NONLINEARLABS

C15

User Manual

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Document Version: 12.5
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Appendix - Signal Flow Diagrams 206

I. Safety Instructions, Precautions

Power Supply

Please consider using only the included power adapter. If this is not possible, get a power adapter matching the following specifications:

- 18 – 20 V DC
- 2.5 A or higher
- Plug: inner contact 2.5 mm (+), outer contact 5.5 mm (–)

Do not use power adapters with different or unknown specifications, as this may cause electrical damage on the device! Furthermore, if an external power adapter is used, this will be at your own risk. Nonlinear Labs will not be liable to damage caused by external power adapters.

Things to avoid

Do not place the C15 on soft surfaces (pillows, mattresses, etc.) in order to maintain air circulation during performance.

As the C15 is an electrical (and electronical) device, strictly avoid water contact.
We strongly advise against opening the C15. The inner parts of the instrument compose an intricate network, fragile to outside influences and potentially dangerous to the unexperienced seeker. We suggest to leave the device as it is unless you are absolutely certain about what you are doing.

Try to avoid using the C15 at extreme environmental temperatures. We can not guarantee a stable performance at very hot or cold conditions. Furthermore, try to also avoid high humidity or other difficult circumstances.

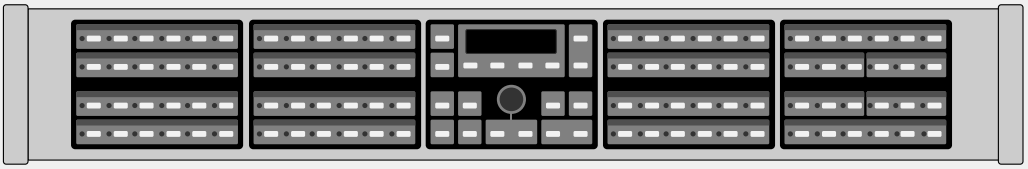
Always wait for the shutdown process to complete before cutting the power supply. Do not cut the power supply during performance. Otherwise, data loss can occur.

Pedal Integration

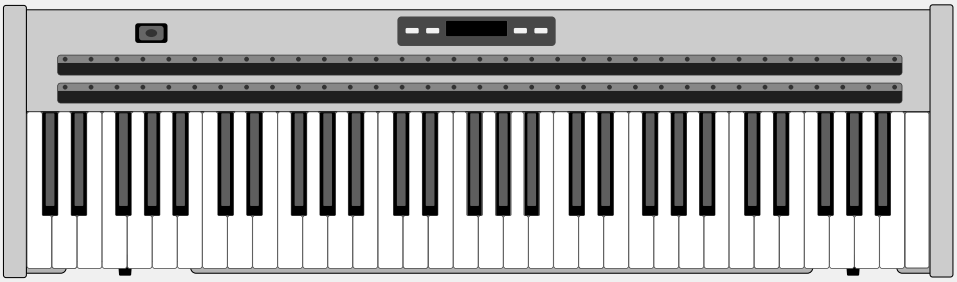
The C15 provides four Pedal Connectors (TRS sockets) allowing for the integration of external pedal controllers. As pedal controllers come with a wide variety of different behaviors and functionalities, there are a few things to consider in order to integrate them correctly.

The Pedal Manual will guide you through every step and aspect of connecting and setting up a pedal controller to the C15. Use it to avoid invalid integration of pedal controllers, which may lead to overheating or permanently damaging the C15.

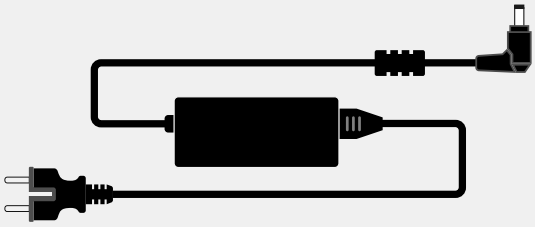
II. Package Contents



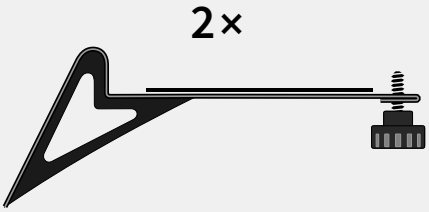
C15 Panel Unit



C15 Base Unit

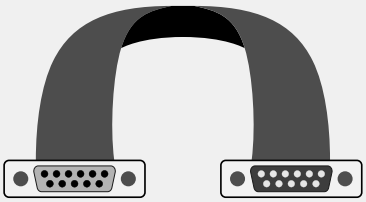


Power Supply Adapter and Cable



2 Mounting Brackets

Printed C15 Quickstart Manual

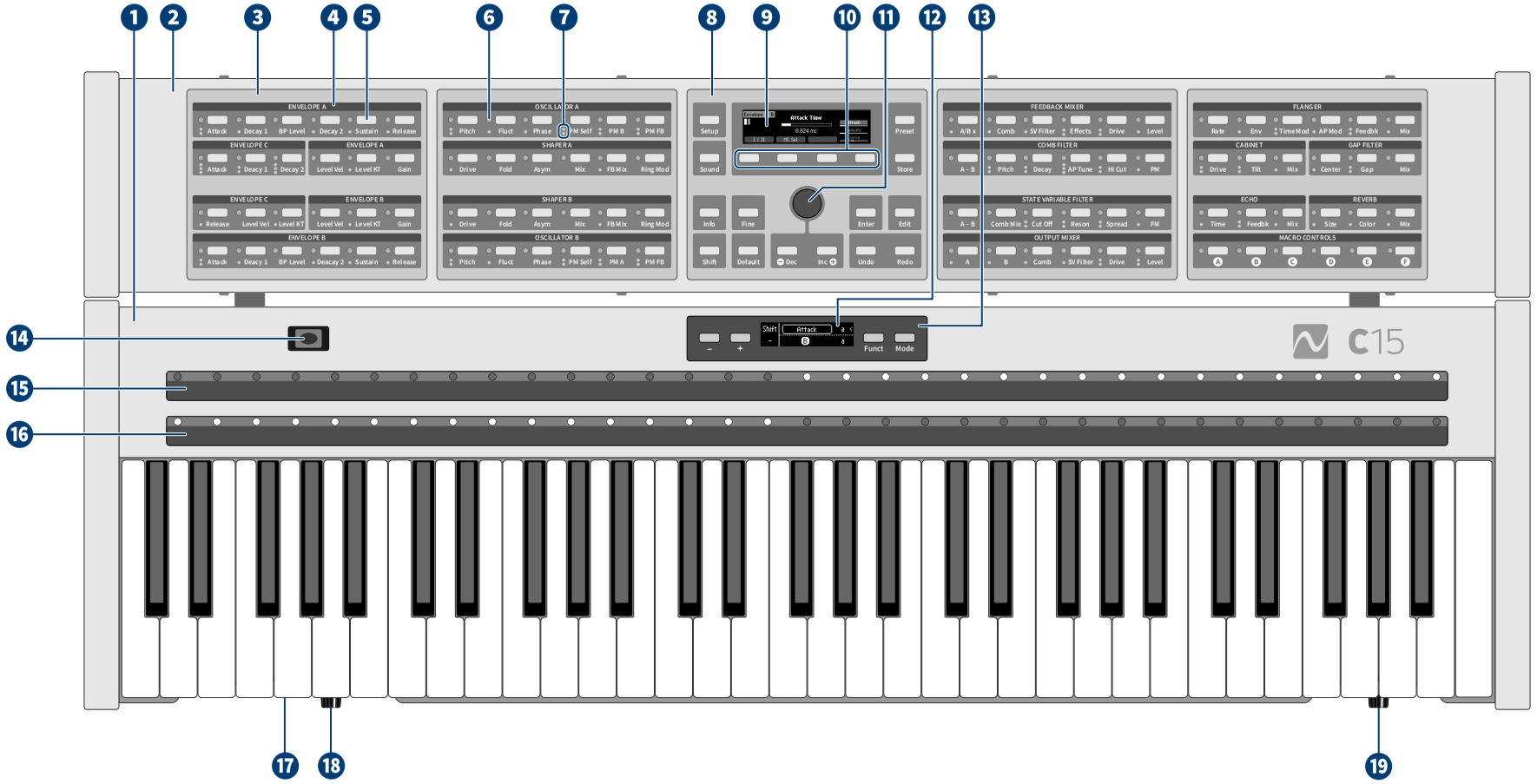


Unit Connector Cable

USB Stick containing:
• the Factory Preset Collection
• the complete C15 User Reference

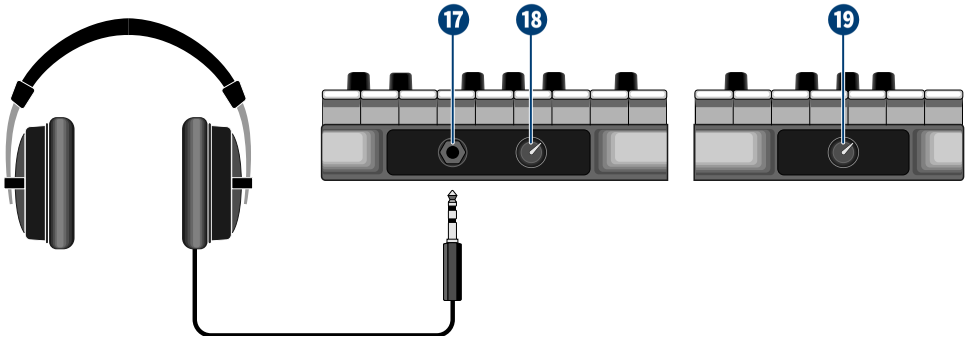
⚠ *The USB stick is specially formatted for installing updates. Do not format it and keep it safe!*

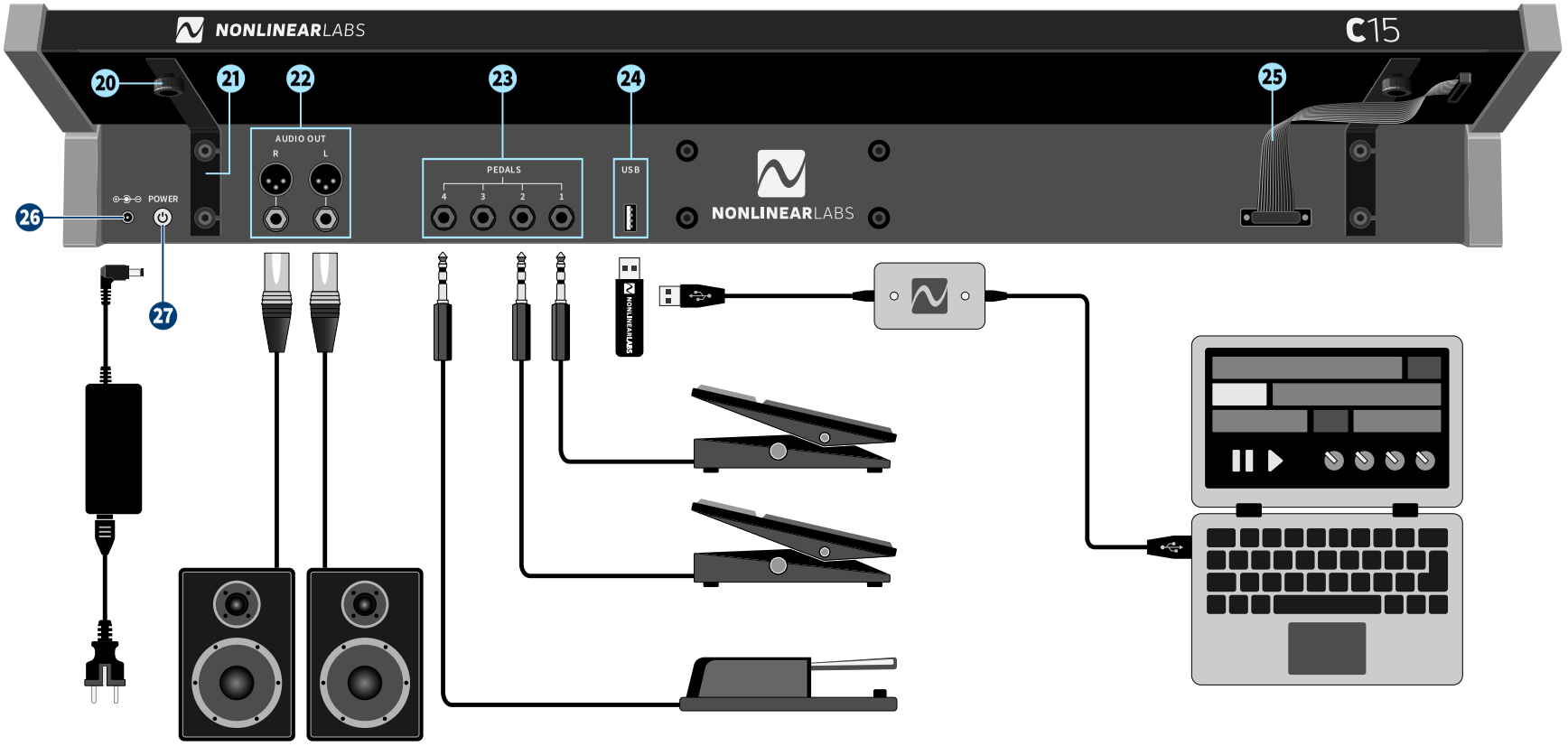
III. Device Overview



1 Base Unit
2 Panel Unit
3 Parameter Panel
4 Parameter Group
5 Parameter Selection Button
6 Parameter Selection Indicator
7 Multiple Parameter Indicator
8 Edit Panel
9 Panel Unit Display
10 Soft Buttons
11 Encoder
12 Base Unit Display
13 Base Unit Control Panel
14 Bender
15 Ribbon 1
16 Ribbon 2
17 Headphones Connector
18 Headphones Volume
19 Output Volume

20 Panel Unit Fixation Screw
21 Mounting Bracket for Panel Unit
22 Audio Outputs
23 Connectors for Pedals
24 USB Connector
25 Unit Connector Cable
26 Power Supply Connector
27 Power Switch





1. Introduction

The C15 is an instrument for the performing musician, designed for playability and detailed sound editing. Its unique sound character spans from crisp and organic to complex and experimental. The top-quality semi-weighted keybed drives a digital synthesis engine responding with a wide spectrum of sound colors and intensities.

As a dedicated real-time instrument, the C15 is built for human control. There are no sequencing modules to create rhythmic patterns — we leave this to the musician. Instead, the C15 is a decidedly responsive instrument which combines high-resolution keys, Ribbons, and Pedal inputs.

Every parameter on the C15 can be directly selected by a button. In other words, all functions are software-defined but have a dedicated haptic control surface. In addition, a Graphical User Interface can be displayed and edited on any device that has a browser and Wi-Fi. Like many classical instrument builders, we have chosen wood for most parts of the housing. All other parts are made of steel or aluminum. Along with the excellent keyboard, there is a specially-designed ergonomic (pitch) Bender, two very long touch-strips (Ribbons), and inputs for up to four Pedals.

Symbols and formats used in this Manual:

Important notes begin with an exclamation mark and have a red border:

> ⚠ *Ensure that the power supply is not interrupted when using the C15 …*

A hint or a background information starts with an “i” symbol and has a blue border:

> ℹ *If you encounter problems navigating the Setup menu, please refer to …*

A section, explaining a user interaction or task has a heading on blue background. Typically, it will be first explained for the **Panel Unit**:

Panel Unit

If available (most times), it is followed by an explanation for the Graphical UI. This type of heading is set in dark and has a lighter background:

Graphical UI

For interactions on the Base Unit see chapter *4.14 Base Unit Functionality*

About the Manual Content

The following chapters refer to different important aspects of working with the C15 instrument. Each chapter tries to exclude the „broader picture“ by focussing only on the crucial related aspects. Nevertheless, this manual attempts to cover as many details as possible. When using this manual, it may be helpful to first be certain about your aspect of interest, before actually looking something up. The following overview may help clarifying:

2. Setting up the C15
At least for the first attempt of putting all components together, consider reading this chapter describing the whole process.

3. Basic Concepts
This chapter outlines a general approach to the C15 instrument, explaining how to perform, how the modulation mechanism works and how everything is organized.

4. User Interfaces
This chapter explains how to actually work with the instrument. Methods of navigation, editing and preset access are described in detail for each available interface.

5. The Synthesis Engine
All signal- or DSP- related aspects are subject of this chapter, including details on signal synthesis and flow, tutorials as well as details on the integration of Hardware Sources.

6. Recorder
This chapter explains the Recorder feature of the Graphical User Interface.

7. MIDI
This chapter explains the MIDI features of the C15.

8. Setup (C15 System Settings)
When you have already gained some familiarity with the instrument, the setup chapter provides insight into the C15’s advanced system settings.

9. Updating the C15
Learn how to keep your C15 up-to-date with the latest firmware versions.

10. Specifications
This chapter outlines the technical specifications of the C15, including hardware and software.

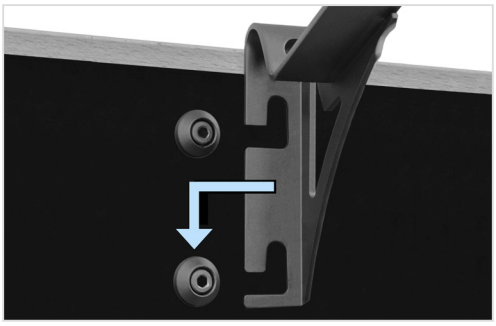
11. Shortcuts for the Graphical User Interface
Discover the keyboard shortcuts to navigate and operate the C15’s graphical user interface more efficiently.

12. Parameter Reference
A detailed reference guide to all the adjustable parameters within the C15.

2. Setting up the C15

2.1 Installing the Panel Unit

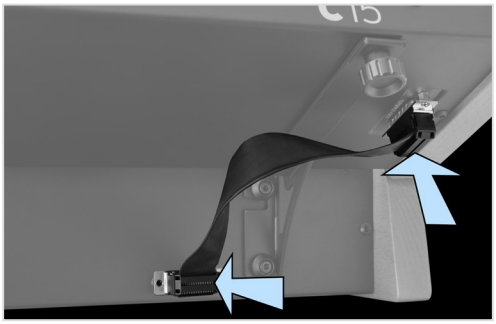
Make sure the C15 is switched off before proceeding in the following four steps:



Attach the Mounting Brackets to the Base Unit by hooking and snapping them into place.

Place the Panel Unit onto the installed Mounting Brackets. The two Mounting Screws on the bottom of the Panel Unit fit into the holes at the top of each Mounting Bracket.

Tighten down the Mounting Screws to lock the Panel Unit into place.



Connect Base Unit and Panel Unit with the Connector Cable.

Now the C15 is ready to use and can be switched on. In order to disassemble the paired configuration, undo above four steps in reverse order. The C15's Base Unit can also be used without the Panel Unit.

2.2 Connections

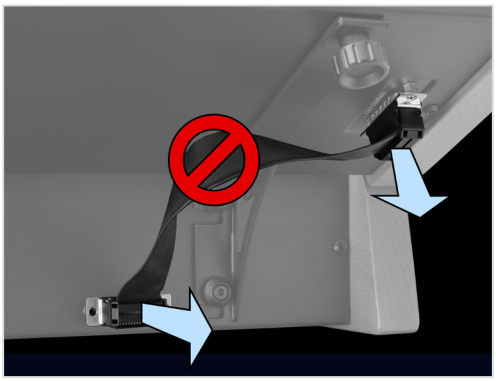
The following external connections are provided by the Base Unit:

The headphone output provides a 6.3 mm stereo headphone socket with separate, preset-independent adjustable headphone level. The headphone socket is suitable for all kinds of headphones but we strongly recommend to turn down the level when connecting low-impedance ear plugs. The headphone level is independent from the main output level (see below).

The line output level is adjustable by the potentiometer at the right end of the front bar

The audio output provides two parallel line-level stereo pairs of audio sockets (6.3mm TRS and XLR). Both pairs of sockets provide identical signals. The signals are transformer-balanced and ground-free, therefore in most cases a DI-box is not necessary. Unbalanced and balanced plugs can be connected. When connecting to unbalanced inputs please use unbalanced cables and plugs.

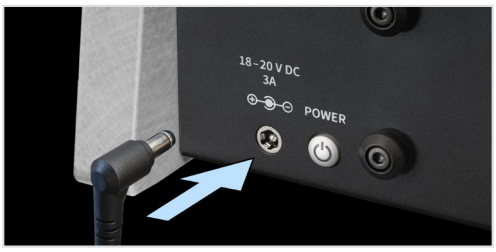
> ⚠ *Note that using both TRS and XLR outputs at the same time may cause hum.*



> ⚠ *To avoid stress on the cable itself, hold the plastic housing when pulling the Connector Cable.*

Four 6.3 mm pedal sockets are provided for external pedal control. In general, any keyboard controller pedal can be connected. However, we recommend continuous pedals as they allow for the most nuanced performance.

The USB connection is used for plugging in the USB flash drive included with the C15. The drive is used for transferring preset Banks and installing Updates. The MIDI Bridge as well as external MIDI devices can be connected here as well.



The C15 comes with its own external power adapter, which connects to the power inlet. An LED in the power switch indicates the power, boot and shut-down status of the C15.

2.3 Start and Shutdown

To turn on the C15, press the power switch. It will take several seconds for the device to boot up and be ready to use. The most recent settings are loaded on startup. To shut down the C15, press the power switch again. The shutdown process takes several seconds, during which it stores the current settings for the next startup, before the device turns off. An LED in the power switch indicates the C15's status as follows:

steady lit	on/normal operation
slow flashing	booting up
fast flashing	shutting down
one flash every 2 seconds	standby

A flickering LED indicates abnormal operation. For instance, it may mean that the supply voltage is too low.

⚠ *Make sure not to disconnect the power supply while you are using the C15 (booting up, performance, shutdown), otherwise its data may be lost.*

2.4 Setting up a device for the Graphical User Interface

Concept

The C15 is designed to be of flexible usage and interaction, requiring at least the Base Unit for connections and performance. In addition, the Panel Unit provides the Hardware User Interface and therefore access to all parameters, presets and settings.

Finally, the Base Unit also provides a Wi-Fi hotspot in order to connect external devices, such as smartphones, tablets, laptops and desktop computers. When connected, the Graphical User Interface can be accessed by using a browser from the external device. Multiple external devices can be connected simultaneously, each capable of showing different features. However, only one parameter can be focussed at a time, synchronizing the Hardware User Interface with every connected external device.

Furthermore, the Wi-Fi connection allows for preset interchange and therefore the possibility of backing up preset banks to the external device. The C15 User Manual is also accessible in the browser.

System Requirements

Due to the browser-based implementation of the Graphical User Interface, there are almost no limitations concerning compatibility between operating systems or browsers. Basically, the only required device functionalities are the device being capable of a Wi-Fi connection and an installed browser.

However, in the wide variety of devices, operating systems and browsers, there may be some restrictions and optimal performance can not be guaranteed. Differences between browsers, fast technological advances and frequent updates contribute to a complex situation, in which it is increasingly hard to state what is suitable.

Nevertheless, there are some experiences that emerged during development and can be expressed as a recommendation, or understood as minimal requirements:

- The device should run at least with a 1 GHz processing unit and 2 GB RAM space.
- The device display should support multi touch, or a mouse should be connected. A connected or integrated keyboard is useful in the Graphical User Interface.
- The device display should span at least 7'' diagonally.
- Although the choice of the browser is completely up to the user, currently (January 2025) the best performance is achieved by using a Google Chrome browser.

⚠ *If you encounter problems with your setup, try to restart your device or change to another browser (or device). If not, or if the problem won't go away, please contact us directly for help. We appreciate feedback and user reports and will do our best to solve your problem as soon as possible.*

Wi-Fi Settings

To set up a well defined Wi-Fi connection, enter the Setup Menu on the Hardware User Interface (**Setup Button**) and navigate to System Info. Here, all relevant aspects of the Wi-Fi connection are listed:

Device Name You can name your C15 instrument by focussing on the device name entry and pressing **Enter** to access the Rename Screen. Once the name is set, an SSID will be generated. The SSID is composed of a prefix (NL-C15-) and the name you just gave to the instrument.

SSID A Wi-Fi network with the same name as the SSID will be displayed when you scan for available networks on your external device. Connecting to this network enables your external device to control the C15 with a browser. The SSID is generated once during the booting process, so you will have to reboot the device when you rename it.

Passphrase Use the displayed passphrase to establish a secure connection between your external device and the C15 network. Pressing the **Enter Button** will bring up various editing options.

Edit: allows you to manually edit the passphrase
Randomize: generates a random alphanumeric password (case sensitive)
Default: resets the password to the factory default

We recommend that you create a new passphrase if you suspect that your current one has been compromised.

Address **192.168.8.2**
Once the connection is established, copy and paste the address into your browser's address bar and the Graphical User Interface should appear in your browser.

The Wi-Fi connection can also be disabled to provide a more secure setup and prevent anyone else controlling the device remotely. This may be especially useful when performing live. Enter the Setup Menu (**Setup Button**) and navigate to Device Settings. At the bottom of the list, find Enable/Disable WiFi and change the setting.

⚠ *If you encounter problems navigating the Setup menu intuitively, please refer to chapters 4. User Interfaces and 6. Setup (C15 System Settings).*

Browser-specific issues

As already mentioned, there may be restrictions on some browsers, as there is no real standard on functionality. We do our best to keep track of browser-specific issues and offer solutions if we can find them.

2.5 Pedal Integration

Connect a cable to the pedal and turn down the volume control (if necessary). Plug the other end of the cable into one of the four TRS sockets on the C15 (Pedal 1 to 4). If the C15 is already switched on, try to insert the cable quickly (ideally less than 1 second).

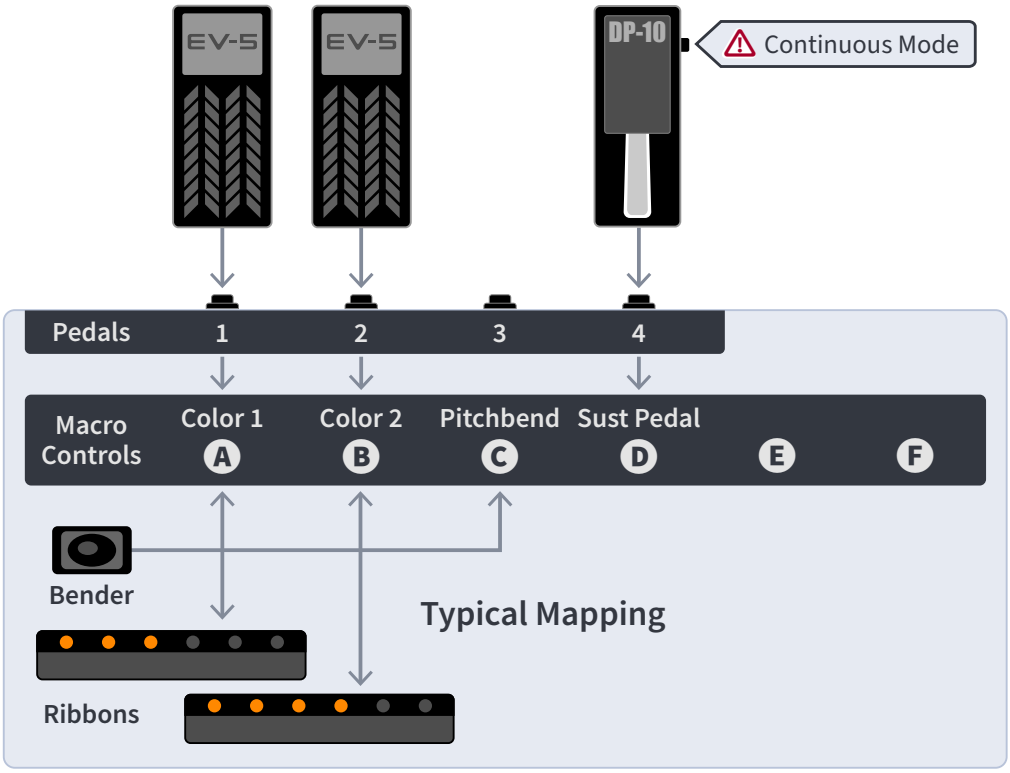
Go to Setup > Device Settings > Pedals, scroll past Pedal Modes and select the Pedal input to which you have just connected your pedal by pressing Enter. Select your pedal model from the preset list and press Enter to confirm. If your exact model is not listed, try one of the generic presets ("Pot, Tip-Active", "Pot, Ring-Active", etc.) until the pedal works as intended.

To calibrate the pedal, move it to one end of its mechanical travel, wait a moment (1 second), then move it to the other end and wait again.

Check that the position indicator on the Pedal Settings screen moves evenly over the whole range from 0% to 100%. If you are using one of the generic presets and find that the approximate center position gives a reading that is too high, try the pedal preset with the pin-out reversed (e.g. ring active instead of tip active).

If you find that the pedal no longer moves over the full 0%...100% range, reset and recalibrate the pedal by temporarily selecting a different pedal preset or simply reconnecting the pedal.

Shown below is the standard way of connecting the pedals and mapping all the Hardware Sources, which is also used by the vast majority of the presets. Over the years, this method of assigning Hardware Sources has proven to be practical. However, we encourage you to try out other setups, which may be more suitable for your use cases.



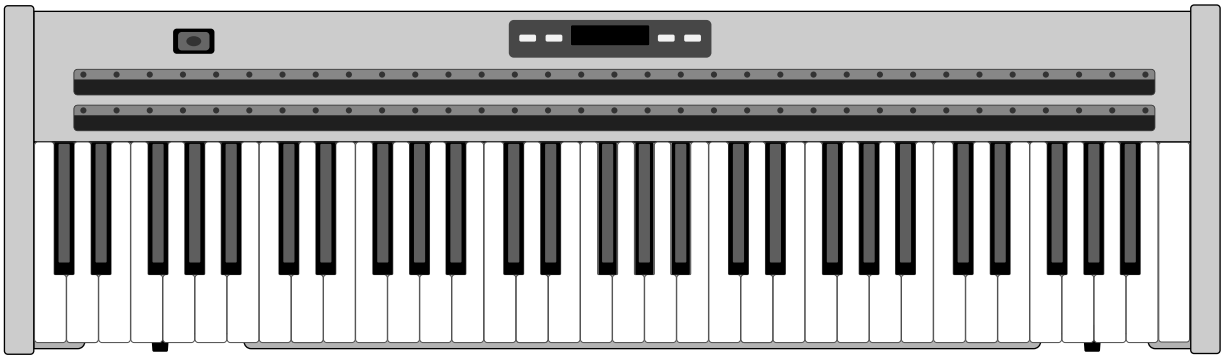
3. Basic Concepts

There are multiple ways to interact with the C15, each consisting of a different organisation and optimized layout of the information it represents, depending on the interface you are using. However, the basic structure and handling options remain comparable, as each form of interaction follows the same underlying principle.
This chapter covers these general concepts, terms and keywords in detail, and explains the various means of interaction with the Hardware User Interface and Graphical User Interface, along with the modulation mechanism and presets.

3.1 Interfaces

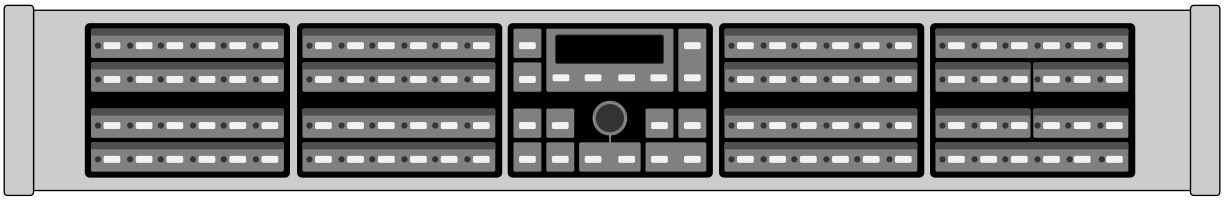
Overall, three interfaces are available:

Base Unit



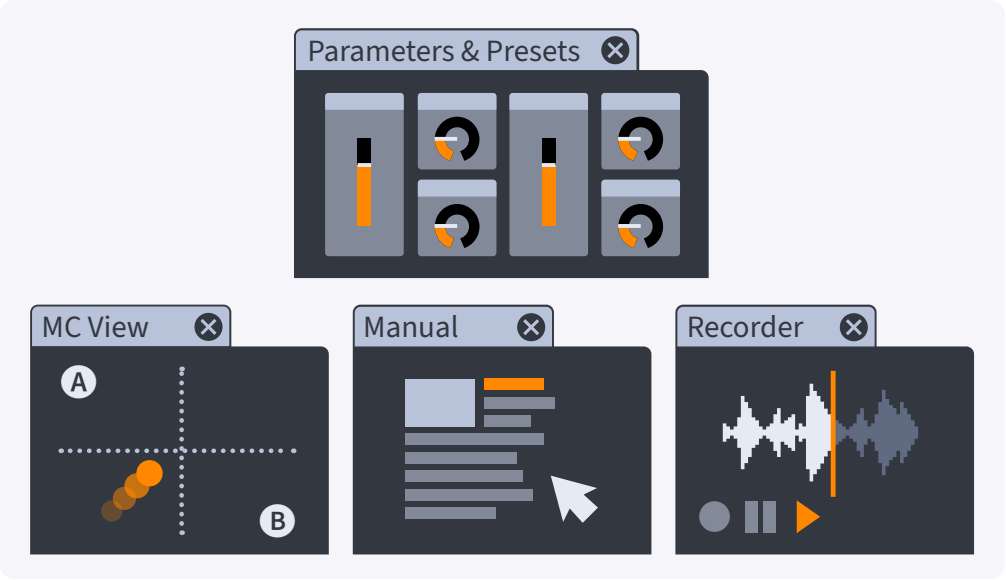
The Base Unit provides access to all performance-related items (Hardware Sources, Keys). It can also be used to edit parameters and navigate presets and banks. Navigation of parameters may be provided in future upgrades to the system.

Panel Unit



The Panel Unit can be used to select and edit parameters, modulation controls and system settings. Presets, banks and the undo history can all be navigated and managed here. In short, all the C15's data can be controlled with the Panel Unit.
Four Parameter Panels, are provided, each consisting of 24 Parameter Selection Buttons. Most of the parameters can be accessed this way.

Graphical User Interface



The Graphical User Interface also provides full access to all parameters, modulation controls and system settings. However, it also offers more extensive helper features and settings, such as access to the C15 Documentation.

3.2 Keybed

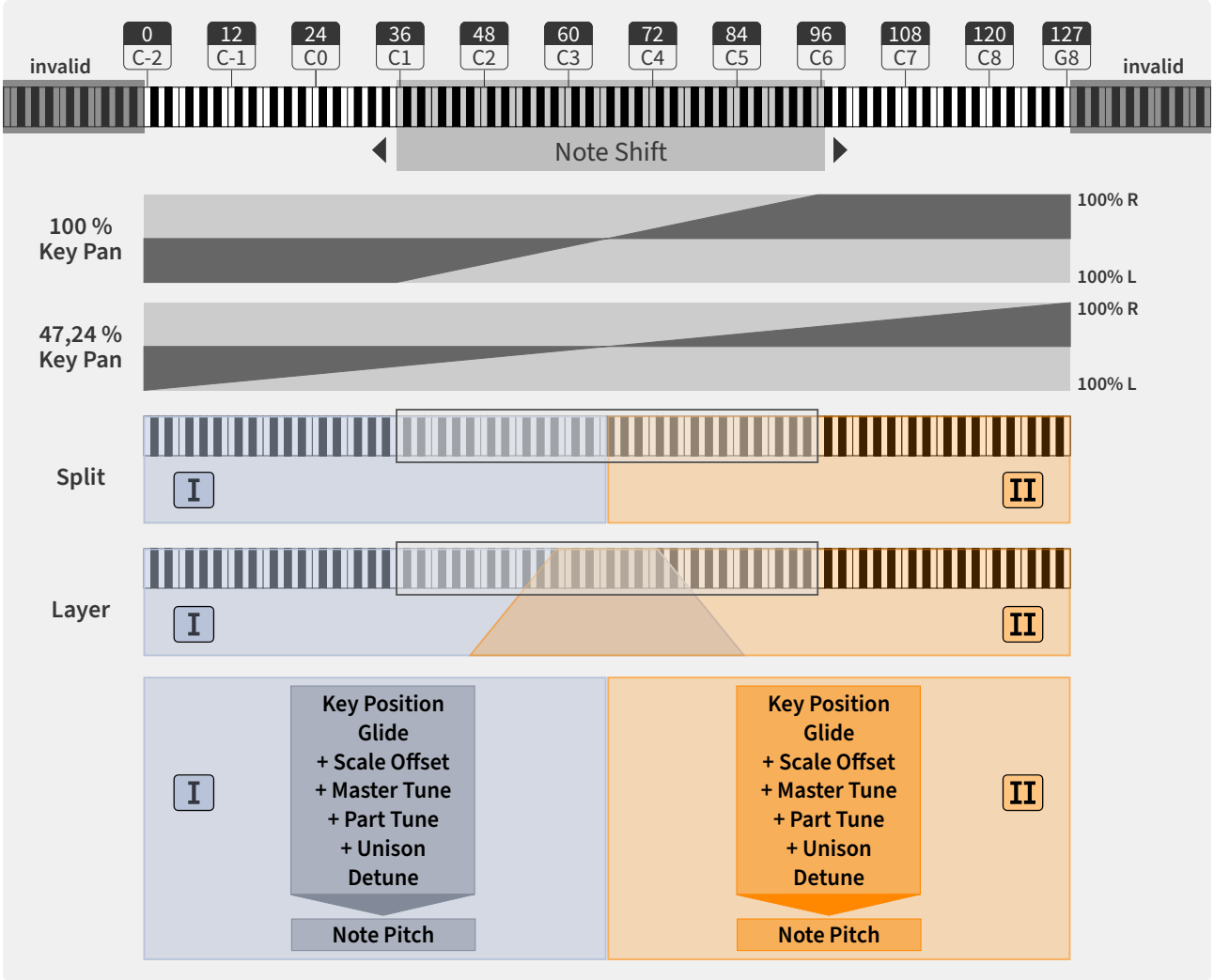
A pressed key (left), with Aftertouch (right)

The keybed, arguably the most important performance input, provides polyphonic control over notes (currently 48 voices at 48 kHz) and global Aftertouch (as shown above). The semi-weighted, high quality keybed is produced by Fatar, and has 61 keys (5 octaves)

The C15 has a virtual key range of 128 keys (C-2 ... G8). The physical key range of 61 keys is projected onto the virtual key range, depending on the Note Shift. Extreme Note Shift may exceed the virtual key range for certain keys, in which case no note is produced.

Split Point and "Fade From" or "Fade Range" parameters operate within the virtual key range and the Note Shift can be used to transpose into or out of parts. The parameters can only be set within the physical key range (C1 ... C6).

Polyphonic Key Pan in the Output Mixer also operates within the virtual key range and the Note Shift can be used to transpose into or out of more extreme panning. At 100%, the panning starts to clip at the physical key range's edges (C1 ... C6), at 47.24 % the panning covers the whole virtual key range (C-2 ... G8).



3.3 Hardware Sources

Bender and Ribbons

Apart from Aftertouch, seven further integrated Hardware Sources can be used in performance. These are: the Bender, two Ribbons and up to four external Pedals (as shown below). The two Ribbon touchstrips are mappable to two pairs of virtual Ribbons (Ribbons 1/2 and 3/4), increasing the number of integrated Hardware Sources to 10.

All sorts of expression, sustain or damper pedals can be integrated into the system for expressive play.

Expression pedal

Damper pedal

While performing, notes can be played (on the keybed) and movements made (with the Hardware Sources) to bring motion and variation into your sound. Similarly, notes and all Hardware Sources can also be controlled externally by using MIDI (see chapter 7. Midi). The C15 MIDI functionality provides one more, non-integrated Hardware Source: Polyphonic Aftertouch. This Hardware Source is extending the integrated monophonic modulation mechanism by introducing true polyphonic control for specific notes (see chapter 3.5. Modulation Scheme).

The 11 Hardware Sources are the first of three modulation stages. They gather the user's performance input and distribute the hardware source movements to the six Macro Controls. The Hardware Sources work in various ways, depending on the behavior and settings of the individual sources. The following section looks at all the relevant aspects of hardware sources and external controllers in general.

Hardware Source behavior in detail

Continuity
Controllers come in two forms: switches (e.g., a Sustain Pedal) and continuous controllers (e.g., a Volume Pedal). While continuous controllers are usually recommended, switch controllers can also be integrated. All four integrated Hardware Sources are continuous.

Directionality and Polarity
Switch controllers come in two types: opener switches (e.g., Sustain Pedal), which move from minimum to maximum, and closer switches (e.g., Mute or Damping Pedal), which work in reverse. However, regardless of a controller's direction, it can still be integrated, and its direction can be adjusted by modulation amounts.

In contrast, continuous controllers are either unipolar (moving in one direction) or bipolar (like a Pitch Bender, moving both up and down).

Physical Return Behavior of Controllers
Some controllers (e.g., Sustain Pedal, Pitch Bender) return to a set position after use – usually center or zero –, while others maintain their last position. Controllers that revert to center are typically bipolar.

Hardware Source Return Behavior Property

The Pedal and Ribbon Hardware Sources have a Return Behavior property, saved within presets. It offers three options: 'Non-Return', 'Return to Center' and 'Return to Zero' (Pedal only). These settings correspond to the physical return behavior of controllers and should be set accordingly. This property ultimately governs how Hardware Sources are set and how they influence Macro Controls:

Non-Return	Return To Zero, Return To Center
In this mode, a Hardware Source's value directly sets the position of the assigned Macro Control (direct behavior), with the most recent movement taking precedence when multiple sources are involved. Non-returning Ribbons can only control a single Macro Control, so any adjustment is immediately reflected in both. In non-returning mode, Hardware Amounts can only be set to On or Off, enabling/disabling the full range of modulation.	Returning Hardware Sources operate by adding their value to the Macro Control rather than directly setting it (additive behavior). A continuously adjustable Hardware Amount (0% to 100%) controls the proportion of the value transferred. This additive mechanism enables seamless combination of multiple sources, making it ideal for merging effects like Bender and Aftertouch for interesting pitch modulations.

We recommend leaving returning Sources in their return positions when changing their Return Behavior. Otherwise, the modulation to associated Macro Controls may be compromised due to offsets and clipping Macro Controls.

Returning vs. Non-Returning: Impact on Macro Control Position

Switching a Hardware Source to returning mode means its physical position no longer directly matches the Macro Control's position, which is especially important for Ribbons. In non-returning mode, Ribbons mirror the Macro Control's position. In returning mode, they only show the additive change, so a centered Ribbon might not set the Macro Control to center. In that case the final Macro Control position depends on all active Hardware Sources influencing it.

Recalling Hardware Source Positions

The Return Behavior of Hardware Sources is part of a Preset and may change when loading a Preset. However, the positions of Hardware Sources are not saved within a Preset. The following sections describe the recall behavior of Hardware Source positions in more detail.

Returning Hardware Sources

If presets are loaded while returning Hardware Sources are at their return positions (zero/center), they will match the saved state. If not, the preset will differ until the sources return to their return positions.

Non-Returning Pedals

When a Preset is loaded, the positions of non-returning Pedals are ignored by their associated Macro Controls, often causing the Macro Controls to differ in position. Moving a Pedal will cause the Macro Control position to jump to the current Pedal position and both positions will be synchronized again.

Non-Returning Ribbons

When a Preset is loaded, the Macro Control positions will overwrite the position of associated non-Returning Ribbons, causing them to be synchronized from the start.

Ribbons: Relative Mode
Ribbons can operate in relative mode, amplifying drag gestures. This lets you modulate over the entire range using a small active section of the Ribbon.

Hardware Source Functions
Some Hardware Sources offer extra functions. For example, pedals can control global sustain and sostenuto directly without macro mapping. Similarly, bender and monophonic aftertouch can be mapped to global pitch parameters. The bipolar bender has separate upward and downward settings, while unipolar aftertouch provides only one.

Additional Settings
Each Hardware Source has additional type-specific settings in the Setup menu. Bender and Aftertouch include curves to weight movements. Ribbons feature a “Relative Factor” for defining the active modulation zone in relative mode. Pedals can be configured to act either as standard Hardware Sources or as switches for navigating presets or banks.

Functionality Overview
All the mentioned different aspects of Hardware Sources are shown in the following table:

Source	Bender	Monophonic Aftertouch	Ribbon 1 - 4	Pedal 1 - 4	Polyphonic Aftertouch
Continuity	continuous			continuous / switch	continuous
Polarity	bipolar	unipolar	unipolar / bipolar	unipolar / bipolar	unipolar
Return Behavior	center	zero	non / center	non / zero / center	zero
Integration	integrated	integrated	integrated / virtual	external (physical)	external (MIDI)
Recall Behavior	**Returning HW Sources:** Presets loaded while returning HW Sources are in their return positions (zero/center) will look and sound the way they were saved. Presets loaded while returning HW Sources are not in their return positions will look and sound different to their saved state. If HW Sources return to their return positions again, the Preset will return to its saved state. **Non-returning Pedals:** When a Preset is loaded, the positions of non-returning Pedals are ignored by their associated Macro Controls, often causing the Macro Controls to differ in position. Moving a Pedal will cause the Macro Control position to align with the current Pedal position and both positions will be synchronized again. **Non-returning Ribbons:** When a Preset is loaded, the Macro Control positions will overwrite the position of associated non-Returning Ribbons, causing them to be synchronized from the start.				
Settings	Curve		Relative Factor	Pedal Modes / Pedal Presets	–
Touch Mode	absolute		absolute / relative	absolute	
Hardware Source Functions	Global Pitch	Global Pitch	–	Sustain, Sostenuto	–

3.4 Macro Controls

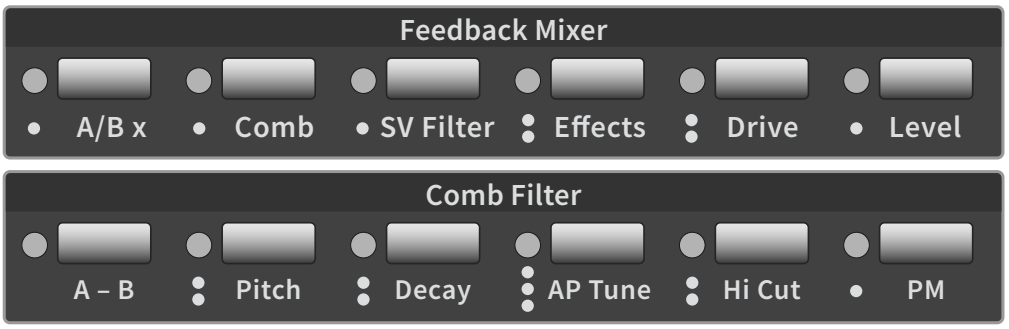
There are six additional parameters that don't have any connection or effect by default. These are the Macro Controls, and they represent the second of three modulation stages.

The Macro Controls are modulated by the Hardware Sources, whereas the Synthesis Engine Parameters themselves are modulated by the Macro Controls. The Macro Controls can thus be seen as the hub of the Modulation Mechanism, which distribute the control movements of the Hardware Sources to the Synthesis Engine's Parameters.

The function of a Macro Control is defined by the sound designer. It acts as a primary tool for varying the sound, as Macro Controls are both interactive (they can be edited) and performant (they can be modulated by the Hardware Sources).

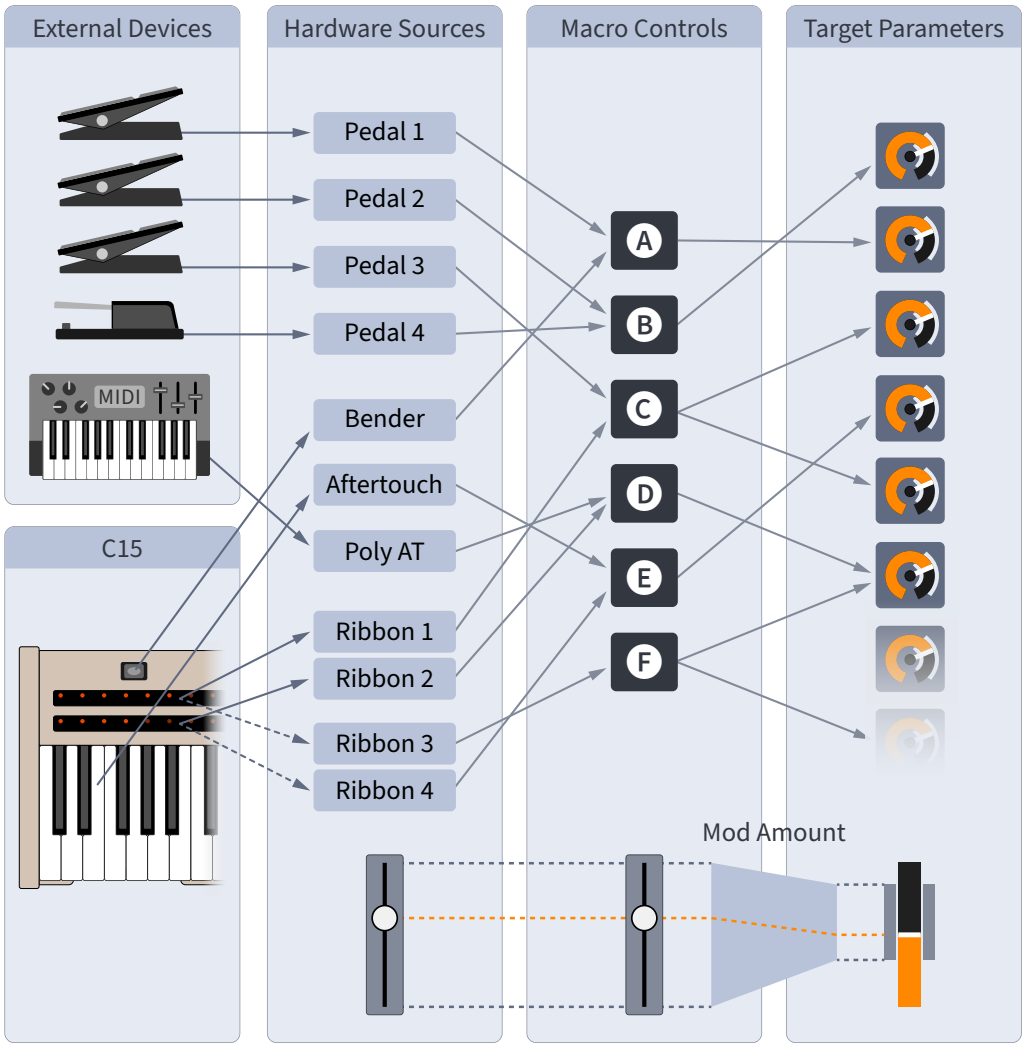
3.5 Parameters

Items that are relevant for synthesis are called Parameters and are organized in Parameter Groups. Each group combines all Parameters relating to a given Synthesis Engine process (such as a mixer or filter).



Most Parameters are integrated into the modulation mechanism and can be referred to as Modulation Targets.

3.6 Modulation Mechanism



General Aspects

The C15 does not have dedicated automatic modulation processes like LFOs (with the exception of the Flanger/Tremolo and to some extent Envelope C).
While playing, it is left to the performer to add further expressive motion to the sound by using the Hardware Sources. The Modulation Mechanism captures the movements of Hardware Sources and provides routing options to distribute this motion from Macro Controls to target Parameters.

In a given preset, the flow of movements is defined by several Amount Parameters, which weight the amount and direction of a particular movement:

- Each Hardware Source has a separate Amount for each Macro Control
- Multiple Hardware Sources can control a single Macro Control
- Each Target parameter can be influenced by only one Macro Control.
- Each Target parameter features a Modulation Amount Parameter.

How Hardware Sources affect Macro Controls depends largely on the types and settings of the sources in question (*see 3.3 Hardware Sources*), making generalizations difficult. However, when the attached Hardware Sources are non-returning, Macro Controls affect target Parameters according to consistent rules.

Modulation Aspects

> *In the following passages, assume the Macro Control is influenced only by non-returning Hardware Sources.*

The Modulation Amounts "*MC Amt*" define the range within which target Parameters move when their corresponding Macro Controls are moved. Adjusting the Modulation Amount will not change the Macro Control position nor the corresponding target Parameter position (fig. 1).

There may be cases in which the modulation range exceeds the parameter range: this is also known as virtual overdrive. When a modulation tries to move a parameter out of its operational range, it remains at the parameters limit (clipped) until the modulation returns to within the parameter range again (fig. 2).

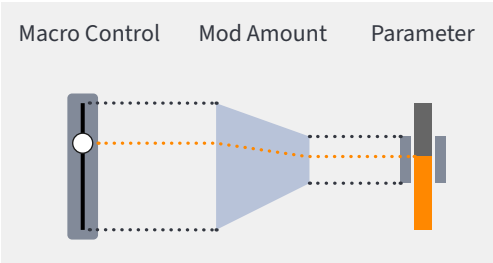


fig. 1

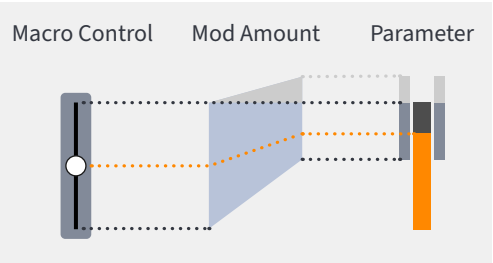


fig. 2

In case of virtual overdrive, we recommend adjusting it using the upper or lower limit parameters. This ensures the full range of the Macro Control (and Hardware Source) is effectively utilized for modulation. That said, there may be situations where intentional virtual overdrive is desirable, depending on your creative goals.

Unlike modifying the modulation amount, adjusting the upper or lower limits of the modulation range affects the target parameter's position. This adjustment depends on the current position of the associated Macro Control.

If we compare unipolar and bipolar target parameters (fig. 3), it is clear that the full modulation range (-100% ... 100%) of bipolar parameters is effectively twice the modulation range (0% ... 100%) of unipolar parameters.

When a target parameter has linear scaling, the modulation amount can be displayed in the same format as the parameter's unit of measurement. Target parameters with nonlinear scaling display the modulation amount as a percentage (fig. 4).

