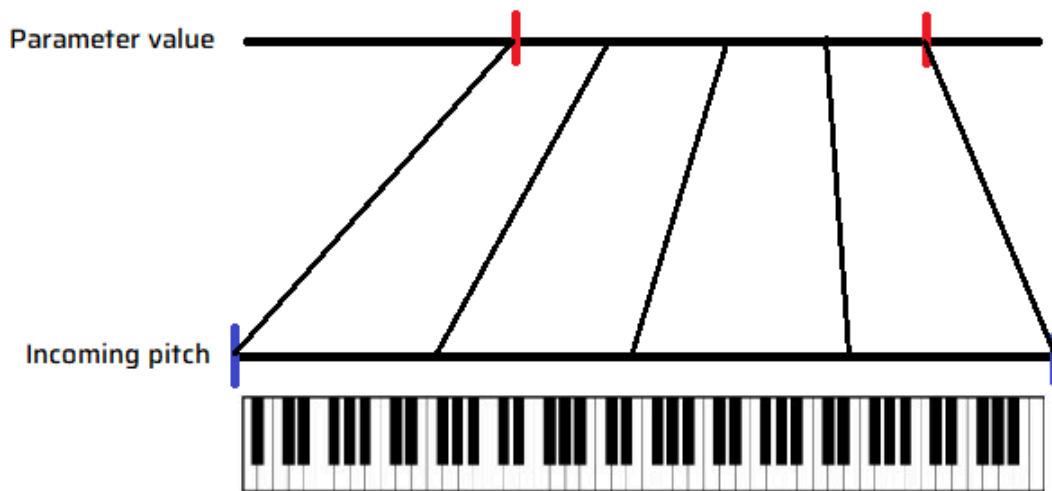
MODULATION UI OPTIONS

Modulating a parameter is simple:

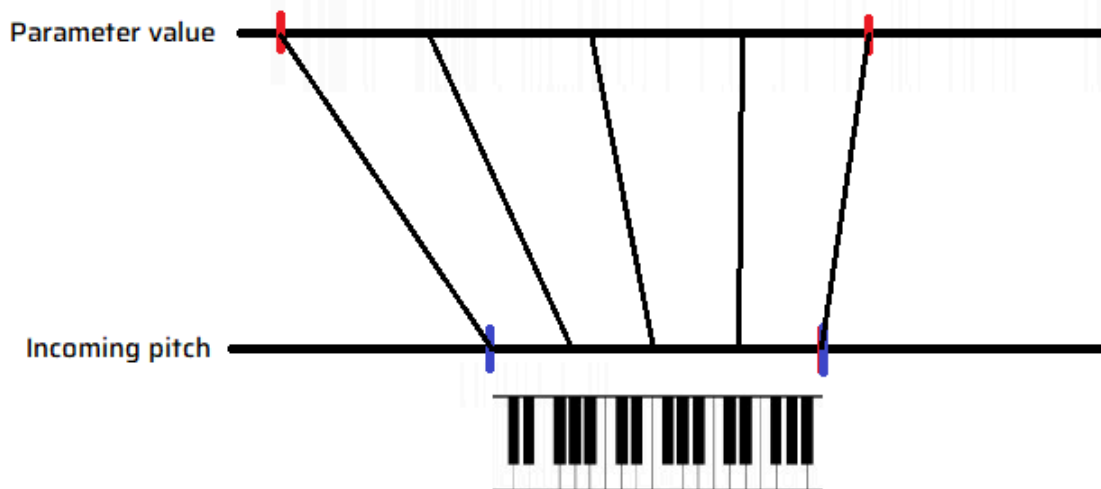
- Pick a modulated parameter, not all of them can be modulated. If the MOD LEDs are blank they can be modulated, red ones can’t. If there are no MOD lights on, then currently the value is affected by knob only.
- Press MOD to cycle through.

The value LED bar will change. This new bar represents the entire range of parameter values that the lights can take on, the leftmost being the lowest value and the rightmost being the highest value. The knob changes the offset and holding FUNC changes the range.

With pitch selected, incoming notes with the lowest pitch are mapped to the lowest end of the parameter range and will take that value. Conversely, the highest pitch will be mapped to the highest value and pitches in between will be mapped linearly.



By default, the entire range of pitches and velocities are in play, but if you are working with a smaller subset of pitches, such as the 88 key piano, or a smaller midi controller, or even a single octave, you can limit the input range to just modulate these notes. The same applies to velocity.