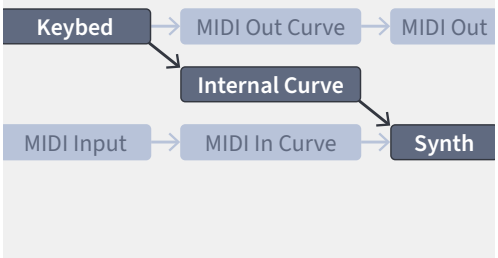


fig. 3

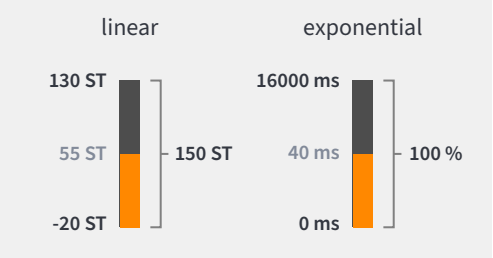


fig. 4

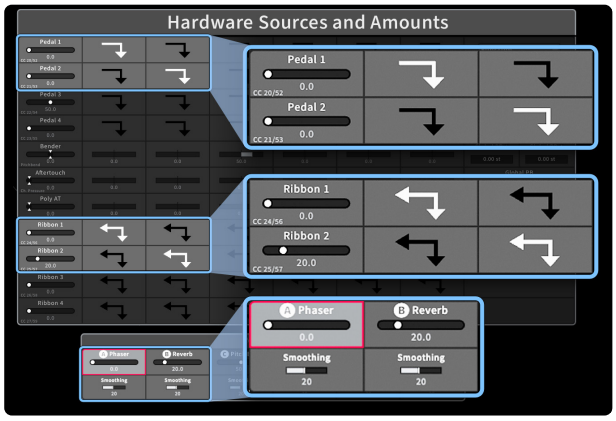
Modulation Matrix and Modulation Template

The ensemble of parameters and aspects underlying the modulation mechanism is termed the Modulation Matrix. Specifically, it is composed of:

- Hardware Source Assignments/Amounts
- Hardware Source Return Behavior (Pedal/Ribbon)
- Hardware Source Functions (Global Pitch, Sustain, Sostenuto)
- Macro Control Positions
- Macro Control Smoothing Times

All of these parameters are saved within a preset. Macro Control Assignments are also saved but are considered part of the Sound Design rather than the Modulation Matrix. Hardware Source Positions are not saved in a preset to prevent unpredictable behavior when switching to presets that have different Return Behaviors for Pedals or Ribbons.

For most presets, the modulation matrix follows a standard “Modulation Template” that generally includes some default Macro Control Assignments.



The template assigns two non-returning continuous Pedals (1 and 2) to Macro Controls **A** and **B**, modulating sound characteristics — typically affecting timbre. Ribbons 1 and 2 are mapped to these controls as well. Additionally, Macro Control **C** is driven by the Bender for pitch bending, while a returning continuous Pedal (4) is linked to Macro Control **D** to serve as a Sustain or Damper Pedal, depending on the sound.

> *Despite the use of a returning pedal, the Return Behaviour of Pedal 4 is set to non-return for the majority of presets. This is a legacy artefact, but it also simplifies the setting of the hardware amounts.*

3.7 Presets

The current sound can be stored as a preset at any time for later use. Presets are organized into banks, so that each preset has a unique path (bank number/preset number). Some other aspects of presets are explained as follows:

Preset Name

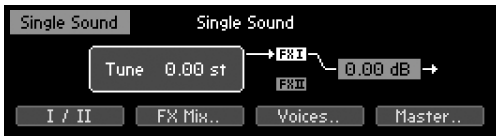
Each preset can be given a unique user-definable name. When you store a preset, you will be prompted to name it. You can change the name of the preset at any time.

Preset Number

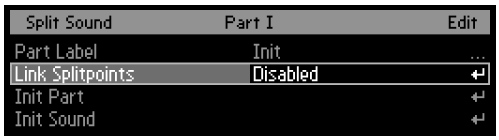
Each preset has a certain position in its bank. This position and the bank number are combined to define a unique number for the preset, which displays on each user interface. For example, the unique number “1-001” refers to the first preset in the first bank.

Sound Type

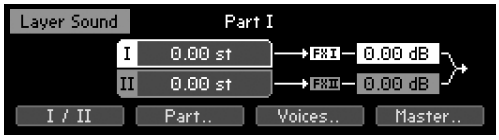
A C15 preset can be one of three sound types: Single, Split, or Layer.



A **Single Sound** has one set of parameters (excluding the Effects Section) and can use up to 48 voices (or 24 at 96kHz internal sample rate). Split and Layer Sounds have two Parts (I and II), each with their own set of parameters. A Part can use up to 24 (12) voices.



In **Split Sounds** (**II**) the Parts are assigned to two separate keyboard ranges. Part I can be played between the lowest key (C0) and the Split Point, Part II between the Split Point and the highest key (C6). The Parts have separate voice allocations, which means that they can have different settings for Mono and Unison. The Split Point is not affected by the Note Shift function, the Master Tune or the Part Tune.



In **Layer Sounds** (**=**) each voice of Part I will be played simultaneously with the corresponding voice of Part II. Both Parts share the same voice allocation, which means that they have identical settings for Mono and Unison.

⚠ *Note that held Keys will reset when loading whole Presets or Parts of different types.*

Preset Info

Each preset contains a set of metadata. Some are defined automatically when you store the preset and others can be edited.

Auto-generated Metadata	Editable Metadata
Property Tags	Preset Number
Sample Rate	Preset Name
Time Stamp	Color Tag
Device Name	Comment Text
Software Version	

Comment Text

The comment text can be used to describe the sound, give performance instructions and set keywords for the search function. We recommend to use the hashtag symbol “#” when defining keywords, which sets them apart from other types of descriptions in the comment text and makes them easier to search for using the search function.

Property Tags

In addition to any self-defined keywords in the comment text, the Preset Info also contains automatically generated property tags. These are dependent on certain Parameter settings and can also be used as search terms in the search function. The following table illustrates all property tags and their associated Parameter settings.

Property	Hashtags
Single/Split/Layer Sound	#Single/#Split/#Layer
Mono Enable Off/On	#Poly/#Mono
Unison Voices 1 (off) /2-24	#1-voice/#Unison
Scale Note Offsets No/Yes	#12-TET/#Scale

Change Recognition

When you change a loaded preset, the system recognizes the change and indicates this by appending an asterisk (*) to the unique preset number. When you store a preset after making changes to it, the system considers it to be a new preset, unless you force it to overwrite an existing preset.

More information about dealing with changes to loaded presets can be found in chapter 4.10 Overviews.

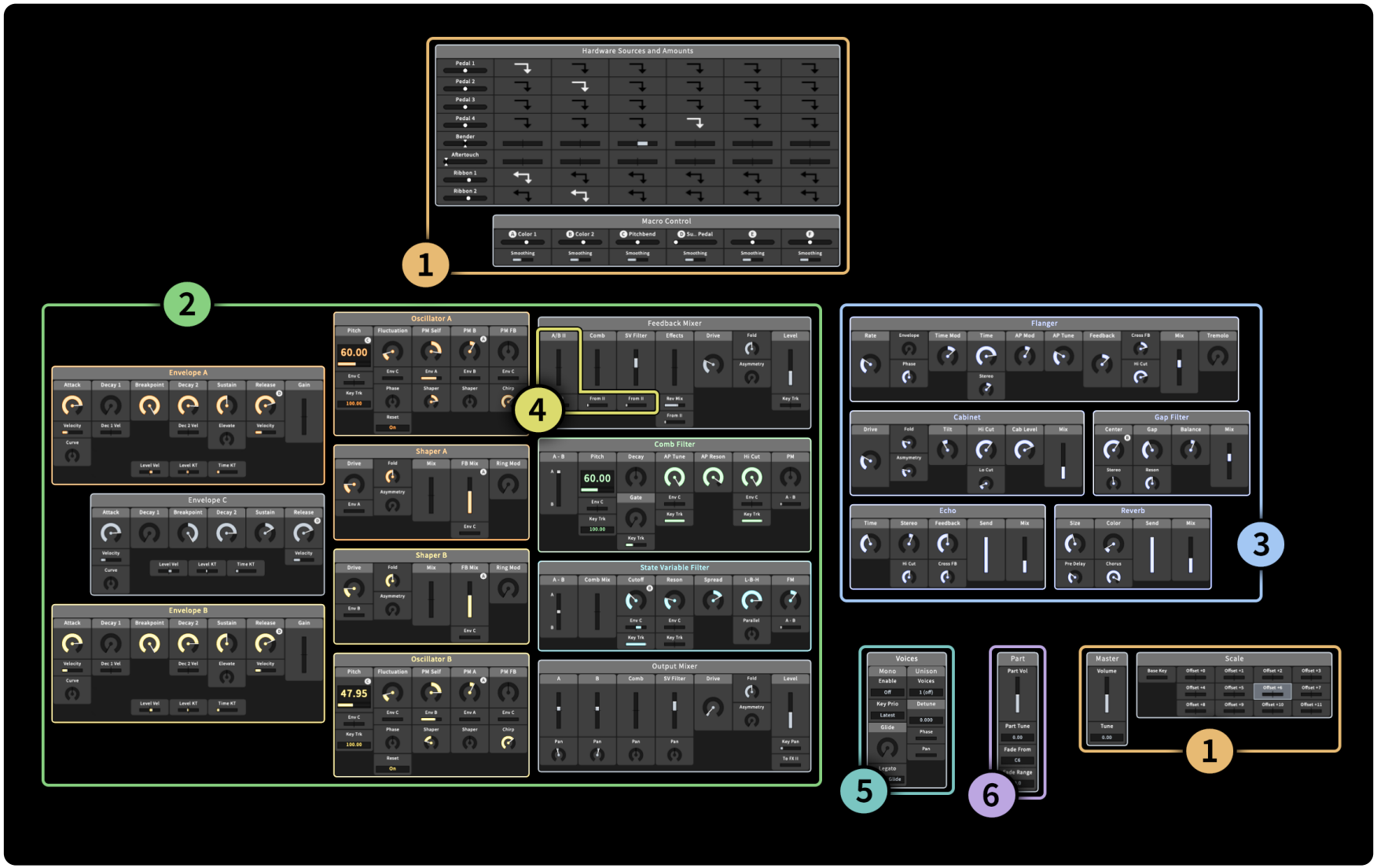
Note that modulations, changing parameters, are considered as a preset change.

3.8 Organization

All accessible items on the C15 are organized into functional groups. Parameters are grouped according to their functional relations as part of the synthesis engine, the Hardware Sources and Macro Controls are grouped next to each other, and other items are organized into menu structures.

The Hardware User Interface (consisting of the Base Unit and Panel Unit) gives quick access to all Parameters. However, not every parameter can be accessed with a single click, as several Parameters may be stacked behind one Parameter Selection Button. Furthermore, a few Parameter Groups (Master, Part, Unison, Mono) can only be accessed via the **Sound Button**.

In the Graphical User Interface, every Parameter and every Bank is shown in the main area. This requires physical space to display all the necessary information, and some screens may not be large enough or sufficiently high resolution to do so. These limitations are dealt with by zooming into and out of the display, which is a crucial aspect of working with the Graphical User Interface, as different levels of detail emerge at different zoom levels.


Hardware Sources and Amounts
Pedal 1
Pedal 2
Pedal 3
Pedal 4
Bender
Aftertouch
Ribbon 1
Ribbon 2
Macro Control
Color 1
Color 2
Pitchbend
Su.. Pedal
Smoothing
1
2
Envelope A
Envelope B
Envelope C
Attack
Decay 1
Breakpoint
Decay 2
Sustain
Release
Gain
Velocity
Curve
Oscillator A
Oscillator B
Pitch
Fluctuation
PM Self
PM B
PM FB
PM A
60.00
47.95
Shaper A
Shaper B
Drive
Fold
Mix
FB Mix
Ring Mod
Feedback Mixer
Comb
SV Filter
Effects
Level
4
Comb Filter
Decay
Gate
AP Tune
AP Reson
Hi Cut
PM
State Variable Filter
Comb Mix
Cutoff
Reson
Spread
L-B-H
FM
Output Mixer
Pan
Flanger
Rate
Envelope
Time Mod
Time
AP Mod
Feedback
Cross FB
Mix
Tremolo
Cabinet
Tilt
Cab Level
Gap Filter
Center
Gap
Balance
Echo
Send
Reverb
Size
Color
3
Voices
Mono
Unison
Enable
Key Prio
Glide
Detune
5
Part
Part Vol
Part Tune
Fade From
6
Master
Volume
Tune
Scale
Base Key
1

1. The Hardware Sources, their Amounts, Macro Controls, their Smoothing Times, Master and Scale parameters are considered global and exist only once within a preset, regardless of Sound Type (Single, Split, Layer). For Single sounds, the Master Group also contains the FX Mix I-II parameter.

2. All the parameters from Envelope A to the Output Mixer are considered to be local and form a single Voicegroup. Since one Voicegroup (or two for Layer/Split sounds) is responsible for creating a single voice, the Voicegroup parameters are considered polyphonic.

3. All of the parameters in the effects section are also considered to be local and form one effect chain. Each preset contains two effect chains. This applies regardless of the Sound Type. As they exist exactly twice (effect chain I/II) for all voices, the parameters of the two effect chains are considered monophonic.

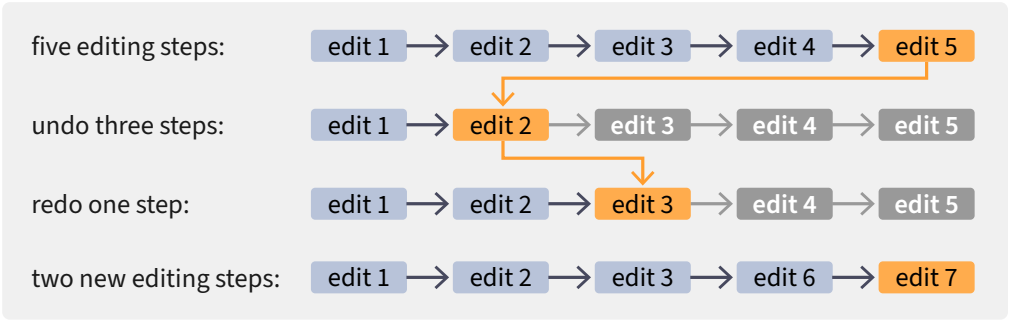
4. Some of the parameters in the Feedback Mixer group are special because they are only available if the current Sound Type is Layer. These parameters are: A/B I/II, A-B, Comb From I/II and SVF From I/II.

5. The Voices group consists of the Unison and Mono parameters. These are present once in a Single or Layer sound and twice in a Split sound.

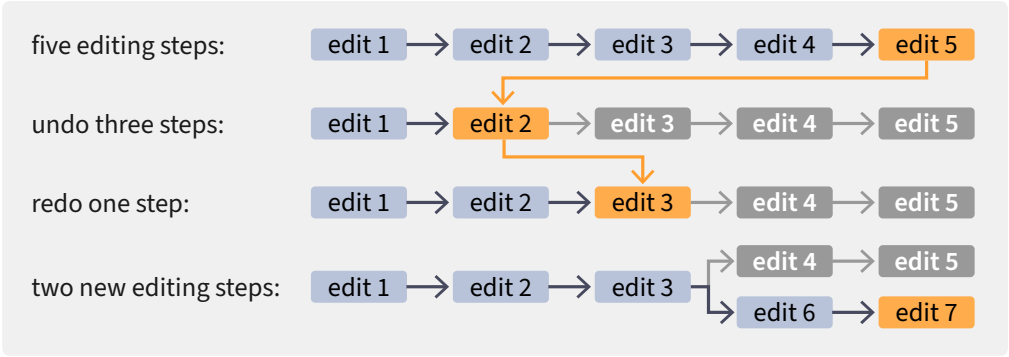
6. The Part group consists of the Part Volume/Tune parameters as well as the Split Point (Split presets) or the Fade From and Fade Range (Layer presets) parameters. This group is only available when the Sound type is Layer or Split.

3.9 The Undo Tree

The usual undo history of a program would be a list-like data structure. When an editing action is tracked, it is simply appended to the list. If you undo a number of edits, they are lost when you make new edits.



The C15's undo history, on the other hand, is a tree-like data structure. All editing actions are tracked and new branches are created when you undo edits and then make new changes.



Using this mechanism, there will be no loss of editing steps, as all steps and branches are accessible. Nevertheless, an ever-growing undo tree will require lots of memory and may be capable of slowing down the system. This can be avoided by making a certain element the new root of the tree (elements prior to that position will be lost in this case) or by deleting inactive branches of the undo tree.

Within a branch, the mechanism is quite similar to the ordinary list-based undo, providing backward and forward navigation via undo or redo. The extended tree-based functionalities emerge when navigating to other branches.

The C15 undo mechanism tracks different user actions. Parameter selection, edits to Parameters, Preset recalls and edits to Presets and Banks can be undone. However, the Modulation Mechanism is not integrated into the undo mechanism, as it is part of the user performance.

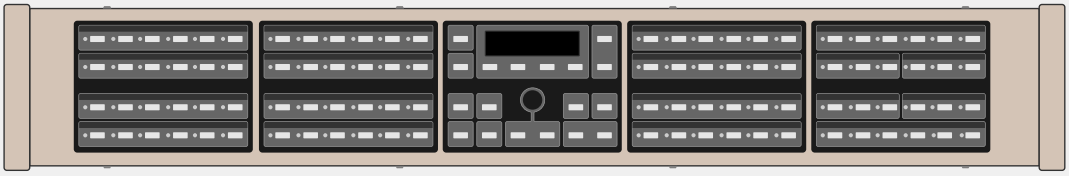
4. User Interfaces

As described, the C15 has two different user interfaces. The Hardware User Interface consists of the Base Unit and Panel Unit with their haptic (“hands on”) controls.

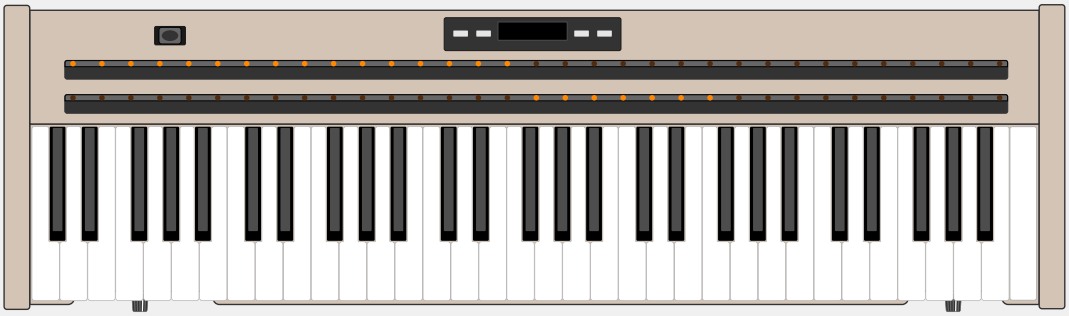
The Graphical User Interface is available on external devices via a Wi-Fi connection, and offers a detailed representation of all parameters and presets. Multiple devices can be connected in parallel, each focused on different aspects.

⚠ *Note that all available interfaces operate in a synchronized manner, sharing the same state and focus.*

Panel Unit



Base Unit



Graphical UI

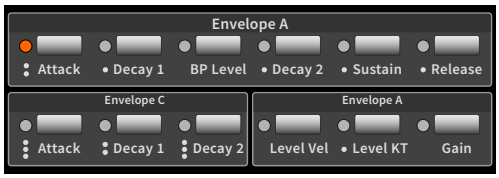
The following chapters explain how to focus on items and their aspects to edit them.

4.1 Parameters

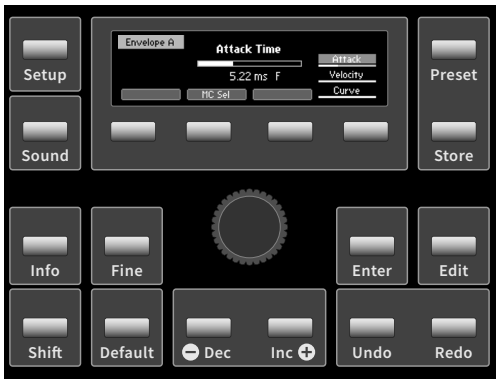
The C15 architecture was designed to offer quick access to all items and aspects, providing one central area representing the current focus. This main principle (of focusing on one item at a time for further editing) affects each interaction on any available user interface. As mentioned, the current focus will be shared with all involved devices.

4.1.1 Selection

Parameter Selection

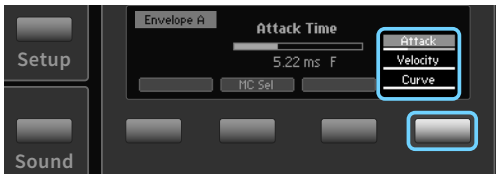


Parameter Panels provide **Parameter Selection Buttons**. The corresponding LED (left of the button) lights up to indicate the current focus.



The Panel Unit Display provides a corresponding screen for the selected item. The buttons of the Edit Panel give access to all aspects of the items.

Multiple parameters can be provided by one **Parameter Selection Button** (indicated by circles below the LED).

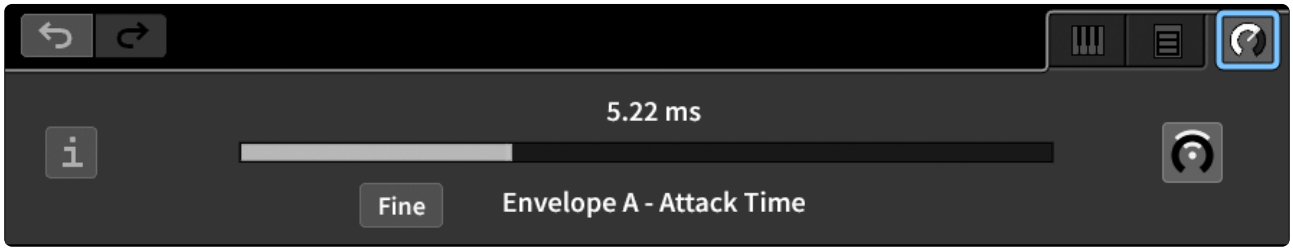


The **Parameter Selection Button** or **Soft Button 4** will cycle through the stack.

Graphical UI

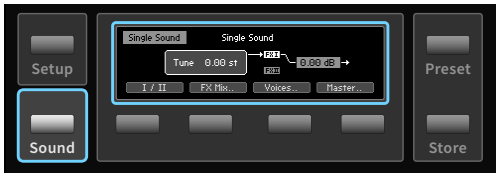
All parameters are displayed in the main area and can be selected by clicking on them. The background of an element highlights when selected. Zooming in with the mouse wheel or pinch gestures reveals additional details based on the zoom level.

Double-clicking a Parameter Group header zooms into the group.

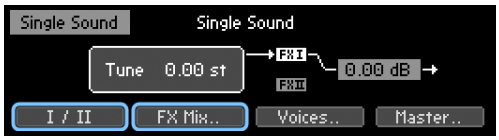


The expandable tab area at the bottom of the screen shows all item-related aspects. Parameters can be edited in the Parameter Tab indicated by the knob-icon on right side above the Tab area.

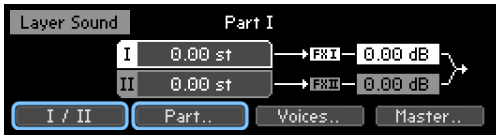
Sound Screen



The **Sound button** opens the Sound Screen, which provides access to the few parameter groups that are not directly accessible on the Parameter Panels.



For Single Sounds, **Soft Button 1** [**I/II**] changes the FX focus and **Soft Button 2** [**FX Mix**] focuses on the FX Mix parameter.



For Dual Sounds, **Soft Button 1** [**I/II**] changes the Part focus and **Soft Button 2** [**Part..**] opens the Part Group.

Graphical UI

The Sound Tab features a similar graphical representation as the Sound screen. Some parameters of the Master and Part group can also be edited in here. It also gives you access to different functions for Sound Manipulation (*see ch. 4.6 Sound Manipulation*). To open it, click or tap the keyboard-icon on the right side above the Tab area.

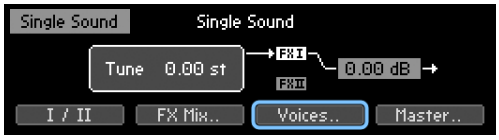
Selecting Master Parameters

Soft Button 4 [**Master..**] opens the Master screen and can be used to navigate through the Master parameters.

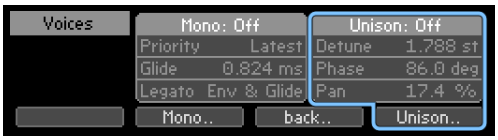
Selecting Scale Parameters

In the Master screen Press **Soft Button 1** [**Scale..**] to access the Scale group, where **Soft Button 4** is used to move through the parameters.

Selecting Voices Parameters



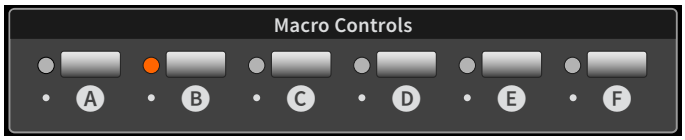
On the Sound Screen, **Soft Button 3** [**Voices..**] opens the Voices Screen, which shows an overview of the Mono and Unison parameters.



In the Voices Screen, **Soft Button 2** [**Mono..**] opens the Mono Screen, while **Soft Button 4** [**Unison..**] is used to access the Unison Screen.

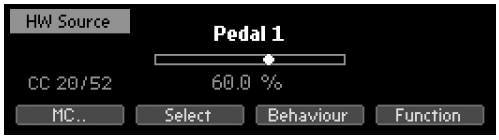
In both the Mono and the Unison screen you can use **Soft Button 4** to navigate through the parameters.

Selecting Macro Controls & Hardware Sources



The Macro Controls are shown as a distinct group on the bottom right corner of the Panel Unit.

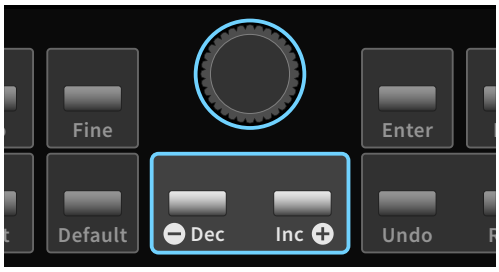
Pressing a **Macro Control Selection button** opens the Macro Control Screen.



Pressing a **Macro Control Selection button** twice redirects to the Hardware Sources.

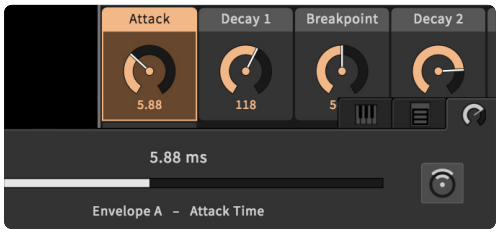
4.1.2 Editing a Parameter

Adjust Control Position, coarse

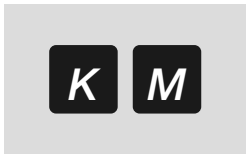


Use the **Encoder** to adjust the currently selected parameter. The ⊖ **Dec** and **Inc** ⊕ buttons can be used for stepwise adjustments.

Graphical UI



Click/tap & drag a parameter element to change its value. You can also use the Tab slider at the bottom of the screen once the parameter is selected. The editing behavior can be changed in the GUI Settings. Refer to *chapter 4.15.6 GUI Settings* to find more information on this.



If the external device has a keyboard, you can use the **K** and **M** keys to make stepwise adjustments (**K** to increment, **M** to decrement). If the external device has a mouse, you can also use the **mouse wheel** to make adjustments when the cursor is hovering over the slider in the Parameter Tab.

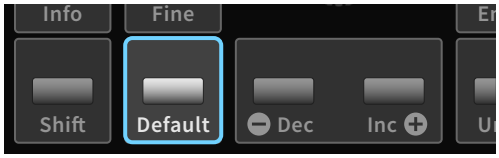
Adjust Control Position, fine

The **Fine Button** activates Fine mode, which increases the resolution for parameter adjustments. This mode is indicated by an **F** on the parameter screen. Fine mode is normally deactivated when the focus is moved to another parameter. Pressing the **Fine Button** while holding down the **Shift Button** will permanently activate Fine mode. Pressing the **Fine Button** again will release the hold function.

Graphical UI

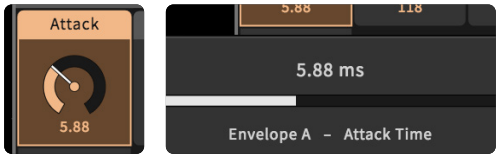
The Fine Mode can also be enabled by clicking or tapping the **Fine Button** below the parameter position bar.

Reset Control Position



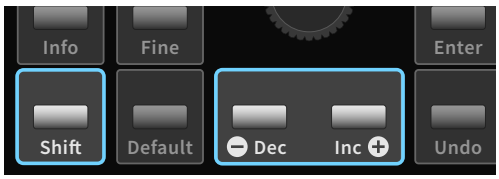
Press the **Default Button** to toggle between the selected parameter's default and current value.

Graphical UI



Double click on the element in the main area (if the GUI settings allow for it) or the slider in the Parameter Tab to toggle between the selected parameter's default and current value.

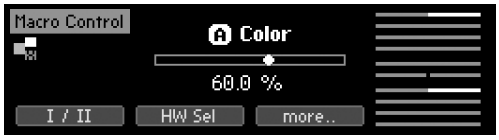
Control Position Edges



Hold the **Shift Button** and press the ⊖ **Dec** button for the minimum or the **Inc** ⊕ button for the maximum value.

4.2 Macro Controls

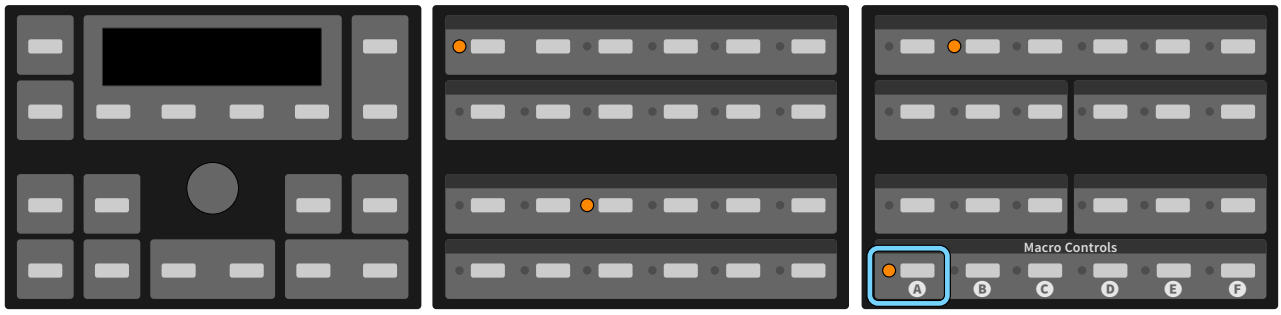
Macro Controls modulate assigned parameters and are typically linked to Hardware Sources, allowing players to vary the sound spontaneously while performing. When a Macro Control's position changes, all assigned parameters transition to their modulated values. The range of variation is determined by the Modulation Amounts. The rate of the transition is limited by the Smoothing Time, which can be set individually for each Macro Control.



Selecting a Macro Control opens the Macro Control Screen, where you can adjust its position, set Smoothing Times, Hardware Source assignments and access Macro Control Properties.

4.2.1 Assigning a Macro Control to a Parameter

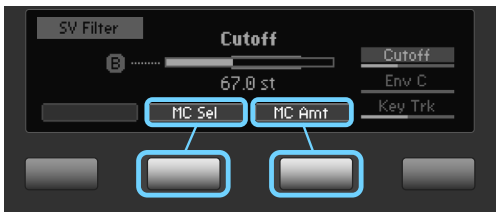
Fast Mapping (Panel Unit only)



Hold down a **Macro Control Selection button** and press the **Parameter Selection button** for the desired target. The display instantly focuses on the Modulation Aspects of that parameter, allowing you to adjust the modulation range. This only works for target parameters at the top of the stack.

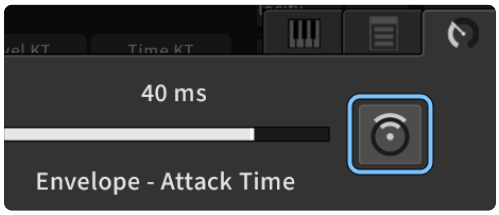
> ⚠ *This method only handles the actual mapping of target parameters to a Macro Control. Modulation amounts can only be adjusted by focusing on each parameter. However, the modulation amounts are kept, and the last value they were adjusted to is recalled.*

Access Modulation Aspects



If you want to edit a parameter's modulation or apply modulation to one that is not at the top of the parameter stack, select the specific target parameter using the **Parameter Selection button**. If the parameter is modulateable, **Soft Button 2** will display the function [**MC Sel**]. Pressing **Soft Button 2** grants access to the Modulation Aspects, allowing you to select a Macro Control for modulation. If a Macro Control is already assigned, **Soft Button 3** [**MC Amt**] also provides access to Modulation Aspects, enabling immediate adjustment of the Modulation Amount. To exit press the currently selected **Soft Button** again.

Graphical UI



In the Parameter Tab, you can click on the Modulation Icon to toggle the focus on modulation aspects (if a Macro Control is assigned, all aspects are available). The horizontal slider represents the aspect in focus (or the control position, by default). Elements in the main area and the parameter shown in the Parameter Tab display their modulation aspects.

MC Selector

While viewing the Modulation Aspects, **Soft Button 2** brings up the MC Selector, allowing you to change or remove the Macro Control. You can set the assignment to none (–) or choose any Macro Control from Ⓐ through Ⓕ.

Graphical UI

Change the MC assignment by pressing any of the six provided assignment icons. To clear the assignment, press the currently selected assignment icon. This aspect will not be in focus on the slider.

MC Position

Press **Soft Button 1** in order to focus on MC Position and adjust it like a parameter. This has the same effect as adjusting the Macro Control position in its dedicated Macro Control screen.

Graphical UI

Click on the MC position icon in order to focus on MC Position and adjust it like a parameter on the slider.

⚠ *This will cause a modulation and may affect other parameters as well.*

MC Amount

Press **Soft Button 3** to focus on MC Amount and adjust it like a parameter. The modulation range is visually indicated within the slider, with the total modulation amount displayed above **Soft Button 3**. The exact upper and lower limits of the range, along with the current Parameter Position, are shown on the right side of the screen. Note that the modulation range is determined relative to the Macro.

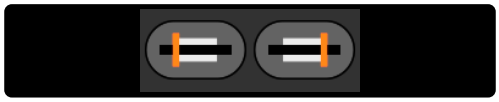
Graphical UI

Click on the MC Amount icon, then drag on the slider to adjust the amount. The modulation range will be indicated separately, next to the slider and on the main area parameter element.

Modulation Range Aspects

Pressing **Soft Button 4** cycles through the upper limit (top) and lower limit (bottom) of the modulation range and the parameter position (middle). The selected aspect can be adjusted like any other parameter. An exclamation mark indicates clipping if a limit exceeds the parameter's range. Depending on the Macro Control's position, adjusting these limits may modulate the parameter.

Graphical UI



Click on the lower or upper limit icon to focus on the modulation range aspect and change it like adjusting a parameter on the slider. The control position is in focus when no aspect is selected. If the upper or lower limit exceeds the range of the parameter, clipping is indicated by an exclamation mark.

4.2.2 Assigning a Hardware Source to a Macro Control

Selecting a Hardware Source

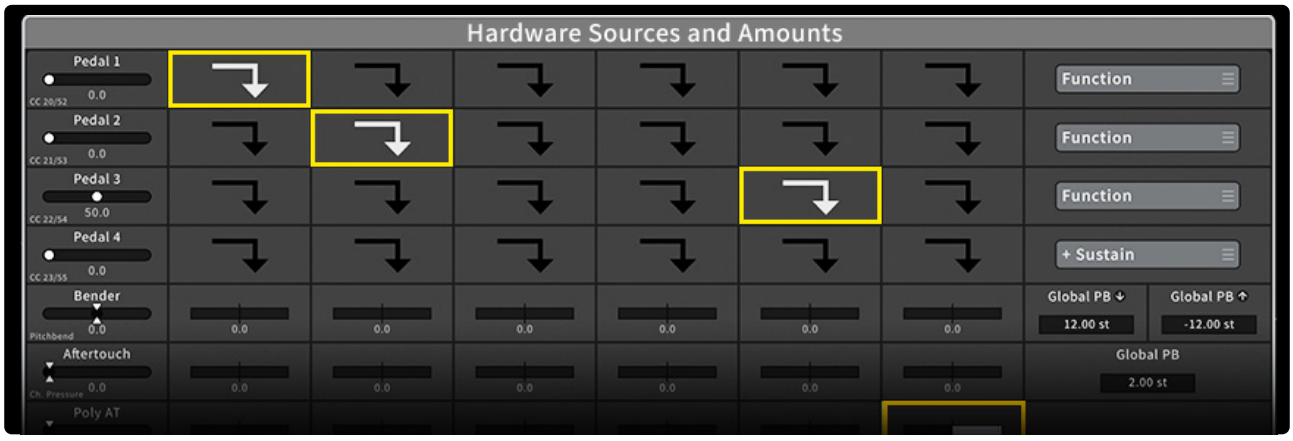
On the right side of the Macro Control Screen, you'll find the Hardware Source Stack, where eleven sliders indicate the influence of each Hardware Source on the selected Macro Control. Press **Soft Button 2** [**HW Sel**] to focus on the Hardware Source Selector, which lets you select the Hardware Source using the **Encoder** or the ⊖ **Dec** / **Inc** ⊕ buttons. Pressing **Soft Button 2** again will exit the selector. Alternatively, you can use **Soft Button 4** to cycle through the Hardware Source Stack. Note that in this case, the Hardware Amount will be in focus, which has to be pressed instead of **Soft Button 2** to exit.

Assigning a Hardware Source

To assign a selected Hardware Source, press **Soft Button 3** [**HW Amt**] to focus on the Hardware Amount and adjust it like any other parameter. Press **Soft Button 3** again to exit.
Alternatively, if you selected the Hardware Source using **Soft Button 4**, you can adjust the Hardware Amount directly without pressing **Soft Button 3** [**HW Amt**] first.

Press **Soft Button 1** [**HW Pos**] in order to focus on the currently selected Hardware Source and adjust its position like a parameter. Press **Soft Button 1** again to exit.

The Modulation Matrix [Graphical UI only]



The top-center parameter group „*Hardware Sources and Amounts*“ provides access to all Hardware Sources and their amounts on Macro Controls, represented as a modulation matrix. Items of interest can be selected and adjusted like a parameter.

4.2.3 Macro Control Properties & Functions

Adjust Macro Control Smoothing Time

When in the Macro Control Screen, **Soft Button 3** [**more..**] shifts the focus to its Smoothing Time, which determines how fast assigned parameters will respond to movements of the Macro Control. Adjust the time like editing a parameter. Pressing **Soft Button 3** [**back..**] a second time will shift the focus back to the Macro Control.

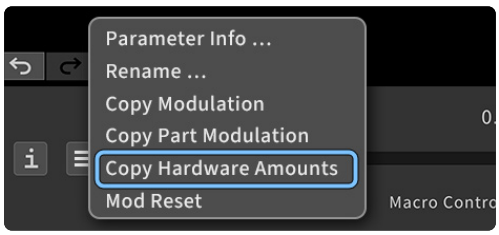
Graphical UI

Below each Macro Control, its Smoothing Time is shown as a separate parameter.

Access Macro Control Properties & Functions

When in the Macro Control Screen, press the **Edit button** to open the Macro Control Properties & Functions menu. Use **Soft Button 4** to cycle through the entries, then press **Enter** to edit a selected property or execute a selected function. The properties and functions will be explained in detail in the following sections.

Graphical UI



In the Parameter Tab, click on the menu icon when a specific Macro Control is selected to access the Macro Control properties and functions. In the main area, right click on a Macro Control element to call up a context menu and access its properties.

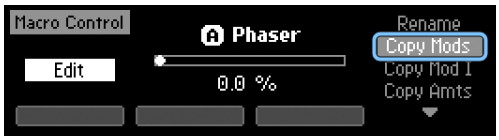
Rename

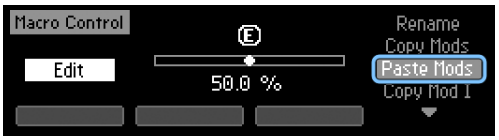
Rename allows you to edit the label of the selected Macro Control. **Soft Button 1** cancels the process, **Soft Button 4** or the **Enter button** confirms and applies the edit (*see chapter 4.11 The Rename Mechanism* for details).

Graphical UI

A rename dialogue appears when clicking on the "*Rename*" option in a context menu, and you can edit the label with your mouse and keyboard.

Copy Modulation Assignments

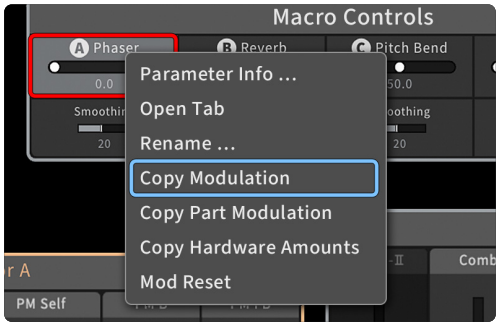


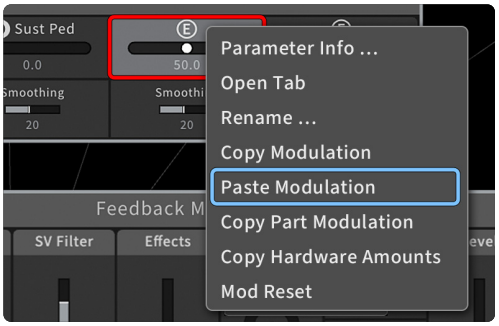


To copy Modulation Assignments, select the Macro Control with the assignments you want to copy. Then press the **Edit button** to focus on the Macro Control's properties and select "*Copy Mods*" by pressing **Soft Button 4**. Copy the Modulations by pressing **Enter**, which will immediately move the focus to "*Paste Mods*". Without leaving the Macro Control properties menu, select the Macro Control to which you want to paste the Modulation Assignments. Then press **Enter** again to paste the assignments to that Macro Control.

> *The Modulation Assignments are stored in the Clipboard until something else is copied (names, presets, banks, etc.). This allows you to paste Modulation Assignments onto Macro Controls of other presets. When copying and pasting Modulation Assignments within the same preset, the assignments are cut rather than copied. This is due to the fact that each parameter can only be modulated by one Macro Control at a time.*

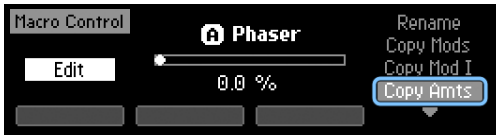
Graphical UI





Right-click on the Macro Control from which you want to copy the Hardware Amounts. Select "*Copy Hardware Amounts*" from the drop-down menu. Then right-click the Macro Control to which you want to paste the assignments and select "*Paste Hardware Amounts*" to apply them.

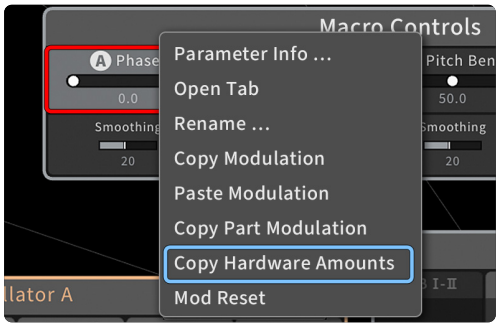
Copy Hardware Amounts



To copy Hardware Amounts, press the button of the Macro Control with the assignments you want to copy. Then press the Edit button to focus on the Macro Control's properties and select "Copy Amts" by pressing **Soft Button 4**. Copy the Amounts by pressing Enter, which will immediately move the focus to "Paste Amts". Without leaving the Macro Control properties menu, press the button of the Macro Control to which you want to paste the Amounts. Then press Enter again to paste the Amounts.

> *The Hardware Amounts are stored in the Clipboard until something else is copied (names, presets, banks, etc.). This allows you to paste Amounts onto Macro Controls of other presets. When copying and pasting Hardware Amounts within the same preset, the Amounts are cut rather than copied. Here it was implemented to have consistent behavior across all types of Hardware Sources, as non-returning Ribbons can only be assigned onto one Macro Control at any given time.*

Graphical UI



Right-click on the Macro Control from which you want to copy the Hardware Amounts. Select "Copy Hardware Amounts" from the drop-down menu. Then right-click the Macro Control to which you want to paste the assignments and select "Paste Hardware Amounts" to apply them.

Edit Info

Edit info allows you to edit the info of the selected Macro Control. The process is identical to the Rename function.

Graphical UI

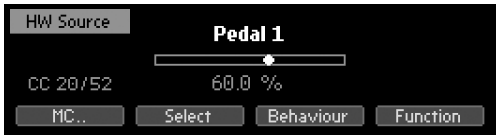
The Parameter Info window appears when clicking on the Parameter Info option in a context menu, and you can edit the label as well as the info text with your mouse and keyboard.

4.3 Hardware Sources

Hardware Sources are parameters directly linked to integrated (Ribbons, Bender) or external controllers (Pedals, etc.). They are used to adjust Macro Control positions during performance. Hardware Sources can be adjusted like any other parameter, causing modulation when assigned to a Macro Control.

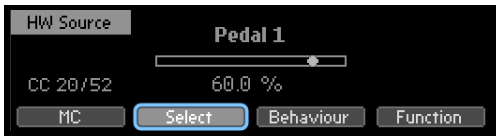
4.3.1 Editing a Hardware Source

Hardware Source Screen



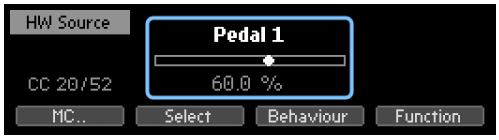
When pressing any **Macro Control Selection button** twice, you will access the Hardware Source Screen. Here you can adjust Hardware Source Positions, edit Return Behaviors and Hardware Source Functions. The linked CC channel for the selected Hardware Source is shown in the bottom left corner in the format “CC MSB/LSB”. To exit, use **Soft Button 1** [**MC..**] or press any **Macro Control Selection button**.

Select a Hardware Source



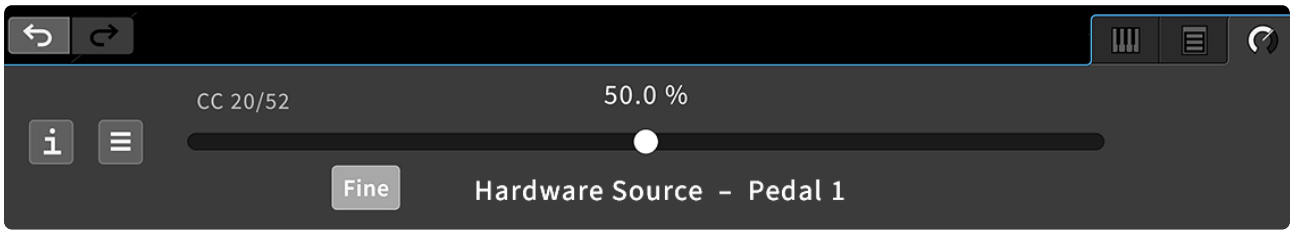
Press **Soft Button 2** and use the Encoder or the ⊖ **Dec** and **Inc** ⊕ buttons to select a specific Hardware Source. Press **Soft Button 2** again to exit the selection.

Adjust Hardware Source Position



In the Hardware Source Screen, adjust the selected Hardware Source position like any other parameter. Changing the value this way has the same effect as using the linked hardware controller.

Graphical UI



The Parameter Tab provides all parameter aspects of the selected Hardware Source. Adjust the position using the slider.

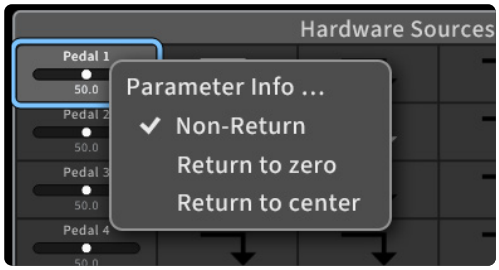
> ⚠ *Changing the Hardware Source position will cause a modulation of linked Macro Controls and target parameters. The source’s Return Behavior will be reflected in this parameter.*

4.3.2 Hardware Source Properties and Functions

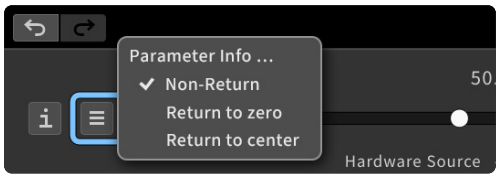
Edit Return Behavior

In order to change the Return Behavior property of a Pedal or Ribbon, select the desired Hardware Source and press **Soft Button 3** [**Behavior**]. Now you can adjust it using the Encoder or the ⊖ **Dec** and **Inc** ⊕ buttons. Press **Soft Button 3** again in order to return to the default focus.

Graphical UI



In the main area, right click on a Hardware Source element (Pedal or Ribbon) to call up a context menu in order to change the Return Behavior.



In the Parameter Tab, the menu icon provides a context menu, providing available Return Behaviors for the selected source.

> ⚠ *When adjusting the Return Behavior, no Hardware Source should be moved or held during this time, otherwise clipping problems in the modulation may occur.*

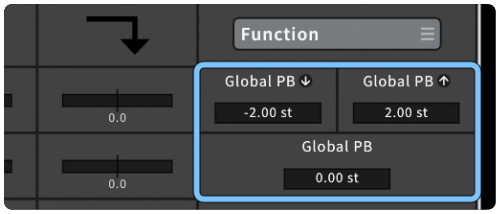
Edit Hardware Source Functions

To select a Pedal Function for one of the Pedals, press **Soft Button 4** [**Function**] and use the Encoder or the ⊖ **Dec** and **Inc** ⊕ buttons to select the desired function. Press **Soft Button 4** again to return to the default focus.

To map the Bender or Aftertouch to the global pitch parameter, select the Hardware Source and press **Soft Button 3** [**Global PB**]. Adjust the pitch modulation amount using the **Encoder** or ⊖ **Dec** and **Inc** ⊕ buttons. For the Bender, press **Soft Button 4** to switch between upward and downward modulation amounts. Press **Soft Button 3** again to return to the default focus.

Graphical UI

All the way on the right side of the Hardware Source Section, click or tap on the Function button of the desired pedal and select the function from the drop-down menu.



Just below the Function buttons you can find the global pitch parameters. Just click/tap and hold the value box and move the cursor/finger up or down to adjust the modulation amounts.

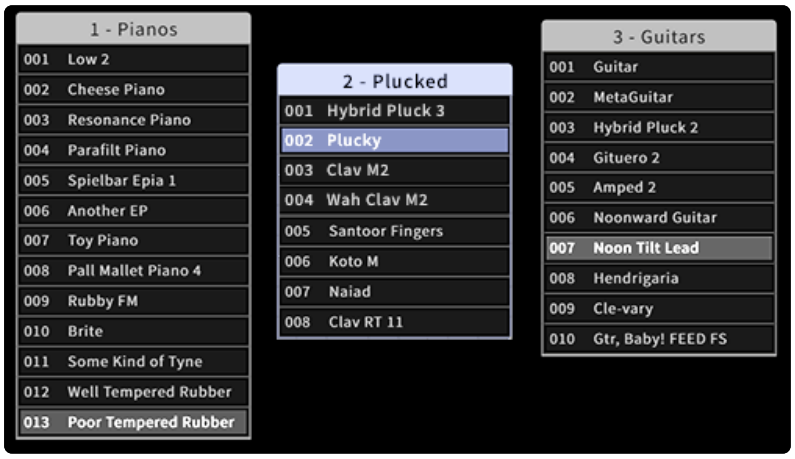
4.4 Presets

4.4.1 Loading a Preset

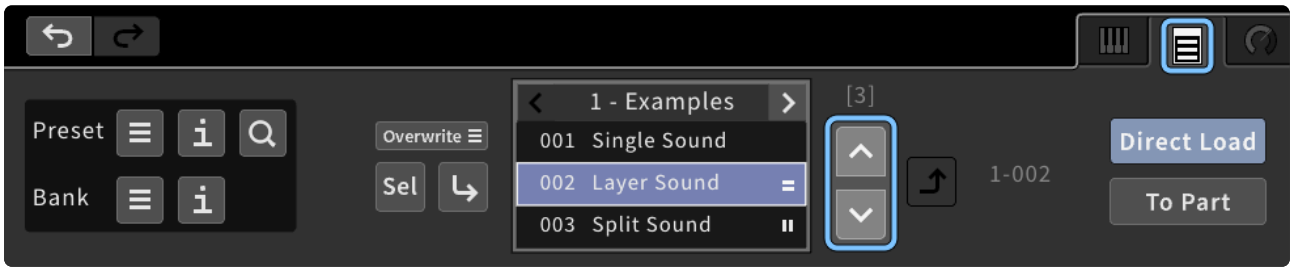
Preset Navigation

Press the **Preset Button** to focus on the Preset screen. The **Encoder** and the ⊖ **Dec**/**Inc** ⊕ buttons navigate through the current bank. A highlighted background indicates the selection.

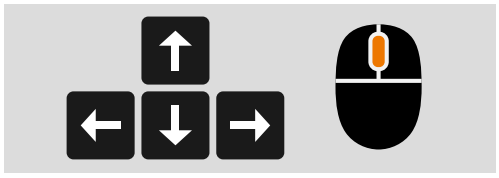
Graphical UI



In the main area, every bank is available and can be dragged on any position. If expanded, presets can be selected by clicking.



The Preset Tab can be opened by clicking/tapping the list icon on the right side above the expandable tab area. Here the currently selected bank can be navigated by using the corresponding navigation icons.



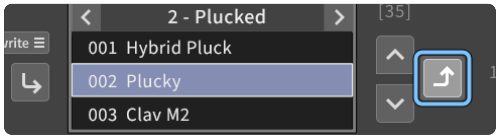
The **arrow keys** can be used to navigate presets (up, down) and banks (left, right).
If the external device features a mouse, using the **mouse wheel** while hovering over the Preset Tab will also navigate through the currently selected bank.

Loading a Preset

When loading a preset, every parameter will start a transition to the new value (specified by the selected preset). The transition is defined by the Transition Time in the system settings.

On the Panel Unit press the **Enter Button** in order to load the selected preset (for more information on that refer to *8. Setup*).

Graphical UI



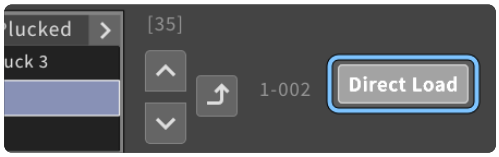
On the Graphical User Interface the Preset Tab provides a Load Icon in order to load the currently selected preset. Or click on a bank element twice.

> ⚠ *The described load process will load a particular preset fully, meaning that individual Parts of a Split or Layer sound will be overwritten. Note that it is also possible to load a preset (or part of a preset) into a part, meaning that the particular preset will only be partially loaded (see chapter 4.7 Part Manipulation for more details).*

Direct Load

The process of loading Presets can be shortened by using the Direct Load option, which allows for loading Presets directly upon selection. On the Panel Unit press the **Soft Button 4** in order to toggle the Direct Load option.

Graphical UI



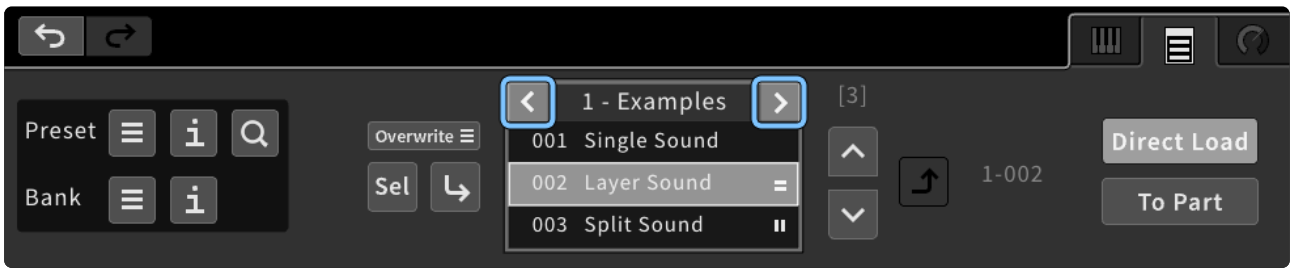
On the Graphical User Interface press the Direct Load icon in the Preset Tab in order to toggle the Direct Load option.

Bank Navigation

Next to the actual presets, banks contain additional meta data (some of which can be edited, see chapter *4.9 Contextual Info*). For example, they keep track of their last selected preset, which may be loaded when navigating banks (depending on the Direct Load option).

Press **Soft Button 1** in order to focus on banks and navigate them instead. **Soft Button 2** and **Soft Button 3** will navigate presets now.

Graphical UI



In the Preset Tab, banks can be navigated by the corresponding navigation icons (the left and right arrow keys can be used as well, as described). In the main area, clicking/touching on the header of a floating bank will select the bank, clicking/touching on a preset will select only the preset. After loading the selected preset, the bank selection will update as well, indicating the bank containing the loaded preset.

⚠ *The Direct Load option will be indicated on each interface. The Panel Unit Display and the Graphical User Interface also show the preset count of a selected bank (in brackets) and the current bank-preset-number.*

4.4.2 Storing a Preset

Store Select

Press the **Store Button** in order to focus on the Store screen and start the Store Select mode. The store position and bank can be adjusted by preset and bank navigation (as described in chapter *4.6.1 Loading a Preset*). The process can be canceled by pressing the **Store Button** again, pressing the **Enter Button** on the other hand will complete the Store process, storing the preset at the desired location according to the Store method (see below).

Graphical UI

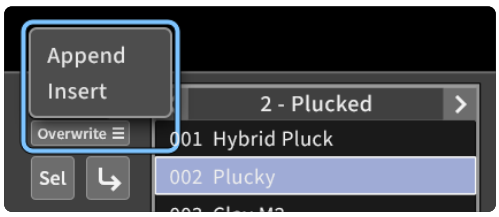
The Preset Tab provides a Store Icon. Clicking/touching on it will store the preset in the currently selected bank at the current position, according to the Store Method (see below). The additional Select Button will start the Store Select Mode and a bank and position can be chosen (without loading any preset), then the preset can be stored at the desired location (disabling the Store Select Mode), according to the Store Method (see below). Another way of storing a preset in a particular bank or position is simply dragging and dropping the Store Icon to the desired location (the Store Select Mode and Store Method can be ignored in this case).

Store Method

Soft Button 4 provides three available Store Methods in the rightmost stack and cycles it. Pressing the **Enter Button** applies the process, pressing the **Store Button** again dismisses it. The store position will be finally influenced by the chosen Store Method, which can be one of the following three:

Append	The preset will be stored at the end of the currently selected bank.
Overwrite	The preset will be stored at the current position in the currently selected bank, overwriting the existing preset.
Insert	The preset will be stored behind the current position in the currently selected bank.

Graphical UI



The Store method can be selected in the Preset tab, above the store icon.

Preset Naming

If the preset is considered “new”, the Rename Screen will appear, requesting a name for the preset (see *chapter 4.11 The Rename Mechanism* for more details).

4.4.3 Editing Presets and Banks

Common Preset editing actions are listed in the table below:

Rename	The selected preset can be renamed (see chapter *4.12 The Rename Mechanism* for details).
Cut	The selected preset will be moved into the clipboard (being deleted at the current position).
Copy	The selected preset(s) will be copied into the clipboard, ready to be pasted at any time.
Paste	Once a preset was copied or cut into the clipboard, this option will become available. The copied preset(s) will be inserted behind the currently selected preset.
Delete	The selected preset(s) will be deleted from the bank.

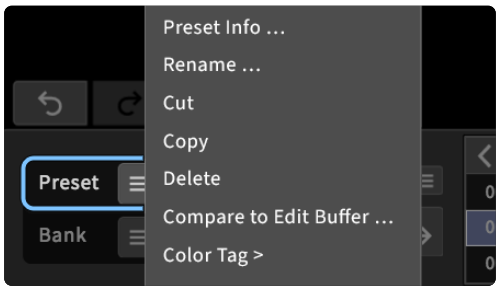
⚠ *When deleting all presets of a bank at once from the Graphical User Interface, a Dialog window will appear, asking if the bank should be deleted as well.*

Preset Edit Mode

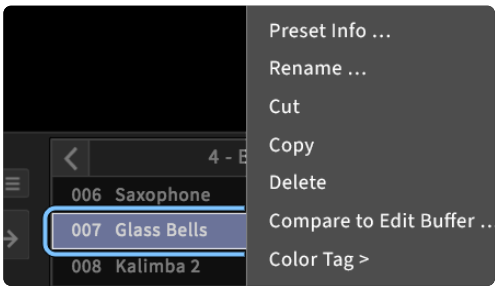
When the Preset Screen is in focus, pressing the **Edit Button** invokes a menu, represented in the rightmost stack. Cycle the stack by pressing **Soft Button 4** in order to select a menu entry and press the **Enter Button** in order to focus on an aspect. Press the **Edit Button** again to return to the Preset Screen.

Graphical UI

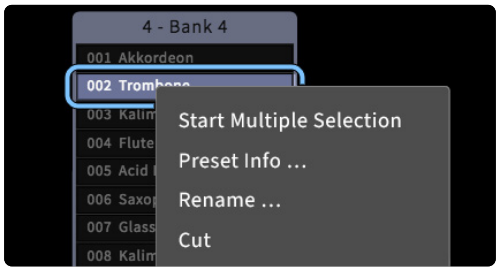
In the Preset Tab, a Preset menu button is provided. Clicking on this button or right-clicking (or long touch gesture) on a preset element in a (floating) bank invokes the context menu, providing access to all aspects.



Preset Menu 1: Preset tab > Preset button



Preset Menu 2: Preset tab > preset list



Preset Menu 3: floating bank > preset entry

Common Bank editing actions are listed in the table below:

New	A new bank will be created.
Rename	The selected bank can be renamed (see chapter *4.10 The Rename Mechanism* for details).
Copy	The selected bank will be copied into a temporary buffer, ready to be pasted.
Paste	Once a bank was copied into the clipboard, this option will become available. ⚠ ***The copied bank will be appended as a new bank. This mechanism is not fully developed yet. For more information, refer to the separate "Known Issues" document.***
Delete	The selected bank will be deleted.
Move left/right	The bank number (position in the bank list, visible in the Preset screen and Preset tab) can be altered by moving it left (decreasing the position) or right (increasing the position).
Import/Export	Single Banks can be transferred from and to external devices. (see chapter *4.6.4 Importing/Exporting Banks* for more details).

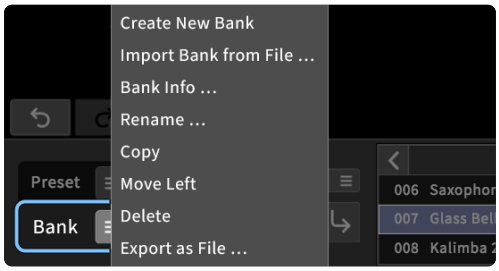
⚠ *The Graphical User Interface provides another way of moving a bank via the Bank Info window, where the bank number (position in the bank list) can be adjusted directly (see 4.9 Contextual Info for more details).*

Bank Edit Mode

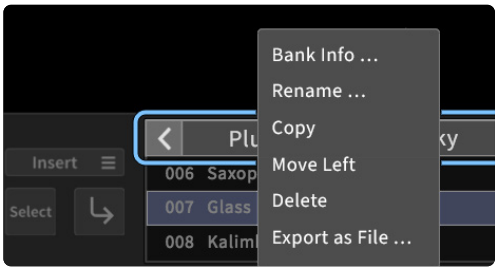
When the Bank Screen is in focus, pressing the **Edit Button** invokes a menu, represented in the rightmost stack. Cycle the stack by pressing **Soft Button 4** in order to select a menu entry and press the **Enter Button** in order to focus on an aspect. Press the **Edit Button** again to return to the Bank screen.

Graphical UI

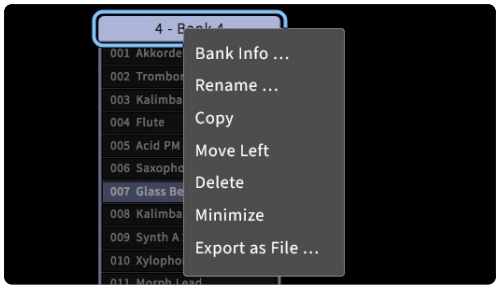
The Graphical User Interface provides two menus for editing banks. There is a global menu (invoked by a right-click/long touch gesture on the background) and a local menu for banks (provided by a bank menu icon in the Preset tab or by a right-click/long touch gesture on any bank header).



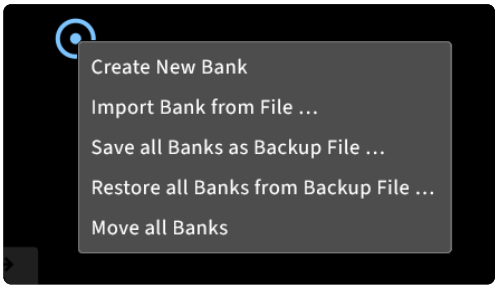
Bank Menu 1: Preset tab > Bank button



Bank Menu 2: Preset tab > bank header



Bank Menu 3: floating bank header

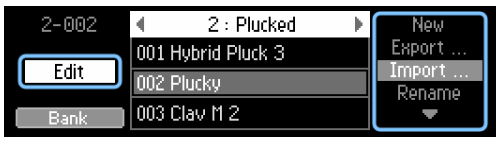


Bank Menu 4: main area background

4.5.4 Importing/Exporting Banks

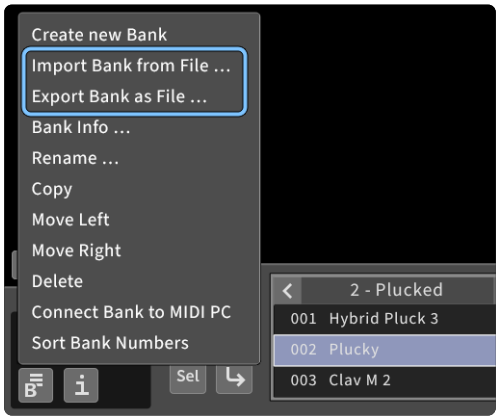
The C15 provides two ways of transferring (importing, exporting) single banks in order to manage big preset collections. When importing a bank, the bank will not be selected and no preset will be loaded.

Import and Export on USB stick



When a USB stick is connected, the selected bank can be exported to it by using the Export option. Any bank present on the USB stick can be selected and imported by using the Import option.

Graphical UI



The bank menu provides an option to save the current bank as a file, which will be downloaded on the external device. The menu also includes an option to import a particular bank from a file present on the external device, which can be selected and uploaded. Other Bank context menus (as explained in chapter *4.16 Graphical UI Functionality*) will also offer import and export options.

> ⚠ *The process of transferring multiple banks can be further simplified by the C15 backup capabilities. See chapter 4.14 Backups for more details.*

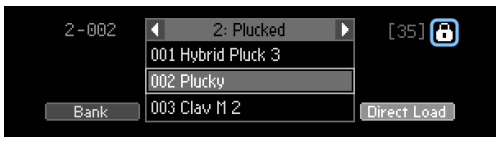
4.5 Locking

In some situations, it may be useful to load only specific parts of a preset while leaving other parts as they are. This can be achieved by using the Lock mechanism, which can lock particular parameter groups and prevent the contained parameters from being overwritten by a preset recall or sound manipulations. Parameters of locked groups can still be edited, though.

> ⚠ *Currently, only whole groups can be locked, but a parameter-specific Lock mechanism is intended for the future.*

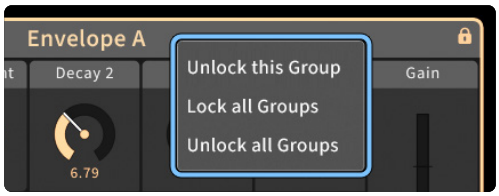
Locking a Parameter Group

In the Parameter screen showing the currently selected parameter, the **Edit Button** provides the lock menu. Individual lock options can be selected by pressing **Soft Button 4** and applied by pressing the **Enter Button**.
Depending on the lock status of the associated group, the lock options provide locking the specific group/all groups, or unlocking the specific group/all groups.



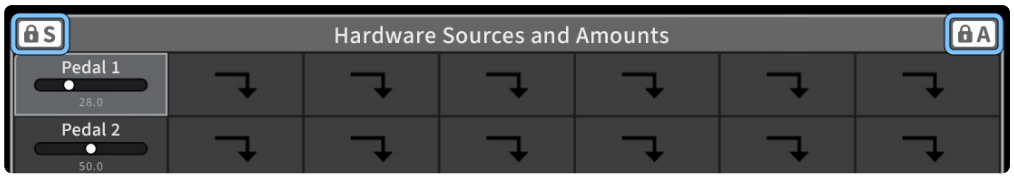
When one or more groups are locked, the lock symbol is also shown in the Preset and Sound screens.

Graphical UI



A right click or long touch gesture on a particular group header invokes the lock menu. Depending on the lock status of the associated group, the lock options provide locking the specific group/all groups, or unlocking the specific group/all groups.

When one or more groups are locked, the lock symbol is also shown in the Preset and Sound tabs.



> ⚠ *Note that Hardware Sources and Hardware Amounts are two separate lockable groups. In the Graphical User Interface, the header of the "Hardware Sources and Amounts" group shows two separate lock symbols.*

Locking – a practical example:

Let's consider a situation where the user wants to use certain groups of preset **A** as a template for other presets (**B, C** ...), which shall have those group settings as well. Useful scenarios may be the Hardware Sources and their Amounts on Macro Controls, or the whole effect chain. In a few steps, the particular groups of preset **A** can be copied to the other presets:

1. Load preset **A** (the template preset)
2. Activate lock on the corresponding groups (that shall be transferred to the other presets)
3. Load preset **B** (the locked groups still remain as defined by preset **A**)
4. Save preset **B** (making the template transfer persistent)
5. Load and then save preset **C** (repeating the process, the locked groups still remain as defined by preset **A**), et cetera

4.6 Sound Manipulation

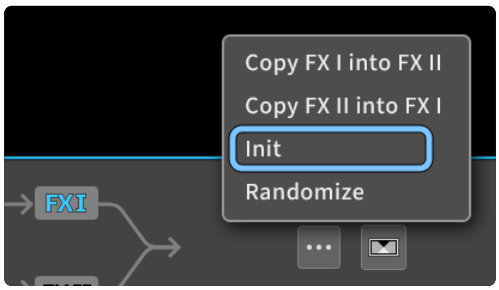
4.6.1 Manipulating Sounds

When initializing, every parameter of the sound (or part) will start a transition to its default value, as defined by the Edit Smoothing Time in the system settings.

Init Sound

Holding down the **Default Button** in the Sound or Preset screen displays the Initialize screen. Here, **Soft Buttons 1,2 and 3** can be used to initialize with the desired Sound Type. For split or layer sounds, **Soft Button 4** can be used to initialize only the Part/FX currently in focus.

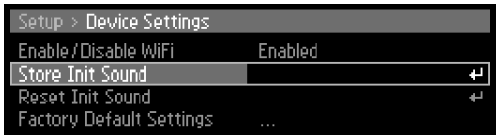
Graphical UI



On the right side of the Sound Tab is the *"..."* menu button, which offers the "*Init"* option for Single sounds.
For Layer or Split sounds, the menu will instead contain the "*Init Sound"* and *Init "Part"* options.

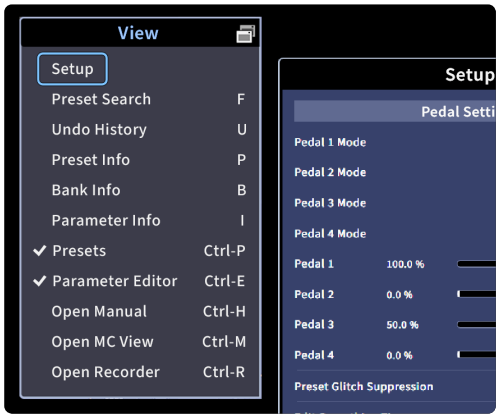
Store/Reset Init Sound

The Init Sound represents every parameter with it's default value. The default values were carefully chosen to form a meaningful initial state (in which no sound will play, as all channels of the Output Mixer are disabled). Nevertheless, custom defaults are also possible.



In order to store the current sound as the Init Sound, press the **Setup Button** and navigate to "*Device Settings"* > "*Store Init Sound"*, then press the **Enter Button** to confirm. The default Sound Type and the parameter values will be overwritten. In order to restore the factory defaults, choose "*Reset Init Sound"* instead.

Graphical UI



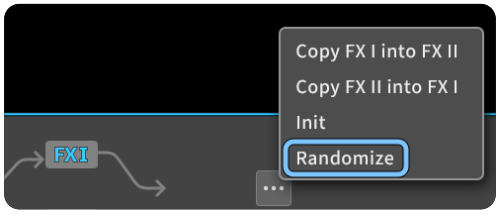
Click on the View Menu in the top-right corner and choose "*Setup*" in order to open the Setup Window. In the first tab "*Device Settings*", the "*Store*" and "*Reset*" options can be found on the bottom.

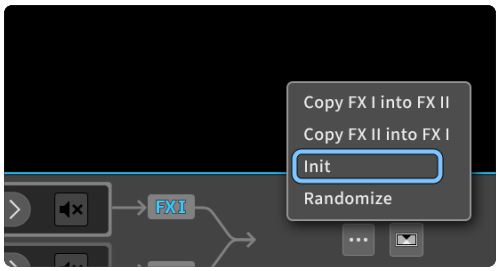
> ⚠ *If you encounter problems navigating the Setup Menu intuitively, please refer to chapters 4.12 Setup Navigation and 8. Setup (C15 System Settings).*

Randomize

Randomization starts a transition to a random value for each parameter of the sound (or selected Part). The amount of randomization is adjustable and the speed of the transition can be set in the Device Settings "*Edit Smoothing Time*".
On the Sound screen, press **Edit** and use the **Encoder** or ⊖ **Dec**/ **Inc** ⊕ to navigate to "*Randomize*" (if in a Single sound) or "*Randomize Part*" (if in a Split or Layer sound) and press **Enter**. You can now adjust the amount of randomization. Pressing **Enter** a second time will apply the randomization. To exit the randomization setting, press **Soft Button 1 or 2**.

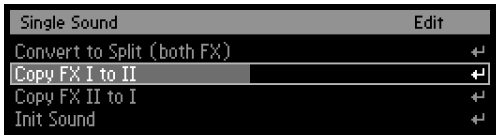
Graphical UI





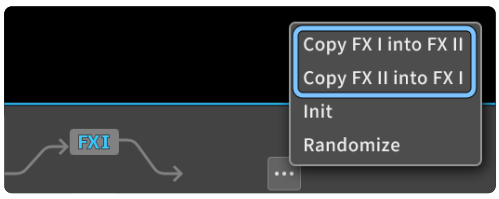
In the Sound Tab, press the menu icon "..." and choose "*Randomize*" (when in a Single sound) or "*Randomize Part*" (when in a Split or Layer sound). A dialog will appear, providing the adjustable randomization amount and an "*Apply*" button to complete the process.

Copy FX



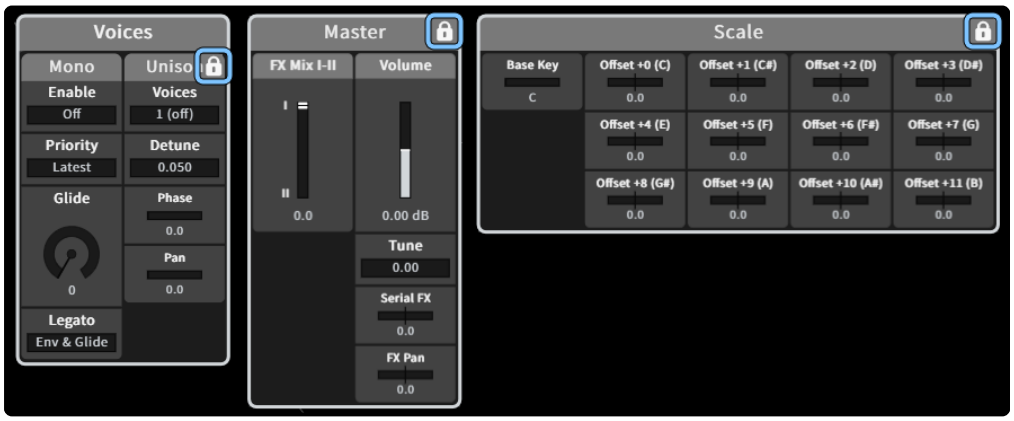
When pressing the **Edit Button** on the Sound Screen, two new options provide a quick way to copy the effect chain from one Part to another.

Graphical UI



In the Sound Tab, press the menu icon "..." and choose which FX section to copy on the other one.

Sound Manipulation and Locking

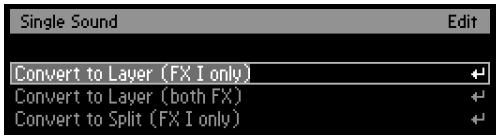


As described in chapter *4.6.5 Locking*, parameters of locked groups are not affected by sound manipulations. For example, randomizing all parameters may not be a good idea when considering the Master, Unison and Scale groups, as the random change can have too much of an impact, leading to unwanted, bad sounding or even harmful results (should the Master Volume increase considerably). So we recommend to lock these three groups before using the randomize function.

4.6.2 Converting Sound Types

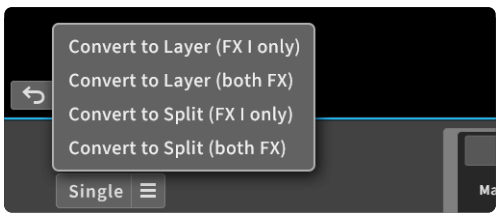
Single , Split and Layer sounds can be converted in between. In general, most parameters will be available twice in Split/Layer sounds, although the details are a little more subtle. (In order to explore the part structure in more detail, refer to the next chapter *4.7 Part Manipulation*). In this section, the individual conversion methods are explained.

Converting a Single Sound to a Split or Layer Sound



First, load a Single preset. On the Sound Screen press the **Edit Button** to open the Sound Edit Screen. In this Menu you can select to either convert to a Layer or to a Split sound, with the option to copy both effect chains (both FX) or to copy the first one on both parts (FX I only).

Converting a Single Sound to a Split or Layer Sound [Graphical UI]

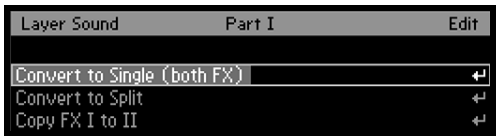


You can also achieve this conversion in the Graphical UI. Make sure the Sound Tab is selected (keyboard symbol in the bottom right corner) and click on the Sound Conversion button on the left. A drop-down menu will open with all the different options.

Storing a Split or Layer Sound as Preset

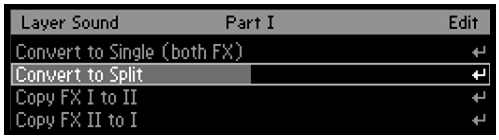
A Split or Layer sound can be stored in the same way as a Single sound. The C15 banks can hold presets of all three types. Split presets are marked with a **||** symbol. Layer presets have a **=** symbol.

Converting a Part of a Split or Layer Sound to a Single Sound



To convert a Part of a Layer/Split Sound to a Single sound, navigate to the Sound Screen and select the Part to be converted using **Soft Button1** [**I/II**]. Then press **Edit** and navigate to "*Convert to Single*" by using ⊖**Dec**/**Inc**⊕ or the **Encoder**, then press **Enter**. This type of conversion always copies both effect chains.

Converting a Split (Layer) Sound to a Layer (Split) Sound



As with the other conversions, press **Edit** in the Sound Screen and navigate to "*Convert to Layer*" using ⊖**Dec**/**Inc**⊕ or the **Encoder**, then press **Enter**.

4.7 Part Manipulation

4.7.1 Main Parameters of a Part

Part Volume and Tune

In Split/Layer sounds, the Volume and Tune of a Part can be adjusted by its Part Volume and Part Tune parameters. The stereo signals of both Parts are mixed before the Master Volume control. The Master Tune is added to the two Part Tunes.

When a Single Sound is converted to Split/Layer , its former Master Volume and Master Tune will be copied to its Part Volume and Part Tune while Master Volume and Master Tune are set to zero. When a Single Sound is loaded into a Split or Layer Sound, its former Master Volume and Master Tune will also be copied to its Part Volume and Part Tune but Master Volume and Master Tune stay unchanged.

When a Part of a Split/Layer sound is converted to Single , the Master Volume and Master Tune values are summed up with Part Volume and Part Tune to create the Master Volume and Master Tune of the Single Sound. Furthermore, the delegation of the Master Volume/Tune to the Part Volume/Tune parameters also includes potential assignments to Macro Controls.

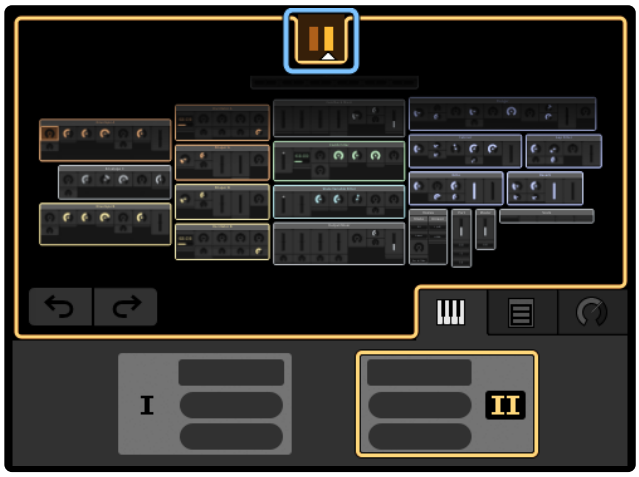
In Dual (Split/Layer) sounds, the Part Volume/Tune is designed to serve as the potential Master, should the Part get converted to Single again. In order for this to work properly, we recommend not to create Macro Control assignments to Master Volume/Tune within Dual Presets. Or to be more precise: these assignments will be discarded, when converting a Dual Preset back to Single.

4.7.2 Working with Parameters of Split or Layer Sounds

When editing a Split/Layer Sound in the Parameter Screen, **Soft Button 1** is labeled “I/II” and can be used to access the parameters of both parts. A square with two Part indicators show which Part is in focus.

On the Graphical User Interface there is a colored frame around the main area including an indicator for the selected part. A touch/click on the indicator opens the parameters of the other part.

Layer Sound, Part I selected



Split Sound, Part II selected

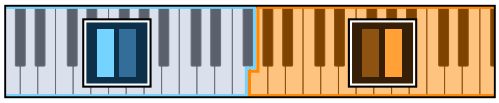
> ⚠ *By default, both Hardware and Graphical User Interfaces share the same Part Focus, meaning that Part Selection is reflected everywhere. However, the Hardware User Interface has its own Part Focus and can ignore Part Selections in the Graphical User Interface, if explicitly enabled in the system settings, see chapter 8. Setup (C15 System Settings).*

4.7.3 Split Sound Details

Adjusting the Split Point

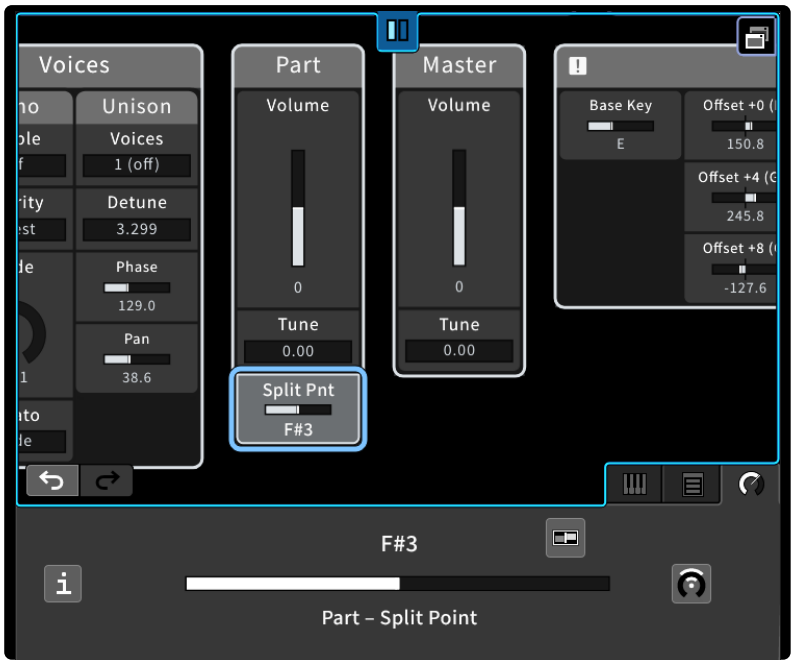
On the Split Sound Screen the Split Point is shown in the center. It can be edited directly by the **Encoder** and ⊖ **Dec**/**Inc** ⊕. If Part I is selected it shows the highest key of the lower key range. If Part II is selected it shows the lowest key of the upper key range. The Split Point is also available as a parameter in the Part Screen. Use **Soft Button 2** [**Part..**] to open it.

On the Part Screen, navigate with **Soft Button 4** to the third parameter. The Split Point parameter can be controlled by a Macro Control. As Hardware Source, a Ribbon will make a lot of sense. The part association of individual voices happens only when a key is pressed, according to the current value of the Split Point.



By default, the Split Point is linked - meaning that both Parts don't overlap (see “Overlapping Split Points” below in order to produce intersections).

Graphical UI

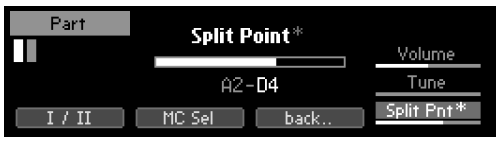


In the Graphical User Interface, the Sound Tab provides the Split Point between the two parts. Use drag gestures in order to change it. In addition, the Part group (left to the Master group) provides the Split Point as a regular parameter, which can be manipulated further in the Parameter Tab when selected.

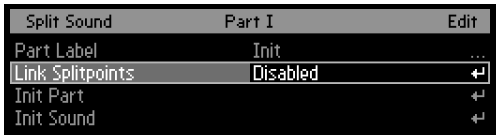
Unlink Split Points

In earlier versions, the C15 only provided one Split Point parameter in a Split sound, determining the inner edges of both fully separated Parts , so no overlap was possible. The described behavior is still available by default and referred to as linked Split Points. Now, unlinked Split Points are available as well, providing separate Split Points for each part (but still sharing one unique Macro Control assignment). When unlinked, an overlapping range of shared keys can be defined, in which both Parts will sound. The two Split Point parameters are still sticked to one another, preventing a negative overlap with a key range with no part association. The linking behavior can be changed via the **Edit Button**:

When in the Parameter Screen, pressing **Edit Button** will provide a menu with the option to Unlink/Link. Navigate with **Soft Button 4** for the entry before pressing **Enter Button**.



When unlinked, the key ranges of both Parts are shown. Overlap can be achieved by raising the Split Point of Part I or by lowering the Split Point of Part II - using the ⊖ **Dec**/**Inc** ⊕ **Buttons** or the **Encoder**.

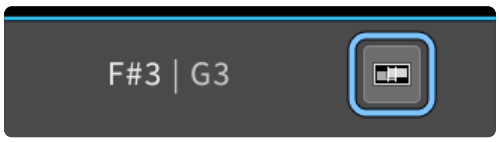


When in the Sound Screen, pressing Edit will provide a menu screen. Navigate with ⊖ **Dec**/**Inc** ⊕ **Buttons** or the **Encoder** to the Link Split Points option and press the **Enter Button** to toggle between the two behaviors.

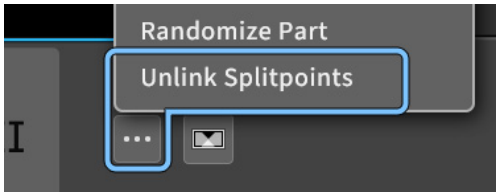
When unlinked, the key ranges of both Parts are shown.

⚠ *Enabling a linked Split Point will collapse any prior overlapping range.*

Graphical UI

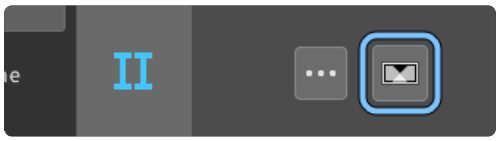


In the Parameter Tab, an icon on the right of the shown key position indicates the linked/unlinked Split Point behavior. Clicking on it will toggle in between.

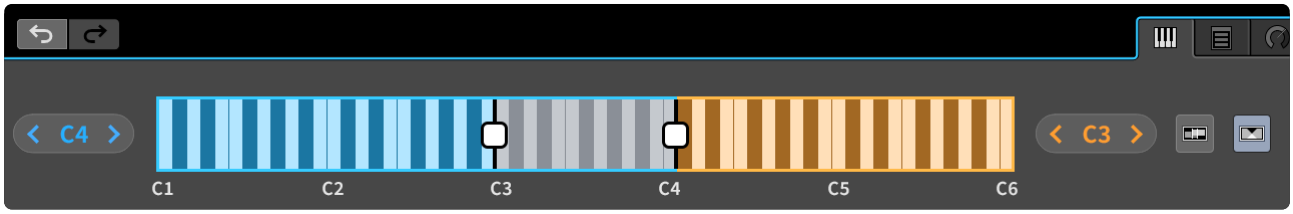


In the Sound Tab, clicking on the "..." icon on the right invokes a menu in which the linking behavior can be set.

Split Point Editor [Graphical UI only]



In the Sound Tab, the rightmost icon redirects to the Split Point Editor, providing the two parameters and an interactive visual representation.

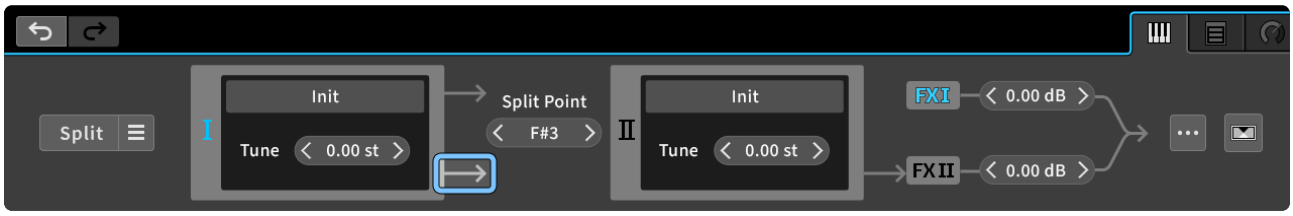


Split Points can be set by clicking or dragging on the corresponding values or by dragging the indicators on the shown keybed. The linking behavior can be set as well.

Signal Flow Indicators in a Split Sound

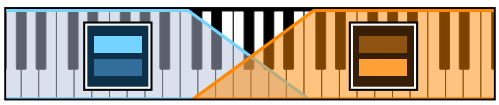
In Split sounds, the "*ToFX*" parameter is available in the Output Mixer, allowing the mixed signal to be sent to the Effects Section of the other Part. When active, the flow across parts will be indicated in the Sound Screen/ Tab by additional arrows.

Graphical UI



4.7.4 Layer Sound Details

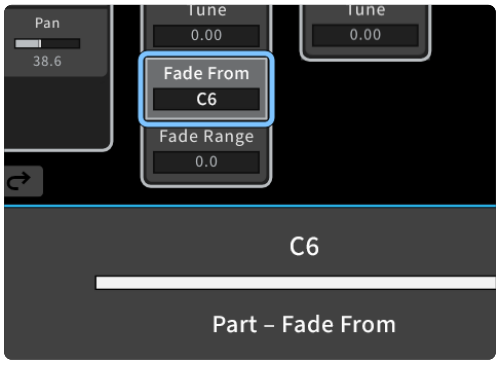
Key Fades in Layer Sounds



Each Part of a Layer sound has two parameters to control the key range where this part is mixed at its full level and a key range where it is faded out to silence. Depending on the key position the voices are processed by an attenuator in the Level stage of the Output Mixer.

To adjust key fade aspects press the **Sound Button** for the Sound Screen, then **Soft Button 2** for the Part Screen. **Soft Button 4** then brings the parameters into focus.

Graphical UI

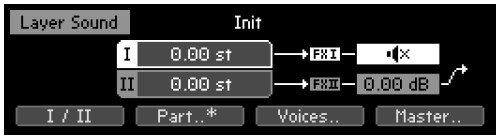


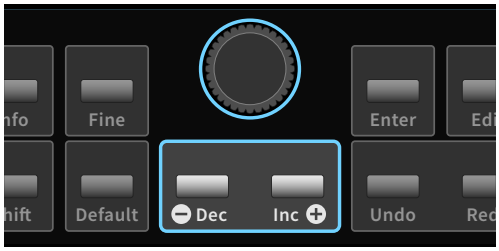
In the Graphical User Interface, the Part group (left to the Master group) provides the Fade From and Fade Range parameters, when a Layer sound is loaded.
The full level range of Part I spans from the lowest key (C1) to the adjustable "*Fade From*" key. Here begins the fade-out. Its width is adjustable by the "*Fade Range*" parameter.
The full level range of Part II spans from the highest key (C6) to the adjustable "*Fade From*" key. Here begins the fade-out. Its width is adjustable by the "*Fade Range*" parameter. Both parameters default to being without effect.

Possible applications for these key fade ranges:

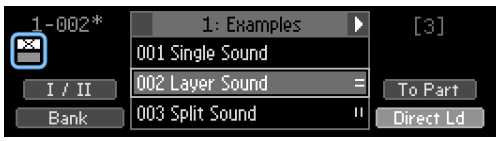
- keyboard splits with a smooth transition (crossfade) between the parts
- one of the parts being added only at the low or high end of the keyboard
- crossfades over a wide keyboard range to change the resulting timbre gradually

Muting a Part of a Layer Sound





On the Layer Sound Screen you can use the **Encoder** and the ⊖ **Dec/Inc** ⊕ **Buttons** to mute one of the Parts: turning the **Encoder** to the left or using the ⊖ **Dec Button** will mute Part II. Turning the **Encoder** to the right or using the **Inc** ⊕ **Button** will mute Part I. The first step back to the center will unmute the muted part.



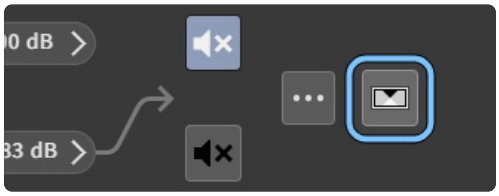
Typical Screens (Parameter/Preset/Sound) will indicate the two present parts, highlighting the selected part. When a Layer sound's part has been muted, a cross indicates the muted part.

Graphical UI

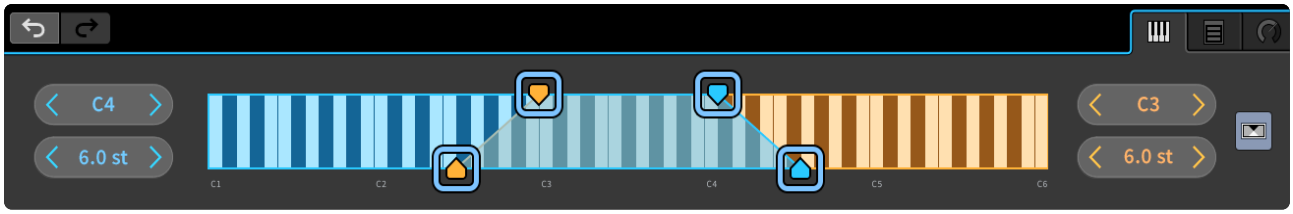
The Graphical User Interface provides a Part Indicator similar to the screens. It is located centered at the top. When a Layer sound part has been muted, a cross indicates the muted part. The Sound Tab provides a mute button for each part. Clicking on a muted part's button will unmute the part, clicking on an unmuted part's button will mute the part, potentially unmuting the other.

> ⚠ *When muting a Part of a Layer sound, only the final Part Volume stage will be affected, so any signal flow across parts will be maintained regardless.*

Fade Editor [Graphical UI only]

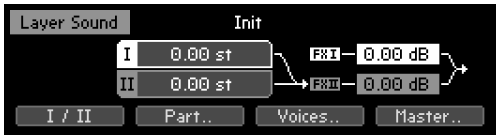


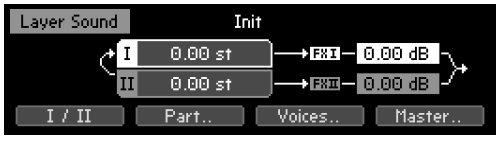
In the Sound Tab, the rightmost icon redirects to the Fade Editor, providing all related aspects and an interactive visual representation.



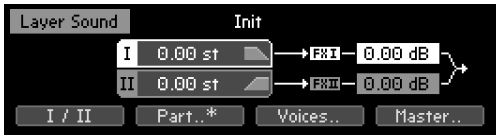
For each part, Fade From and Fade Range can be adjusted by clicking or dragging on the corresponding values or by dragging the indicators shown on the keybed.

Indicators in a Layer Sound





In Layer Sounds, the "*ToFX*" parameter is available in the Output Mixer, allowing the mixed signal to be sent to the Effects section of the other Part. When active, the flow across parts will be indicated in the Sound Screen/ Tab by additional arrows. In the Feedback Mixer, several parameters allow for feedback flow across Parts. When active, the flow across parts will be indicated in the Sound Screen/ Tab by additional arrows.

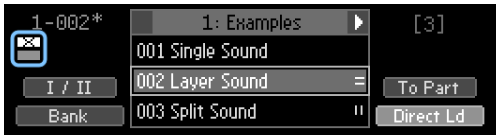


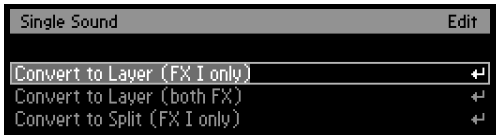
When Key Fades are present, they also will be indicated in the Sound Screen/Tab by small fade graphs inside of the Part boxes.

4.7.5 Loading from/into Parts

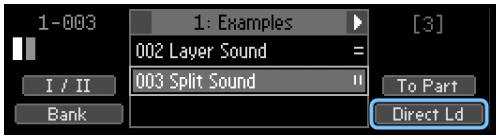
In the following, a step by step guide leads through every stage of the “Load to Part” process. Although this process can be shortened, we recommend following the guide until being familiar with the stages.

> ⚠ *We also recommend to not change the Hardware Sources or Macro Controls during the “Load to Part” process, as they will affect both Parts. Changes on the modulation will be reflected when a part is loaded and can easily lead to unexpected assignments to modulateable parameters.*



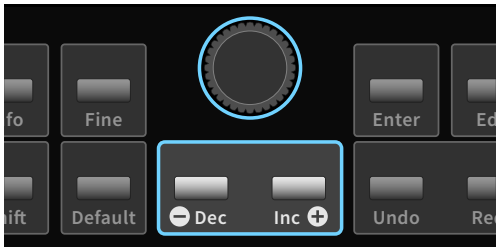


First, select two presets: a Dual Sound (Split or Layer) whose Part you want to replace (Target) and another sound of any type (Single, Split or Layer) to serve as the replacement (Source). For simplicity, we recommend placing both presets in the same bank, although this is not strictly required.
Select the Target preset and press **Enter** to load it. When a Dual preset has been loaded, **Soft Buttons 1/4** will have two functions. These can be accessed by either pressing the button shortly or holding it for a second.

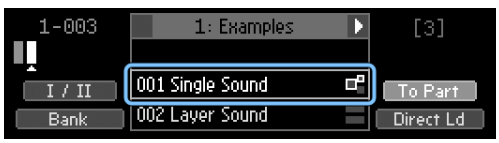


To avoid any confusion in the upcoming steps, please disable “*Direct Load*” by pressing **Soft Button 4** shortly.
To start the loading process, press and hold **Soft Button 4** (for about 1 second), which enables the “*To Part*” mode.

By pressing and holding **Soft Button 1** you can select the Part you want to replace. The selected Part will be marked as white and indicated with a small arrow.



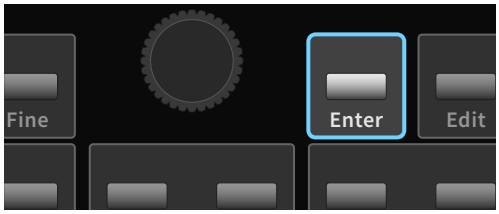
Navigate to the Source preset using the Encoder or the ⊖**Dec**/**Inc**⊕ buttons. If you need to move between banks, use **Soft Buttons 2 and 3**. Pressing **Soft Button 1** briefly opens the Bank screen, effectively swapping the roles of the Encoder and ⊖**Dec**/**Inc**⊕ buttons with those of **Soft Buttons 2 and 3**.



If the Source is a Single Sound, you can select which effects chain (FX I or FX II) to copy.

For Dual Sounds, you can select which Part to copy; the corresponding FX section (Part I + FX I or Part II + FX II) will be copied as well.

It's also possible to use this method to replace a Part with the other Part of the same preset.



Once you've selected the correct Source, press **Enter** to confirm the replacement. This process doesn't delete the Source preset or automatically overwrite the Target preset. If you're satisfied with the result, be sure to save it as a new preset (Append or Insert).

Modulation Assignments from the Source are added to the Target's Macro Controls. If a Macro Control is present in both Source and Target, their Modulations merge; if it's only in the Source, that assignment is added. The Source's Hardware Source Assignments and Amounts are always discarded.

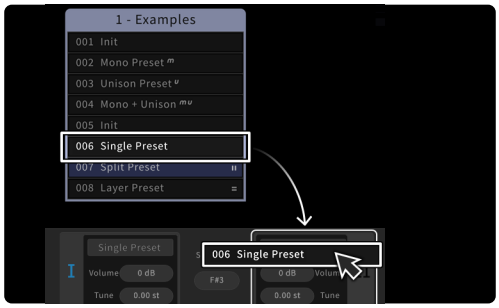
Note that the "Load to Part" process distinguishes and remembers different aspects of selection:

***selected Target**: referring to the currently loaded preset's selected part*
***selected Source**: referring to the currently selected preset (if the preset is of Type Single) or the currently selected preset's part (if the preset is of Type Split/Layer)*

This means, that any time the Load to Part process is invoked, all Source selection aspects are restored as they were the last time.

Graphical UI

In the Graphical User Interface, the Load process is comparable. The Preset Tab provides a To Part button when a Dual preset has been loaded. Preset and bank navigation in the tab will behave similarly to the screens of the Hardware User Interface. Furthermore, individual presets of visible banks in the main area can be selected by clicking, shortening the whole process, especially when Direct Load is enabled.

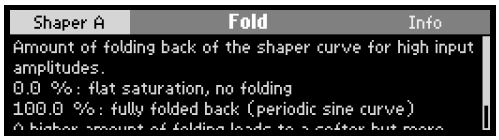


Presets can even directly be dragged and dropped onto a Part of the Sound Tab, further simplifying the whole process.

When combining presets of different types, there are some limitations that should be considered.
(see chapter 4.1 Parameter Organization)

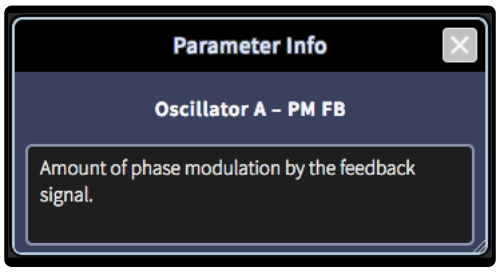
4.8 Contextual Info

Parameter Info



When a parameter is selected, the **Info Button** invokes the Info Screen, showing the current parameter's description. If the info text is too long to fit the screen, use ⊖ **Dec**/**Inc** ⊕ or the **Encoder** to scroll.

Graphical UI



The Info Icon in the Parameter Tab works accordingly when selecting a Macro Control, context menus for the main area elements are also provided. The provided Info window allows for edits on the user-definable info text.

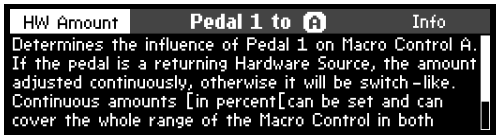
Macro Control Info

When a Macro Control is selected, the **Info Button** invokes the Info screen, showing the description of the currently selected Macro Control. When pressing the **Edit Button**, the user-definable info text can be edited in the Rename screen.

Graphical UI

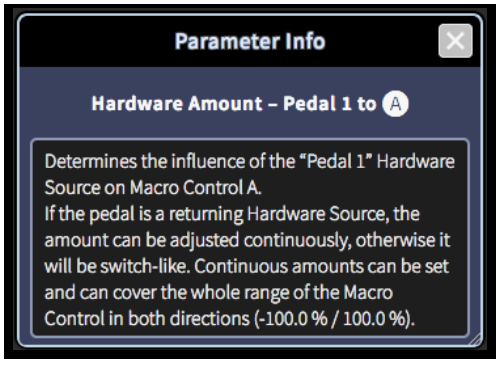
The Info icon in the Parameter tab works accordingly when selecting a Macro Control, context menus for the main area elements are also provided. The provided Info window allows for edits on the user-definable info text.

Hardware Source/Amount Info



When the focus is on a Hardware Source/Amount, the **Info Button** provides the Info Screen according to the item in focus.

Graphical UI



The Info window will display the description of a selected Hardware Source/Amount as described for ordinary parameters.

Preset Info

The Preset Info contains a variety of auto-generated and editable meta data. For more detailed information on preset meta data, please refer to *3.6 Presets*.

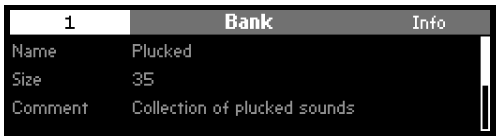
Graphical UI

The preset Info window can be made visible when clicking on the preset Info Icon in the Preset Tab or by a right click on a preset within a bank, selecting the show info option. The window can be left visible and will update when loading other presets. In addition, the global View menu also provides a visibility option for the preset Info window.

> ⚠ *In the Graphical User Interface, the preset Info window allows for editing the preset number (position in the bank), name, comment and color tag.*

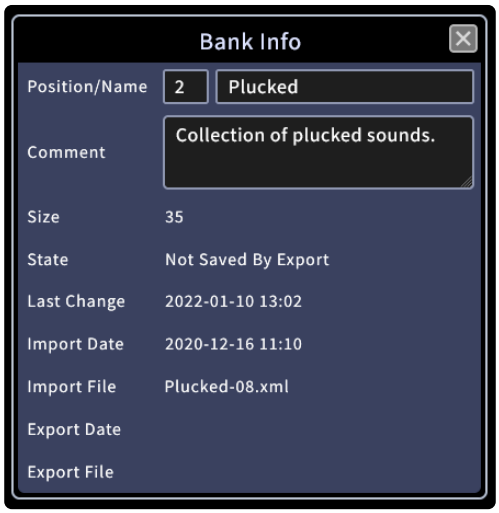
Bank Info

Banks contain a collection of meta data, some of which can be edited. The meta data collection includes: the bank number (position in the bank list), the bank name, a comment text, the bank size (number of contained presets), a state (indicating if unsaved changes occurred since the last export) as well as information about the last change (date), import (date, filename) and export (date, filename).



When in the Bank screen (available when pressing **Soft Button 1** while in the Preset screen), the **Info Button** invokes the Info screen for the currently selected bank. The screen can be scrolled by the **Encoder** or ⊖ **Dec**/**Inc** ⊕ buttons. When pressing the **Edit Button**, the comment text can be edited in the Rename screen.

Graphical UI



The bank Info window can be made visible when clicking on the Bank Info icon in the Preset tab or by selecting "*Show Info*" in the context menu provided by the bank menu icon or in other bank context menus. The window can be left visible and will update when selecting other banks. In addition, the global View menu also provides a visibility option for the Bank Info window.

> ⚠ *In the Graphical User Interface, the Bank Info Window allows for editing the bank number (position in the bank list), name and comment text.*

The Info window will display the description of a selected Hardware Source or Amount as described for ordinary parameters.

4.9 Overviews

There are different overviews provided on the Panel Unit, enabling the user to quickly get an impression of the inner workings of a particular sound, just by a brief glance at the Parameter Panels. Without listening to the sound or studying parameter values, certain assumptions on signal flow and modulation assignments can be easily made.