Go to pitch range, and select the offset and range. You can see incoming notes. Green means it's within the range, and red means it's out of the range. The same thing applies to the velocity range as well.

If you don't care about the pitch or velocity range, leave it to full so you don't get any weird or unexpected results from modulation.

ADVANCED MODULATION OPTIONS

You might have asked yourself already, what happens when a note is outside the selected input range? Three things:

- Levelled. By default, notes outside the range will just take on the lowest or highest, whichever they are closest to.
- Looped. Press FUNC and MOD to get it to loop. Which means the input range will continuously loop and cycle through the modulated parameter range. Perfect for repeating every octave, for example.
- Cutoff. Maybe you want to not display any notes that are outside of the range, you can do this by applying cutoff. Press FUNC and MOD when editing the pitch or velocity range. Now it will not display any notes outside the range. This is perfect if you want to assign different zones to the left and right sides of a keyboard, for example.

MODULATION CC CONTROL

All modulation parameters can be changed with MIDI CC

The modulation mode is its own CC number, with knob only, pitch, velocity and random being distributed evenly throughout the CC range.

Levelled and looped is another value, both also distributed evenly.

PRESETS

Let's say you've been playing around with a bunch of parameters and you have a look you really like. You don't want to change anything or lose the parameter values that created this look. With presets you can save and store this set of parameters.

The purpose of presets: To put it simply, it's to store and recall sets of parameter values and their settings.

A couple details to keep in mind:

- Each zone has 8 preset slots.
- Each preset has a color associated, which is reflected in the preset parameter and underglow LEDs.
- You are always working in a preset slot.

PRESET UI OPTIONS

To go to the Preset menu

Press FUNC and ZONE when in the parameter menu.

Selecting Preset

When you enter the preset menu, you are automatically editing the preset. From here you can select and MAINFRAME will automatically display the preset.

Saving

If the MOD LEDs are flashing red, then that preset is not saved - meaning one or more parameter values or options have been changed. Press MOD to save.

Copy

To copy a preset, press FUNC and press PARAM while editing the preset. The selected preset will flash and you can select a new preset within the same zone or a different

zone. Press PARAM again to overwrite the existing preset slot and copy the previously selected preset.

Sending

To send all parameter values and options for the selected preset through MIDI CC, press FUNC and MOD. Perfect for recording and saving presets within your DAW.

CHANGING MIDI CHANNEL

To change the MIDI channel assigned to that zone:

- Go to the Preset Menu by pressing FUNC and ZONE.
- By default you are editing the preset for the selected zone, so exit preset edit by pressing PARAM.
- Select CH and press PARAM to edit. The highlighted LED is the channel number.
- Remember you must save!

CHANGING PRESET VIA MIDI CC

Each preset can be selected using the program change MIDI command, numbers 1-8.

This will change the preset for the zone(s) assigned to that channel.

STARTUP ANIMATION

MAINFRAME-B features a slick startup animation, which is customizable. The Startup Animation is tied to the final preset on all three zones (8). If you edit this preset you are also editing the final startup animation.

It just displays a long note on all three zones, regardless of MIDI channel. If you don't want a startup animation, you can set the brightness to zero.

TROUBLESHOOTING

NO LIGHTS DISPLAYING?

If there are no lights displaying, follow these steps to debug:

- Is external power plugged in? Green PWR LED should be on. Was there a startup animation?
- Try changing to Animation Mode #1, which turns on the LEDs regardless of MIDI notes. This will tell you if there is a power issue.
- If using USB, Is MAINFRAME connected to your computer and is it detected?
- If you are sending MIDI, is MAINFRAME-B receiving midi? The zone led should blink with each note on.
 - Sometimes Ableton and other software doesn't send MIDI unless you reboot MAINFRAME. This seems to happen under some circumstances.
- Check parameters:
 - Brightness and Decay should be non-zero.
 - Output range should be set so it is displayed on the strip and not off-strip. Offset and Range should be non-zero.
 - pRG/vRG should not be in cutoff.
 - You can always reset the zone to default!
- Are you sending MIDI to the correct channel? Channel is set within the preset menu for each zone.
- Global brightness & Number of LEDs non-zero? Check within the Global Configuration Menu.

GLITCHY LIGHTS?

Encountering glitchy lights is not too uncommon unfortunately and often has to do with the following:

- Poor/busted LED cable, or it is too long. Try another (shorter) cable.
- Busted LEDs and/or connector. Rare, but happens.
- Too little power. If you are powering a long strip at full brightness, and only with a single supply, often the far end of the strip can begin to glitch. Reduce the brightness or better, power both ends.