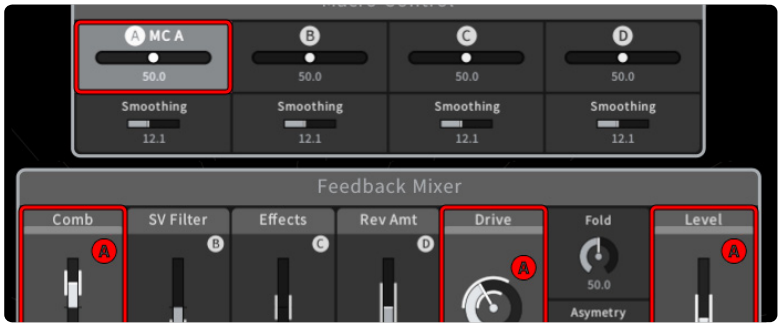
Activity Overview (Panel Unit only)

At any time, when the Preset Screen is in focus, active overview will be provided. Signal-flow related parameters that are not zero ("active") will have lit LEDs. When Macro Controls are mapped to at least one parameter, they will show lit LEDs as well.

MC Target Overview

When a Macro Control is selected, all assigned target parameters will show their assignment by blinking LEDs. This applies to parameters that are available on one of the Parameter Panels.

Graphical UI



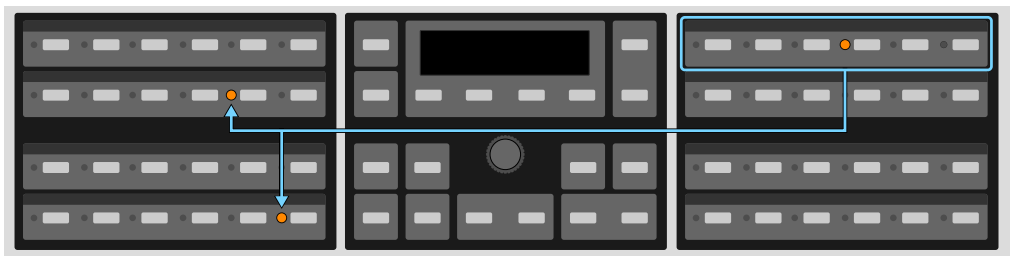
When a Macro Control is selected, it will be surrounded by a red rectangle.
All assigned target parameters show their assignment by surrounding red rectangles as well. In Split/Layer sounds, the Part in focus is reflected.

MC Target Indicators (Panel Unit only)

When a Macro Control is selected, assigned Main parameters (not available on any Parameter Panel) are indicated by literal symbols in the Macro Control Screen.

M	Indicates assignments to Master Volume or Master Tune.
u	Indicates an assignment to Unison Detune. In a Split sound, the Part in focus is reflected.
m	Indicates an assignment to Mono Glide. In a Split sound, the Part in focus is reflected.
P	Indicates assignments to Part Volume, Part Tune (in Split/Layer Sounds) or the Split Point (in Split sounds).

Signal Flow Overview (Panel Unit only)



When selecting a parameter of a particular group, blinking LEDs on the Panel Unit show where the output signal of this group is applied further in the signal chain. (If, for example, a parameter of the Feedback Mixer is selected, the PM FB and FB Mix parameters of the Oscillators and Shapers will have blinking LEDs, if they are unequal to zero - indicating that the output signal of the Feedback Mixer is applied in these particular sections.

> ⚠ *The Signal Flow indicator is optional and can be disabled in the Setup Menu (see chapter 8.Setup (C15 System Settings) for more details).*

Furthermore, in Split/Layer sounds, the Sound Screen/ Tab can indicate send and feedback flow across Parts , as explained in *4.7 Part Manipulation*.

Changed Overview

When a previously loaded Preset has been edited, an asterisk (*) will be shown. It can refer to different elements, depending on the context.

On the Panel Unit, the **Shift Button** can be used to overview or navigate to changed elements.

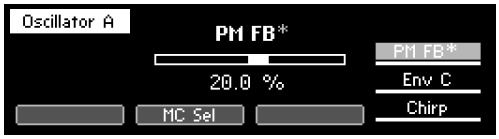
Presets

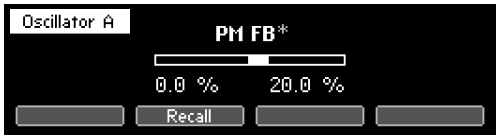
As mentioned in chapter *3.6 Presets*, the Preset Screen will indicate changes (user edits) to a loaded preset by showing an asterisk behind the unique number. When changes occurred to a loaded preset, holding the **Shift Button** while in the Preset Screen will show the Changed Overview on the Panel Unit, as changed parameters will now have blinking LEDs.

Graphical UI

In the Preset Tab, an asterisk (*) will be shown as well. For each changed parameter, an additional yellow frame will be shown. The highlighting can be disabled in the GUI Settings tab of the Setup window.

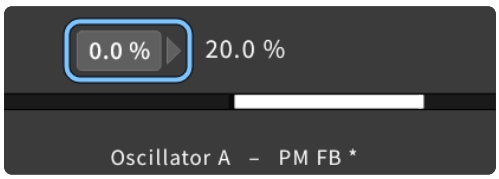
Parameters





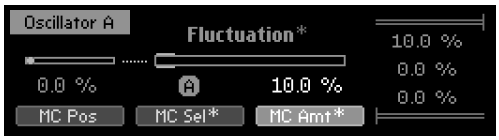
When a changed parameter is selected and visible in the Parameter Screen, an asterisk behind its label will be shown as well. Holding the **Shift Button** now will redirect to the Compare Screen, showing the loaded (original) and changed (edited) positions simultaneously. Both can be recalled by using **Soft Buttons 2/3**.

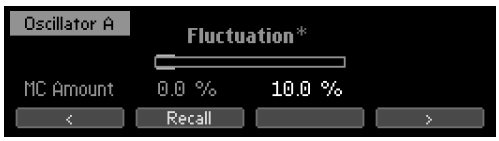
Graphical UI



When a changed parameter is selected and visible in the Parameter Tab, an asterisk behind its label will be shown as well. Furthermore, the previous state will be indicated left to the shown value. When selecting the previous state, it will be recalled.

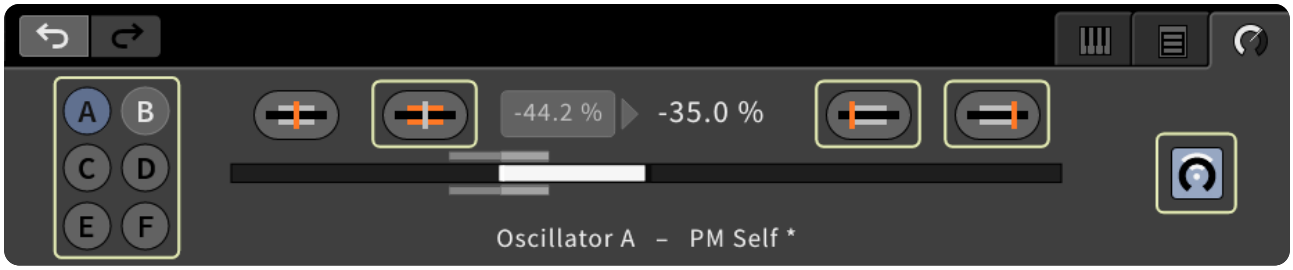
Parameter Modulation Aspects





When the modulation aspects of a parameter have changed, an asterisk will be shown for each Soft Button label. When a particular modulation aspect is in focus, the **Shift Button** can again be used to compare and recall states. **Soft Buttons 2/3** can be used to recall loaded/changed states and **Soft Buttons 1/4** can be used to navigate changed modulation aspects, as long as the **Shift Button** remains pressed.

Graphical UI



When the modulation aspects of a parameter have changed, the modulation icon will appear with an additional yellow frame. After selecting the modulation icon, any changed modulation aspect will be shown with an additional yellow frame. Except for the Macro Control selector (just indicating the previous state), any particular aspect can be focused by selecting the corresponding icon. With the aspect in focus, the previous state will be indicated left to the shown value. When selecting the previous state, it will be recalled.

Scale Overview

In order to quickly notice if any keys have an individual tuning (as controlled by the Scale group's Offset parameters), the Scale group provides an overview, showing if active (non-zero) offset parameters are present.

Panel Unit

The active state is indicated by a highlighted bar for the Scale group in the selection stack, and when the Scale group is selected, a Reset option is provided by **Soft Button 1**, which will set all active Offset parameters to zero when confirming with **Enter**.

Graphical UI

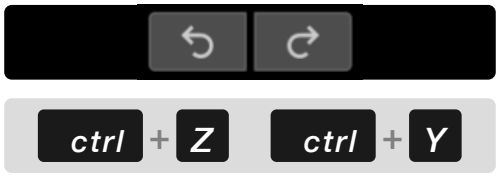
The active state is indicated by an exclamation mark ! in the Scale group header, and a "*Reset*" option is provided by the header context menu, which will set all active Offset parameters to zero.

4.10 The Undo Mechanism

Simple Undo/Redo

The current, active branch can be navigated by using the **Undo** and **Redo** buttons in the Edit Panel, recalling the corresponding state immediately.
When the **Undo Button** was pressed, an Undo indicator will appear in the Preset screen, showing that the Redo option is available. The Parameter screen also shows the Undo indicator, as long as no other parameter is selected.

Graphical UI

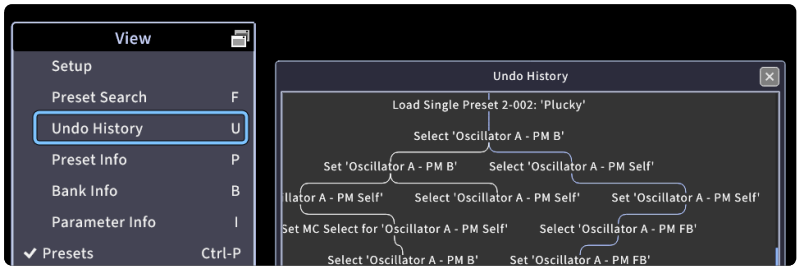


The current, active branch can be navigated by using the Undo and Redo icons above the tab area, recalling the corresponding state immediately. The icons indicate which Undo options are available, as shown by their color. Alternatively, the usual keyboard shortcuts for undo and redo can be used.

Focus on Undo History

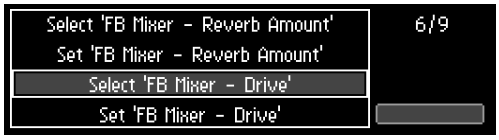
Pressing both **Undo** and **Redo** buttons at once will invoke the Undo screen, providing full navigation of the undo history.

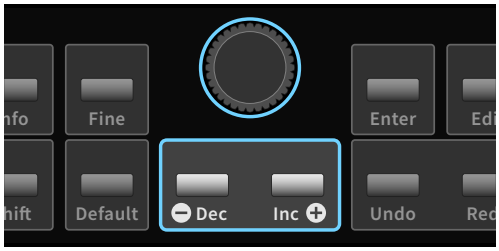
Graphical UI



In the View menu, the Undo History window can be shown or hidden. It provides full access on undo-related aspects.

Navigate current Branch



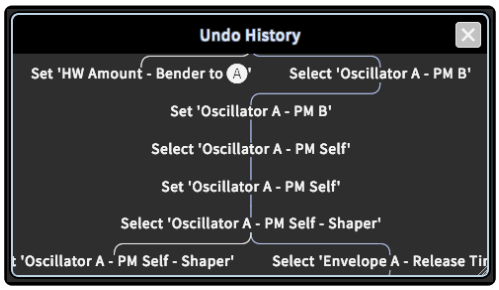


The Undo Screen can only show one branch of the undo tree. It can be scrolled by using the **Encoder** or ⊖ **Dec**/**Inc** ⊕. The current position will be indicated by a rectangle and can be recalled by pressing **Enter**.

Navigate Branches

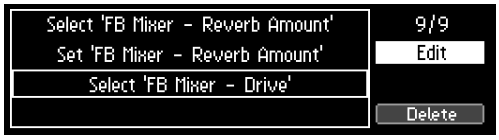
If a branch splits at the current position, pointy brackets are visible on the entry. Use **Soft Buttons 1** and **3** to switch between branches. Recalling an entry of an inactive branch will make it active.

Graphical UI



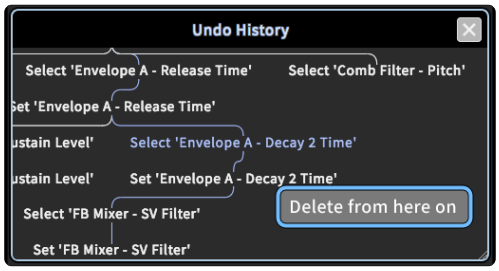
The Undo History window can be scrolled by drag gestures on the background or the scrollbar, or by using the **mouse wheel**. A simple click on an element will recall the corresponding state. As all branches of the tree are visible in this window, the branch navigation is fully integrated. A right-click (or long touch gesture) on an element provides a context menu for further options. The "*hide*" option will hide the selected branch, the other options follow below.

Delete (inactive) Branch



When navigating an inactive branch, press the **Edit Button** in order to get the "*delete*" option. Pressing **Soft Button 4** will delete the whole branch.

Graphical UI

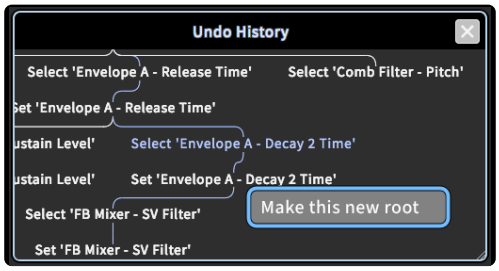


When the selected element is on an inactive branch, the "*delete from here*" option will be provided by a right-click. Confirming this option will delete the whole branch.

Make Element the new Root

When navigating the current, active branch, press **Edit** in order to get the "*Make Root*" option. All entries and branches prior to the current position will be deleted by pressing **Soft Button 4**.

Graphical UI



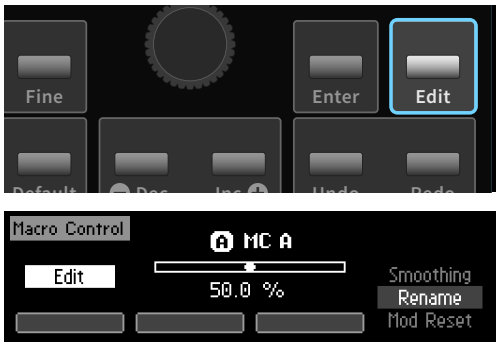
When the selected element is on the current, active branch, the "*Make this the new root option*" will be provided by a right-click. Confirming this option will delete all elements and branches prior to the selected element.

4.11 The Rename Mechanism

Affected Items

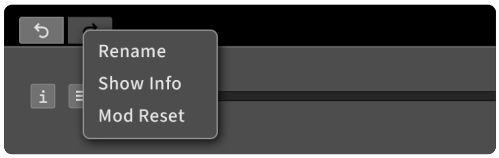
As previously described, renaming options will be provided when pressing Edit in the corresponding Screen.

Get Rename Option



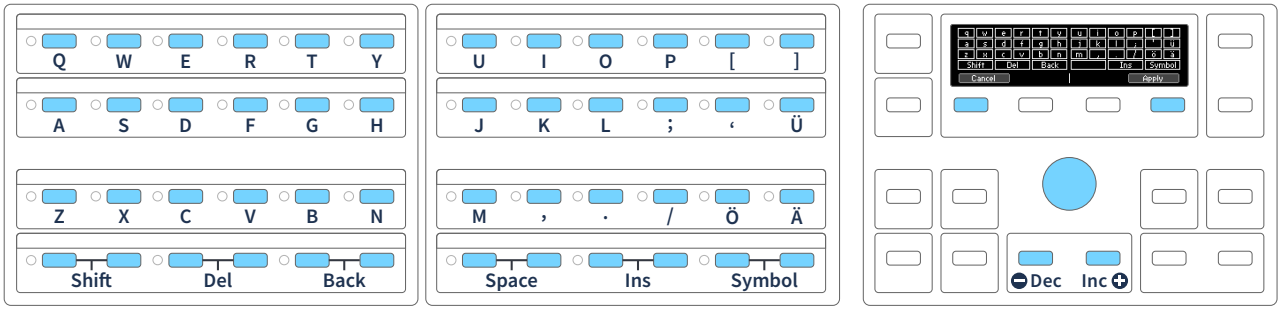
As previously described, renaming options will be provided when pressing the **Edit Button** in the corresponding context.

Graphical UI



As previously described, renaming options will be provided when invoking a context menu for corresponding items.

Rename Dialogs



Parameter Panel 1 | Parameter Panel 2 | Edit Panel

When the Rename Screen is shown, the two Parameter Panels on the left or on the right side of the display can be used as a keyboard, as indicated by the keyboard layout in the screen. The cursor can be moved by using the **Encoder** or ⊖ **Dec**/**Inc** ⊕. **Soft Button 1** will cancel the process, **Soft Button 4** will apply the process.

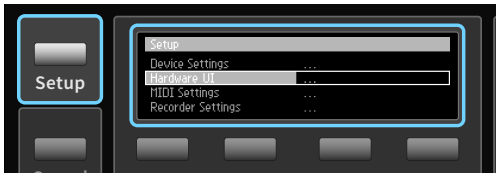
Graphical UI

When a rename option was called, a dialog window will appear, containing an entry or text box element. Mouse and keyboard on the external device can be used to rename the corresponding item. Dialogs provide OK and Cancel buttons in order to finish the process accordingly.

4.12 Setup Navigation

This section explains the navigation to and within the setup menu. Refer to chapter *8 Setup (C15 System Settings)* for a detailed reference.

Focus on Setup Menu

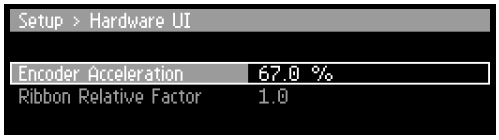


Press the **Setup Button** in order to invoke the Setup Screen. The menu content is organized in different levels which can be entered.

Scrolling

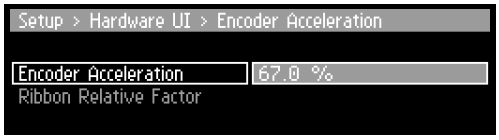
Scroll the menu by using the **Encoder** or ⊖ **Dec**/**Inc** ⊕. The position will be indicated by a highlighted background.

Enter a Submenu/Property



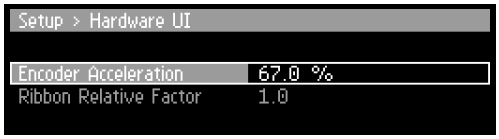
Press **Enter** or **Soft Buttons 3/4** in order to enter a submenu or a menu property, according to the current position.

Adjust a Property



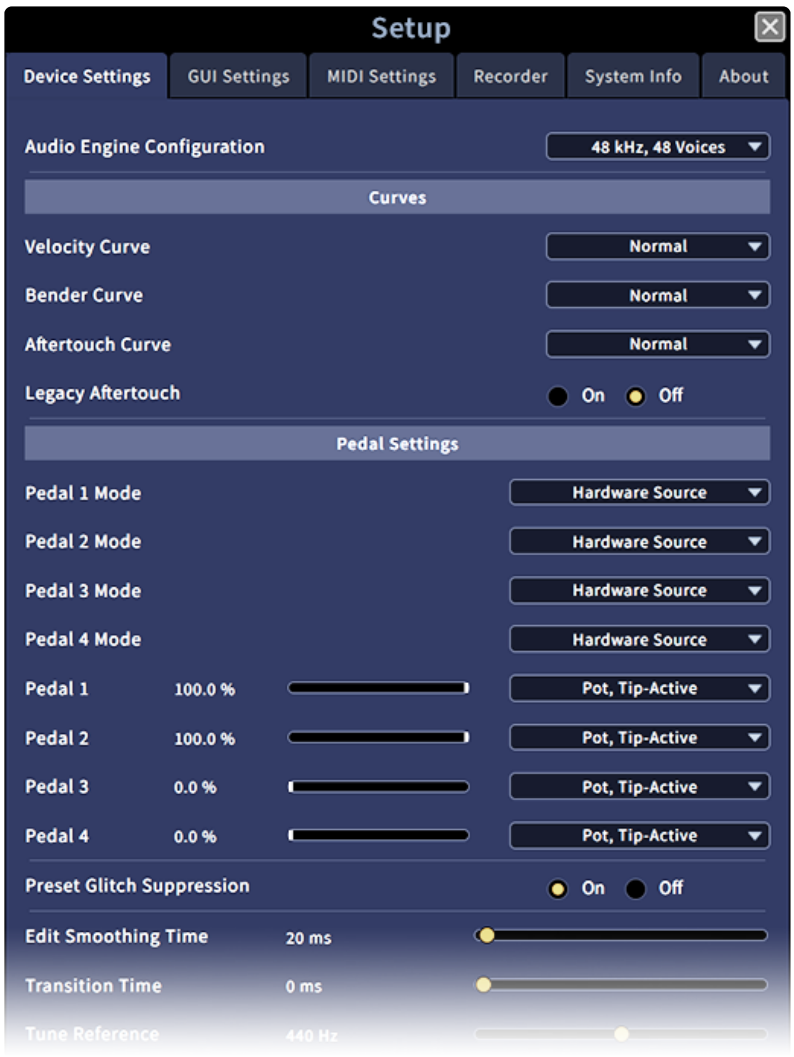
When focusing on a property, adjustments can be done like editing a parameter, by using the **Encoder** or ⊖ **Dec**/**Inc** ⊕. Numerical settings (Edit Smoothing Time, Tune Reference, Transition Time, Encoder Acceleration, Ribbon Relative Factor) can also be fine-tuned by using the **Fine Button**. You can also use the **Default Button** to reset most of the settings in the Setup menu. In the Graphical UI, settings shown as sliders can be set to default by double-clicking.

Escape a Submenu/Property



Soft Buttons 1/2 can be used to navigate back to the next higher level. When a property is in focus, **Enter** has the same effect.

Setup Window (Graphical UI only)



The top right View menu provides the "*Setup*" option, toggling the visibility of the Setup window. The menu content is organized in tabs which can be focused. In each tab, the corresponding properties are provided and can be adjusted (some properties have context menus, some can be adjusted by drag gestures, like a parameter).

4.13 Backups

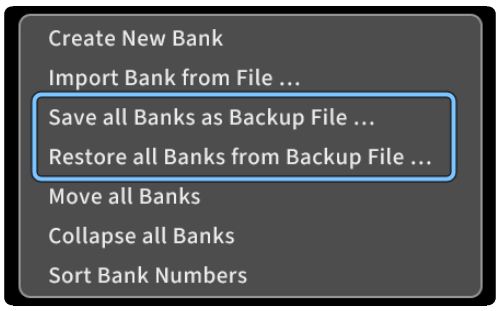
As previously mentioned, single banks can be imported and exported from and to either a connected USB stick or the connected external device. In addition, the transfer of all banks at once is also provided, which allows for fast and easy backups.

> ⚠ *We recommend creating backups of your banks regularly. Although the C15 can hold an arbitrary number of banks, it can be helpful to keep the interface clean by not overloading it with banks, speeding up booting, backup and shutdown processes. Using single backup files for bank collections may also be helpful for live musicians who may need to load their presets on a C15.*

Saving and Restoring Backups on USB Stick (Panel Unit only)

In the Setup Screen, the Backup submenu can be found, providing a "*Restore all Banks...*" and a "*Save all Banks...*" option. It will be indicated when a USB stick is connected, pressing **Enter** will then allow for exporting or restoring of backups.

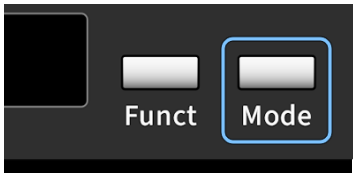
Saving and Restoring Backups on External Device (Graphical UI only)



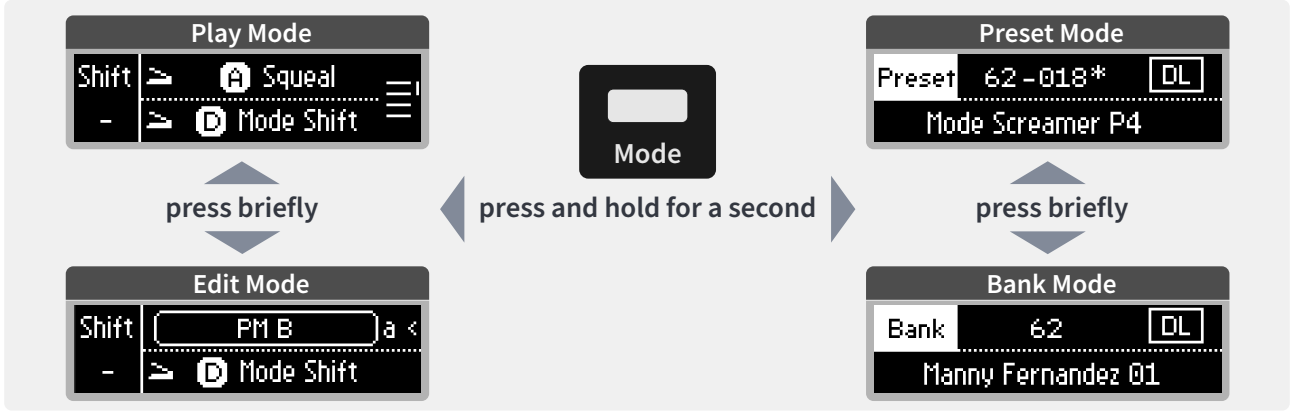
The background menu of the Graphical User Interface provides options for saving and restoring backups. When "*Save all Banks as Backup File...*" is selected, all banks will be copied into a single file which then will be downloaded on the external device. (You will find the downloaded file at a location depending on your browser settings.) When "*Restore all Banks from Backup File...*" is selected, a backup file present on the external device can be chosen and uploaded.

⚠ *Please keep in mind that when restoring from a backup file, all banks currently present on the C15 will be lost. We recommend to save a backup file before restoring in order to maintain all preset data.*

4.14 Base Unit Functionality



Here is a quick recap of the Base Unit functionality, compiling all available features into a single overview. The **Mode Button** cycles four distinct operation modes, which are explained in the following. The functionality of the remaining buttons depends on the current mode.
The following illustration shows how to navigate between the different modes:



Play Mode

This is the default mode of the Base Unit. The Ribbons work as ordinary Hardware Sources, if assigned to Macro Controls (Macro Control names will be displayed).
−/+ Buttons can be used to shift the keyboard up/down by 12 semitones. Shifting by single semitones is achieved by holding either of the **−/+ Buttons** and then pressing the other one.

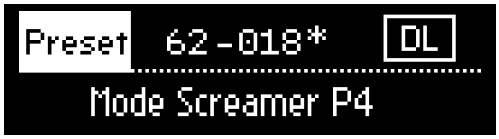
Ribbon Pair Selection	Ribbon Mode Selection
	
Pressing **Funct** briefly will switch between Ribbon pair 1/2 and 3/4.	Holding **Funct** for a second changes to a screen where you can switch the Touch mode of the most recently used Ribbon between absolute and relative.

Ribbon Mode Selection will apply to the currently selected Ribbon Pair.

Edit Mode

Pressing the **Mode Button** while in Play mode will select the Edit mode. In this mode, the top Ribbon will operate as an additional parameter editor for the current parameter focus. The remaining functionality remains as described for the Play mode. Pressing **Funct** will toggle the operation-style of the top Ribbon between absolute and relative. To go back to Play mode, press the **Mode Button** again.

Preset Mode



Holding the **Mode Button** for a while in Play or Edit mode will select the Preset mode. In this mode, both Ribbons remain operable as Hardware Sources. The **−/+ Buttons** can be used to navigate presets. The **Funct Button** will serve as a Load button (when pressed) or as a Direct Load switch (when held for a second). To go back to Play mode, press **+** hold the **Mode Button** again.

Bank Mode

Pressing the **Mode button** while in Preset mode will select the Bank mode. In this mode, both Ribbons remain operable as Hardware Sources. The **−/+ Buttons** can be used to navigate banks. The **Funct Button** will serve as a Direct Load switch (when held for a second). The last selected preset of the corresponding bank will be loaded. Pressing **Mode** will bring you back to Preset mode, while holding **Mode** will take you back to Play mode.

4.15 Graphical UI Functionality

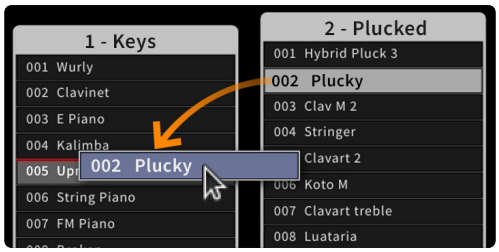
There are some more features of the Graphical User Interface, which are not available on both Base/Panel Unit. Other features are available on both User Interfaces, but are organized in different ways.

GUI Shortcuts

For a detailed reference of all available keyboard shortcuts see *13. Shortcuts for the Graphical User Interface*.

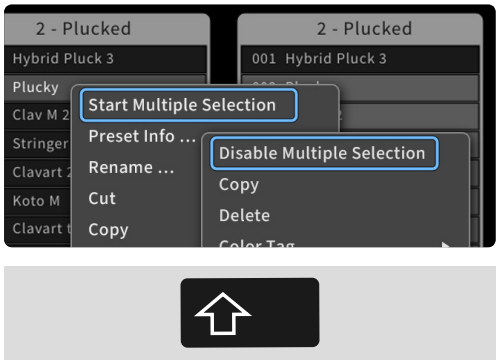
4.15.1 Presets

Preset Drag and Drop



A selected preset can be dragged on other positions in a bank, into other banks or on the background. When it is dropped, it will move to the new position (if the bank remains the same), or it will be copied to the new position (creating a new bank if it was dropped on the background). If a preset is dropped directly on another preset (as indicated by a red background), the other preset will be replaced. In a similar manner, banks can be dragged as well in order to change their position in the main area, or to copy their contents into other banks.

Multiple Preset Selection

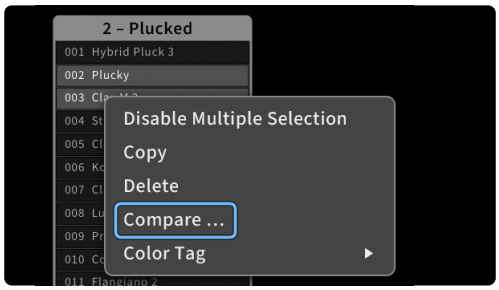


Bank context menus (invoked by a right-click or long touch gesture on a bank in the main area) provide an option to start and finish the selection of multiple presets. Alternatively, the Shift key can be used to hold the multiple selection mode. During multiple selection, presets of any bank can be added or removed from the selection (but they will not be loaded). All selected presets can then be deleted or copied (see context menu), or dragged into any bank at any position or on the background, creating a new bank containing copies of the selected presets. The selection of multiple presets can be finished in the context menu or by a click on the background.

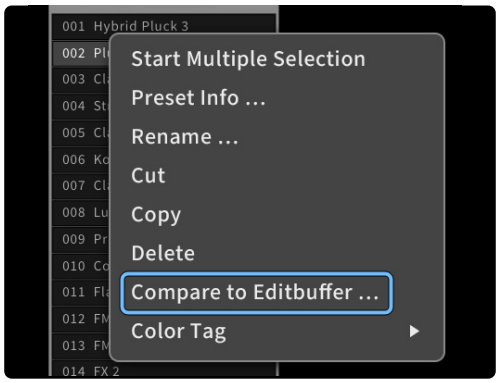
> ⚠ *Note that Preset Drag and Drop and Multiple Preset Selection are only available, if the GUI Settings (explained in the following) allow for context menus and drag and drop.*

Preset Compare

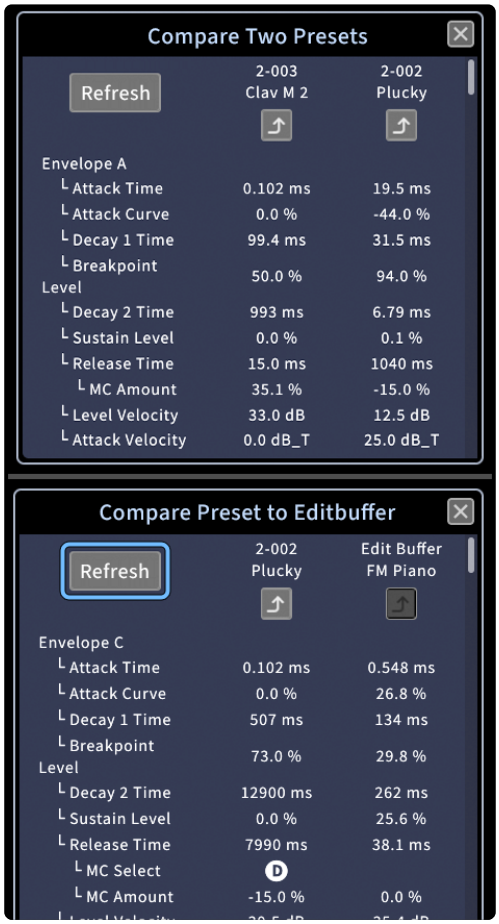
Two presets can be compared against each other, examining their individual differences. This may be useful for distinguishing several versions of a preset that are only slightly different. Two compare methods are available, as shown in the following:



Using the multiple preset selection mechanism and selecting two presets, a context menu entry "*Compare ...*" will be available when right-clicking on the selection. The two presets will be compared against each other.



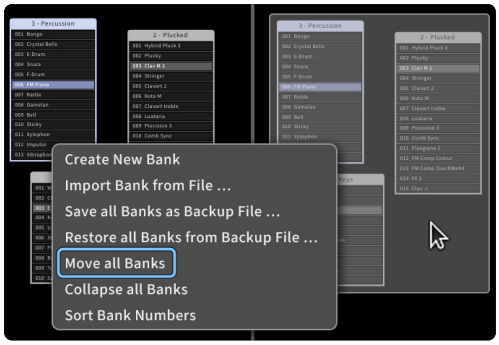
A right-click on any preset will provide a "*Compare to Editbuffer ...*" option. The preset will be compared to a copy of the Edit Buffer (the current parameter settings).



When starting the compare mechanism by either method, the Compare window will appear, showing every parameter or aspect that differs between the two presets. Equal parameters or aspects are not visible. Any of the two presets can be loaded, as provided by a Load icon in the header section of the window (so, both presets can be tested and played without closing the Compare window). When comparing a preset to the Edit Buffer, subsequent adjustments to parameters that change the Editbuffer will not be recognized by the Compare window automatically. The Refresh button can be used in order to get a new copy of the current Edit-buffer, ensuring that the comparison is up-to-date.

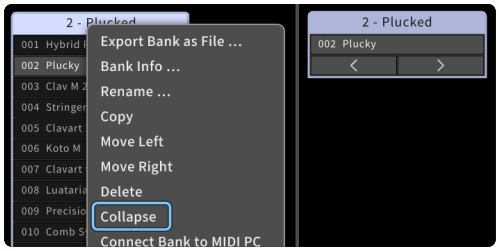
4.15.2 Banks

Move all Banks



There is a shortcut to move all banks at the same time, provided by the global context menu (invoked by a right-click or long touch gesture on the background). If the "*Move all Banks*" option is selected, a white rectangle will appear, surrounding all banks. Drag gestures now allow for moving all banks to another place in the main area. To stop, re-select the option or click on the background.

Collapse Banks



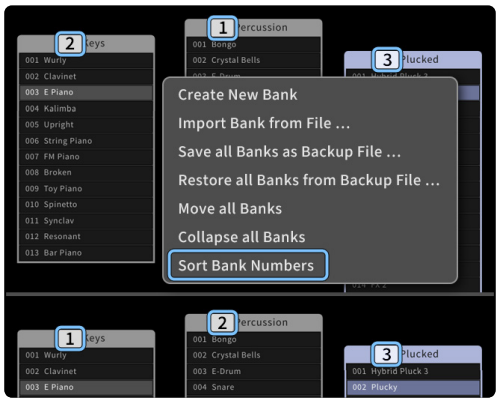
The local bank context menu provides an option to minimize a bank. A double click on a bank header has the same effect. When a bank is minimized, it will consume only a small space, but still provides access to all contained presets (the access is only sequential, though).

Docking Banks

When dragging banks manually to certain positions in the main area, they might not align very well. In order to create an alignment, a bank can be docked to another by dragging it close to other banks. The bank outlines change, indicating possible docking targets (top, right, bottom, left) for the dragged bank. When banks are docked together, they also behave as a group that can be dragged as a whole or docked to larger bank clusters. The top- or leftmost bank of a cluster behaves as the master and will move the whole cluster when dragging it, while the other banks can be dragged away from the cluster in order to split the group back into individual parts. Furthermore, when dragging a single bank between two banks of a cluster, it can be inserted as well.

> ⚠ *Banks can be docked ontop of each other as a vertical cluster. When minimizing or maximizing an individual bank, the cluster will maintain the alignment and shift the other banks accordingly.*

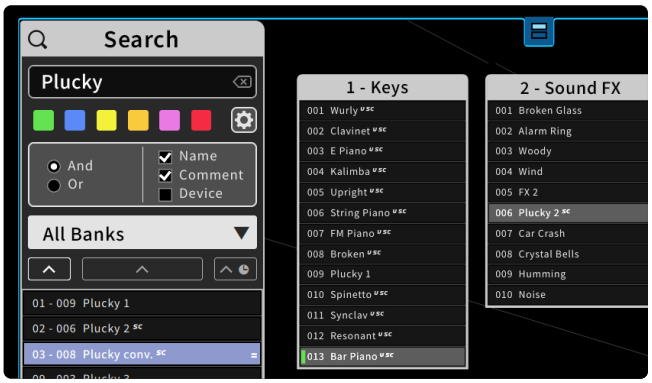
Sort Bank Numbers



The background context menu provides an option to sort the bank numbers. This will re-evaluate their order in the bank list, which is available by sequential access in the Preset screen or tab. The new order will be affected by clusters (which will be evaluated first), and the bank positions on the main area or within a cluster (from upper left to lower right).

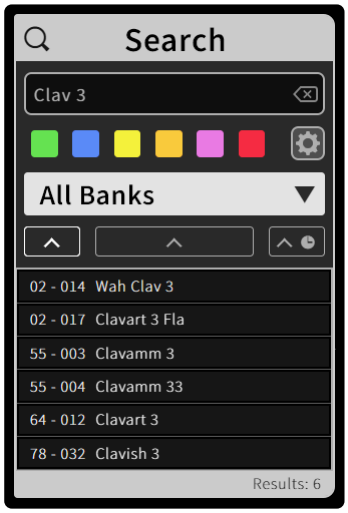
4.15.3 Preset Search

Open/close search window



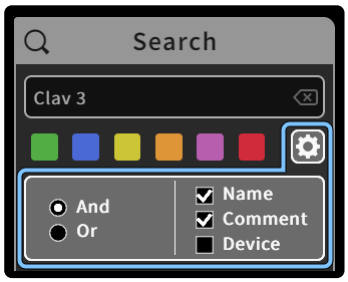
The Search window can be quickly accessed in the Graphical UI via the magnifying glass icon in the top left corner. A click or tap on the icon will open or close the window. The Search window is designed to stay in place and is not affected by the zoom level of the parameters and preset banks.

Search terms & settings



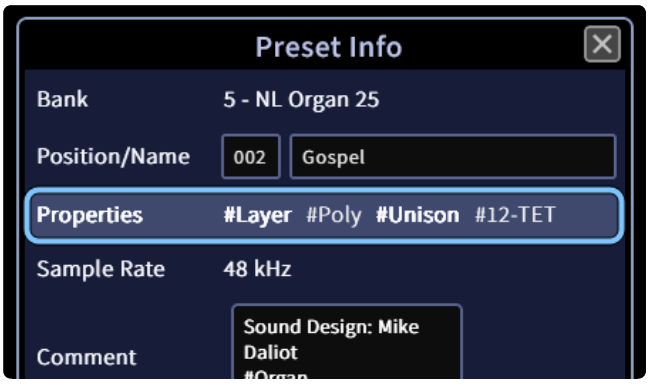
If you do not enter any search terms, the list of search results will show all of the presets that you have loaded onto your system. To narrow down the number of presets, you can enter one or more search terms in the search box.

By default, multiple search terms are linked using the "*And*" operator. To change this, open the search settings by clicking or tapping the search gear icon underneath the search box. Here you can choose between the default "*And*" operator and the "*Or*" operator. "*And*" will only show presets that contain all of the terms, while "*Or*" will show presets that contain at least one of the terms.



The search settings also allow you to choose whether you want to search by name, comment and/or device. The last option allows you to search for presets created on a specific device (e.g. your own). To do this, enter the name of the device you want to find in the search box. You can find the name of your own device in the System Info: ("*Setup*" > "*System Info*" > "*Device Name*").

> ⚠ *Your device name can also be changed. For more information, see chapter "8. Setup (C15 System Settings)"*

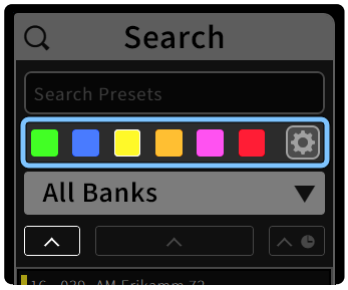


You can also search for automatically generated property-hashtags using the '#' symbol. These hashtags are included in the presets meta data and depend on specific settings within the preset. You can find the active hashtags in the "*Properties*" field of the Preset Info. The following table lists all hashtag-generating properties:

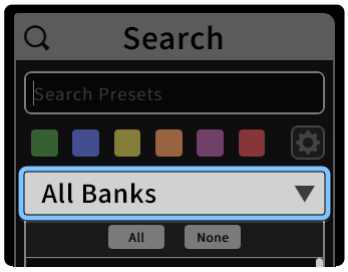
Property	Hashtags
Single/Split/Layer Sound	#Single/#Split/#Layer
Mono Enable Off/On	#Poly/#Mono
Unison Voices 1 (off) /2-24	#1-voice/#Unison
Scale Note Offsets No/Yes	#12-TET/#Scale

You can also create your own hashtags, by typing “#YOURHASHTAG” in the comment section. Hashtag search terms can also be combined with any number of other search terms or filters.

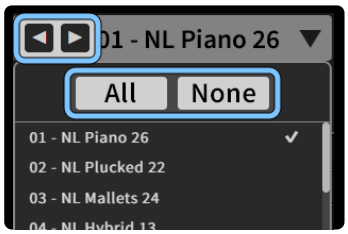
Search filters



Below the search box are the Color Tags. Click on one or more of the colored boxes to filter the search by Color Tags. These tags have an OR relationship and can also be used as the sole search criterion.
Additionally, search results can also be filtered by preset bank. By default, all banks are searched. This is indicated by “*All Banks*” in the Bank Selection drop-down menu just below the Color Tag selectors.

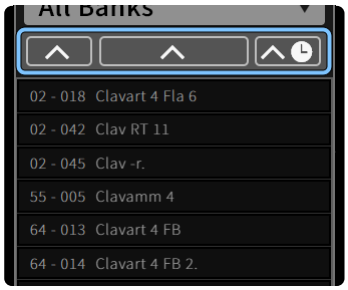


To select which preset banks to include in the search, click or tap the Bank Selection drop-down menu. Clicking or tapping one of the preset banks listed will tick its check box, indicating that it will be included in the current search.

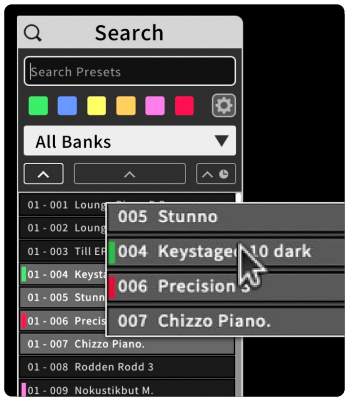


If only one bank is selected, its name will appear in the drop-down menu with two left/right buttons, allowing you to browse through the banks one by one.
The “*All*” and “*None*” buttons in the open drop-down menu allow you to select or deselect all banks with a single click.

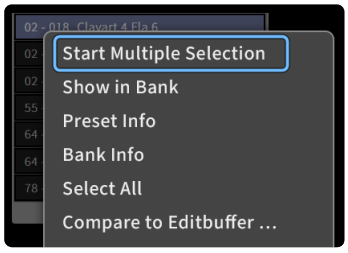
Search result handling



After entering your search criteria, the list below will show all the results. The number in the bottom right-hand corner of the search window indicates the number of search results. You can use the scroll bar, the mouse wheel or a touch gesture to scroll through the list.
If Direct Load is enabled, a single click will load the selected preset. Otherwise, double-click to load the preset.

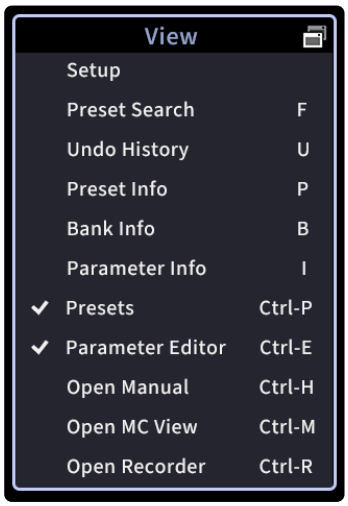


Just above the search results list are three buttons that sort the banks by Bank & Preset Number, Name (alphabetical) and Creation Date. Arrow down means lowest to highest, A to Z or oldest to newest. Arrow up means the opposite.
When you find a preset you like, you can drag and drop it into your favorite preset bank, or drop it on the empty background to create a new preset bank. To select multiple presets in the list, simply hold down the Shift key on your computer keyboard, click and drag over the presets you want.



If you are using a touch device, hold and release your finger on a preset to open the context menu. Select the first item, "*Start Multiple Selection*", and you can select multiple presets by tapping on them individually. Exit multiple selection mode in the same way. In the context menu you will also find "*Select All*" to select all presets in the search results list at once.

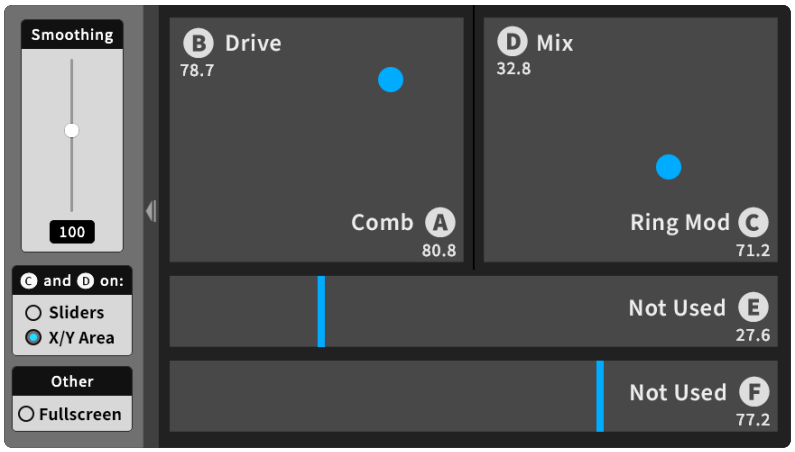
4.15.4 The View Menu



The View menu (available in the top-right corner, indicated by a menu icon) provides quick access to crucial components of the Graphical User Interface. The following components can be made visible or invisible (GUI shortcuts to the components are shown as well).

Setup	When clicking this option, the Setup menu opens in a new window. For more information about the Setup menu, refer to chapter 8 Setup (C15 System Settings).
Preset Search	As described, presets can be searched for keywords. Click on this option to start a search task, opening the Search window.
Undo History	All user actions are tracked and can be undone, as provided by Undo/Redo Icons above the tab area. In order to have a complete overview or browse through the history, the Undo History window can be used, showing all tracked actions in a tree-like structure.
Preset Info	Every preset contains meta data, such as a comment text or the creation date, for example. All the preset-relevant information is provided by the Preset Info window.
Bank Info	Similarly, banks also contain meta data which will be provided by the Bank Info window.
Parameter Info	In addition, specific parameter information will be provided by the Parameter Info window.
Presets	All the floating banks in the main area can also be shown or hidden, shifting the focus to the parameters. Nevertheless, all banks still are available in the Preset Tab.
Parameter Editor	All parameters in the main area can also be shown or hidden, shifting the focus to presets and banks. The Parameter Tab still provides the opportunity to edit a selected parameter. However, parameters cannot be selected anymore (the Hardware User Interface still provides complete access).
Open Manual	The C15 Documentation is also available as a separate HTML document, which will open in a new browser tab.
Open MC View, Open Recorder	Open the MC View or Recorder (see below) in a new browser tab.

Open MC View



The MC View is an experimental feature which allows for a more dynamic, screen-based interaction with Macro Controls. By clicking on this menu option, a separate browser tab will be opened, providing two XY controls and two large sliders, representing the Macro Controls. Their positions are following mouse or touch gestures with a smoothed speed.

At the left edge, the settings can be accessed. They contain:

- the amount of additional smoothing
- an option to assign MC C and D to the second XY field or to the two horizontal sliders.

> ⚠ *Note that the provided smoothing times are completely separate of the Edit Smoothing Time (found in the Device Settings of the Setup Menu) as well as the Macro Control Smoothing Times (found below each Macro Control slider in the Graphical User Interface).*

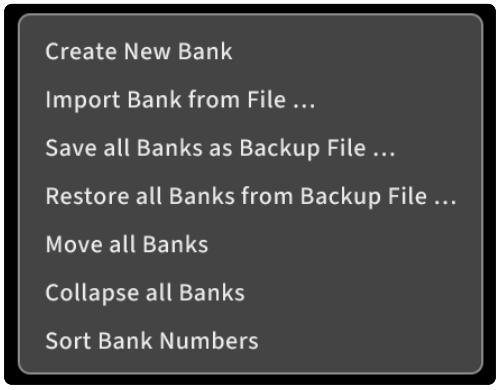
Open Recorder

The Recorder is a new feature which allows for recording audio material (see chapter *6. Recorder*).

4.15.5 Context Menus

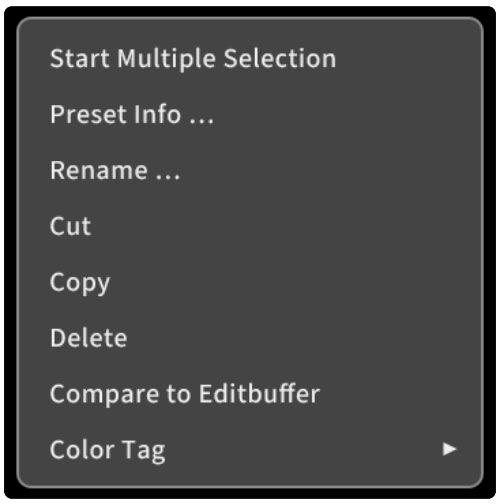
There are several context menus available providing different functionalities (according to the context). They all can be closed by pressing the Escape key.

Background Context Menu



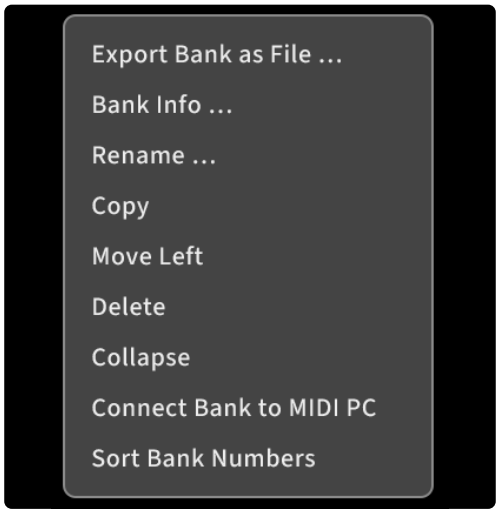
The Background context menu appears when right-clicking on the background. Alternatively, a long touch gesture can be used to invoke the menu. The menu provides global functionality such as creating a new bank, importing a bank (from the external device), saving or restoring back-ups and moving all banks at once.

Preset Context Menu



There are a two ways to invoke the Preset context menu. In the Preset Tab, a menu icon is provided for presets. In addition, a right-click (or long touch gesture) on a preset (in the Preset Tab or in the main area) can also be used. The menu provides preset-specific functionalities such as handling multiple preset selection, an option to show the Preset Info window, a rename option, cut/copy/paste/delete options for selected presets, the compare option and a fast way to change the color tag of selected presets.

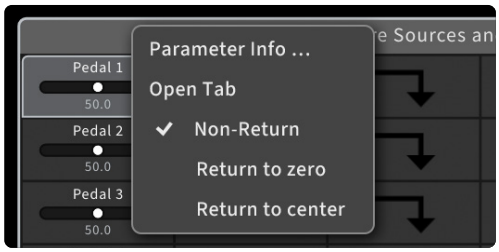
Bank Context Menu



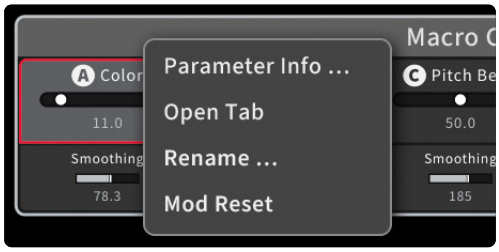
The Bank context menu can be invoked by the Bank menu icon in the Preset Tab, or by a right-click (or long touch gesture) on any bank header (in the Preset Tab or in the main area). Depending on where the Bank context menu was invoked, different functionalities will be provided. In general, the following options are provided: create a new bank, import/export a bank (from/to the external device), an option to show the Bank Info window, a rename option, copy/paste/delete options, move left/right options and the collapse/expand option.

Parameter Context Menus

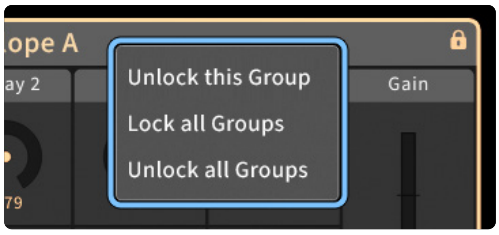
Finally, all parameters and all parameter group headers also provide a context menu in order to adjust parameter-specific behaviors. Similar to the other context menus, they can be invoked by right-clicking on an element, or by using a long touch gesture.



In the Hardware Sources and Amounts group, the return behavior of pedals and Ribbons can be set.



Macro Controls provide options for renaming, viewing the Parameter Info window (showing their user-definable info text) and resetting (clearing all mappings to target parameters).



Each group header additionally provides local (affecting the specific group) and global (affecting all groups) locking options.

The Parameter context menu provides an option to get the parameter info (by showing the Parameter Info window) or view the parameter in the Parameter tab (if not already visible).

4.15.6 GUI Settings

There are some options concerning only the Graphical User Interface. They are provided in the Setup menu, which can be called via the top right View menu icon. These settings are not available on the Hardware User Interface.

Selection Auto Scroll	Determine if selected items should be automatically scrolled to. Available options are Off, Parameter, Preset and both (Parameter and Preset).
Edit Parameter	Determine if parameters can be directly adjusted in the main area. Available options are Always, If Selected and Never. In the Parameter Tab, edits are always possible.
Highlight Changed Parameters	Determines, if parameters which have been changed are highlighted by yellow frames.
Context Menus	Determine if context menus are available in the main area. They can be invoked by a right-click or a long touch gesture. Available options are On and Off.
Preset Drag and Drop	Determine if presets can be moved in the main area by drag and drop gestures. Available options are On and Off.
Display Scaling Factor	Should the Graphical User Interface appear too small or big for the device screen resolution, this option can compensate. Available scaling factors are 50%, 75%, 100%, 125% and 150%.
Stripe Brightness	The main area background features a radial arrangement of lines pointing to the center position. They can help keeping track of the current position. Available options are Off, 10%, 25% and 50%.
Bitmap Cache	Determine how objects of the Graphical User Interface should be redrawn. Available options are On and Off. If the bitmap cache is activated, CPU consumption on the device will decrease, but more RAM will be required. If the cache is deactivated, CPU consumption will rise but RAM usage will decrease. The effect of this settings strongly depends on the external device.
Show Developer Options	There are some more options (beyond the usual interaction with the C15) that are not relevant for the user, but can be important for developers (when testing a device or running diagnostics of possible malfunctions). Therefore, the Developer Options can remain hidden in usual circumstances. If they are displayed, they can be found way above the parameters in the main area. We recommend to simply ignore these options.

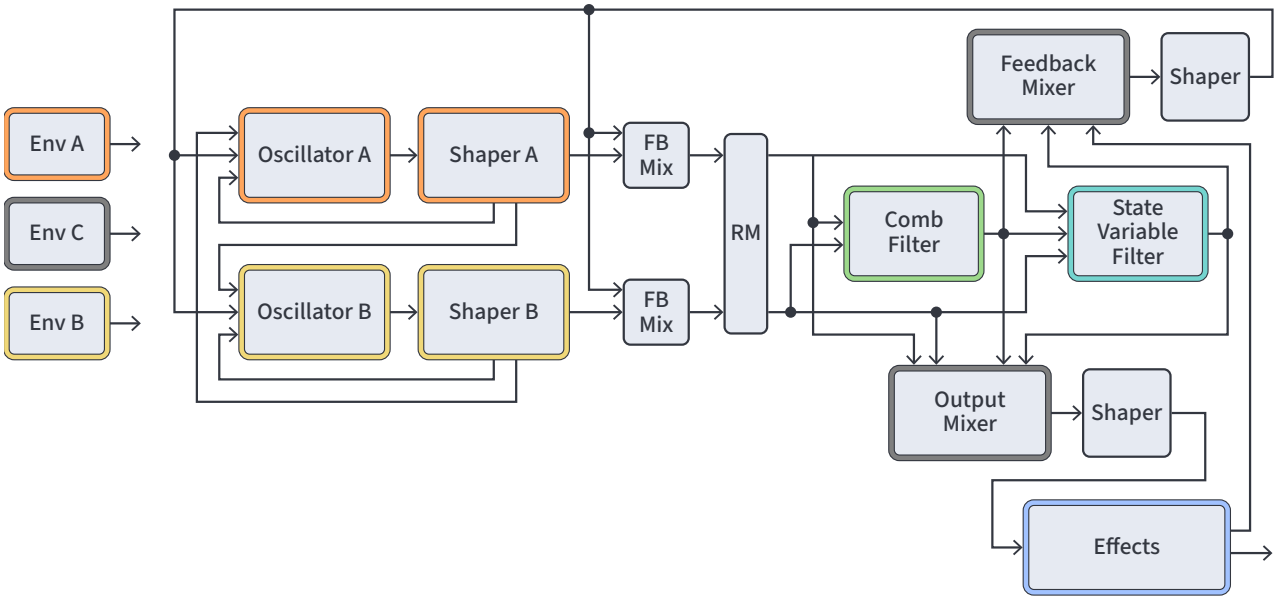
5. The Synthesis Engine

The C15's first synthesis engine is named „Phase 22". It can be seen as the latest stage of an ongoing, long-time development, combining and advancing experiences gained from precursor projects like Spark, Prism, Skanner and Kontour (available for Native Instruments' acclaimed Reaktor series).

There has been a steady evolution and optimization of the overall architecture and signal flow, as well as the modulation mechanism and feedback structures. This process will continue, further refining and advancing the synthesis engine.

5.1 Concept

The synthesis engine architecture is illustrated in the following diagram:



The main design goal for the „Phase 22" project is to exploit digital synthesis algorithms in order to build a highly responsive and expressively playable instrument with a strong individual character. At the same time, the set of parameters should be small enough to be easily accessible. It is intended to harness complexity by a reduced, minimalistic engine architecture, avoiding multi-mode switches for multiple waveforms or selectable filter and effect types. Furthermore, (almost) all parameters of the synth engine are designed to be continuous and time-variant in order to produce smooth transitions between sounds and increasing the overall sensitivity of the instrument.

The core structure is a phase modulation synth that is based on two sine oscillators and two sine shapers only (phase modulation is closely related to frequency modulation aka „FM"). The combination of an oscillator and its envelope can be understood as a classical FM operator. Together with a Shaper and a Feedback injection point it forms one of the two „branches". The signals from Branch A and B can be passed through the Comb Filter, the State Variable Filter or directly to the Output Mixer.

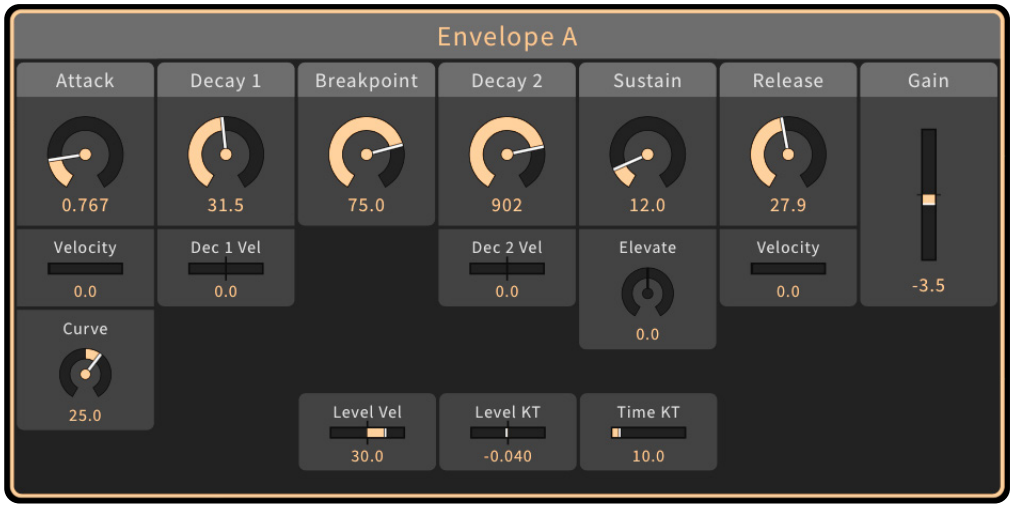
The Comb Filter is a tool for complex spectral shaping and also works as a resonator, the State Variable Filter can be applied for subtractive filtering. Signal routing is determined by both the Output Mixer (defining the mix being passed to the effect section) and the Feedback Mixer (defining the mix for flexibly applyable feedback loops).

Both filters and the effects have a profound impact on the feedback behavior, their amplitude and phase responses determine the frequencies where the feedback can result in self oscillation. In fact, the feedback bus is a unique and versatile feature of the synth engine, raising the perceived acoustic complexity of a sound (if taken use of).

On the other hand, the engine is also capable of producing classical subtractive and FM sounds, so a wide spectrum and variety of sounds can be produced.

The combination of the components can also be understood in a physical modeling sense, as the branches can function as exciters for the Comb Filter as a resonator, while the State Variable Filter and the effect chain work as an acoustic body, amplifier and spatial setting at once.

5.2 Envelopes



The primary purpose of the envelopes is to create modulation signals according to played keys. Their most crucial applications are certainly the amplitudes (peak levels) of the oscillators, which is predefined, where the amplitude of Oscillator A directly depends on the signal of Envelope A and the amplitude of Oscillator B directly depends on the signal of Envelope B. Beside that, there are other targets which can be influenced by the envelopes according to modulation amount parameters. They are referred to in the following sections.

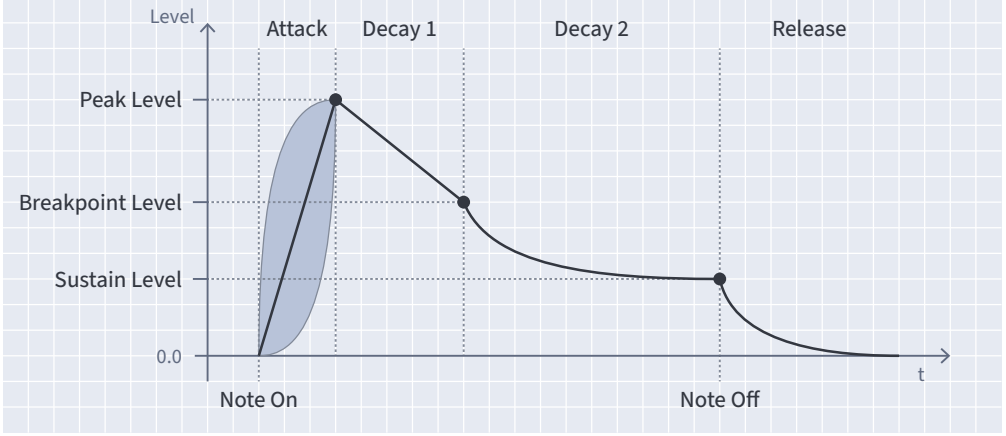
In total, there are four envelope signals to be taken use of. Three of them are flexibly definable, as provided by three parameter groups called Envelope A, B and C. Whereas Envelopes A and B are appliable in the two branches (Oscillators and Shapers), Envelope C can be used more globally for the modulations of pitches, cutoff frequencies, resonances or feedback levels. In addition, a non-parametric Gate signal is produced and applied for feedback control and the decay of the Comb Filter.

The Gate signal is a very simple envelope that jumps to 100% intensity when a key is pressed. When this key is released, the signal drops back to zero within a few milliseconds.

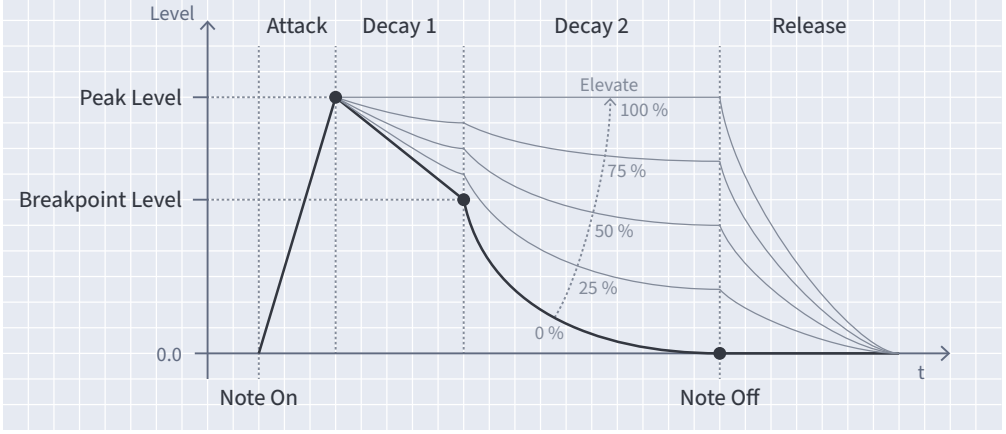
The signals of the other three envelopes are way more advanced. Lots of parameters define the behavior of each envelope, including variable sensitivities to the velocities and pitches of played notes.

The Envelope features an ADBDSR design with an adjustable Attack Curve:

Envelope A & B



Envelope A & B - “Elevate T-A” Parameter



For a particular envelope (A, B or C), there are four consecutive segments defining the signal progression. When a key is pressed, the signal starts by rising from (usually) zero to the peak level within the Attack time. The peak level can depend on the key-down velocity, whereas the time can range between zero and 16 seconds and also can depend on the key-down velocity (shortening or lengthening it for higher velocities). The Attack curve is linear by default but can be tweaked to get a concave or convex shape. With a concave shape it starts with a smaller slope and gets steeper, with a convex shape it is the opposite. The time and curve of the Attack segment determine the perceived sharpness of the beginning tone.

When the signal has reached the peak level, a new transition to the Breakpoint level (between zero and the peak level) will begin. This segment will be active within the given Decay 1 time (also between zero and 16 seconds). It will impact the early evolution of the produced tone. The first two segments determine the start transients, which are important for the perceived character of a sound.

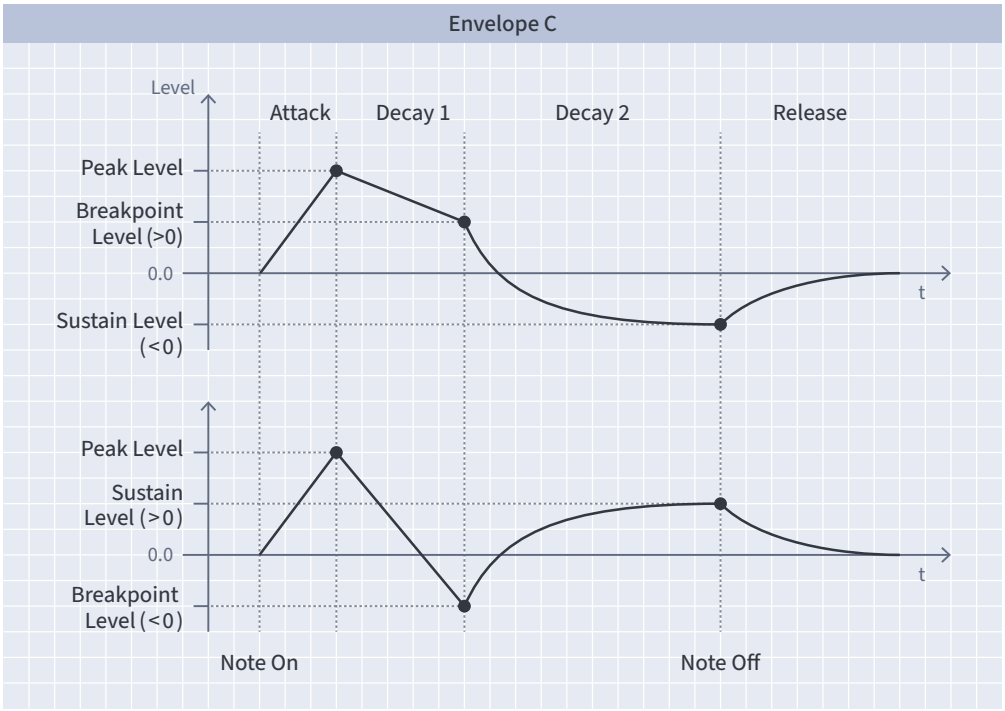
When the signal has reached the Breakpoint level, the Decay 2 segment will become effective. Within a given time, the segment will exponentially approach the Sustain level (between zero and the peak level as well). The Sustain level defines how much the perceived tone will persist at a stationary level while holding the corresponding key.

High Sustain levels are typical for pad and organ sounds, for example. If the sustain level is low or zero, a percussive tone character will emerge, with the Decay 2 time controlling if it sounds shorter or longer. The sustain level will hold as long as the key remains pressed.

The final segment, called the Release phase, will become effective as soon as the corresponding key is released. Within a given time the signal approaches zero exponentially.

Regardless of the perceived loudness of the tone up to now, it will disappear by fading out. Similar to the Attack segment, the Release time can be sensitive to the key-up velocity.

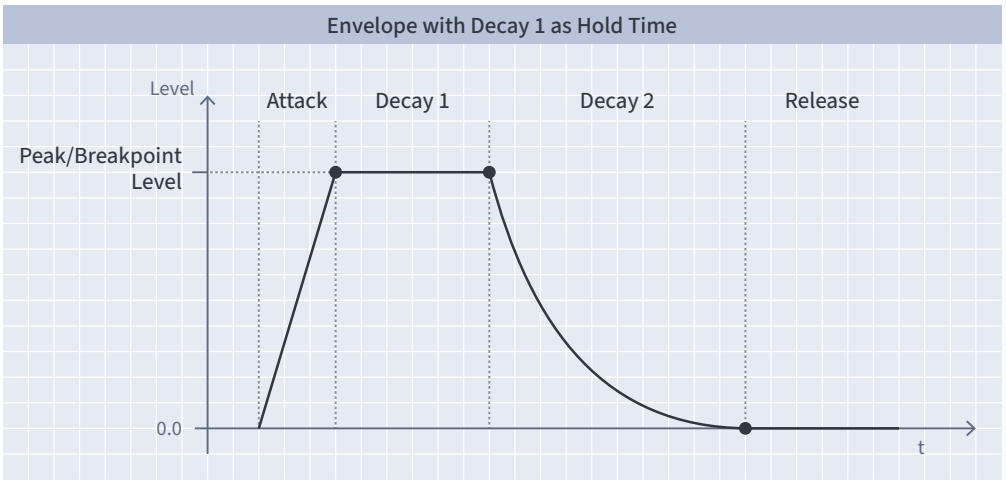
A major difference of Envelope C as a global modulation source is that its Breakpoint and Sustain levels are bipolar. This renders Envelope C more versatile and can make tonal evolutions even more complex.

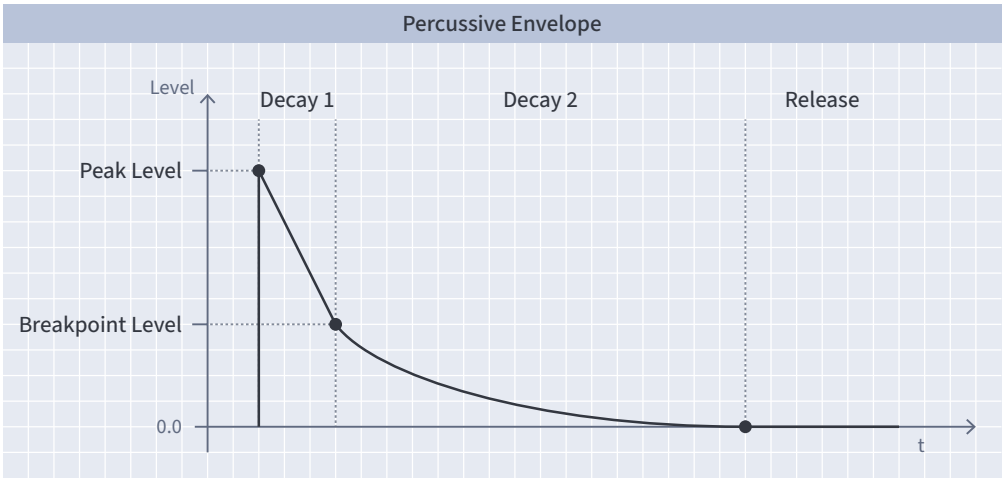


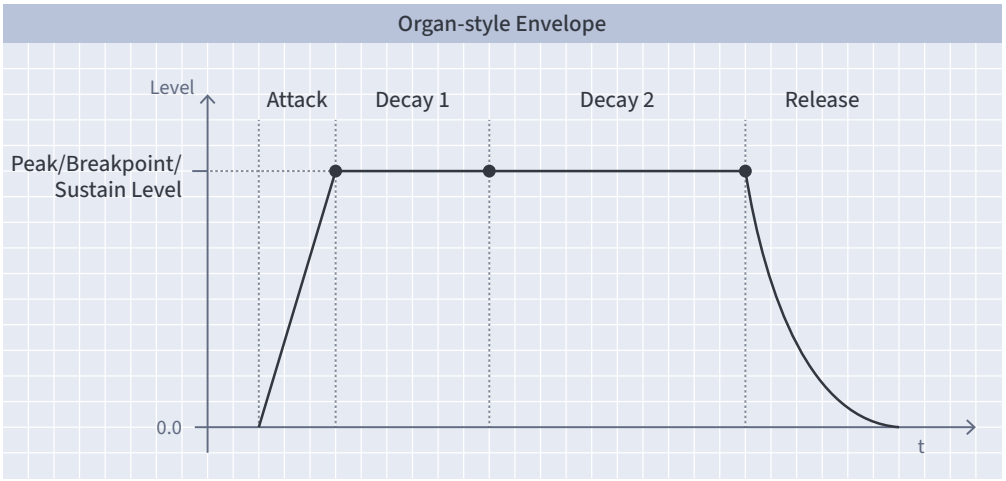
As explained, the key velocities can influence the perceived loudness of the tone as well as the speed of its start and demise. In addition, the Key Tracking parameters determine how much the key position influences both the levels and times of the envelope segments.

In conclusion, an Envelope group can model quite a lot of different tonal processes with varying degrees of realism. It can produce spiky impulses as well as long, complicated and seemingly artificial contours. All parameters, but especially the timing are highly precise and their sensitivities to the performing user can be carefully defined as well.

Examples of Envelopes





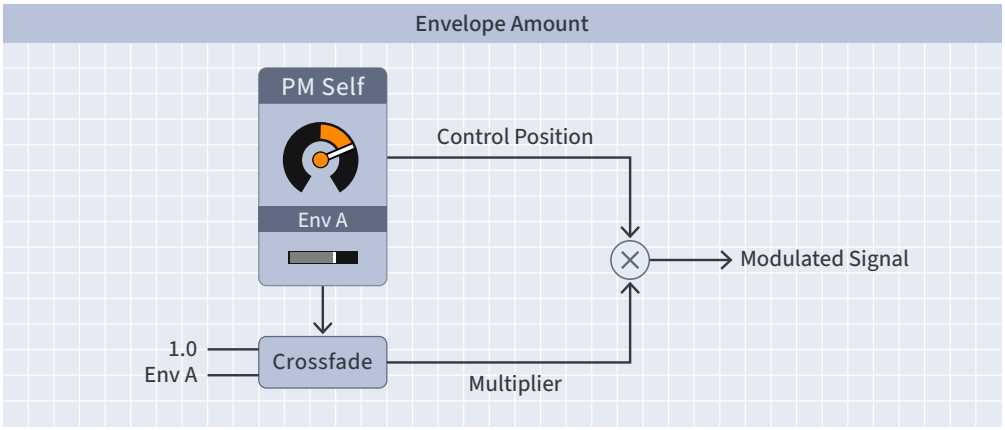


Finally, two more aspects are quite worth mentioning:

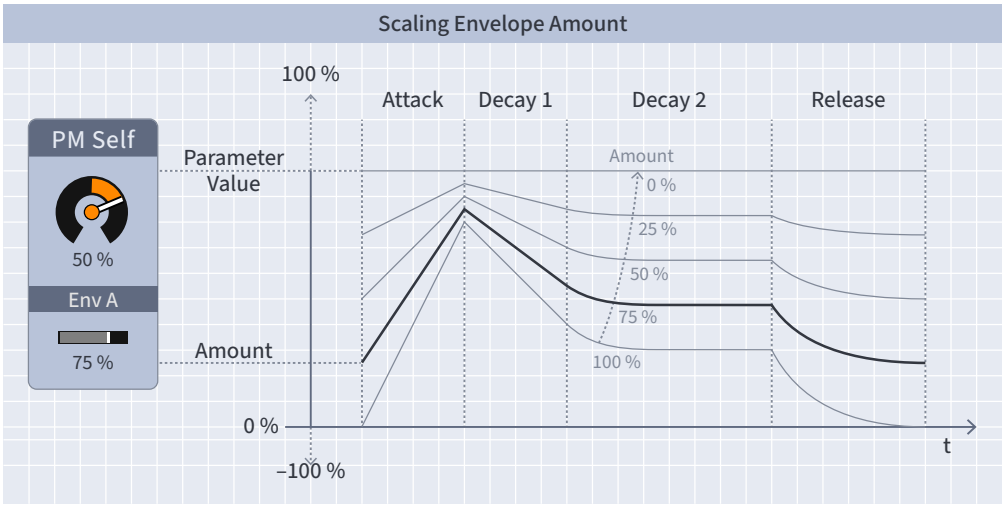
1. The Decay 2 and Release parameters follow an exponential curve, meaning the signal asymptotically approaches a target value without ever fully reaching it. To quantify the speed of this theoretically infinite process, the following definition can be used: at the specified duration (e.g., Decay 2 = 2000ms), the signal will have fallen to approximately 37% of its starting value and will keep on decaying indefinitely toward 0%. While this may seem arbitrary, it mirrors many natural phenomena, such as the decay of a plucked string's vibration.
2. Regarding the modulation range, all segment times are represented as modulation target parameters, so they can be influenced by the Macro Controls. Whereas the times of the first three segments can be precisely tuned between zero and 16 seconds, the Release Time (target) parameter can be further set to infinite, allowing the Release segment to „freeze". This allows for the integration of a „Sustain Pedal", modulating the Release time up to infinity while holding it.

Envelope Amounts

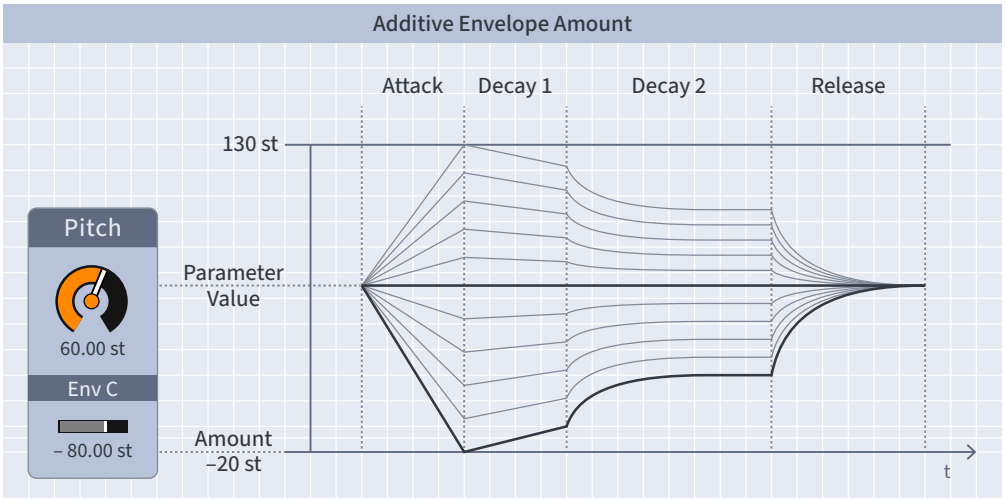
The envelope amount in the oscillator and shaper groups acts as a scaling factor that determines how much influence an envelope has on a target parameter.



At 0% the envelope has no effect, and the parameter remains at its static value. At 100% the parameter follows the full influence of the envelope, scaling from its base value to the envelope-defined modulation range. Intermediate values of envelope amounts create a proportional blend between the static parameter value and its envelope-driven modulation.



On the other hand, for pitch-related parameters (Oscillators, Comb Filter, State Variable Filter) and the State Variable Filter resonance, the associated envelope amount parameters simply scale the corresponding envelope signals.

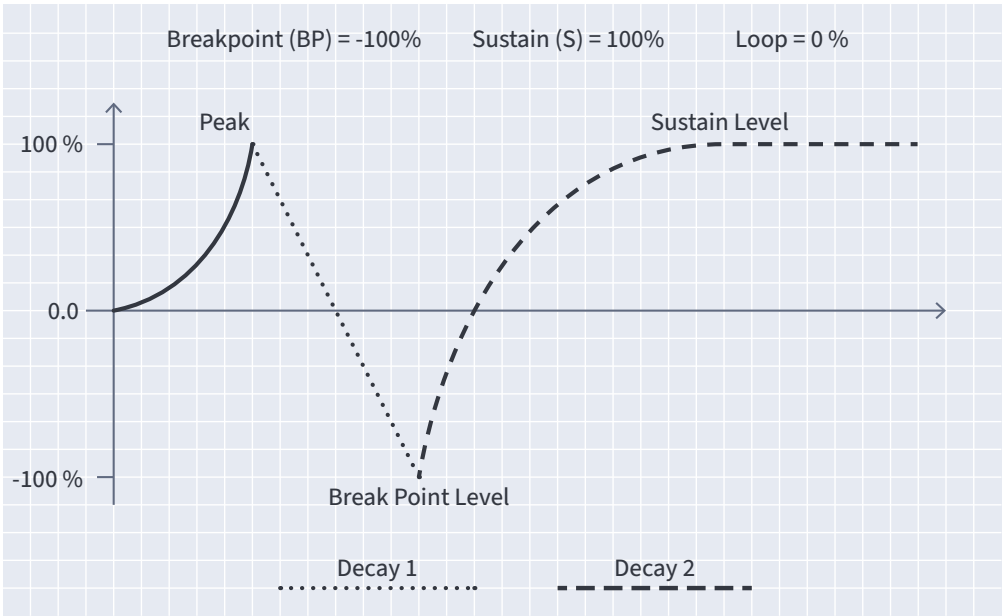


Loop Mode

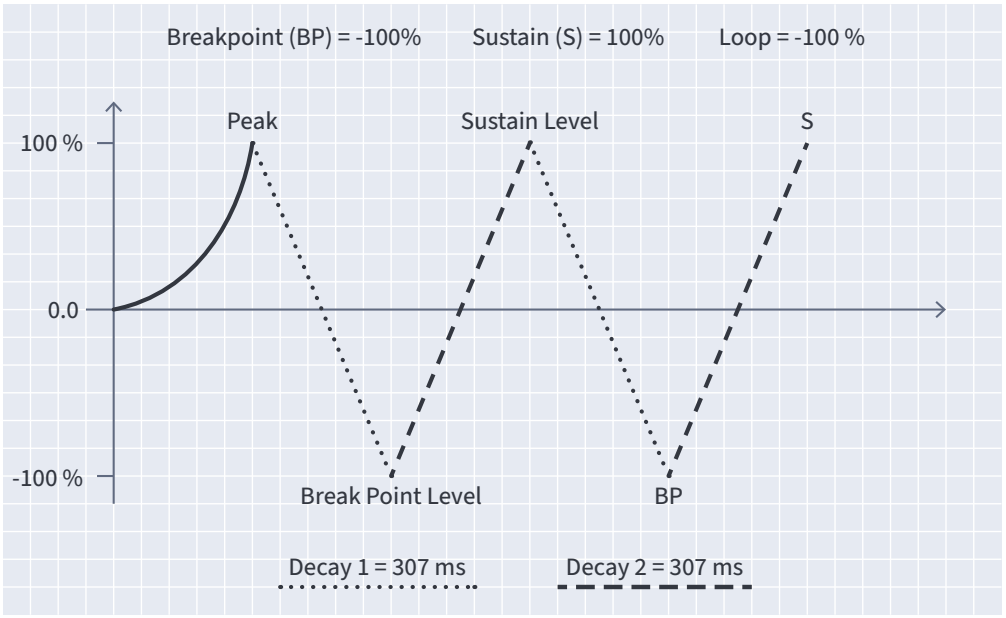
The Loop parameter enables Envelope C to loop between the sustain and the breakpoint level, effectively creating an oscillating modulation signal. Decay 1 and Decay 2 determine the shape and speed of the oscillation.

The following curves highlight the difference between Evelope C in standard operation mode and in Loop Mode.

Standard Mode:



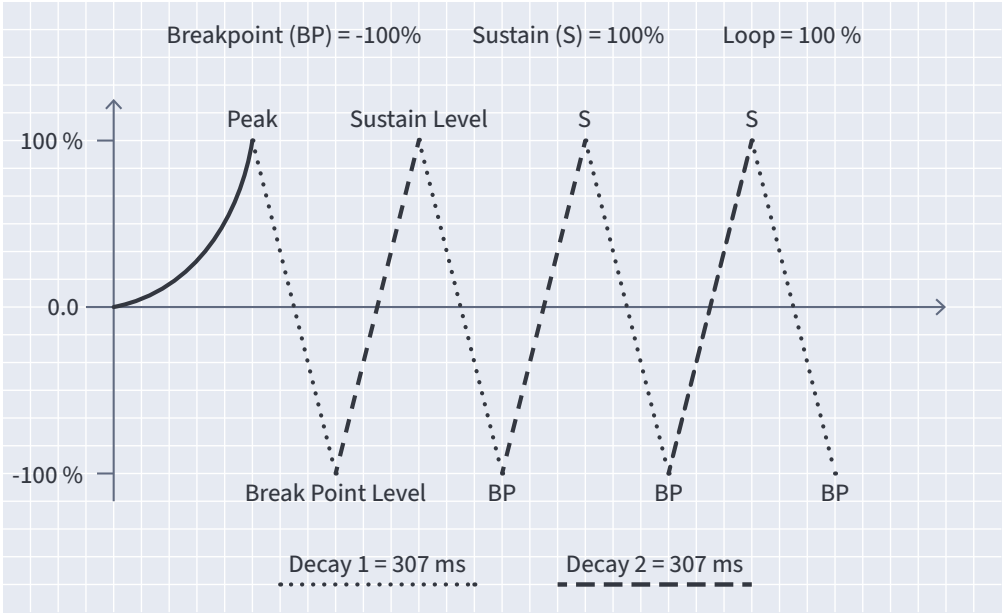
Loop Mode:

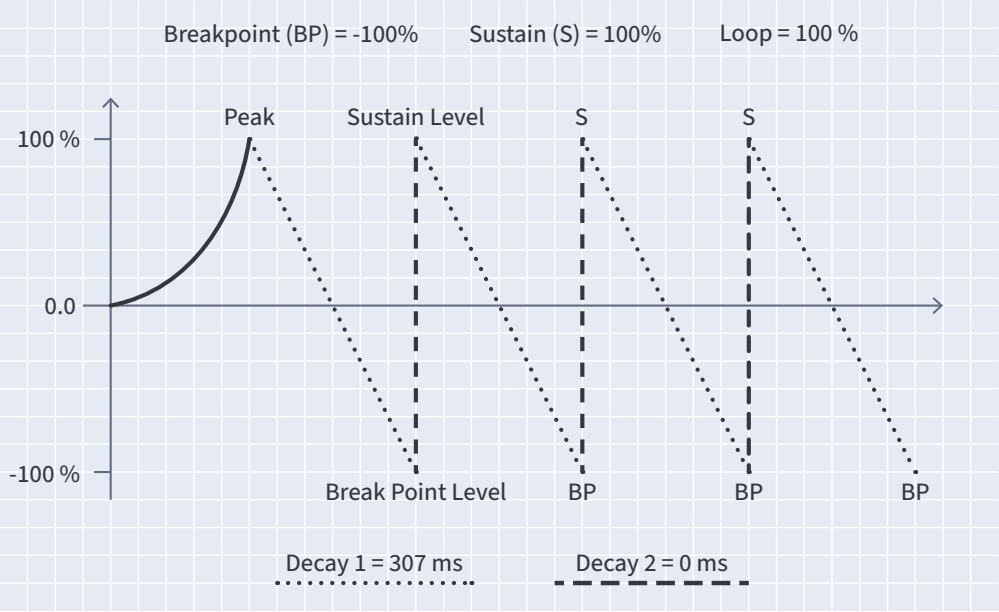


Setting the Loop parameter to a value greater than 0% activates Loop mode, which automatically changes the curve of Decay 2 to linear. With Loop mode enabled, Envelope C continues to be tied to key events. If a key is held down, Envelope C will peak after the initial attack phase and then begin to oscillate between the Breakpoint and the Sustain level.

Decay 1 controls the time from the Breakpoint to the Sustain level, while Decay 2 determines the time from the Sustain level back to the Breakpoint. In other words: the Decay times control the rate and shape of the oscillation, while the amplitude of modulation is controlled by the Break- point/Sustain levels.

By adjusting the durations of both decays, as well as the breakpoints and sustain levels, a wide variety of waveforms can be achieved:





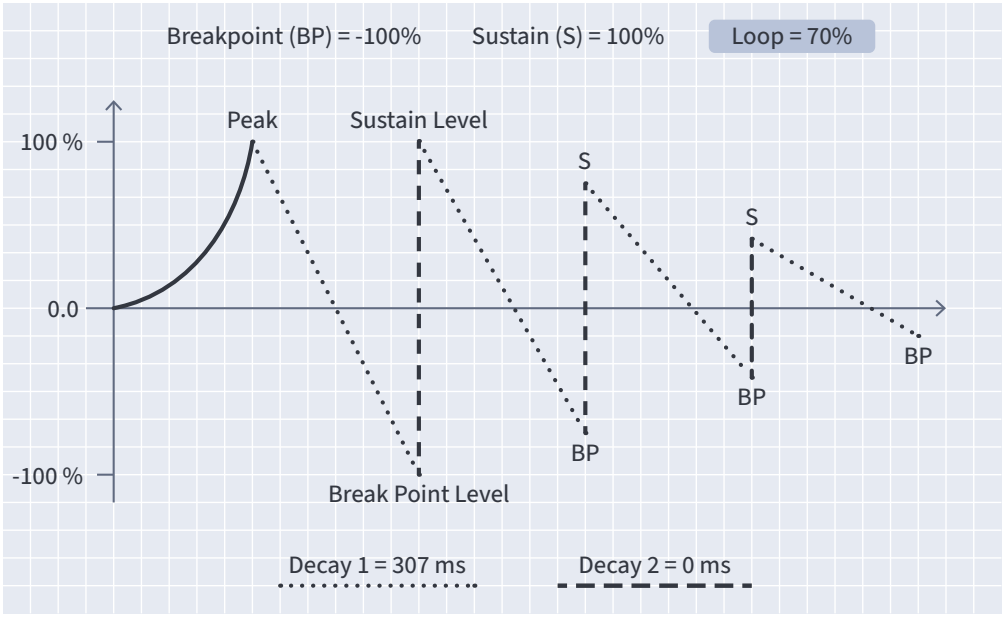
As the loop repeats, the amplitude gradually declines to zero, with the Loop parameter controlling the rate of decay (lower values mean a quicker decay). The overall behavior of the Loop parameter is summarized in the following table:

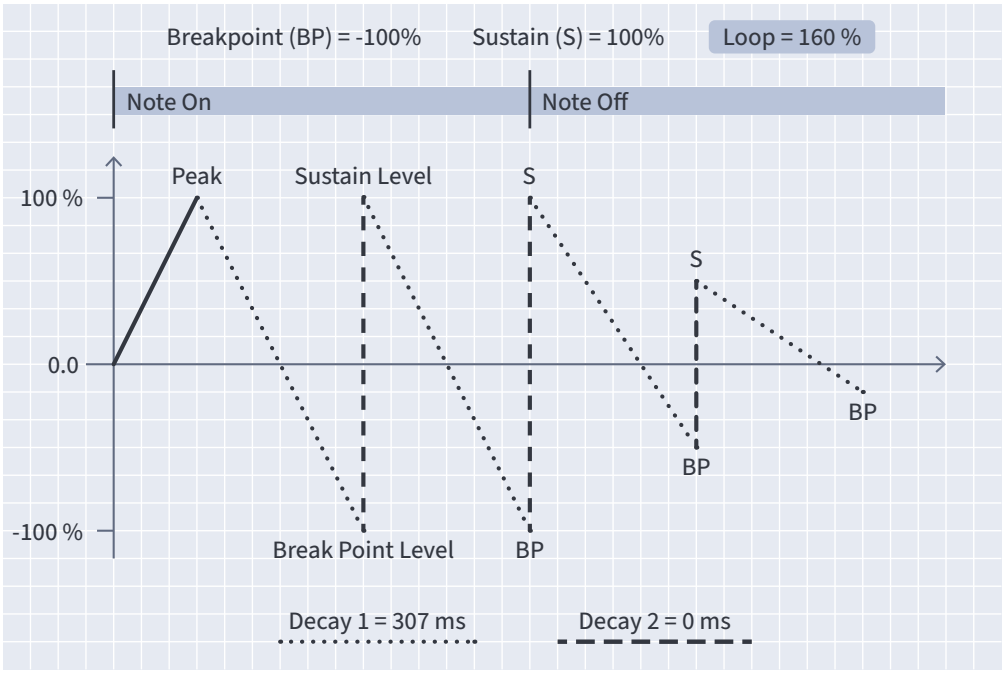
Parameter Value	Key is held down	Key is released
Loop = 0%	Regular behaviour of Envelope C	Regular behaviour of Envelope C
Loop = 1 - 99%	Envelope C loops; Amplitude gradually decays towards zero	Regular Release phase
Loop = 100%	Loop continues infinitely	Regular Release phase
Loop = 101 - 199%	Loop continues infinitely	Envelope C continues looping; Amplitude gradually decays towards zero
Loop = 200%	Loop continues infinitely	Loop continues infinitely

Regarding the parameter modulation, decay Times 1 and 2, Breakpoint and Sustain Level can also still be modulated by macros. This allows you to change the shape, rate and amplitude while playing. The Loop parameter can also be modulated by macros, however, changes will only apply to the next key pressed.

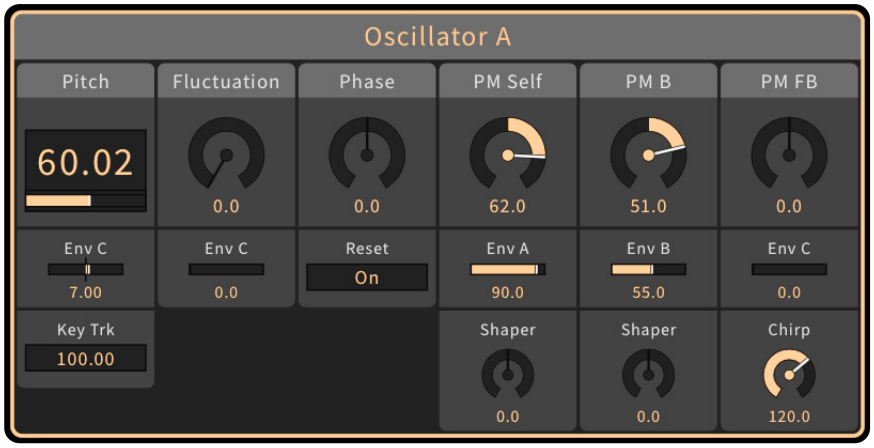
Level and Decay Velocities as well as Level and Time Key Tracking still apply in Loop mode.

Amplitude decay examples of Loop Mode:





5.3 Oscillators



The branches A and B both contain an Oscillator – a source for a sine-wave signal.

The perceived sound of a sine wave is rather simple, as there is just the fundamental, which is detected by the ear as a pitch. It lacks any further harmonics or partials in general, so the perceived sound is devoid of any timbre.

By phase modulation, wave shaping or ring modulation, new partial tones can be created. The resulting waveforms and spectra can vary enormously and evolve over time. This is the foundation of a sound that later can be further manipulated by the two filters.

Pitch
The frequency of an oscillator (the number of oscillations per second) is represented as a Pitch parameter, providing the familiar format of semitones and cents.

The Pitch can be modulated by Envelope C. The amount of modulation can be set in semitones (and cent steps in fine mode).

The influence of the position of a pressed key can be weighted by the Key Tracking parameter, adding to the basic tuning of the oscillator. At 100% Key Tracking, the Oscillator pitch directly corresponds to the keyboard. 0% Key Tracking removes the influence of the keyboard on the Oscillator Pitch entirely, whereas 200% Key Tracking will double the tuning per key. This results in whole tone intervals between neighbouring keys.

When a key is pressed, each oscillator can be synchronized to a particular start phase. This allows both oscillators to run in or out of phase up to the point, where they will cancel each other out. If the start phase of an oscillator is not zero, it will not start at the zero-crossing of the sine wave. With short Attack times, a clicking will be noticeable, as sharp transients can occur in that scenario.

Manipulation of Harmonics
In order to manipulate both harmonics and noisiness of the sine wave, phase modulation („PM“, often also referred to as „FM“) can be exploited, as each Oscillator provides several parameters dedicated to define the complex relations of intermodulations.

Basically, if a slow „modulator“ signal modulates the phase of another fast and tonal „carrier“ signal, the perceived frequency of the fast signal will change over time, increasing or decreasing the perceived pitch. The faster the modulator signal becomes, the faster the frequency of the carrier signal will change. If both signals are periodical, new perceived frequencies may emerge and others may disappear.

In general, strong and bright spectra can emerge. The produced sounds can be harmonic and tonal (if the ratios of the Oscillator frequencies can be expressed by fractions of small integer numbers) as well as noisy and atonal (like a metallic character, emerging from non-harmonic partials). This strongly depends on relations that both involved oscillators would have, like their frequency ratios and amounts of phase modulation.

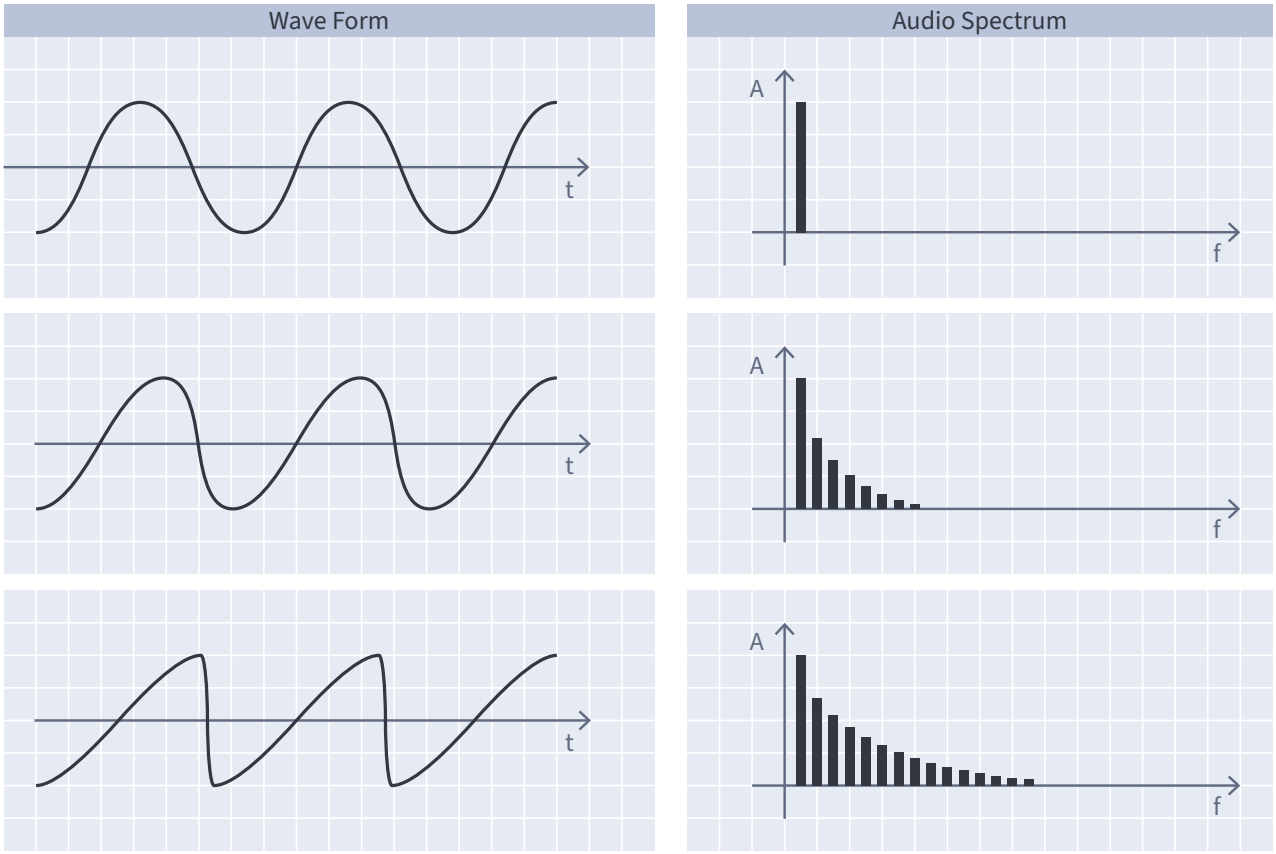
Common Frequency Ratios										
Difference (ST)[1]	0	3.87	4.98	7.02	12	14.04	15.87	19.02	21.69	24
Ratio[2]	1/1	5/4	4/3	3/2	2/1	9/4	5/2	3/1	7/2	4/1

1 tuning difference (in semitones) between Oscillator A and B
2 emerging Ratio

Modulation Sources
Three modulation sources can be used in parallel for each Oscillator.

1. Self modulation allows a particular oscillator to feed its own signal back, adding to its phase. This leads to a saw-like appearance of the oscillator signal and a brighter sound, depending on the modulation amount. The corresponding parameter is bipolar, affect- ing the direction of the saw curve. The corresponding shaper signal can be crossfaded into the modulation signal, further affecting the spectrum of the resulting oscillator signal. The corresponding Envelope can also be applied on the amount.

The oscillator signal for different amounts of self modulation



2. Cross Modulation, where the phase progression of a particular Oscillator can also be affected by the opposite branch (and vice versa). Similar to self modulation, the branch shaper signal can be crossfaded and the branch envelope can shape the intensity. This allows for complex intermodulations and elevates each Oscillator to function as both a carrier and a modulator simultaneously.
3. Global Feedback bus, being defined by the Feedback Mixer. The amount can be defined and Envelope C can shape the intensity as well. As the feedback signal can consist of polyphonic and monophonic parts, intermodulations between several (parallel) voices can occur. In most cases, phase modulation by feedback rapidly leads to noisy behavior.

Chirp Filter

After all phase modulation sources were weighted and added, their sum will be fed to a tunable but static lowpass filter. It can be used to reduce the “chirping” (high-frequency ringing and aliasing noise) that occurs with stronger phase modulations. Since the cutoff frequency does not depend on the played pitch, higher notes are affected more strongly.

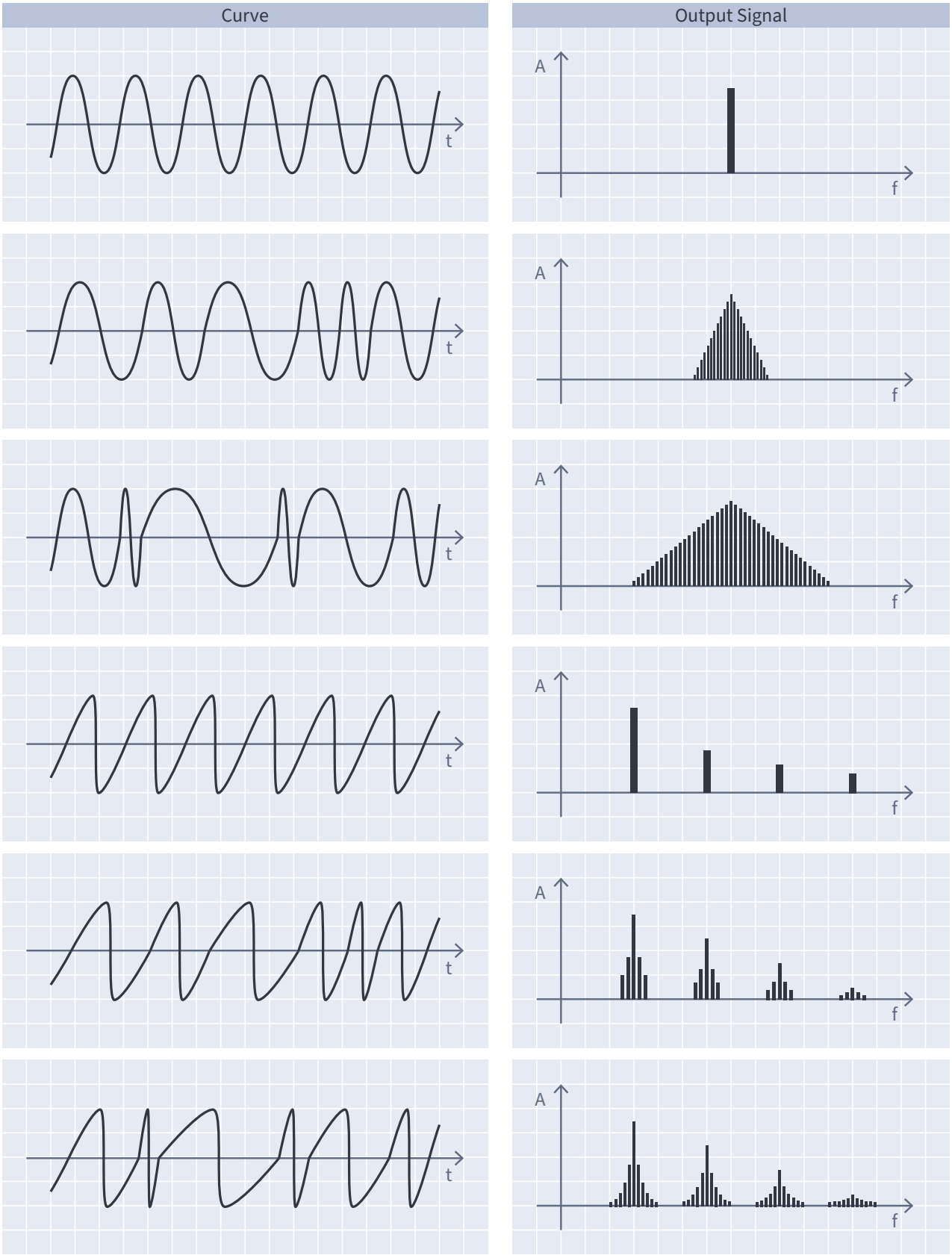
At settings below 80 st, a gain factor is applied to compensate for the amplitude loss caused by the low-pass filtering. The lower the cutoff, the more the chirp filter acts like an integrator. Lower frequencies are boosted, and higher frequencies are attenuated. Since phase is the integral of frequency, the results then increasingly resemble those of frequency modulation (FM).

Oscillator Fluctuation

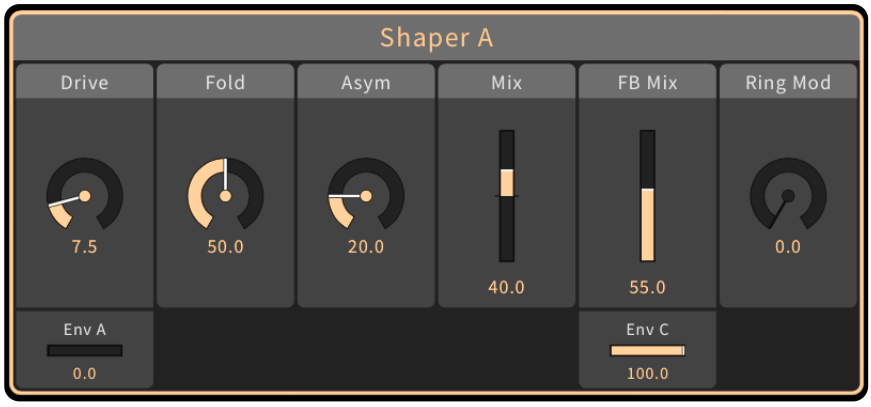
The Fluctuation parameter introduces a random frequency offset to each cycle, transforming a simple sine wave into band-limited noise. At high values, the oscillator can vary between 5% and 195% per cycle, resulting in irregular behavior and a broad spectrum. This parameter is also modulated by Envelope C.

Oscillator Fluctuation

Oscillator signal without self modulation and different amounts of fluctuation



5.4 Shapers

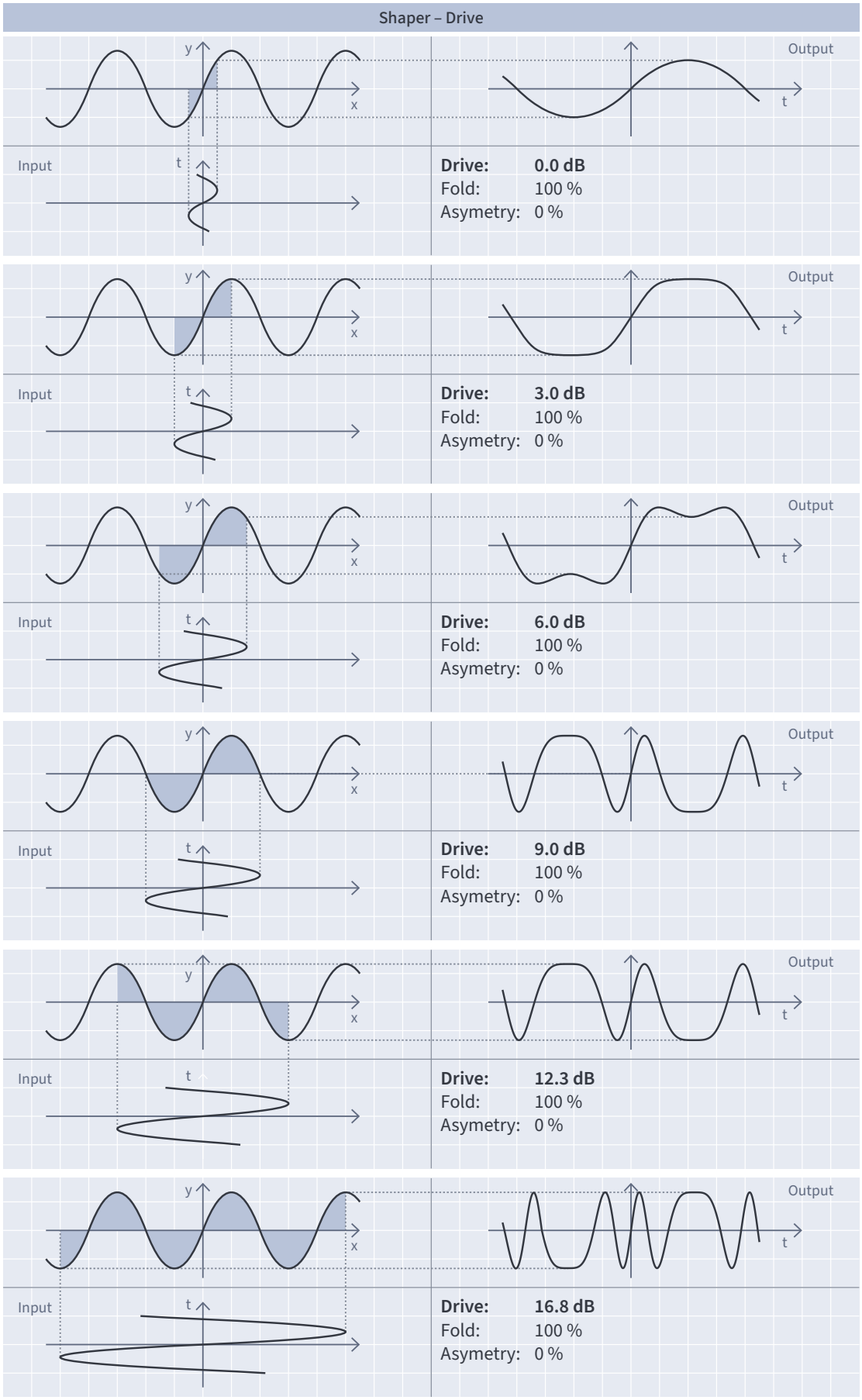


Each of the two branches is completed by a sine shaper unit, which can further manipulate the oscillator signal and enhance its spectrum. It also allows for the integration of the global feedback and a ring modulation signal.

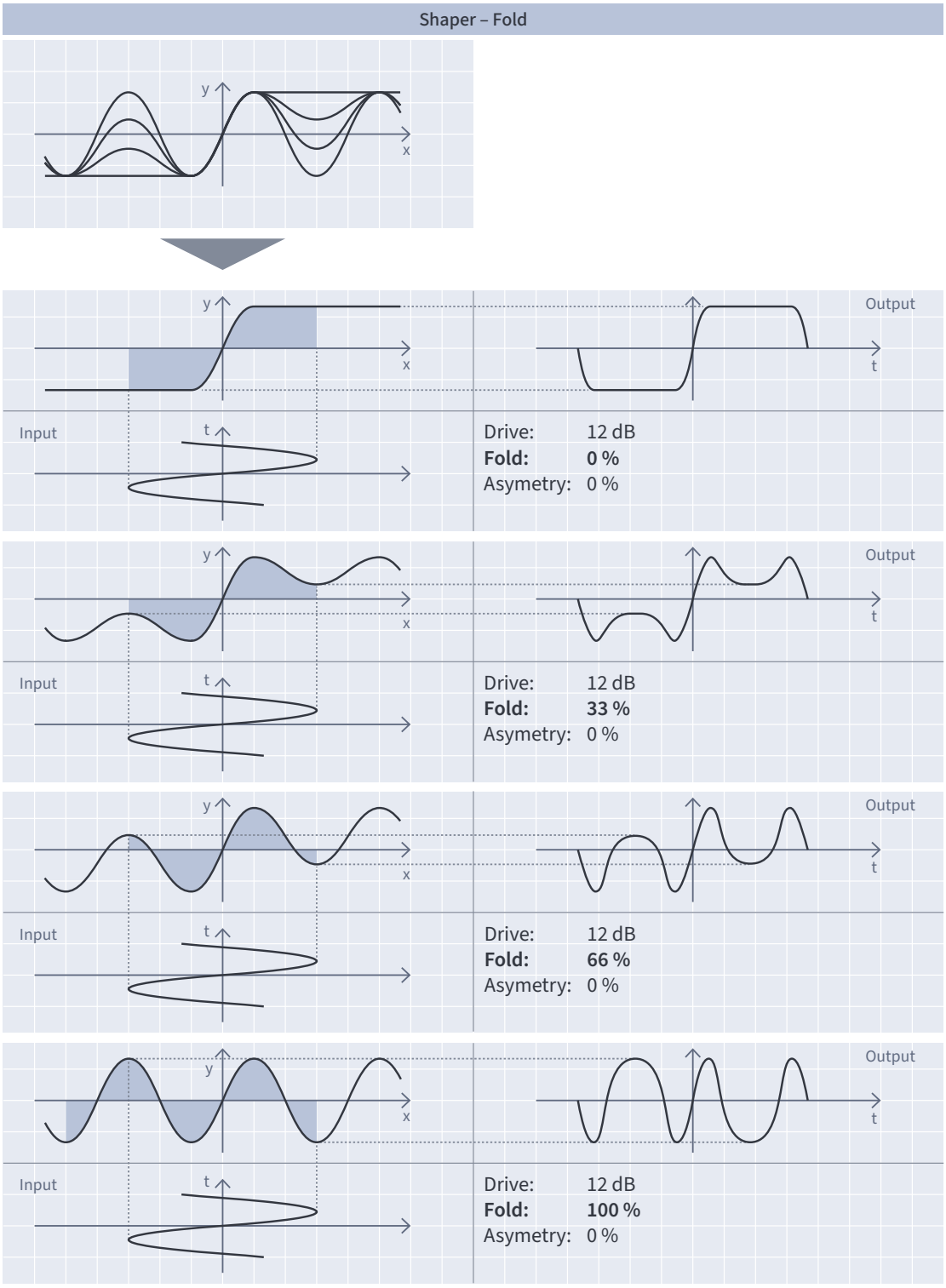
Within a sine shaper, the input signal is first amplified by a Drive parameter, which can be sensitive to the corresponding branch envelope. The folding characteristic can be blended from a soft clipping behavior by a Fold parameter. With no fold present, the shaper effect resembles more a distortion or saturation effect, producing more higher harmonics.

Furthermore, an Asymmetry parameter can add even numbered harmonics. At 100 % it will shift the fundamental frequency by one octave. The resulting shaped signal can be crossfaded with the input signal by a bipolar Mix amount (as previously mentioned, the bipolar nature of lots of signal components can raise the variability when using phase modulations or feedback).

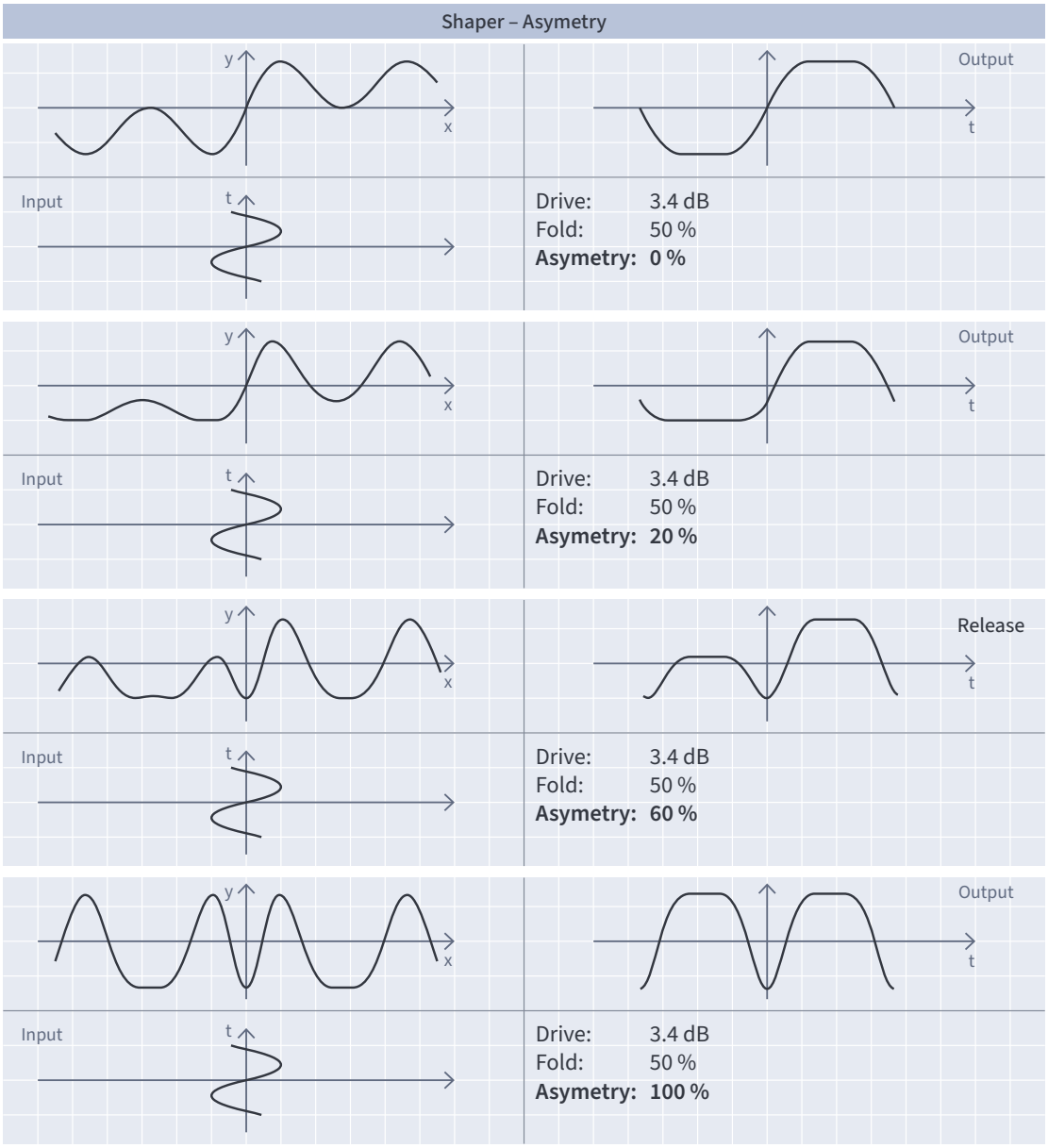
The first set of diagrams shows how the Drive parameter is influencing the audio signal:.



The second set of diagrams shows how the Fold parameter is influencing the audio signal:

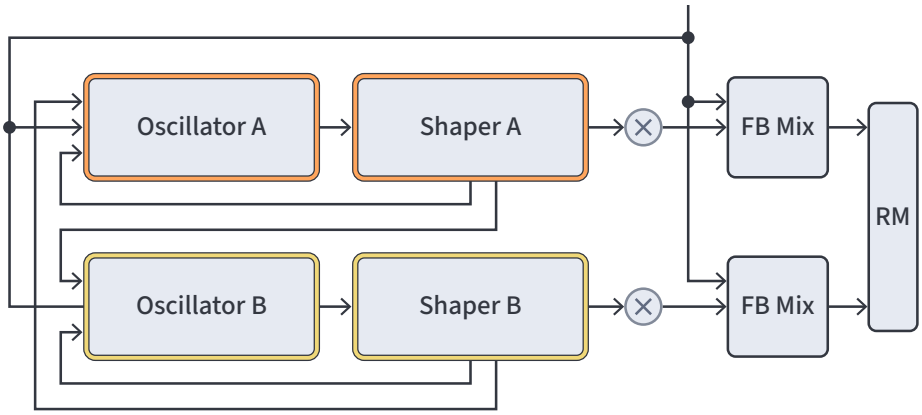


The third set of diagrams shows how the Asymmetry parameter is influencing the audio signal:



Two more signals can be blended into the mix:.

1. The feedback signal can be fed into a branch, the amount can be sensitive to Envelope C (blendable with the Gate signal). With the application of feedback, the global Feedback loop will be closed to some extent (depending on further settings).



2. Finally, the two branch signals are multiplied in a “Ring Modulator” and each branch can blend to the Ring Modulation signal by an adjustable amount. Ring modulation produces interesting patterns in the resulting spectrum, depending on the two incoming signals. Symmetrical frequency components emerge (one with the difference of the incoming frequencies, one with the sum of the incoming frequencies).

In conclusion, the Shaper is another versatile module providing different ways to manipulate an Oscillator signal. Distortion effects are as possible as sine shaping, and feedback and ring modulation can be applied. The shaper not only affects the signal of a branch, but can also be blended onto phase modulation sources for the oscillators.

5.5 Comb Filter

The branch signals (A, B) are provided as sources for two different filter units, the first of which is the „Comb Filter“. In a general sense, the Comb Filter can act as a tunable, delay based resonator that can strongly alter the spectrum of the incoming signal due to its integrated allpass filter.

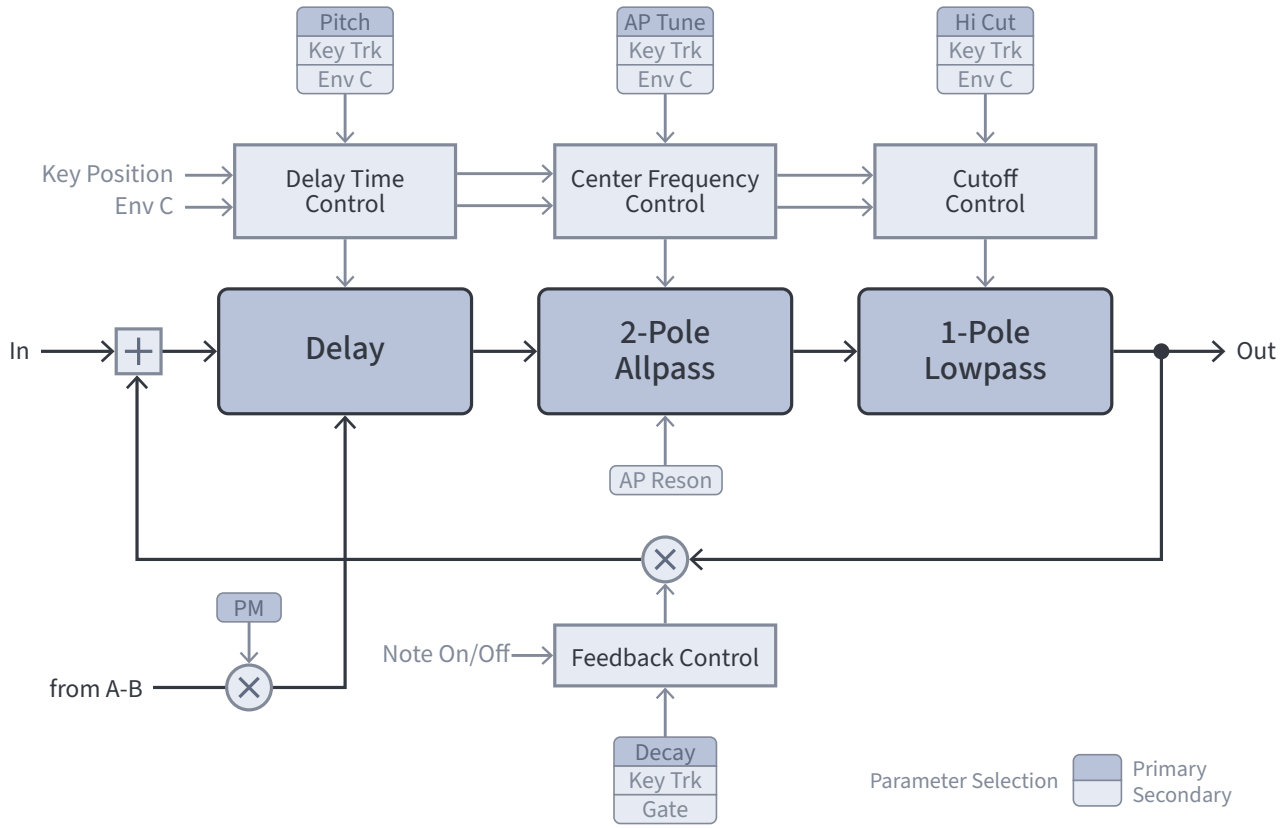
It combines the signals with a delayed version of itself, leading to phase interferences (which can be constructive or destructive, mainly depending on the delay time). Certain harmonics of the input signal can be amplified or canceled, so the spectrum is affected.

When the delay time is sufficiently small the signal repetitions influence the perceived tonal frequency (smaller times produce higher frequencies, as usual). In addition, the „Pitch“ parameter of the Comb Filter can be sensitive to Key Tracking and the influence of Envelope C.

The Comb Filter contains:

- a precisely tunable delay (Pitch)
- a control for the Decay time of the impulse response
- a second-order Allpass (AP) filter
- a lowpass (Hi Cut) in the feedback loop
- a delay modulation by the Oscillator signals, similar to phase modulation (PM)

Block diagram of the Comb Filter:



The local feedback branch includes two filter components. At first, a two pole allpass filter is applied (where its tunable frequency can be sensitive to Key Tracking and the influence of Envelope C and a resonance). Allpass filters do not affect the amplitudes of certain frequency components (as high or lowpass filters do), instead they will affect the phases of these components individually: At the Center Frequency the phase shift is 180 degrees. Below this point the phase shift is minimal (zero) and above it rises up to 360 degrees.The Resonance parameter defines the slope of that shift. This mechanism has a profound effect on the signal spectrum, as it can both create and destroy harmonic signal components.

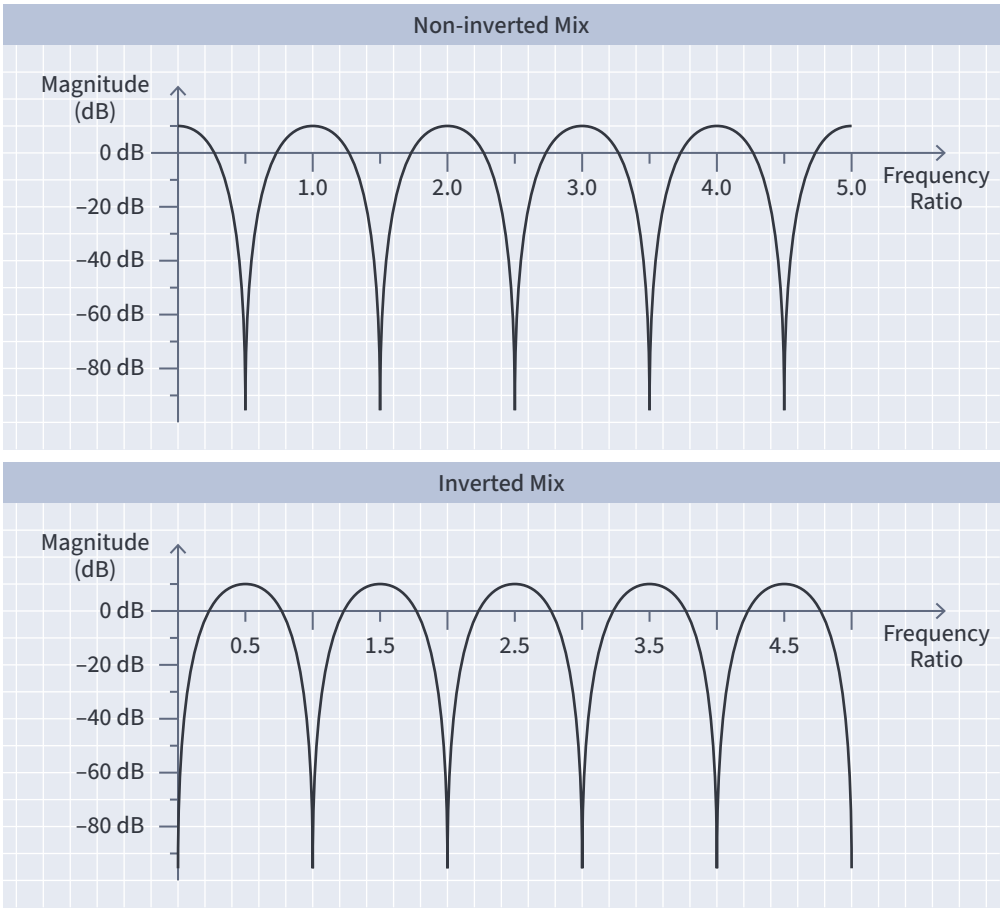
The allpass filter is followed by a lowpass filter, damping higher frequency components according to a tunable pitch parameter, which can be sensitive to Key Tracking and the influence of Envelope C. The damping effect is closely related to acoustic processes(as substances like air have this property) and also affects the persistence of the local feedback.

The amount of feedback determines how long it takes for the feedback to disappear after the input signal has faded out. This exponential process is referred to as the „Decay Time“, which can be also sensitive to Key Tracking (modeling a tendency some musical instruments possess, like strings tend to dampen faster with higher notes).

The Decay parameter is bipolar, as negative feedback amounts can cancel every second repetition, effectively tuning the signal down by one octave. The signal of the Gate envelope can also be applied to the local feedback loop, reducing the amount to a certain degree when a key is released (so the Comb Filter feedback only remains for sustained notes).

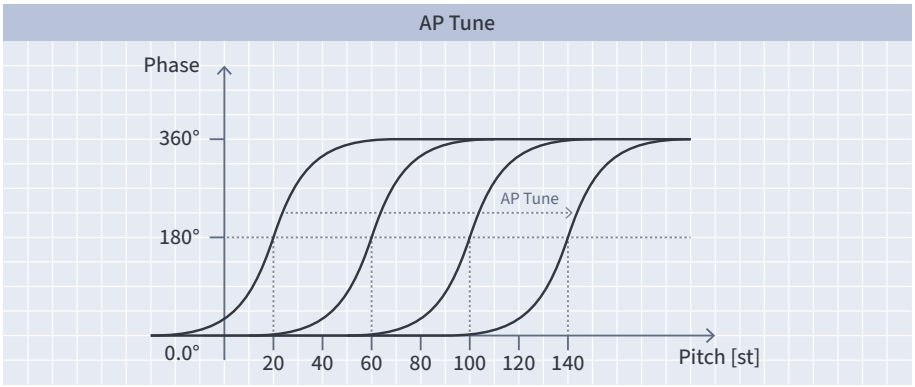
The delay time can additionally be modulated by a crossfade mix of both branches, determined by a „Phase Modulation“ (PM) parameter (as mentioned, in certain scenarios, delay times and phases can closely relate).

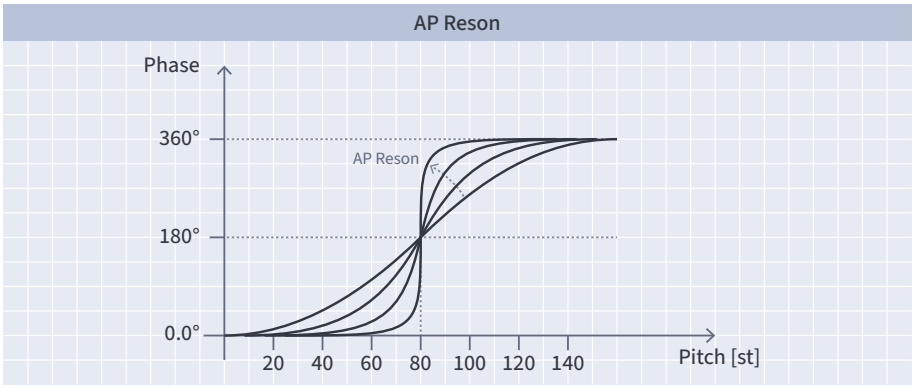
Both graphs below show the typical, generalized frequency response of a comb effect, as shown by the periodical peaks. The width of the peaks depends on the Comb Filter's pitch parameter (equivalent to a delay time), meaning that certain signal frequency components will be attenuated and other components will be amplified, depending on the delay time.

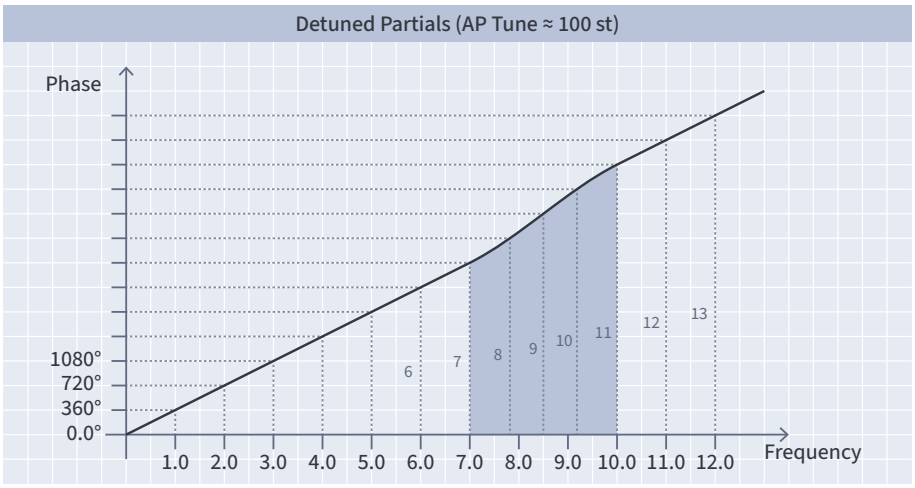


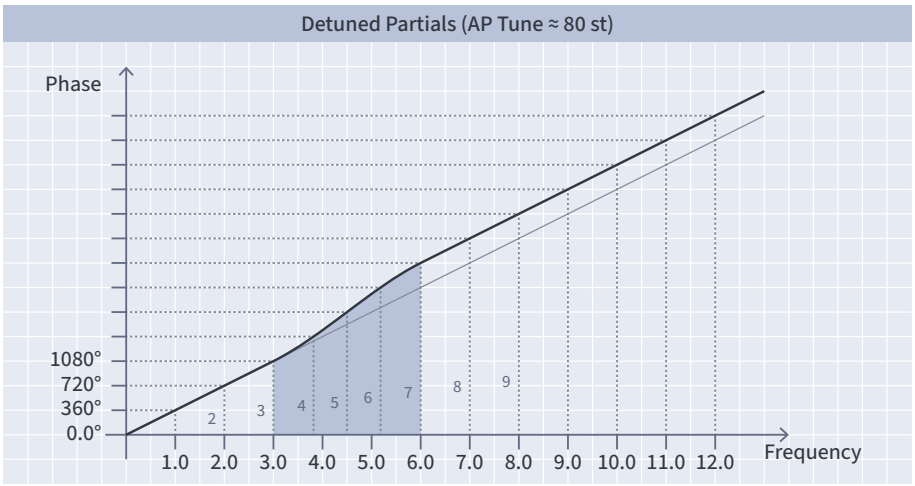
In addition, when subtracting the Comb Filter signal from the incoming signal, the peaks are shifted, and the emerging comb tone will be lowered by one octave.

Effect of the Allpass in the Comb Filter:

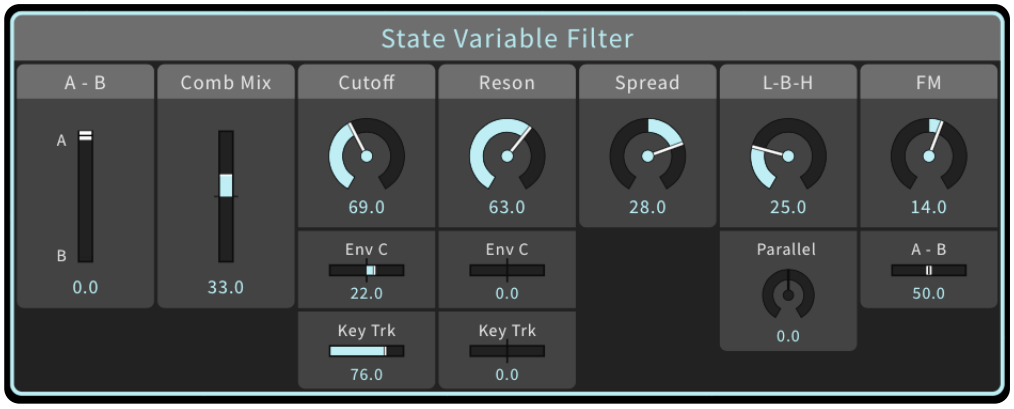








5.6 State Variable Filter

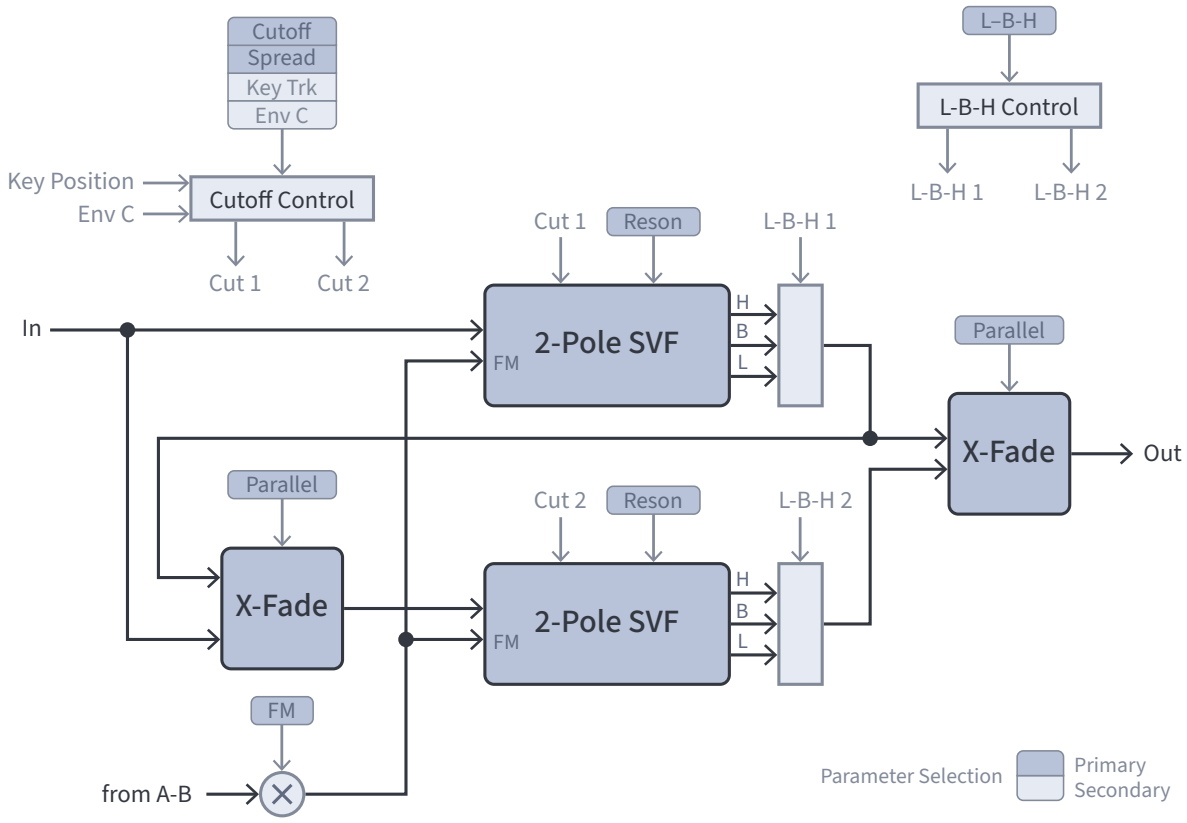


The second appliable filter to the branches is called the „State Variable Filter“, a filter that can simultaneously produce multiple filter responses and is fed by an adjustable crossfade mix of both branch signals. The Comb Filter can be faded into the input mix as well.

The State Variable Filter has a variable 4-pole structure with:

- two internal 2-pole filters with splittable cutoff frequencies (Spread)
- crossfade between serial and parallel modes (Parallel)
- crossfade between lowpass, bandpass, and highpass mode (L-B-H)
- cutoff frequency modulation (FM) by the Oscillator signals

Below the block diagram of the State Variable Filter:



In serial mode, the damping slope can be raised from 12 to 24 dB per octave (becoming a four-pole filter effectively). In parallel applications, the filters can also be used to create two formants (useful for vowel-like sounds).

The filter frequencies are determined by a tunable center frequency which can be sensitive to Key Tracking and the influence of Envelope C. A Spread parameter determines how much the individual filter frequencies are shifted apart from the center frequency. With no spreading, one peak emerges at the center frequency. The strength of the peak depends on the filter resonance, which also can be sensitive to Key Tracking and the influence of Envelope C. When spreading is applied, the peak splits into two peaks, weakening strong resonances and creating formants.

The filter type can be continuously blended between an overall lowpass, bandpass and highpass behavior. In serial mode with a negative spreading, a band-rejecting (notch) behavior can be achieved as well.

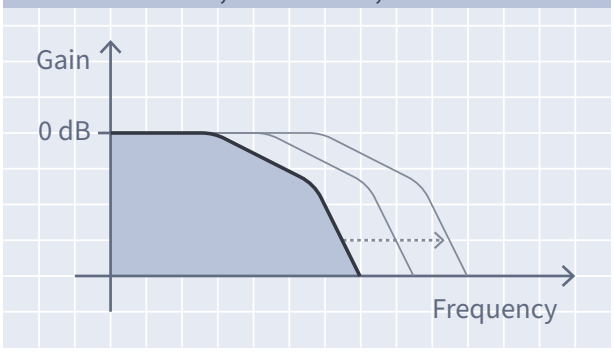
A crossfade mix of both branches can also be applied for frequency modulation (FM). Parallel behavior can be produced in two ways, by either adding or subtracting the second filter to/from the first. Subtraction will lead to phase cancellations.

In conclusion, the State Variable Filter is a versatile subtractive filter capable of creating formants and different characteristics.

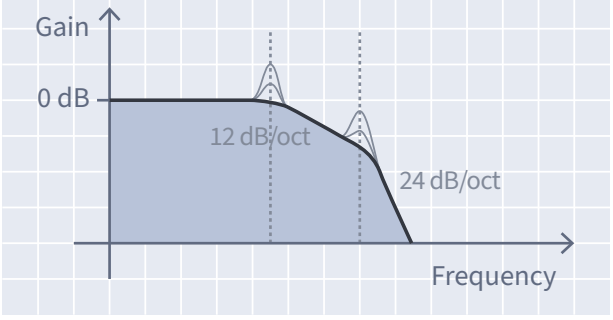
Frequency responses of the State Variable Filter with Parallel set to 0 %:

Parallel = 0 %, Spread > 0 st

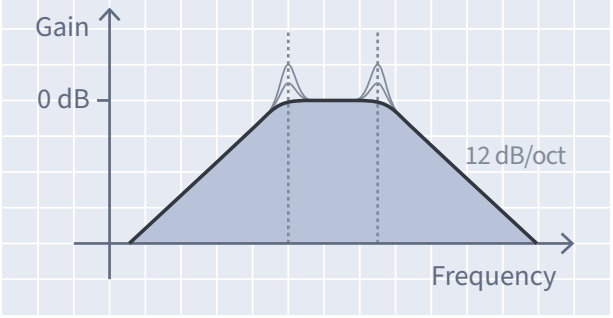
L-B-H = 0 %, Reson = 0 %, Cutoff = var.



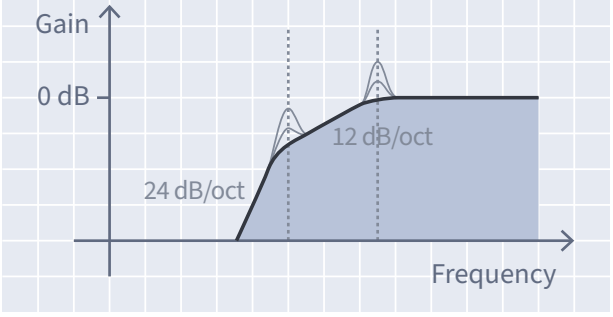
L-B-H = 0 %, Reson = 0…100 %



L-B-H = 50 %, Reson = 0…100 %

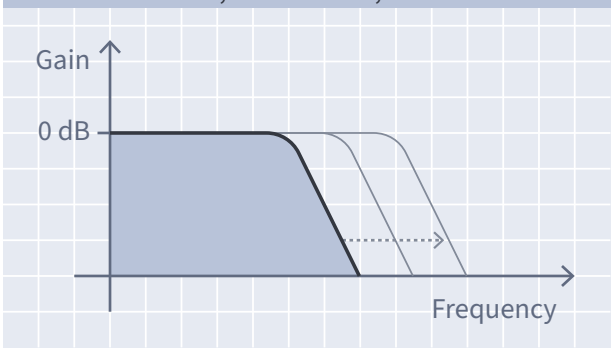


L-B-H = 100 %, Reson = 0…100 %

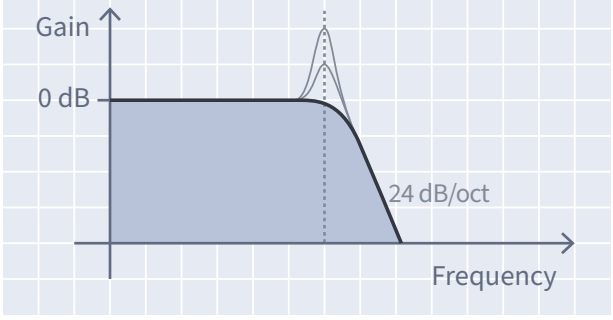


Parallel = 0 %, Spread = 0 st

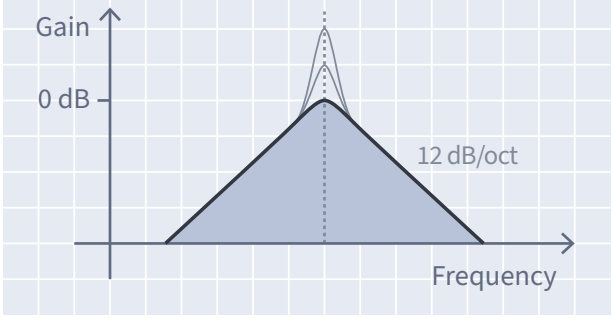
L-B-H = 0 %, Reson = 0 %, Cutoff = var.



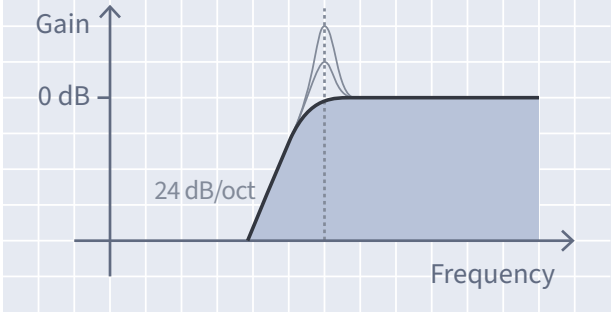
L-B-H = 0 %, Reson = 0…100 %



L-B-H = 50 %, Reson = 0…100 %



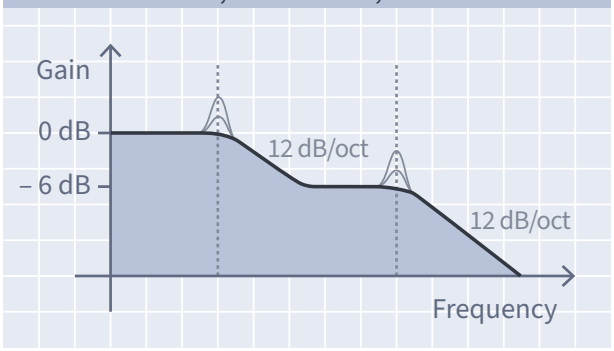
L-B-H = 100 %, Reson = 0…100 %



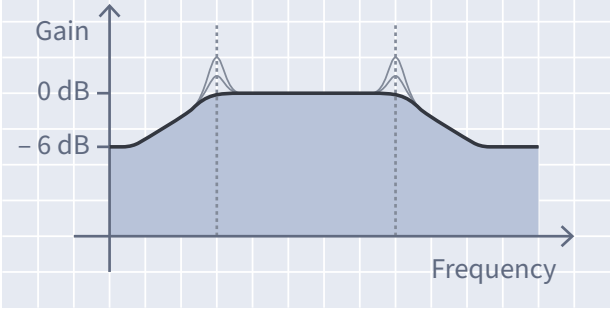
Frequency responses of the State Variable Filter with Parallel set to 100 %:

Parallel = 100 %, Spread > 0 st

L-B-H = 0 %, Reson = 0 %, Cutoff = var.

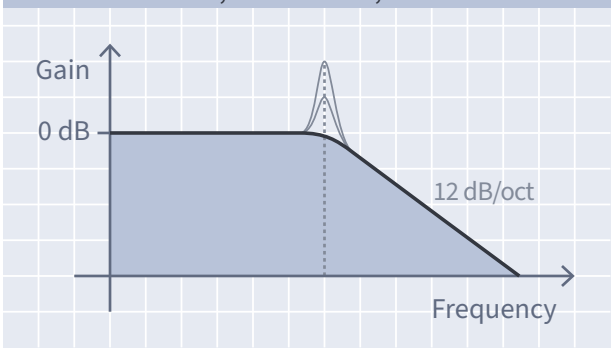


L-B-H = 50 %, Reson = var.

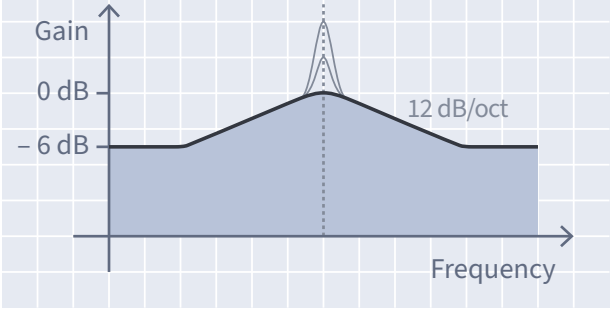


Parallel =100 %, Spread = 0 st

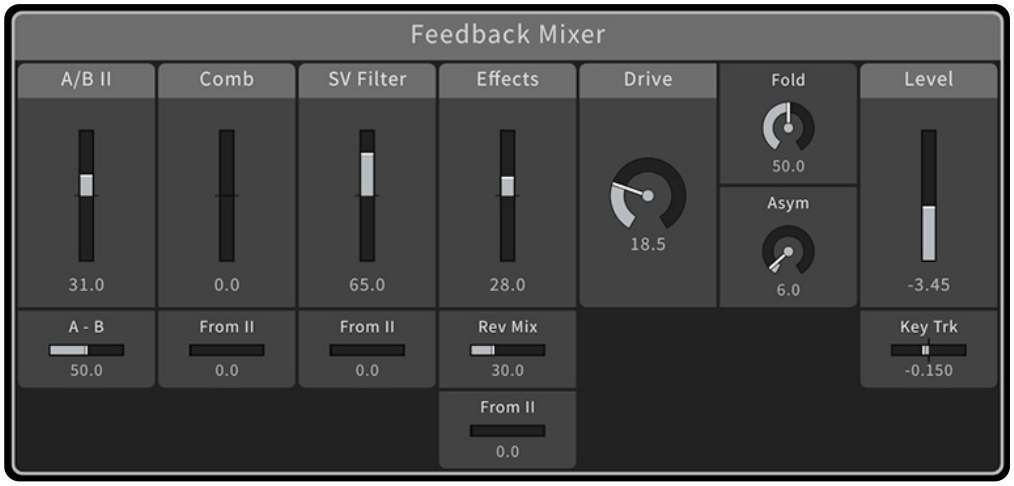
L-B-H = 0 %, Reson = 0 %, Cutoff = var.



L-B-H = 50 %, Reson = var.



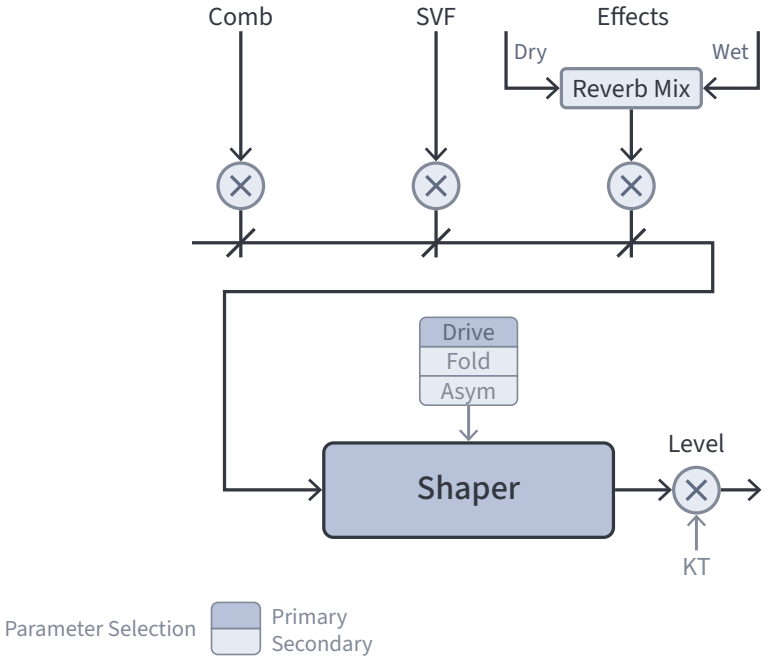
5.7 Feedback Mixer



This mixer combines the following signals for the feedback bus: the outputs of the Comb Filter, the State Variable Filter and the output of the Effects chain, with a separately adjustable amount of Reverb.
Each signal is weighted by a bipolar Amount parameter, as the polarity can have a noticeable influence on the feedback behavior.

A sine shaper (providing Drive, Fold and Asymmetry, as described for the branch Shapers) can manipulate the sum signal and create additional harmonics. The sum also can be amplified or damped by a Level parameter that can be sensitive to Key Tracking.

The feedback signal will be a mixture of polyphonic signals (provided by the filters) and monophonic signals (provided by the effects, having no more voice association and being a downmix of the original stereo signal).



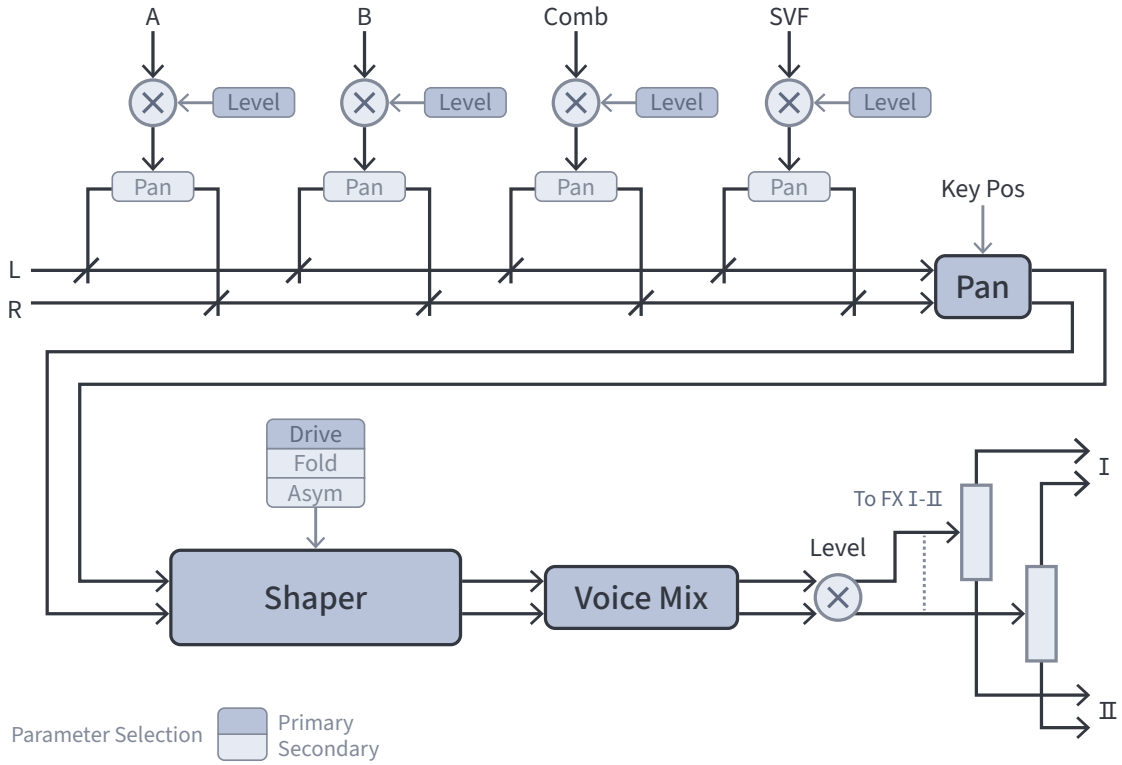
5.8 Output Mixer

The Output Mixer creates a stereo sum of the signals from Oscillator/Shaper A and B, the Comb Filter and the State Variable Filter.

Each signal can be weighted by a bipolar amount and positioned in the stereo field by a panning parameter.

A sine shaper (providing Drive, Fold and Asymmetry, as described for the branch shapers) can manipulate the sum signal and create additional harmonics. The sum also can be amplified or damped by a Level parameter. The key position of a note can also be applied for the tone's position in the stereo field by a bipolar "Key Pan" parameter.

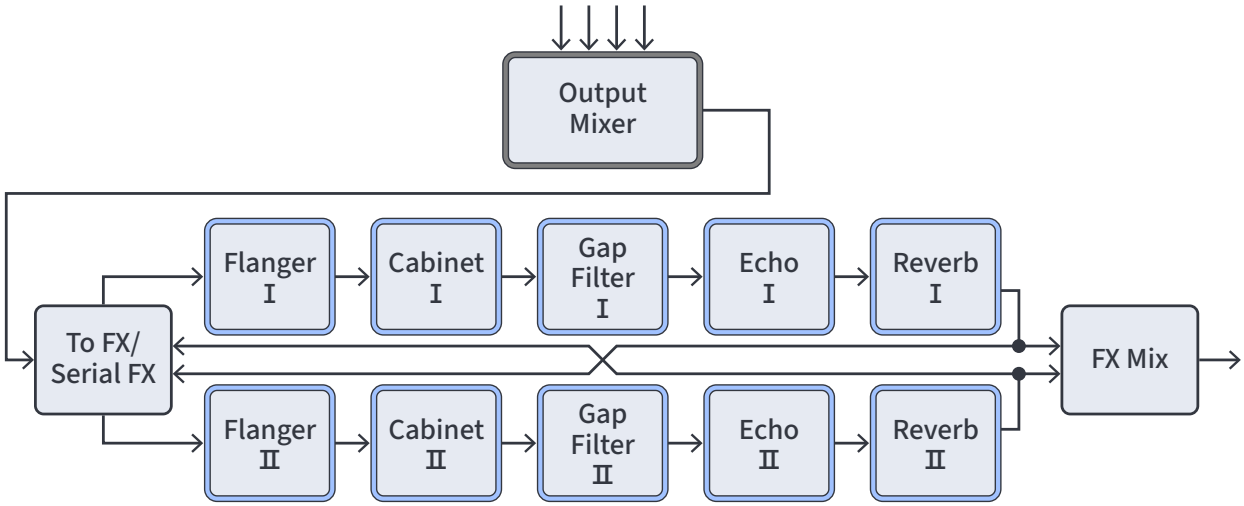
After the output mixer, the signal will be monophonic (the sum of all voices) and at the same time dual channel (with stereo spreading).



5.9 Effects

The effect section consists of two effect groups that can run not only in parallel but also in serial mode. Each group is a chain of five stereo effects with each effect having its own dry/wet Mix control.

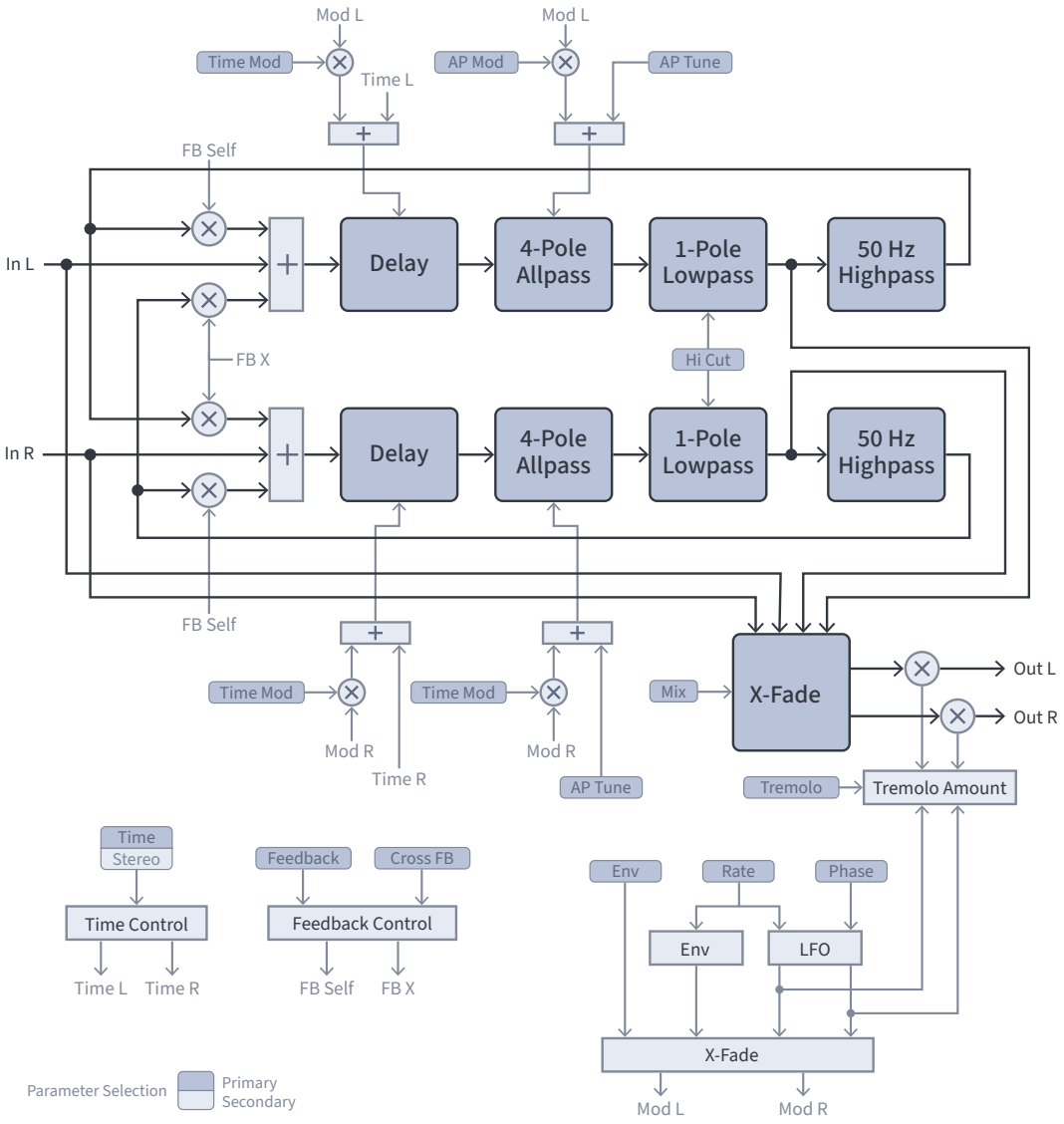
The routing from the Output Mixer to the FX groups is controlled by “To FX I-II” and the serial routing by “Serial FX”. The output signals of the groups are mixed by “FX Mix”, or in dual Sounds via the two “Part Volume” parameters.



Serial chaining of the two FX groups allow for new routings of the FX. For example, by using serial mode a long tailed reverb fed into a strong flanger effect can be used to create ambient sounds.

5.9.1 Flanger

The first effect is a dynamic stereo delay capable of producing chorus-, phaser- or flanger-like sounds. Its basic mechanism can be compared to the Comb Filter, although the Flanger is not sensitive to Key Tracking. The usual sweeping effect arises when the delay time is changing (due to modulations), as the delayed signal is combined with the input signal and changing harmonics are created. As the delay times are relatively short, this effect is not able to create wide spatial effects, but a certain perception of depth will emerge nevertheless.



The delay time can be spread for both channels with a „Stereo“ parameter.

The local delay feedback bus consists of two filters, the first of which is an allpass filter with a tunable frequency, affecting the phases of the signal’s frequency components. The second filter is a one-pole lowpass filter with tunable frequency, damping the feedback signal. The feedback level can be determined by an amount parameter and as this is a stereo effect, cross feedback (FB X) can be applied as well, feeding some amount of a signal from one channel to the other (and vice versa).

Modulation sources for the Flanger are provided by a stereo LFO (with adjustable Rate and stereo Phase offset) and a simple (monophonic) envelope signal (immediately jumping to the velocity when a key is pressed and then exponentially approaching zero within a time corresponding to the Rate parameter). A crossfade of the two sources can be applied as modulation for the delay time and for the allpass filter frequency independently.

Finally, the Flanger signal can be blended into the mix by a bipolar Mix parameter, as the signal polarity can have a strong effect when using the global feedback signal.

5.9.2 Cabinet

The second effect is called „Cabinet“, providing the possibility to further shape the signal in terms of saturation, overdrive and distortion. It can sound similar to a guitar amp driving a speaker.

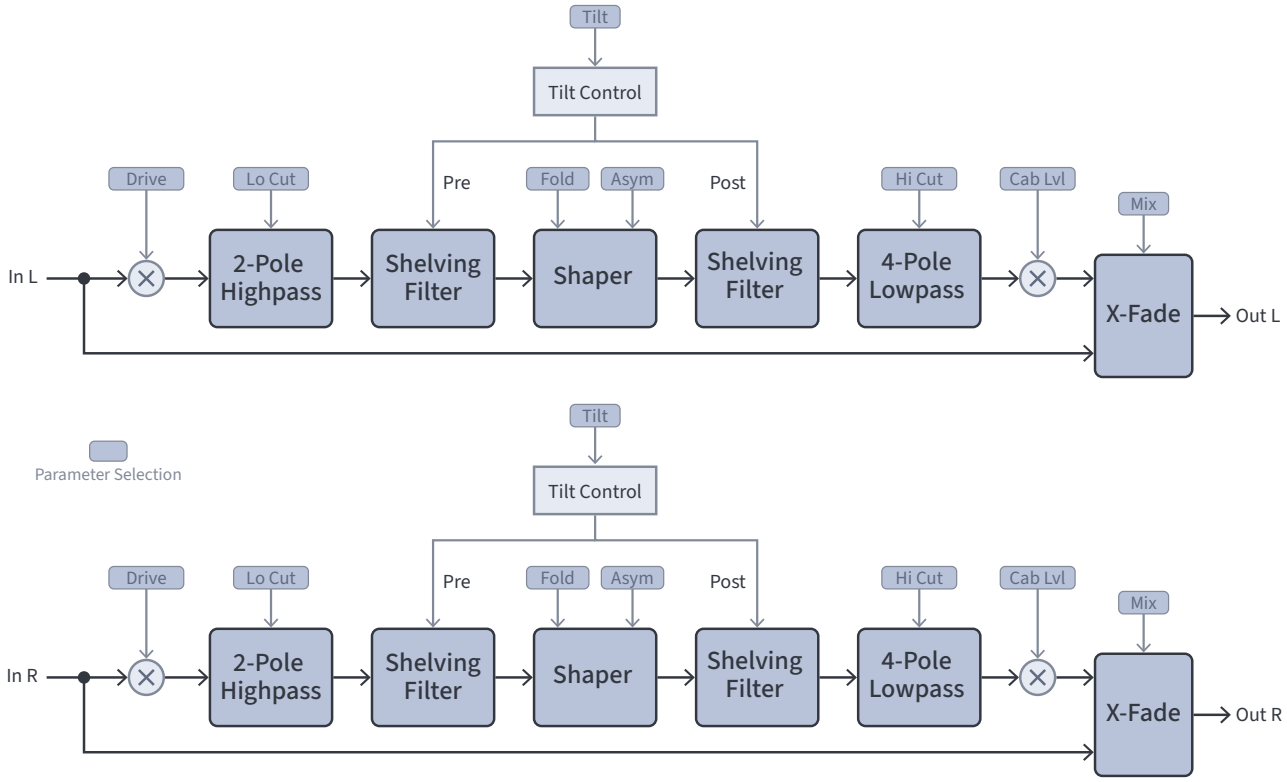
A sine shaper (providing Drive, Fold and Asymmetry, as described for the branch Shapers) is the central element of this effect, allowing for the creation of new harmonics to the signal.

Before and after the actual shaping, filtering is applied in order to further manipulate the distortion effect. The signal passes through a highpass filter with adjustable frequency (cutting low signal components) before being fed into the shaper. After the shaping, a lowpass filter with adjustable frequency determines the amount of high signal components (boosted by the distortion).

A Tilt parameter has a further influence on the signal spectrum before and after the shaping, as it can emphasize either low or high signal components that will be affected by the shaper.

The shaped signal can be amplified by a separate „Cab Level“ parameter, before being crossfaded with the input signal by the Mix parameter.

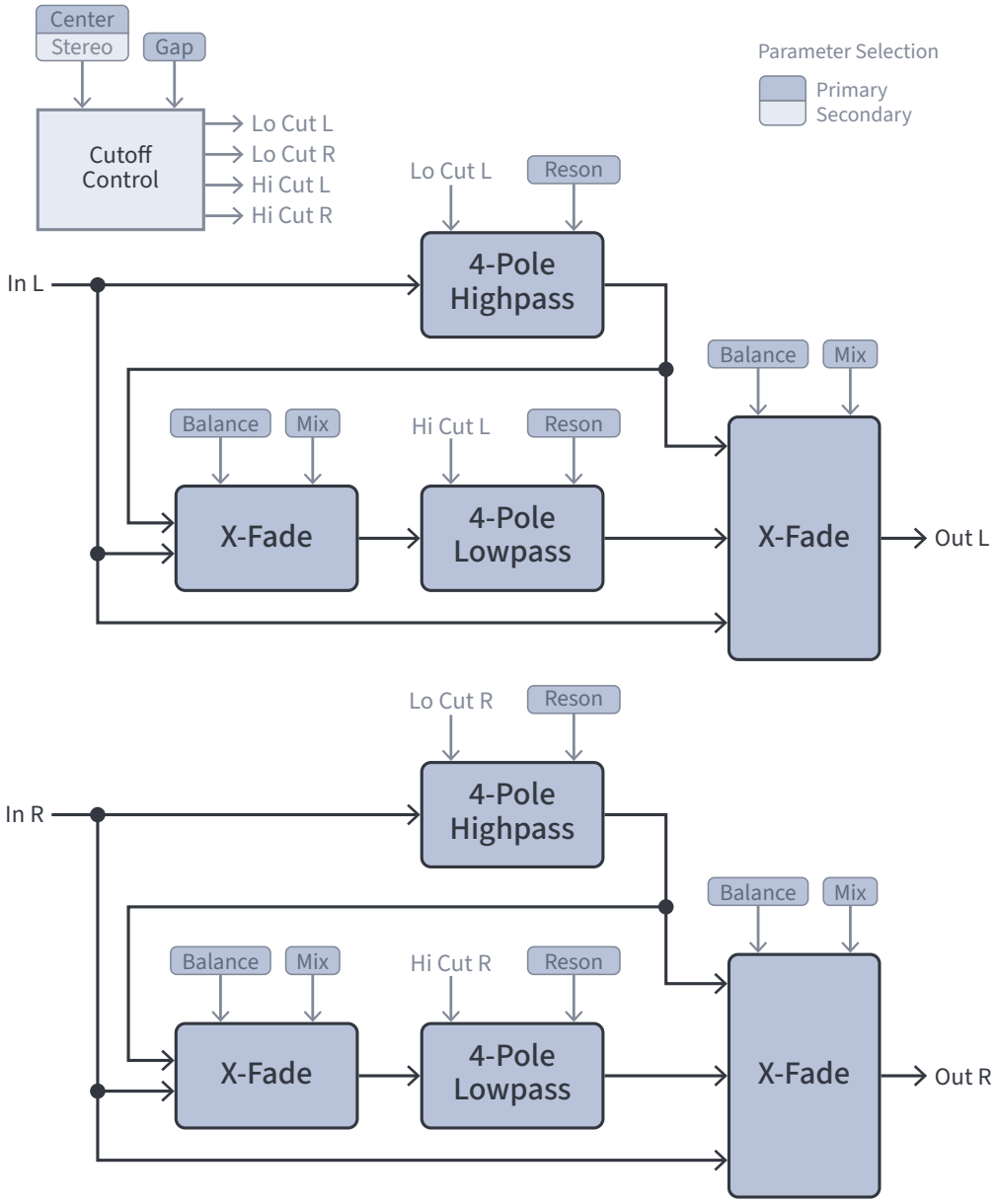
Signal flow of the Cabinet:



5.9.3 Gap Filter

The Gap Filter marks the third effect and provides further filtering of the signal. It consists of two four-pole filters (with a damping slope of 24 dB per octave) which can run in parallel or in series. The filter types are static, as the first filter is a highpass, followed by the second (lowpass) filter.

Signal flow of the Gap Filter

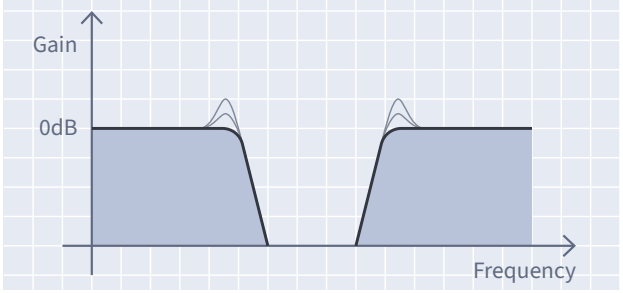
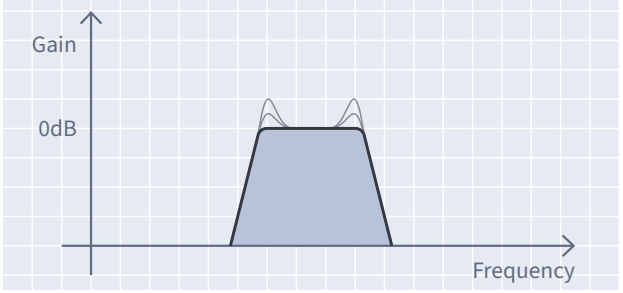
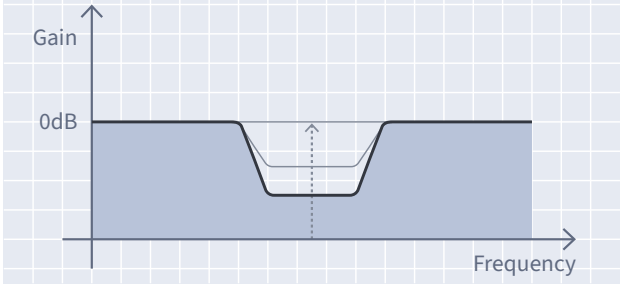
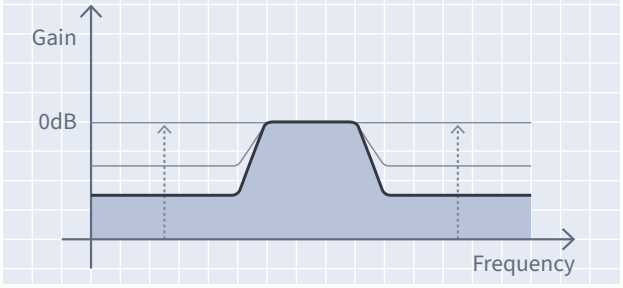
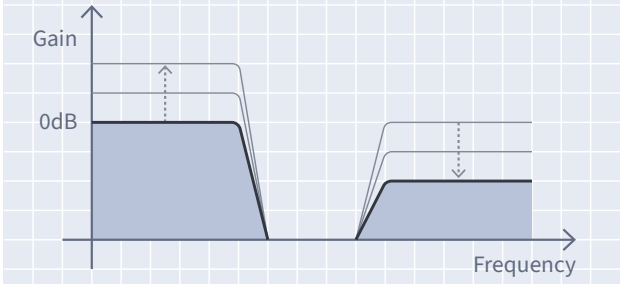
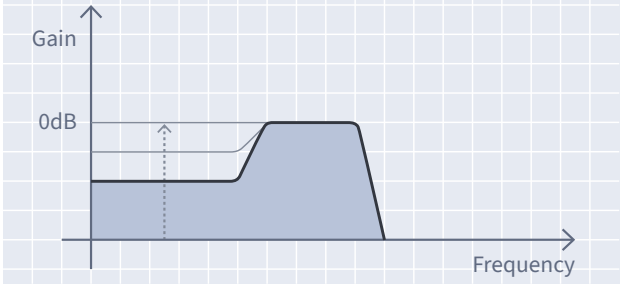
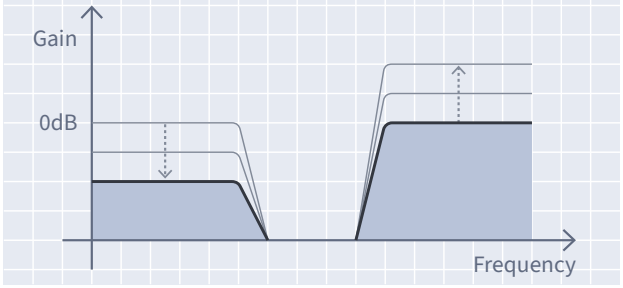
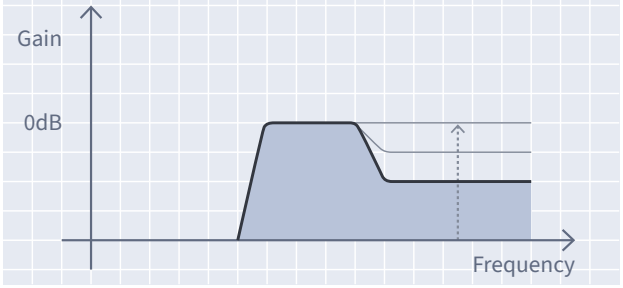
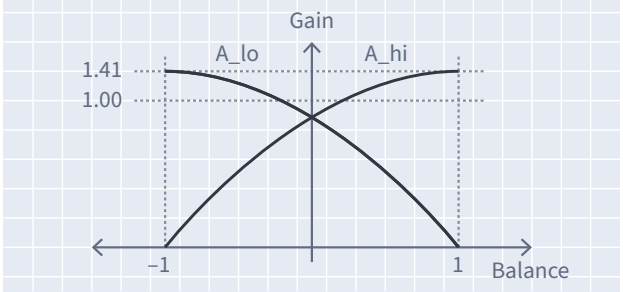
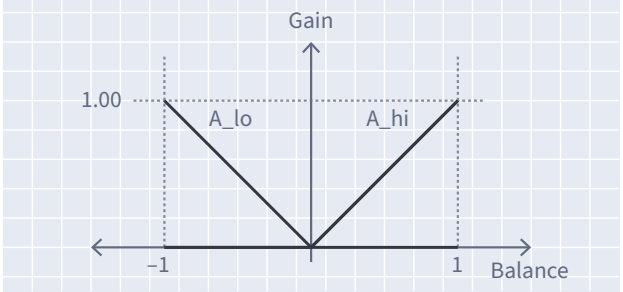


The filter frequencies can be determined by a „Center“ frequency, which can be spread by the „Gap“ parameter, creating a flexible band-rejection or band-pass filter. The filter resonance can be adjusted as well, creating two resonance peaks in the signal spectrum.

Both filter outputs can be blended by a Balance parameter, defining a crossfade mix of the two components.

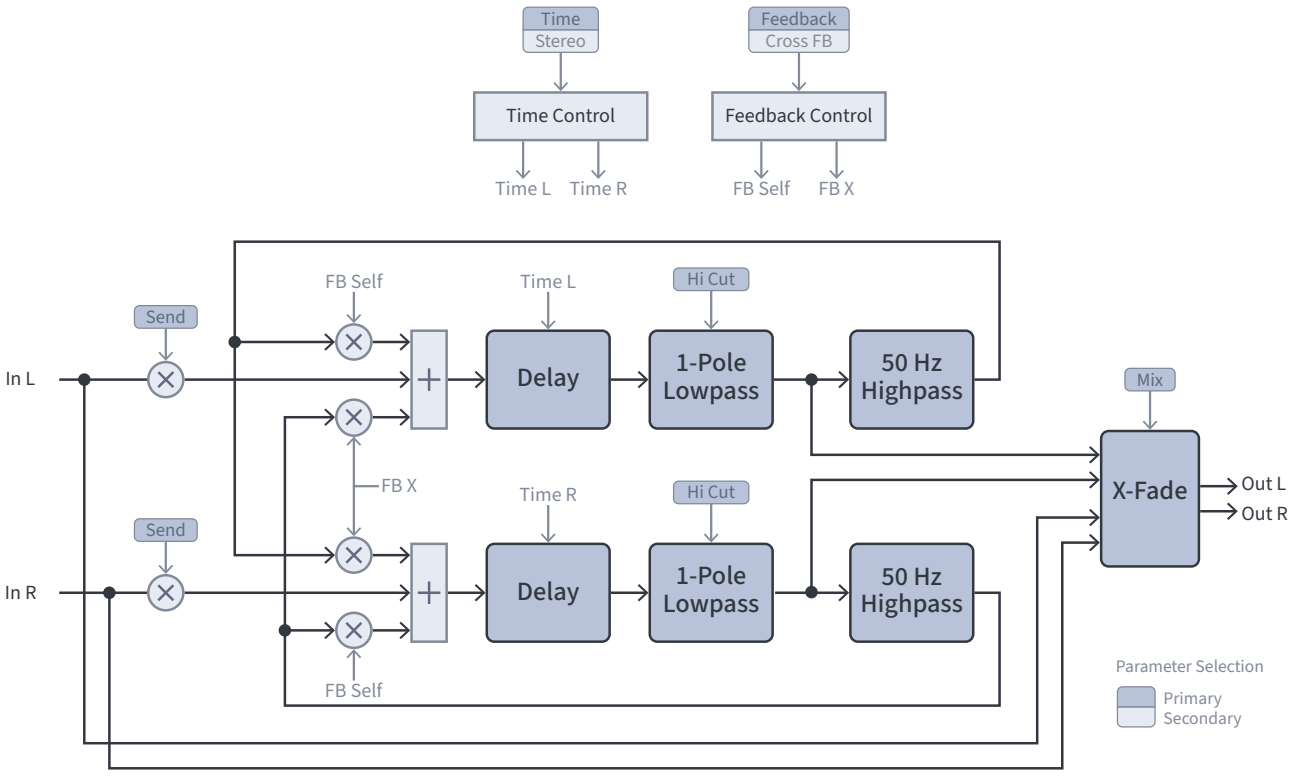
The bipolar Mix parameter determines the amount of filtering in the resulting signal, crossfading the input signal with the filtered signal. Positive mix values mean that the filter components run in parallel, resulting in a band-reject behavior. Negative values produce a bandpass effect, as the filter components are running in series.

Some typical frequency responses:

Parallel/Band Reject (Mix > 0)	Serial/Band Pass (Mix < 0)
Balance = 0, Mix = 1, Reson = var.	Balance = 0, Mix = –1, Reson = var.
	
Balance = 0, Reson = 0.5, Mix = 1 ... 0	Balance = 0, Reson = 0.5, Mix = –1 ... 0
	
Mix = 1, Balance = 0 ... –1	Mix = –1, Balance = 0 ... –1
	
Mix = 1, Balance = 0 ... 1	Mix = –1, Balance = 0 ... 1
	
	

5.9.4 Echo

The fourth effect is a stereo delay, providing a spatial effect of repeating echoes. The delay time can be adjusted and spread between the left and right channel. Within the local feedback, a tunable lowpass filter allows for damping, and the feedback level can be defined by an amount and a cross-feedback (feeding one channel back to the other and vice versa). The echo can be blended into the mix by an adjustable amount parameter.



5.9.5 Reverb

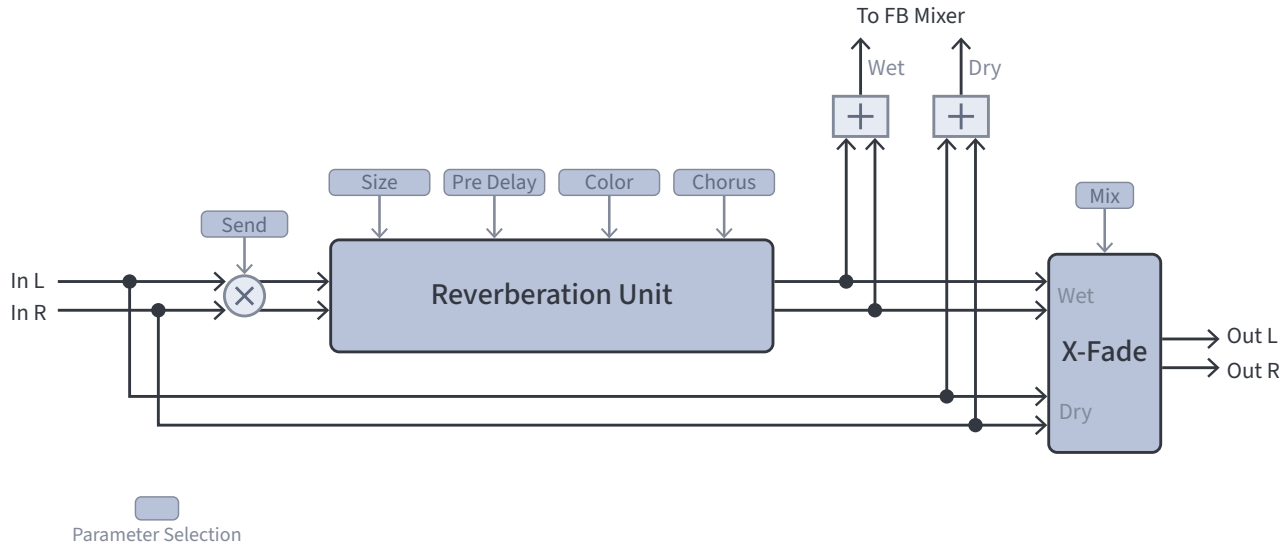
Finally, the signal is passed to the Reverb unit, providing another spatial effect in terms of hall, room or reverberation.

The Size parameter determines how long it takes for a signal to fade out, which has a profound impact on the perceived room size. A Pre Delay parameter can also have a strong influence in the size perception.

The local feedback behavior is determined by a Color parameter, affecting its brightness and a Chorus parameter which can lead to a less static feedback behavior.

The Reverb signal can be blended into the mix by a separate amount parameter.

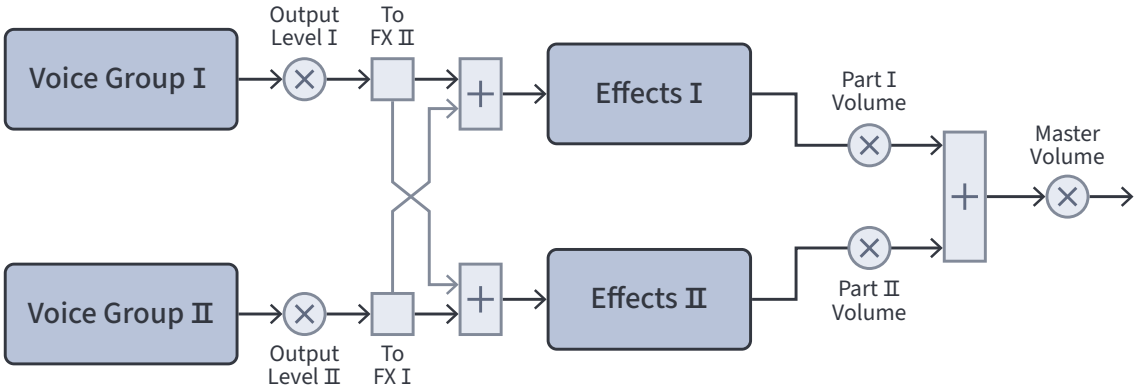
Signal flow of the Reverb:



5.10 Dual Mode Signal Flow

In Split sounds, parameters bound to polyphonic components (Envelopes A/B/C, Oscillators A/B, Shapers A/B, Comb and State Variable Filters, Feedback and Output Mixers) are present twice and form two (dual) Voicegroups.

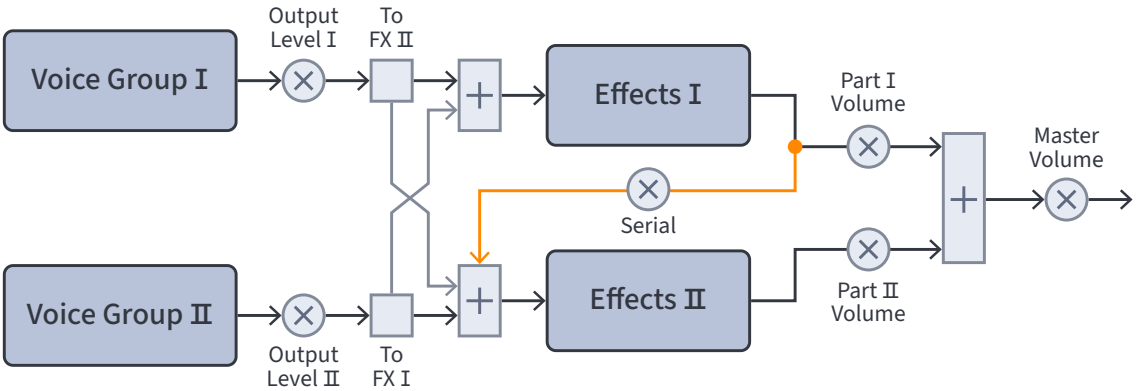
Effects (Flanger, Cabinet, Gap Filter, Echo, Reverb) also are present twice for Split or Layer Sounds and form one two (dual) effect chains.



The illustration can be described as follows:

1. Each Voicegroup has its own stereo output signal coming out of their respective output mixers. These signals are routed to the FX Distributor (To FX I/II), which can distribute the signals to both effect chains.
2. The stereo output of the Effect of a given effect chain is then routed to the corresponding Part component, where the part volume is applied.
3. Both parts are then added together and sent to the global Master Volume for final gain control.

Each Voice group and corresponding effect chain is bound to a Part component with additional Volume and Tune parameters. Also in Dual mode, the two effects groups can run not only in parallel but also in serial mode.

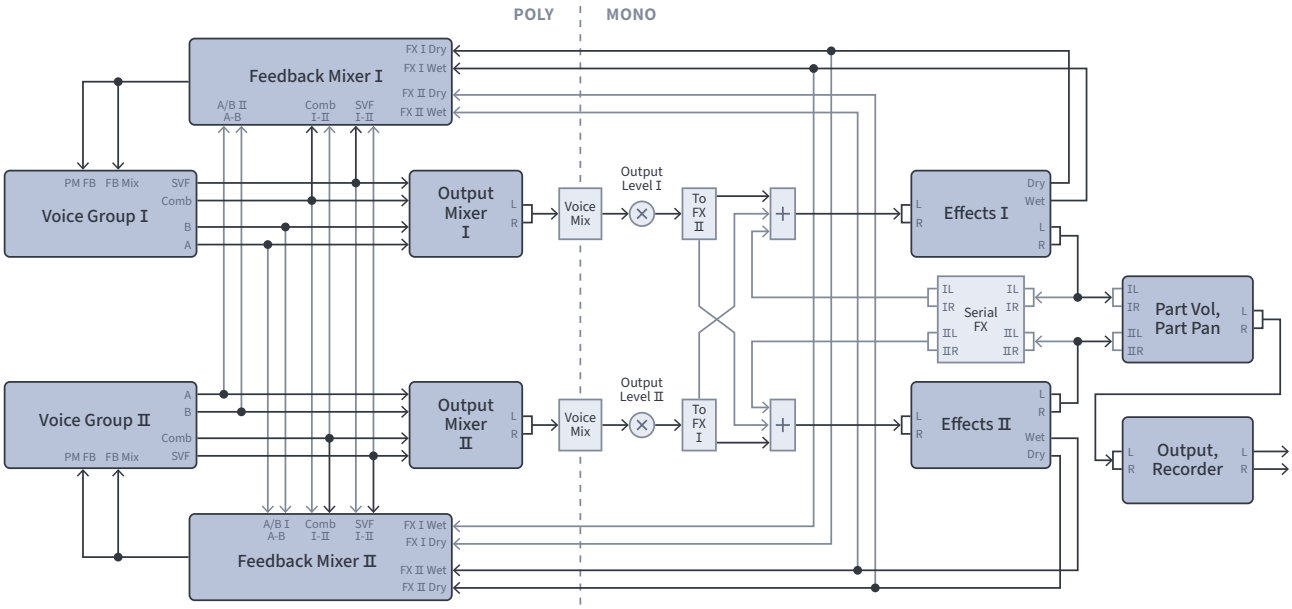


5.4.1 Additional Signal Paths in Dual Mode Sounds

In the case of a Layer Sound, the Feedback Mixer has special parameters facilitating polyphonic cross feedback between both Parts (A-B, A-B From I/II, Comb From I/II, SVF From I/II). The Feedback Mixer of a particular Part can apply polyphonic cross feedback from the other Part, allowing signals from Oscillators A/B and the Comb and State Variable Filters to be sent in between.

In Layer and Split Sounds, the output of a particular effect chain provides an additional dry and wet signal (which are mono downmixes of the stereo reverb input and output signals). These signals are then sent back to the Feedback Mixer of each Voice Part for the application of monophonic self/cross feedback

Complete signal flow diagram of a Layer Sound:



5.11 Main Parameter Groups and Post Processing

Master Group

Volume and Tune
Besides the Master Level, the Master group also contains a Master Tune parameter which can shift the whole tuning of the instrument by up to 48 semitones in both directions.

Serial FX, FX/Part Pan and FX Mix
Usually both Effect chains run in parallel. With the Serial FX parameter, the output of one chain can be fed into the input of the other chain, allowing for flexibility in the order of effects and their complexity.

FX/Part Pan allows the two effect chains to be panned against each other, allowing more flexible distribution of their outputs in the resulting stereo mix. For single sounds this parameter is called FX Mix, for layer and split sounds it is called Part Pan.

FX Mix controls how much of each effect chain is sent to the C15's output. It works similarly to the Part Volumes in Split/Layer sounds, except it is just one parameter that crossfades between FX I and II.

Scale
The Scale group allows for redefining the scale of the instrument, which is the equal temperament by default. The Base Key of a scale can be defined and all 12 keys of the corresponding octave can have an individual offset (up to 1200.0 cents - 12 semitones - in both directions) to the equal temperament. The scaling of the offset has a fine resolution between 0 and 100 cts and a coarse resolution above 100 cts. This allows for a variety of scales, from historical and traditional to exotic and experimental.

Voices Group

The voicing behavior of a preset is defined by the Mono and Unison parameter groups. In Single Sounds, these groups are present once and apply for all available 48 voices. In Split Sounds, these groups are present twice (per Part) and apply for all 24 voices of that Part. In Layer Sounds, these groups are present once and apply for all 24 voices of both Parts simultaneously.

Mono
When Mono is enabled, played keys will affect only one voice (or voice cluster, when using Unison). The behavior is defined by four parameters:

Enable (On, Off)	When on, only one note (containing the defined number of Unison Voices) will be playable, even when multiple keys are pressed. As long as one key stays pressed, the release of a key will not stop the envelopes. ⚠ **Note that changes to Mono Enable will reset held keys.**
Priority (Lowest, Latest, Highest)	When hitting multiple keys, they are sorted by the chosen priority. Keys matching the chosen priority determine the pitch of the Mono voice. When releasing the priorized key, the pitch will be determined by the key with second closest priority match.
Glide Time (0.0 ms ... 16000 ms)	This time can be used to create a portamento by smoothing the transitions of the pitches. Depending on the Legato options the smoothing is applied to each pitch change or only when the keys are played in "legato" style (in an overlapping manner).
Legato (None, Envelopes, Glide, Env & Glide)	**None:** No difference between legato and non-legato playing. The envelopes will be retriggered by every key-down and the Glide parameter will be applied to every pitch step. **Env:** The envelopes will be retriggered only by key-downs that are played non-legato. The Glide parameter will be applied to every pitch step. **Glide:** The Glide parameter will be applied only to keys that are played legato. The envelopes will be retriggered by every key-down. **Env & Glide:** The envelopes will be retriggered only by key-downs that are played non-legato. The Glide parameter will be applied only to keys that are played legato.

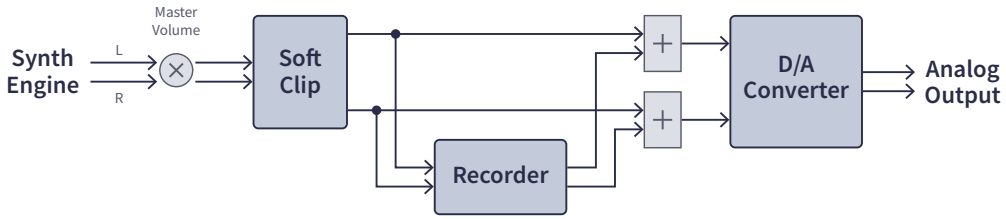
⚠ *The “Reset” parameter of the Oscillators (accessed via the “Phase” Parameter Selection Button) can be set to Off to avoid glitches caused by the oscillator phases being reset at a key-down. They become noticeable if the Release phase of the Envelopes is longer than the time between two notes. Without the phase reset the Oscillators are “free-running” and the Phase parameter has no influence on the start phase. This will also affect the sound of unison voice stacks and will effectively disable the Unison Phase parameter.*

Unison
The Unison group provides additional control and allows for unison voices (more than one sounding voice per pressed key). The number of unison voices can be adjusted (one by default). Three spread parameters can determine, how each unison voice is spread against the others: Detune can spread the pitches, Phase can spread the oscillator start phases and Pan can spread the panning of individual unison voices.

Post Processing
The resulting signal (a mixture of the Output Mix and the Effects section) can be amplified or attenuated by the Master Volume parameter, before it passes through a soft clipper, preventing the signal from being clipped at the D/A converter.

6. Recorder

Recorder Signal Flow



The internal recorder enables you to capture the C15's output signal with the best possible audio quality at any time, without connecting a sound card. The stereo signal after the Soft Clipper and before the D/A converter is written to the RAM, using the lossless compression of the FLAC format (24 bits, 48 kHz).

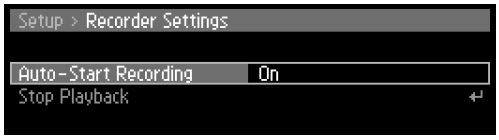
A maximum of 500 MB can be stored in the RAM. Because of the FLAC compression this is enough for hours of permanent playing and for days of recording when there are pauses in the playing. If the recorded amount of data exceeds the limit of 500 MB, the oldest data will be overwritten. Therefore it works like a ring buffer that always contains the latest recording.

You can select a segment of the recorded audio and download it to your computer to use it in your production environment. The recorded audio can be downloaded in both the FLAC and WAV format.

Recorder Settings - Auto-Start

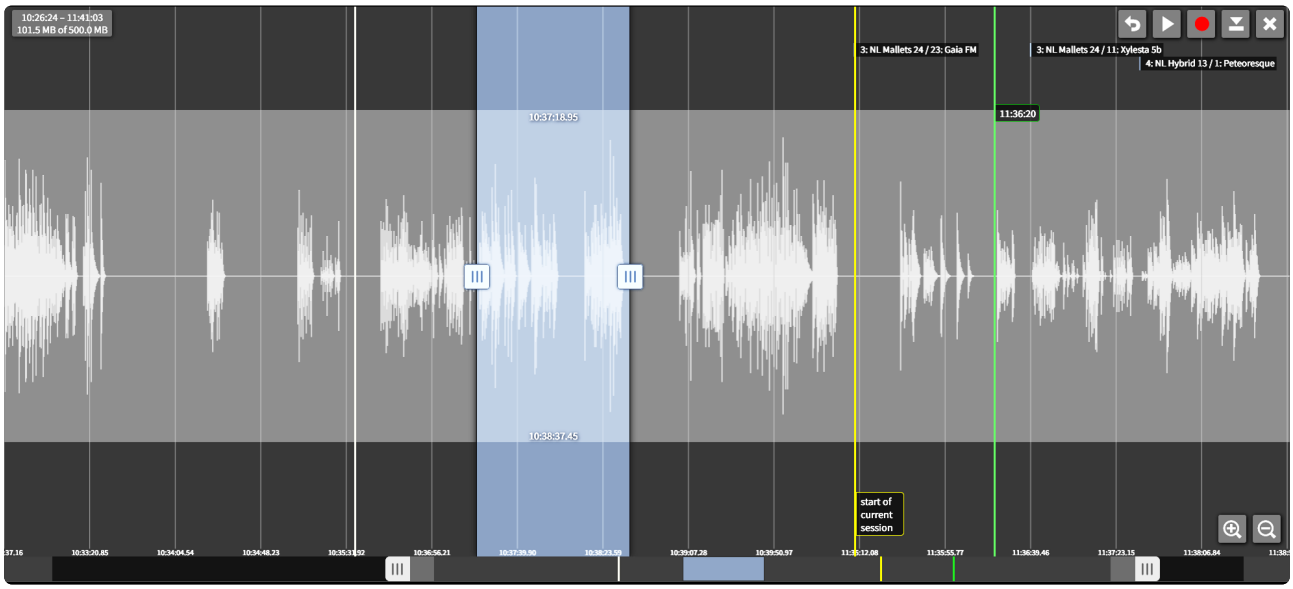
In the Setup you find a page for "*Recorder*" settings. With the option "*Auto-Start Recorder*" the user can decide if the audio recording starts automatically when the C15 is switched on, or if the user has to start it by pressing the Record button.

"*Stop Playback*" let's you stop the playback directly from the device and from the WebUI main window



User Interface

The Recorder tab can be opened by the "*Open Recorder*" entry in the "*View*" menu.
The tab has the address: **http://192.168.8.2/recorder/index.html**
The recorder works independent from its browser tab being open or not.



Zoom and Scroll

There is a dark strip at the bottom of the display that shows the entire saved audio recording. It is also the frame for a bar that is used for scrolling and zooming.
Within the scroll and zoom bar, there is another dark area which represents the section currently displayed in the main window. You can use the two handles on the sides to set the start and end point of this section - this also changes the zoom factor accordingly.

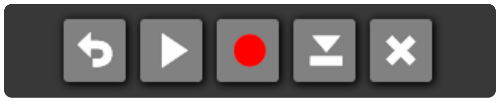
If you drag the middle area between the handles, you can move the displayed section without changing its length. This scrolls within the audio recording. There is a gray buffer area between the handles and the dark area, which ensures that the handle for moving the section is never too small (which could happen at a very high zoom level, for example). If the handles are dragged all the way to the left and right, the entire recording is displayed and the dark area of the bar is congruent with the dark strip of the frame.
The two buttons with magnifier "+" and "–" icons and the mouse wheel respectively the "+" and "–" buttons of your computer keyboard can also be used to zoom in and out.

Time Marker

A bright vertical line indicates that the recording was interrupted at this point - for example, by switching off the device, changing the audio system or manually ending the recording. The yellow line marks the start of the current session, i.e. the last time the instrument was switched on.

Within the current session, the sound used for playing at that time can be restored using the Recall button (see „Restoring a Sound"). Accordingly, the preset markers are only available within the current session, as this metadata is deleted when the device is switched off. Playback and downloading the recording, on the other hand, are possible across the entire recording area.

Control Buttons

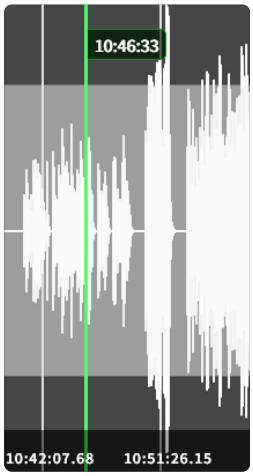


Restore, Play/Pause,
Record, Download, Delete

Computer Keyboard Shortcuts

Command	Shortcut
Play/Pause	space bar
Record	R
Restore	Z
Download	S
Zoom In/Out	+/–
Scroll	left/right arrow keys
To Previous/Net Preset Marker	up/down arrow keys (coming soon)

Playing Back Recorded Audio



The C15 can play back the recorded audio through its outputs. The playback start position is set by a click/touch in the darker outer lanes of the recorder display. A green line - the Play cursor - shows the position. A time label is attached.

When the Play button is pressed, the Play cursor starts to move and the recorded audio is played back. The button gets a “Pause” symbol and can be used to interrupt and continue the playback. Alternatively you can press the space bar for toggling between Play and Pause.

You can play the C15 live while the playback is running, but please be aware that the sum of the two signals can cause clipping distortion.

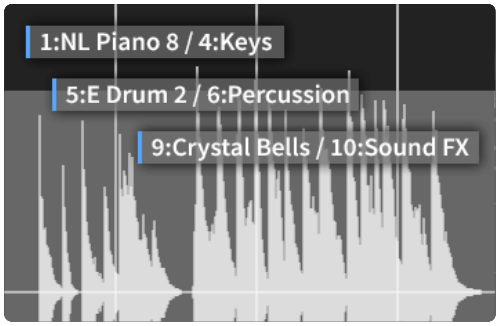
Restoring a Sound

The Undo system of the C15 memorizes every user action on parameters or presets. It allows to go back to the state of the synth engine at any point in time since the start of the session. Therefore it is possible to restore the sound at a certain position on the timeline of the Recorder and to use the same state of the synth engine as it was at the time of recording.

For this you move the Play cursor to the point in time of which you want to restore the sound and press the “*Restore*” button or the Z key on your keyboard. The Undo System will go back to the state of the parameters at the selected point in time, takes a “snapshot” of them and copies it into the editbuffer.

Please be aware that restoring a sound only works within the current session.

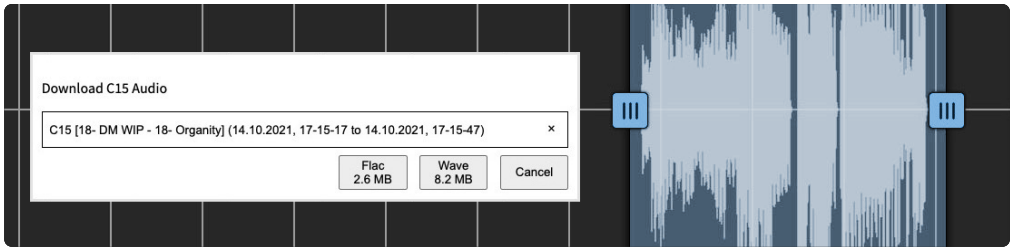
Preset Labels



Please note that the selection and load status of a preset cannot be restored because the preset might have been changed, moved or deleted.

In order to not loose the information which presets were used, the Recorder creates a label when a preset is loaded. The left end of the label is aligned to the loading time. The label contains the number and name of the bank and the preset. This might have changed in the meantime, but often it can still be found under the same name at the same place.

Selecting a Segment for Download



By click/touch and drag in the inner lane you can select a time segment. The start and end points can be shifted by the two light-blue handles. Two labels are showing the times at the start and end points.

The selected part can be downloaded by pressing the Download button or S on the computer keyboard. A dialog opens in which you can change the file name and choose between FLAC and WAV format (24 bit, 48 kHz). If the browser is set to ask for the destination for the downloaded file, it will open the referring dialog now. Otherwise it will store the file in the standard download folder.

The selection can be disabled by a single click/touch in the inner lane.

Starting and Stopping the Recording

If the "*Auto-Start Recorder*" option in the Recorder Settings is "*On*" the Record button will be shown as active from the beginning. You can use it to stop the recording. This might be desired to save memory or to focus on reviewing the recorded material. When you press the button again the recording will be continued.

If the "*Auto-Start Recorder*" option is "*Off*", the Record button needs to be pressed to start recording. The keyboard shortcut for starting or stopping the recording is **R**.

Deleting the Recorded Audio

When you press the Delete button the audio memory will be cleared and as a result the timeline will be empty.

7. MIDI

Since the Studio Package update the C15 can receive and send MIDI messages. Received MIDI messages can control the C15 and affect the sound, similar to playing the instrument itself. When playing on the C15, MIDI messages can be sent, reflecting the performance. Note that received MIDI messages will never be sent, so there is no “MIDI Thru” or loopback functionality.

Receive and Send options include a Channel (Omni, 1 ... 16) specifier, filtering events accordingly. When a Split Sound is loaded, a secondary (Split) Channel can be used in order to separate both Parts from each other.

As classical MIDI operates on 7 bit resolution (128 steps), there is a loss in accuracy (the C15 operates on much higher precision). Nevertheless, precision can be maintained by enabling “High Res.” options. When enabled, the resolution increases to 14 bit (16384 steps). Values are then encoded as a pair of MSB (coarse) and LSB (fine) components, effectively doubling the amount of messages. This is still compatible with the classical resolution, as the LSB component is optional when receiving MIDI messages.

7.1 MIDI Events

The C15 can send and receive MIDI messages for the following events:

Note On and Note Off

When enabled, the C15 will produce sounds when receiving MIDI Note messages. Likewise, the C15 will send MIDI Note messages when playing on the internal keybed, if enabled. Note On and Off velocities are supported and can optionally operate on high resolution, using an additional MIDI CC (Control Change) message on Control Number 88, encoding the LSB component.

When a Split Sound is loaded, Notes can be received and sent on both Parts, using the secondary (Split) Channel setting.

The eleven Hardware Sources

The positions of the Hardware Sources can also be sent and received via MIDI in the following way:

- Pedal 1/2/3/4 can be assigned to MIDI CCs 01...31 for the MSB while CC 33...63 can work as LSB for 14 bit resolution. CC 64...69 can be assigned in a 2-state switching mode.
- Ribbon 1/2/3/4 can be assigned to MIDI CC 01...31 for the MSB while CC 33...63 can work as LSB for 14 bit resolution.
- The Bender can be assigned to MIDI Pitchbend or to MIDI CC 01...31 for the MSB while CC 33...63 can work as LSB for 14 bit resolution.
- Monophonic Aftertouch can be assigned to MIDI Channel Pressure or to MIDI CC 01...31 for the MSB while CC 33...63 can work as LSB for 14 bit resolution, or to one half of the range of MIDI Pitchbend (up or down).
- Polyphonic Aftertouch can only be assigned to MIDI Polyphonic Aftertouch. This is a separate 7-bit channel voice message (polyphonic key pressure) that the C15 can only receive, but not send.

⚠ *Note that assignments are non-exclusive, so multiple Hardware Sources can be bound to the same received MIDI message, as well as being merged into indistinguishable MIDI messages when sent. This may be useful in certain scenarios, so there are no restrictions. However, it is up to the user to find a meaningful setting, apart from the provided default setting, consisting of distinct assignments.*

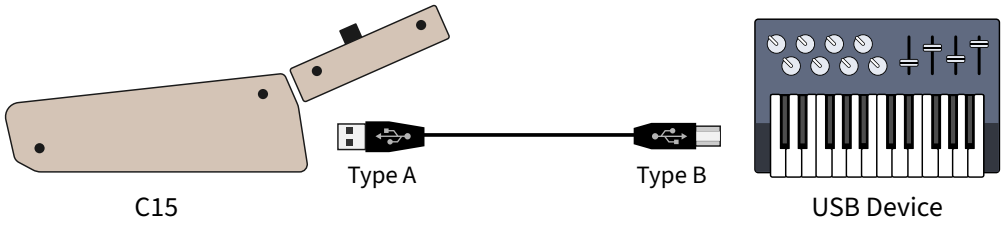
Preset Selection

One of the Preset Banks can be assigned to receive and send MIDI Program Changes. The Program Change numbers are mapped to the first 128 presets of this Bank.

7.2 Connecting the C15 to a USB Device

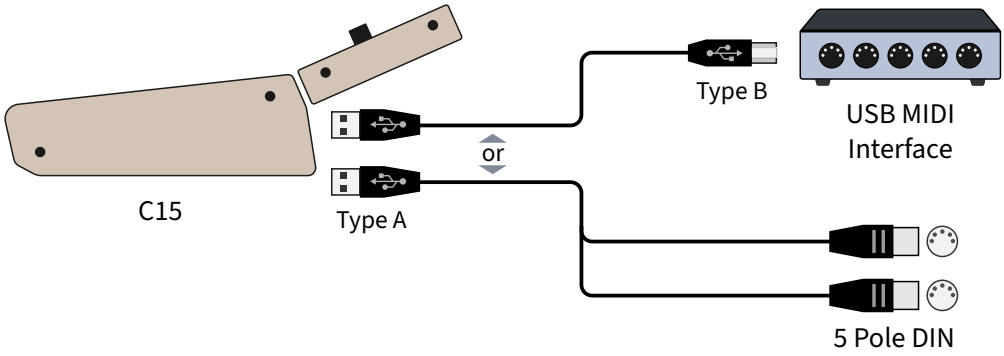
The C15 has a Type A connector for USB, and its embedded computer system works as a “USB host” for “USB devices” connected to this port. This means that you only need a standard USB cable to set up a MIDI communication with an instrument, a hardware sequencer, or a MIDI interface that has a USB Type B connector. You can connect the C15 to multiple USB MIDI devices via a USB hub.

⚠ *Important: The USB port of the C15 can only supply a limited current to bus-powered devices. Devices that have a higher power consumption need to be run with their own power supply, or through a powered hub.*



Connecting the C15 via 5-pole DIN Connectors

To use the classical MIDI cables and 5-pin DIN Ins and Outs a MIDI interface can be connected as an USB device directly to the USB port of the C15. The most convenient and cost effective solution are cables with integrated USB-MIDI interface.

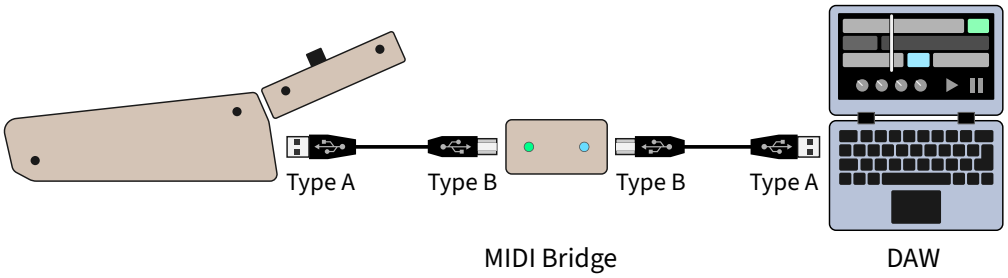


Connecting the C15 to a Computer

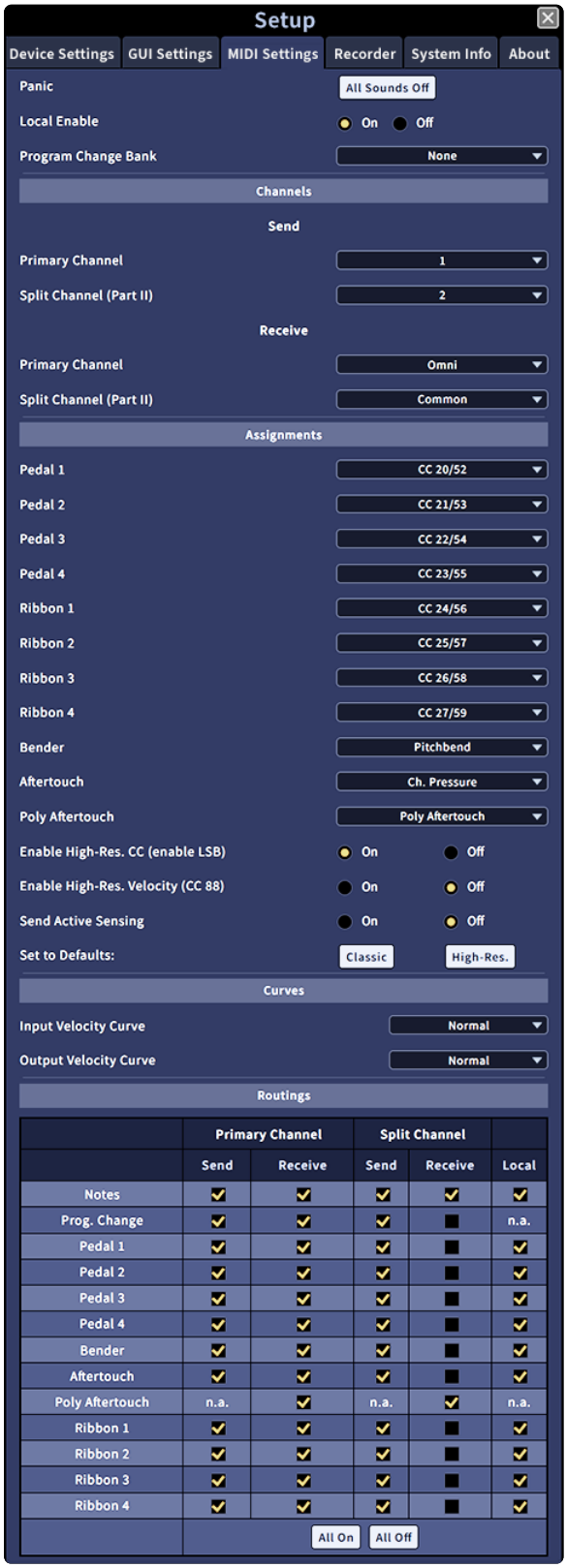
A computer running a DAW or similar is the center of many setups. It functions as a USB host and can only be connected to USB devices. Since the C15 is also a USB host we provide the “MIDI Bridge” that functions as a double-sided USB device with two Type B connectors. One of the ports is connected to the C15 and the second to your computer.

Our adapter will appear as “NLL-MIDI-Bridge” in the list of USB MIDI devices. The two LEDs on top of the box show the operation of the two USB Ports. If both are lit in green color the box is working normal. If one of the LEDs ist not green, the connection to its side is interrupted. More information about the operation of the MIDI Bridge can be found in the MIDI Bridge Manual.

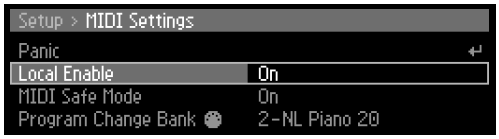
Besides its function for the C15 the MIDI bridge can also be used for the MIDI connection between other USB hosts, like two computers.



7.3 MIDI Settings



In the Setup (both in the Graphical and Hardware UI) you find a new page for “MIDI Settings”. It is divided into the sections “Channels”, “Assignments”, “Curves“ and “Routings”. Furthermore, you find direct access to “Panic”, “Local Enable” and “Program Change Bank” at the very top of the setting.



Panic

When triggered, the C15's Voice Allocation, Envelopes and Buffer will be reset and an “*All Notes Off*” MIDI message will be send on the respective channel(s). As a result, all internal audio and external gear will stop playing. A common method to face stuck MIDI notes, but it also can be helpful, when you lost control of the sound, e.g. through a feedback loop.
Panic can also be triggered by pressing all four soft buttons on the base unit at the same time.

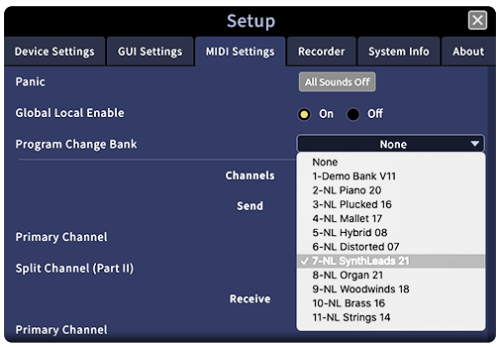
Local Enable

When set to “*Off*” both the C15's keyboard and the eight Hardware Sources are disconnected from the synth engine but still can be used to send MIDI note and Control Change, Pitchbend or Channel Pressure messages.
In this mode the base unit display is not showing the associated Macro Control, but the MIDI-CC number assigned to the Ribbons instead.

> ⚠ *Please note that changing this setting while a note is active resets the voice allocation, the envelopes and the buffer of the C15, so that the audio playback is interrupted for a brief moment. In this case, a MIDI All Notes Off message is also sent on the respective channel(s).*

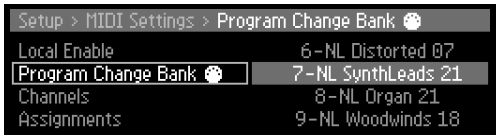
Next to this shorthand option, Local Enable modes are individually available for Notes and all eight Hardware Sources, see below *7.3.3 MIDI Settings: Routings*.

Program Change Bank



Here you can assign the Preset Bank that is used for sending and receiving MIDI Program Change messages. By selecting "*None*", no MIDI Program Change messages will be received or sent. Please see the next subchapter "Choosing a Bank for MIDI Program Change" for choosing a Preset Bank directly from the preset view.

> ⚠ *Please note, that every time you change the Program Change Bank, a corresponding MIDI message is sent.*



Choosing a Bank for MIDI Program Change

To make use of MIDI Program Change messages one of the C15's preset banks has to be assigned as the source and target of Program Changes. A received Program Change would select the preset with the referring number in this bank and the selection of a new preset in the bank will send a MIDI Program Change with its number. Selecting a preset that has a higher number than 128 will not send a Program Change.

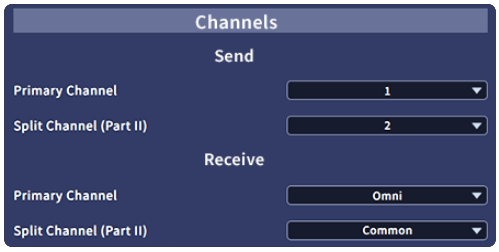
The "*Direct Load*" switch decides if the C15 only sends a MIDI Program Change when you select a preset, or if the preset is also loaded into the sound engine. Therefore it has a similar effect like a "*Local Off*" for Program Changes.

The header of the MIDI-assigned bank is marked by a symbol that looks like a 5-pole MIDI connector. The bank can be connected or disconnected in the following ways:
In the graphical UI you find the entry "*Connect Bank to MIDI PC*" or "*Disconnect Bank from MIDI PC*" in the context menu of the bank header.

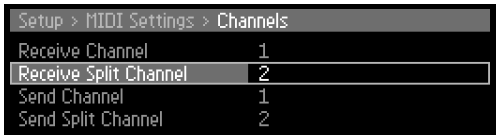
In the Preset Screen of the Hardware UI activate the "Bank" focus by pressing the **Soft Button 1** (with a dual preset hold the button for a second). In the Edit menu you find the entry "*MIDI PC: On" or "MIDI PC: Off*" that can be toggled by the **Enter Button**.

By connecting a bank to MIDI PC the previously connected bank will be disconnected. After disconnecting the currently connected bank, none of the banks will be connected. The currently assigned bank can also be found and changed in the "*Program Change Bank*" menu in the MIDI Settings.

7.3.1 MIDI Settings: Channels



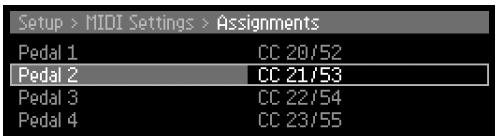
Here you can select the MIDI channel that is used to send and receive MIDI messages for both Primary and Split Channel. The Split Channel is relevant only if a Split Sound is loaded. If you select "*Omni*", messages from all 16 MIDI channels will be applied. "*None*" will block all incoming and/or outgoing MIDI messages. When "*Split Channel*" is set to "*Common*", it will use the same MIDI channel as the Primary Channel.

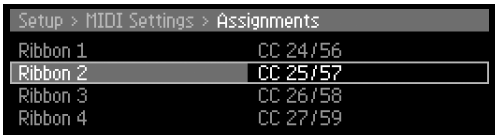


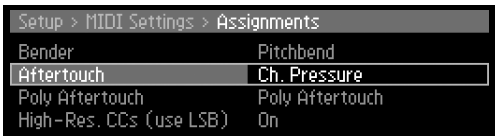
Settings for Split Channels apply to Split Sounds only. It controls the MIDI channel for MIDI messages sent and/or received by Part II. If the Split Channel is not set to "*Common*", the Split Point(s) are not applied to the received MIDI notes and both Parts can be played over the full MIDI note range.

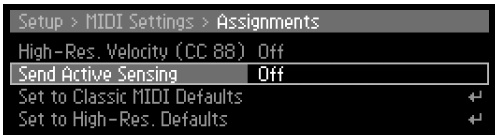
⚠ *Please note that changing this setting while a note is active resets the voice allocation, the envelopes and the buffer of the C15, so that the audio playback is interrupted for a brief moment. In this case, a MIDI All Notes Off message is also sent on the respective channel(s).*

7.3.2 MIDI Settings: Assignments









These settings determine which types and numbers of MIDI messages are assigned to the Hardware Sources. High Resolution options for Velocities and Hardware Sources as well as a Bank selector for Program Changes are also provided. The Assignments apply to both MIDI Send and MIDI Receive.

Pedal 1, 2, 3, 4
Each pedal can be assigned to a MIDI Control Change. The CC numbers 1 to 31 are available for continuous operation in 7-bit and 14-bit (High-Res.) mode. In 14-bit mode a second CC with a number between 33 and 63 is automatically assigned for the LSB.

In addition, the CC numbers 64 to 69 are available. They work as 2-state switches, as it is typical for e.g. a MIDI sustain pedal. When the C15's pedal position rises above 50 %, a MIDI CC value of 127 is sent, when it falls below 50% a value of 0 is sent. A received MIDI CC value smaller than 64 sets the pedal position to 0 %. Values of 64 or larger set the pedal position to 100 %.
By selecting “*None*” the pedal is disconnected from MIDI.

Ribbon 1, 2
Each ribbon can be assigned to a MIDI Control Change. The CC numbers 1 to 31 are available in 7-bit and 14-bit (High-Res) mode. In 14-bit mode a second CC with a number between 33 and 63 is automatically assigned for the LSB. By selecting “*None*” the ribbon is disconnected from MIDI.

Bender
In the typical application as a pitch bender the Bender can be assigned to MIDI Pitch-bend. This has 14 bits resolution by definition.

The Bender can also be assigned to a MIDI Control Change. The CC numbers 1 to 31 are available in 7-bit and 14-bit (High-Res) mode. In 14-bit mode a second CC with a number between 33 and 63 is automatically assigned for the LSB.

By selecting “*None*” the Bender is disconnected from MIDI.

Aftertouch
The most common assignment would be MIDI Channel Pressure. This has only 7 bits of resolution.

Aftertouch can also be assigned to a MIDI Control Change. The CC numbers 1 to 31 are available in 7-bit and 14-bit (High-Res) mode. In 14-bit mode a second CC with a number between 33 and 63 is automatically assigned for the LSB

Two additional options are available to assign Aftertouch to one half of the MIDI Pitch-bend. “*Pitchbend up*” has a range from the center to the maximum while “*Pitchbend down*” goes from the center to the minimum. These ranges have 13 bits of resolution.

By selecting “*None*”, Aftertouch is disconnected from MIDI.

Polyphonic Aftertouch
The only assignment is MIDI Polyphonic Aftertouch (Polyphonic Key Pressure), which has a resolution of 7 bit. The C15 is not capable of sending Polyphonic Aftertouch but can only receive it through MIDI. This means that it cannot be used locally either.

By selecting “*None*”, Polyphonic Aftertouch is disconnected from MIDI.

High-Res. CCs (use LSB)
Control Changes can be transmitted with a resolution of 14 bit by using two CCs, one for coarse (MSB) values and one for fine (LSB) values. The LSB message has to be sent before the MSB message. The number of the CC for the LSB is derived from the number of the CC for the MSB by adding 32.

To avoid conflicts with other applications of the LSB CCs, their use can be disabled (q Off). This setting applies to all assigned MIDI Control Changes.

High-Res. Velocity (CC 88)
Note On and Note Off velocities can be transmitted with a resolution of 14 bit by sending a CC 88 message before each Note On or Note Off message. The value of the CC 88 represents the LSB that is providing additional 7 bits of resolution.

To avoid conflicts with other applications of CC 88, its use as velocity LSB can be disabled ("*Off*").

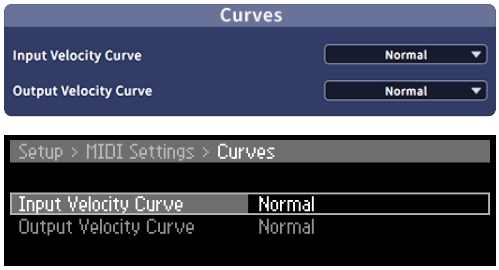
Active Sensing
Some USB-to-MIDI adapters can flexibly change their MIDI ports and automatically switch from send to receive if no MIDI has been sent for a while. Currently, ESI (MIDIMATE) and Swissonic (MidiConnect2) products are known to do this. The switching results in glitchy behavior, but can be avoided by repeatedly sending Active Sensing messages (which should otherwise have no effect).

A new option has been added to the MIDI Assignments section. When enabled, Active Sensing messages are sent continuously, preventing the connected MIDI device from switching its ports. As this causes more traffic (which may be undesirable), the option can be disabled.

Default Mappings

Source	Classic MIDI	High Resolution
Pedal 1	CC20	CC20 + CC52 (MSB + LSB)
Pedal 2	CC21	CC21 + CC53 (MSB + LSB)
Pedal 3	CC22	CC22 + CC54 (MSB + LSB)
Pedal 4	CC23	CC23 + CC55 (MSB + LSB)
Ribbon 1	CC24	CC24 + CC56 (MSB + LSB)
Ribbon 2	CC25	CC25 + CC57 (MSB + LSB)
Bender	Pitchbend	Pitchbend
Aftertouch	Channel Pressure	CC26 + CC58 (MSB + LSB)
Poly Aftertouch	Poly Aftertouch	None
High-Res. Velocity	Off	On (LSB CC88)
High-Res. CCs	Off (MSB only)	On (MSB + LSB)

7.3.3 MIDI Settings: Curves



Input Velocity Curve
The Input Velocity Curve determines whether and how MIDI input velocities are modified before reaching the C15 synth engine.

It can be used to adjust the feeling when playing the C15 from an external MIDI device.

Output Velocity Curve
The Output Velocity Curve determines whether and how note velocities coming from the C15 keybed are modified before being sent out via MIDI.

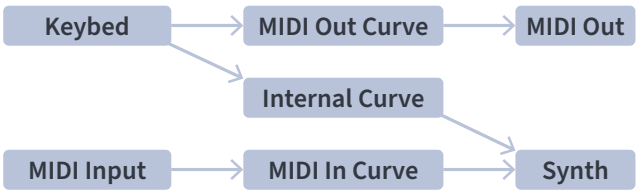
It can be used to adjust the velocity sensitivity when playing an external MIDI instrument from the C15 keybed.

How to use the MIDI Velocity Curve settings
The MIDI Velocity Curve settings allow for flexible adjustment of velocity sensitivities in various use cases. This comes at the cost of potential confusion when used in combination with the Velocity Curve setting found under Setup > Device Settings > Curves. The following chapter describes how to set up the velocity curves for different use cases.

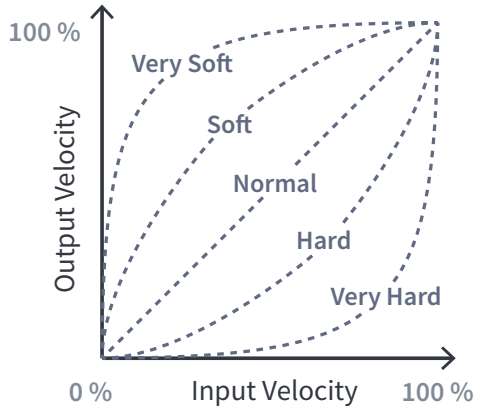
In the following paragraphs and graphics abbreviated terms are used for the different curve settings:

Abbreviation	Setting
MIDI In Curve	Setup > MIDI Settings > Curves > Input Velocity Curve
MIDI Out Curve	Setup > MIDI Settings > Curves > Output Velocity Curve
Internal Curve	Setup > Device Settings > Curves > Velocity Curve

This simplified event flow shows how the different curve settings work together in general:



All three settings share the same 5 transfer curve options for shaping velocity values:

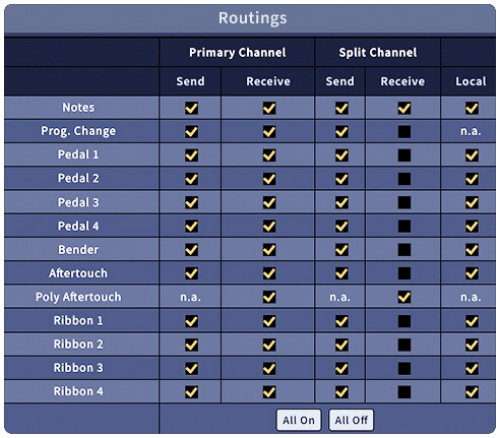


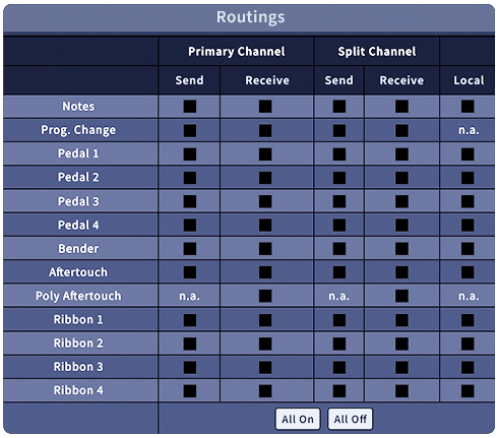
When all three curve settings are set to “Normal“, none of them will have any effect.

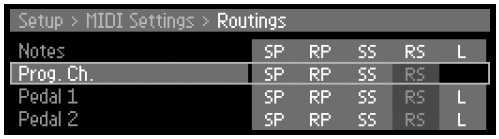
The following table lists common scenarios on how to set up the Velocity Curve settings:

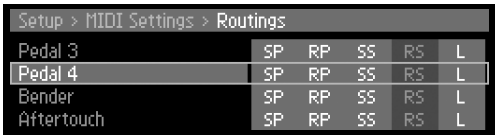
Use Case	Signal Flow	Internal Curve	MIDI In Curve	MIDI Out Curve
Playing the C15 via its internal keybed, no external MIDI devices connected	**Keybed** → MIDI Out Curve → MIDI Out **Keybed** → **Internal Curve** → **Synth** MIDI Input → MIDI In Curve → **Synth**	chosen curve	unused	unused
Playing an external MIDI synthesizer from the C15 keybed	**Keybed** → **MIDI Out Curve** → **MIDI Out** Keybed → Internal Curve → Synth MIDI Input → MIDI In Curve → Synth	unused	unused	chosen curve
Playing the C15 synth and an external MIDI synth from the C15 keybed simultaneously (e.g. for layering purposes)	**Keybed** → **MIDI Out Curve** → **MIDI Out** **Keybed** → **Internal Curve** → **Synth** MIDI Input → MIDI In Curve → **Synth**	chosen curve	unused	chosen curve
Playing the C15 sound engine from an external MIDI keyboard	Keybed → MIDI Out Curve → MIDI Out Keybed → Internal Curve → Synth **MIDI Input** → **MIDI In Curve** → **Synth**	unused	chosen curve	unused
MIDI file recording & playback with curve	**Keybed** → **MIDI Out Curve** → **MIDI Out** *Local Enable: On (for monitoring)* **Keybed** → **Internal Curve** → **Synth** **MIDI Input** → **MIDI In Curve** → **Synth**	chosen curve (same as MIDI Out)	Normal	chosen curve (same as Internal)
MIDI loopback (MIDI Local Off)	Keybed → **MIDI Out Curve** → **MIDI Out** *Local Enable: Off* Keybed → Internal Curve → **Synth** **MIDI Input** → **MIDI In Curve** → **Synth**	unused	Normal	chosen curve

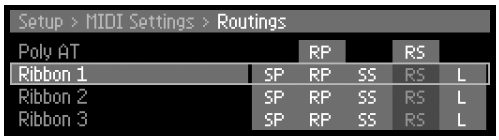
7.3.4 MIDI Settings: Routings

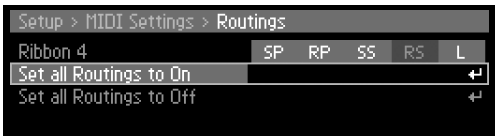












These settings allow to set individual and specific MIDI routings. The matrix consists of five columns: "*Send Primary*" (SP), "*Receive Primary*" (RP), "*Send Split*" (SS), "*Receive Split*" (RS) and "*Local*" (L). The rows list "*Notes*", "*Program Change*" and the eleven Hardware Sources (Pedal 1-4, Bender, Aftertouch, Polyphonic Aftertouch and Ribbon 1-4). In the Web UI, a check mark at the respective matrix position sets the entry to "*On*", removing the check mark sets it to "*Off*".

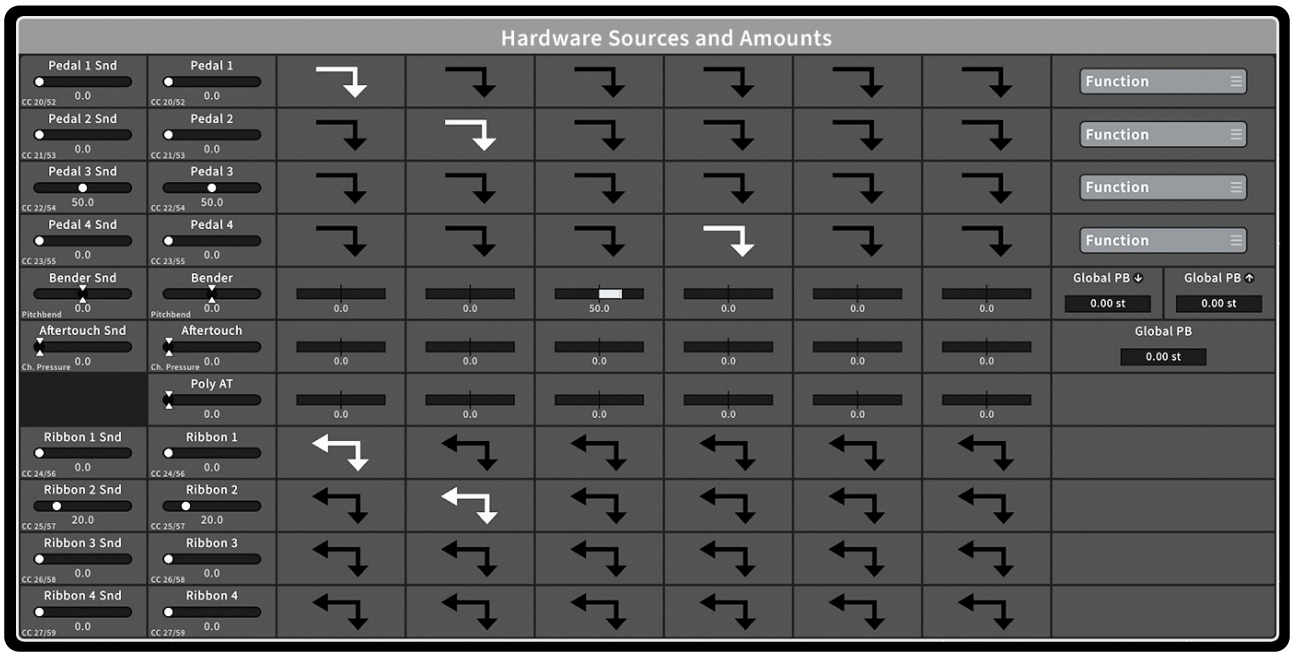
On the hardware, a highlighted entry represents "*On*", a dark one "*Off*". Also, the access to the matrix is different on the hardware. When you choose one of the rows and press Enter, you reach a dedicated settings dialog for this row. In the center, the display shows you the name of the respective component, e.g. "*Notes*". Use **Soft Buttons 2 and 3** to change between the rows. With **Soft Button 4**, you can switch between the columns.

The name of the actual column is also displayed below the chosen row, e.g. "*Send Primary*". By turning the dial, you can set the entry to "*On*" or "*Off*". When holding the **Shift Button** while turning the dial, you can set the whole row to "*On*" or "*Off*". The status is also displayed by the check marks on the right side. By pressing **Soft Button 1**, you get back to the matrix overview.

Send (Primary/Split)
When set to "Off" the respective C15 component will not send MIDI messages on the respective channel.

Receive (Primary/Split)
When set to "Off" the respective C15 component will not receive MIDI messages on the respective channel.

Local
When set to "*Off*" the respective component is disconnected from the synth engine, but still can be used to send MIDI note and Control Change, Pitchbend or Channel Pressure messages.
In this mode the base unit display is not showing the associated Macro Control, but the MIDI-CC number assigned to the Ribbons instead.
Decoupling a Hardware Source from the synth by setting Local Enable to Off, changes their representation in the UI.



"*Send*" shows the physical status of the respective Hardware Source, for example the current position of a Ribbon and relates to all communication with external devices. This value is sent via MIDI.
"*Receive*" assigns the value that is passed internally to the synth. This is either a value received via MIDI or, in the case of the bidirectional Ribbons, a value received via an adjusted Macro Control. This allows the audio engine of the C15 to be triggered by an external device and at the same time the Hardware Sources can be used to control other external devices without conflict.

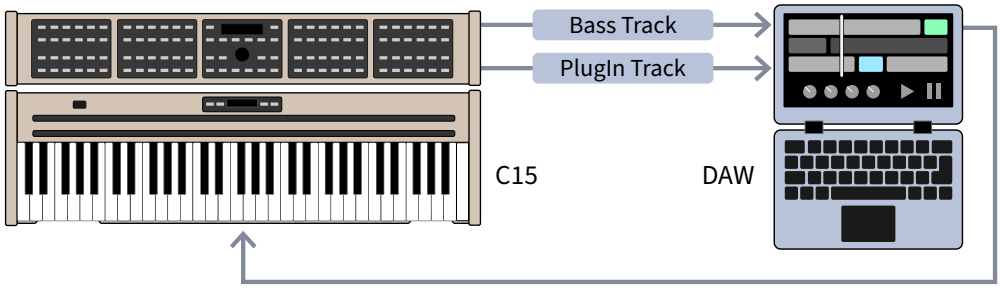
Set all Routings to On/Off
Below the Routings Matrix, you find the options to enable or disable all routings by pressing "*Set all Routings to On*" or "*Set all Routings to Off*" (respectively "*All On*"/"*All Off*" in the Graphical UI).

⚠ *Please note that changing the routings setting while a note is active resets the voice allocation and the envelopes of the C15, so that the audio playback is interrupted for a brief moment. In this case, a MIDI All Notes Off message is also sent on the respective channel(s).*

7.4 Practical Studio Examples

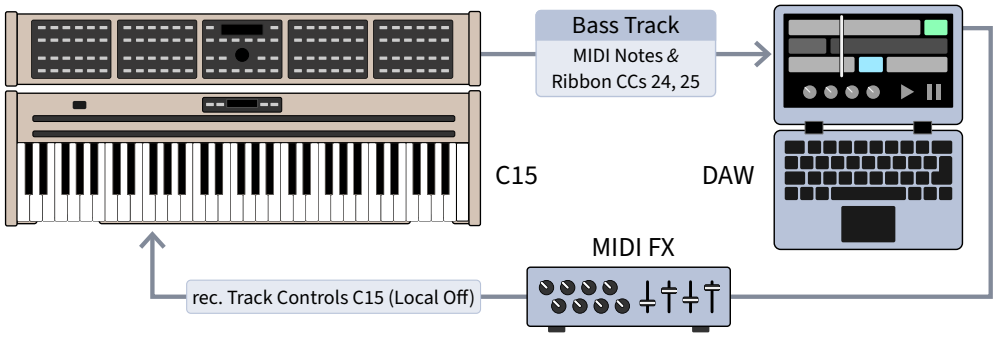
With the C15's MIDI features, it can be used as a master keyboard and production tool in the center of your studio or live performance set. In the following we want to show you exemplary scenarios, which will help you to understand the MIDI settings better and give you some orientation and helpful tips when using the C15 as a production tool.

Scenario 1: Studio Setup

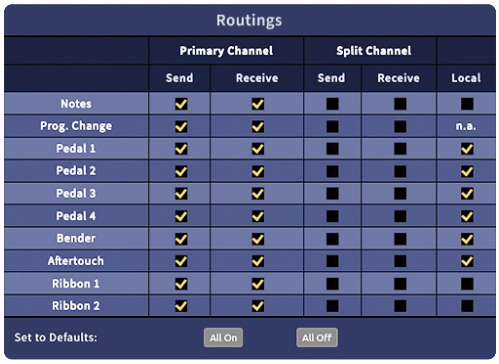


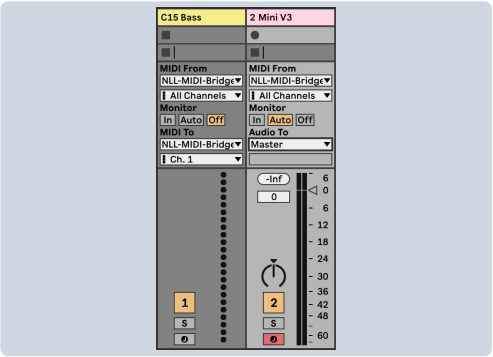
A Digital Audio Workstation (DAW) is the heart of almost every modern music studio. Therefore, this first scenario will focus on using your C15 with the benefits of a DAW, but also as a controller for other instruments within the DAW. So, on the one hand, we will use the C15 as a sound generator, and on the other hand, to control a Plug-In.

> ⚠ *Please note that this setup is not entirely applicable to a live situation as any change to the MIDI settings while a note is active can lead to a reset of C15's envelopes and voice allocation and an All Notes Off MIDI message. As a consequence internal and external audio will stop for a brief moment.*



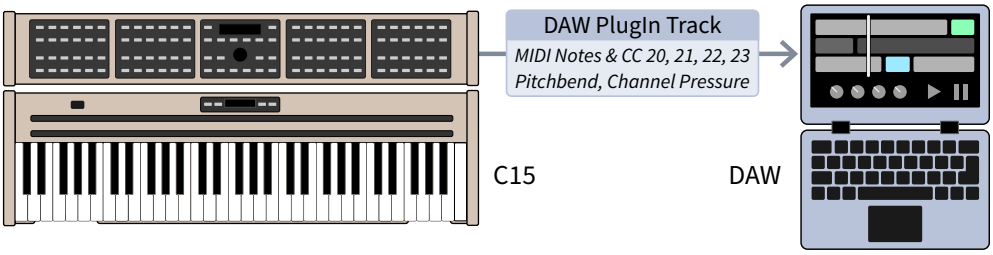
First, we want to record a MIDI track, that triggers a C15 bass sound. This MIDI track receives MIDI notes and CC values by the C15. As we send MIDI data to the DAW and back to the C15, we can benefit from the MIDI processing features of the DAW (arpeggiator, chord generator, etc.). For the bass track, we want to record MIDI-Notes and the ribbon's CC values.





For this purpose, we have to change some of the routing settings: turn on "*Send*" and "*Receive*" for both Notes and Ribbon 1 & 2 for Primary Channel. As we don't want MIDI Echo issues to appear, we turn off Local for them. The direct connection between the keys and both ribbons and the C15 is now interrupted and completely controlled via MIDI. MIDI-Monitoring of your DAW should be activated. You can now record the track.

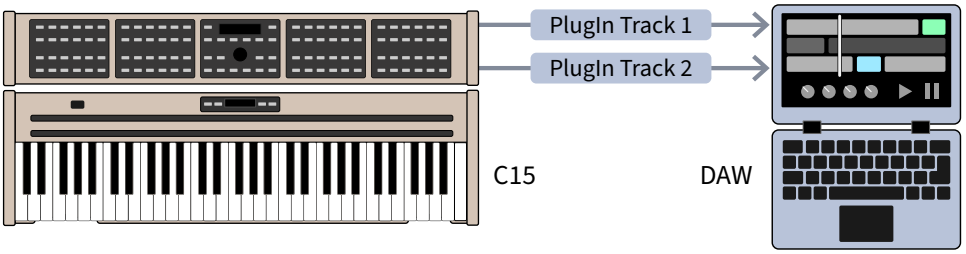
The track "C15 Bass" of the DAW now controls the C15 and the ribbon's LEDs reflect the incoming CC values. You can now use the keys and the remaining Hardware Sources to control a Plug-In in the DAW. In this example we use Arturia's Mini V3. Therefore, we want to turn off track 1's MIDI monitoring and choose track 2 for recording. The C15 keeps on playing, run by the recorded Bass track.



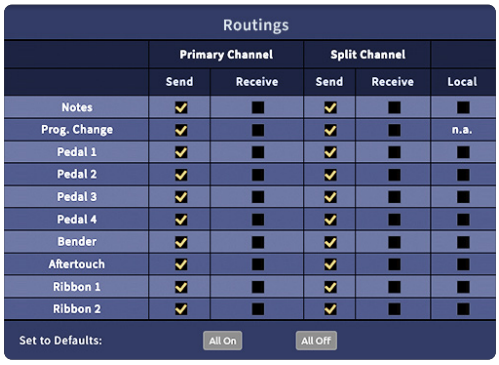
As the C15 is still hearable, we do have to make some adaptions to the Routings settings. We want to turn off Local and Receive for all other Hardware Sources as they would interfere with the playing bass sound otherwise. You can now turn on Local for the Ribbons again, as this allows you a direct impact on the bass sound. Further, turn on "*Send*" for Pedals 1-4, Bender as well as Aftertouch and Notes, as we want to use these to control the Plug-In.

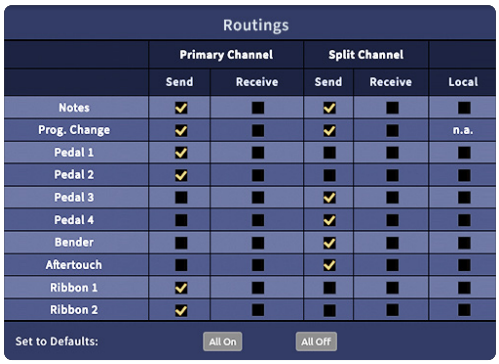
We can now control the Plug-In without changing the bass sound unintentionally.

Scenario 2: Controlling two Plug-Ins at the same time



Thanks to C15's Split Mode, we can use MIDI to control and play two Plug-Ins at the same time. For this scenario, we need to load an existing Split-Preset or create a new one, as only then MIDI data is sent and received on the Split Channel as well. Next, we have to set the "*Send*" and "*Receive*" channels according to our settings in the DAW. In this case, we have two Plug-In tracks set to MIDI Channel 1 and 2. Therefore, we set Primary Channel to 1 and Split Channel to 2 for both "*Send*" and "*Receive*" We can now control Plug-In 1 with the left and Plug-In 2 with the right Split Part.





In the Routing settings, you can distribute the Hardware Sources on the channels or use them on both simultaneously - there are reasonable scenarios for both use cases.

As you wish, you can turn off Local, so you don't hear the C15 and the MIDI-CCs will pop up on the small base unit display.

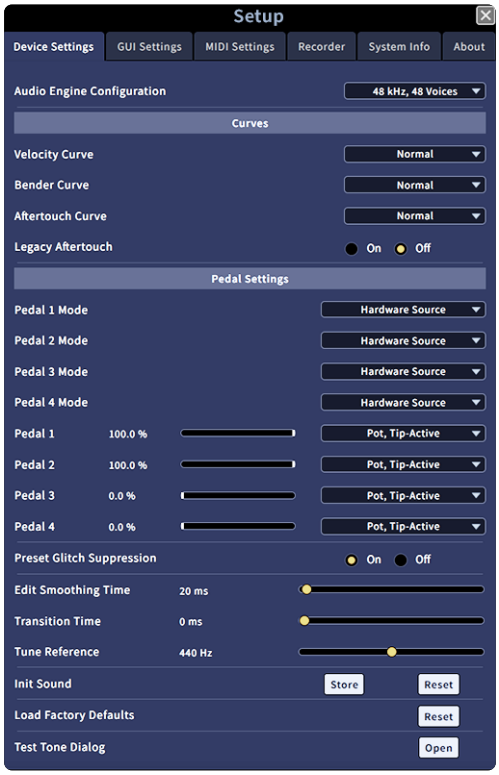
As this setup is just about sending MIDI, all "*Receive*" entries were deactivated for the sake of clarity.

8. Setup (C15 System Settings)

The C15 also features a few global settings that are preset-independant. They are organized in the Setup menu and mainly define the interaction with peripherals (such as sensitivities for velocities, external Pedal integration or connected devices via Wi-Fi). Besides, the Setup menu allows for installing updates and transferring backups.

Chapter *4.13 Setup Navigation* provides all information on accessing and navigating the Setup menu both on the Panel Unit and on the Graphical User Interface. The following passages explain all provided menu items.

Device Settings [Panel Unit, Graphical UI]



Audio Engine Configuration

This setting lets you change the internal sample rate from 48 kHz to 96 kHz or back. Using a sample rate of 96 kHz reduces the usable voices to 24 but increases the audio quality and reduces artifacts.

> ⚠ *Changing the internal sample rate requires the audio engine to be off. The system will shut off the engine on it's own and turn it on again after a brief moment.*

Curves

The Velocity Curve, Bender Curve and Aftertouch Curve determine the sensitivity of the instrument for the respective playing gestures. A soft setting increases the sensitivity for low gesture intensities, a hard setting decreases the sensitivity for low gesture intensities. With the normal setting, the sensitivity remains equal throughout.

When using the Velocity Curve setting, please also take into account potential conflicts with the MIDI Curves.
See section *7.3.3 How to use the MIDI Velocity Curve settings*.

Pedal Settings

The Pedal Modes let you choose whether you want to use the specified pedal as a regular Hardware Source, or as a switch to browse presets or banks. There are five modes to choose from: Hardware Source, Next Preset, Previous Preset, Next Bank and Previous Bank. Below the Pedal Modes you will find the pedal preset selection for each pedal. For detailed information on pedal integration and how to select the correct pedal preset, please refer to *2.5 Pedal Integration*.

Preset Glitch Suppression

This option can be enabled in order to avoid drastical changing pitches and other emerging artifacts, being provoked by a preset change. The suppression will be realized by clearing (flushing) all delay buffers when a new preset is loaded.

> ⚠ *Note that this feature is not fully implemented yet, as the suppression is not perfect in every case and can still produce small artifacts, depending on the preset change's circumstances. But in general, the effect is quite noticeable.*

Edit Smoothing Time
When editing a parameter, the new adjusted value will be approached within the Edit Smoothing Time, which can range between zero and 200 ms. Higher times will lead to a slower response of the sound engine. This time does not affect preset recalls or modulations (having their own, individual times).

Transition Time
The transition time will be effective when recalling presets, defining the smoothing time of the parameters as they approach their new values.

Tune Reference
The tuning of the C15 can be adjusted in order to fit with acoustic instruments, spanning from 400.0 Hz up to 480.0 Hz (default: 440.0 Hz). When using default parameter values[1], pressing the A3 key will produce a tone with the exact frequency provided by this setting.

1) *required default parameter values for: Transposition (no Note Shift), Pitch (at 60.00 st, incl. Key Tracking of 100.0 % and Env C at 0.0 st), Scaling (Offset for A at 0.0 ct).*

Init Sound
As described in chapter *4.3.1 Editing a Parameter* (and *4.7.2 Manipulating Sounds*), specific parameters (and whole Sounds) can be set to their default values. The current Sound can be used for overwriting these default values by pressing Store. In order to restore the Factory default values, press **Reset**.

Load Factory Defaults
Formerly only a Developer Option, this action is now also available as a proper Setting. When invoked, this action has to be confirmed, before all Settings will be reset to their Factory Default values.

Test Tone
Formerly only an internal feature, the Test Tone has been reworked and is now introduced as a new Setting. A pure sine tone with a frequency corresponding to the Tune Reference Setting and an amplitude of -6 dBFS can be added to the stereo signal of the synth. There are four modes for this setting:

Off	Only the stereo signal of the synth is audible.
Left	The Test Tone will be added only to the left channel of the stereo signal.
Right	The Test Tone will be added only to the right channel of the stereo signal.
Both	The Test Tone will be added to both channels of the stereo signal.

GUI Settings [Graphical UI only]

A complete reference to the settings of the Graphical User Interface can be found in chapter 4.16.5 Graphical GUI Settings.

Hardware UI [Panel Unit only]

Encoder Acceleration
The **Encoder** in the Edit Panel can detect acceleration gestures and apply them to an item in focus accordingly. With sufficient acceleration, even high resolution parameters can be completely traversed with only one or a few turns of the **Encoder**.

Ribbon Relative Factor
Similarly, drag gestures on the two Ribbon touchstrips can be amplified by the Ribbon Relative Factor. This option is only effective, when a Ribbon is in relative mode.

Signal Flow Indication
As described in chapter *4.10 Overviews*, the Flow Overview allows for a fast and easy impression on how signals of a preset are routed. However, blinking LEDs may distract the user in some cases, therefore the Flow Overview is optional.

Screensaver Timeout
An optional timeout setting has been added in order to prevent possible pixel deterioration in the two displays, which can occur when the C15 is running for longer periods of time without any interaction.
When the screensaver is running, any interaction will interrupt it and reset the timeout.

MIDI Settings[Panel Unit, Graphical UI]

A complete reference to the MIDI settings can be found in chapter *7. MIDI*.

Recorder (Settings)[Panel Unit, Graphical UI]

With the option "*Auto-Start Recorder*" the user can decide if the audio recording starts automatically when the C15 is switched on, or if the user has to start it by the Record Button (see chapter *6. Recorder* for more details).

System Info

Device Name
The Device Name of the C15 instrument can be chosen by the user. It will appear in the meta data of presets and determine the SSID of the Wi-Fi network. In order to complete the renaming process, restart the instrument afterwards.

SSID [Panel Unit only]
During the booting process, the SSID will be generated according to the Device Name. A Wi-Fi network with the SSID should be available after booting. Besides the Device Name, the SSID contains a static prefix („NL-C15-“). When establishing a Wi-Fi connection, choose the network with the corresponding SSID.

Passphrase
The secured Wi-Fi connection has to be confirmed by a passphrase. This passphrase can be seen and changed in the System Info (effective after rebooting). The passphrase can be set manually, it can be randomly generated or set to default (88888888).

Website Address [Panel Unit only]
When a Wi-Fi connection was established, the Graphical User Interface is available with the shown address, which can be typed into your browser's address bar.

Date / Time
The C15 is equipped with an internal hardware clock that is factory set to the current local time (Berlin = UTC+1 / UTC+2). This time can be adjusted via the Date/Time setting. It should be noted that the setting only acts as an offset, which is added to the time of the hardware clock.

CPU Usage
The CPU Usage entry shows three different CPU load values: lowest value, current value (averaged over the last 250ms) and peak value.

Free Disk Space
The remaining free disk space is displayed in order to see, if the instrument is capable of holding more presets.

RAM usage [Panel Unit only]
For developers, the system's current RAM consumption is indicated.

Software Version
(Device Hardware ID, Branch, Head, Commits, Commit Date, RT Version)
For developers, the Device Hardware ID and versions of integrated components are displayed as well.

Date/Time
The instrument contains its own system clock, which will be included in preset meta data in the form of timestamps. It can be adjusted as well.

Update Available [Panel Unit only]
If a USB stick with a new (not already installed) update file is connected to the C15, this entry will indicate this with "*Yes*". When restarting the C15, the update will be installed.

Buffer Underruns [Panel Unit only]
For developers, the number of detected Audio buffer underruns is indicated, hinting at performance issues.

Upload Software Update [Gaphical UI only]
If an external device is connected to the C15, a software update file can be directly uploaded. The C15 will then restart and install the update.

About [Hardware UI, Graphical UI]

In the About section, the Nonlinear Labs developer team is listed.

Backup [Panel Unit only]

USB Available
In order to backup all banks or restore a preexisting backup, a USB stick has to be plugged in. The "*USB Available*" indicator shows if a USB stick is currently present.

Save all Banks
When entering the "*Save all Banks*" option, a dialog will indicate that this process may take a while (when many banks are present) and ask for confirmation. After confirming, a backup file will be created on the USB stick.

Restore all Banks
When entering the "*Restore all Banks*" option, a dialog will indicate that all present banks will be discarded when proceeding. After confirming, another dialog screen will provide a list of all backup files found on the USB stick. After selecting the right file, the backup process can be started by confirming.

> ⚠ *Details on how to save or restore backups on the Graphical User Interface can be found in chapter 4.1.4 Backups.*

9. Updating the C15

⚠ **Before starting an Update:**
Please save your preset banks before installing the update!

The most convenient way is to use the menu entry "*Save all Banks as Backup File...*" in the Graphical UI or with "*Backup and Save all Banks*" in the Setup menu in the Panel Unit Display. For more information, see *4.1.4 Backups*.

Steps to proceed

- The latest installer is offered on
  www.nonlinear-labs.de/support/updates/updates.html
  By clicking its button you download the file "nonlinear-c15-update.tar" to your computer.
- Your computer might offer to unpack this type of file. Please make sure that the file is NOT unpacked or changed in any way.

When using the C15 USB Stick	When using the Graphical User Interface
Copy the file "nonlinear-c15-update.tar" to the root folder of the USB memory stick that was delivered with the C15. (Other memory sticks will only work if they have the FAT32 format.) Switch off the C15 and plug the memory stick into the USB connector at the backside of the C15. Switch on the C15. The update process will start automatically.	Open the Setup Window in the Graphical User Interface and navigate to the Symstem Info tab. The file "nonlinear-c15-update.tar" can be directly uploaded from your computer by clicking on the corresponding button next to the Upload Software Update option. Once the file was successfully uploaded, the C15 will automatically restart and start the update process. The update process may take several minutes. The Panel Unit Display will indicate different phases of the process by showing "*Updating...*" messages.

⚠ *Do not power off the C15 during the update installation! An interruption of the power in this phase can cause irreversible damage.*

- When the update is finished, the display will show: "*Updating C15 DONE! Please restart!*" Please switch off the instrument, (remove the memory stick) and switch it on again

Further Notes on Updates

⚠ *If you update from version 21-02 you might get the error message "Updating C15 FAILED" during the installation. In this case the installer needs to be run a second time. Please restart the C15 without removing the USB stick. Now the update should be successful.*

⚠ *After a successful update the file on the memory stick is automatically renamed to "nonlinear-c15- update.tar-copied". Please delete this file before using the stick for another update.*

All downloaded update files have identical names “nonlinear-c15-update.tar”. This is the file name required by the C15 to detect an update on the memory stick. If there is an earlier update file with this name in the download folder of your browser, the name of the new update will be modified (e.g. by adding “-1”. Therefore please check if the file has been renamed and restore the original name. It is recommended to remove all C15 update files from the download folder.

If you want to store different updates on your computer, please keep them in separate folders or rename them, so that you can identify them later.

You can check the current software versions in the “*System Info*” section of the Setup Menu. For this press the **Setup Button** on the Edit Panel or the “*Setup*” entry in the View Menu of the Graphical User Interface and select “*System Info*”. Here you find the “*Software Version*”. It shows the release date as well as year and week in the format YY-WW (e.g. 20-40 - week 40 in year 2020).

⚠ *If a “FAILED” message appears in the display, the update was not successful. In this case please repeat the installation. Rename the installer file to the original name “nonlinear-c15-update.tar”, plug in the USB stick and start the C15 again. If this is without success please contact us. On the USB stick you will find a log file (“nonlinear-c15-update.log.txt”) which you can send us to help us analyzing the problem.*

10. Specifications

Synthesis Engine

- 2 Oscillators (sine wave, adjustable jitter/noise)
- Phase modulation: Self, A > B, B > A, via the Shapers, and by the feedback signal
- 2 Shapers (sine curve, adjustable folding and asymmetry)
- Ring Modulator
- Comb Filter (tunable, with allpass and lowpass)
- State Variable Filter (2 - 4 poles, multi-mode, spread cutoffs, FM)
- Feedback Mixer (4 inputs, shaper for the sum)
- Feedback bus with 4 destinations
- Output Mixer (4 inputs, stereo output, shaper for the sum)
- 3 ADBDSR Envelopes, adjustable Attack Curve
- Velocity amounts for envelope levels and all times
- Note-off velocity can be applied to the release times
- Up to 48 voices of polyphony
- Split and Layer modes for two Parts of 12 voices
- Unison: 2 - 24 voices, adjustable detune, phase and pan spreading
- Monophonic mode, adjustable priority, legato modes, and glide time
- Micro-tuning for the 12 steps of the octave
- 5 Stereo Effects:
  - Flanger/Chorus/Phaser/Tremolo
  - Cabinet (amp simulation)
  - 8-pol Gap/Band Filter
  - Echo
  - Reverb
- Parameter resolution: typically 1000 steps (250-15000 steps)
- 6 Macro Controls, each can be routed to up to 106 target parameters
- 96kHz internal sampling rate (24-voice polyphony)

Keys and Controls

- 61-key Fatar TP/8S keybed with semi-weighted long-arm keys
- Two 800 mm ribbons (touch strips), each with 33 LEDs
- Ribbon modes: absolute, relative, combinable with return-to-center
- Lever (magnetic force loaded) for pitchbending and similar applications
- Aftertouch (global)
- Polyphonic Aftertouch via MIDI
- Resolution of velocity, ribbons, bender, aftertouch, pedals: 4000 steps
- Free mapping of pedals, ribbons, bender and aftertouch to the 6 Macro Controls

User Interface

- 96 high-quality buttons for quick access to all parameters
- Magnetic front panel foils are replaceable to support future synthesis engines
- The base unit can be used without the panel unit
- Graphical user interface, available in the browser on WiFi-enabled devices
- Designed for mouse and touch input, unique zoom-and-pan navigation
- Drag and drop handling of presets

Preset System

- Unlimited number of banks and presets per bank
- User-editable comment and color tag per preset
- Functions for searching and comparing presets
- Morphing transition between presets

Undo System

- Unlimited undo for all user interactions, including sound editing steps
- Undo list with support for multiple editing branches (tree view)
- Change indication and comparison with the original parameter value

Continuous Digital Audio Capture

- Permanent lossless recording of the digital output signal
- Hours of FLAC-compressed audio (at least 80 min) stored in a ring buffer
- Browser-based graphical UI for review, play-back and download
- The states of the synth engine along the time line can be restored
- Download of selected segments to the computer as WAV or FLAC files

Connections

- Stereo line outputs, balanced by transformers (TRS and XLR connectors)
- Headphones output at the front with separate volume control
- Four inputs for pedals, switches or CV (TRS, flexible pin-assignment)
- USB host connector for data storage, software updates, and MIDI
- Directly connectable to USB MIDI devices
- Optional MIDI Bridge accessory for connection to a computer
- High resolution (14-bit) option for MIDI velocities and control values

Dimensions, Weight

- Base unit only: 900 x 290 x 100 mm (width x depth x height), 10.5 kg
- Including panel unit: 900 x 410 x 160 mm (width x depth x height), 13.5 kg

11. Shortcuts for the Graphical User Interface

UI Components

Ctrl + P	show/hide Presets
Ctrl + E	show/hide Parameters

Tabs

Shift + P	show/hide Preset tab
Shift + E	show/hide Parameter tab
Shift + N	show/hide Sound tab

Windows

I	show/hide Parameter Info window
P	show/hide Preset Info window
B	show/hide Bank Info window
U	show/hide Undo History window

Context Menus

Ctrl + Click *or*	
Long Touch *or*	
Right Mousebutton	open the local context menu
Esc	close the local context menu

Banks/Presets

Right Arrow	select next Bank
Left Arrow	select previous Bank
Down Arrow	select next Preset
Up Arrow	select previous Preset
Mousewheel on bank in Preset tab	select previous/next preset (depends on direction)
Enter	load/reload selected Preset
Del	delete the selected Preset(s)
D	enable/disable Direct Load (and open the Preset toolbar)
Shift + Click on Preset	start Multiple Selection
Click on background	finish Multiple Selection (and restore the previous selection)
Shift + Mouse frame	select multiple Presets

Preset Store

S	activate Store Select mode (and open the Preset tab)
Enter	apply Store (and finish the Store Select mode)
Ctrl + S	store Preset at current position
	(depending on Append/Insert/Overwrite)

Rename

R	open the Rename dialog
Enter	Apply (and close the dialog)
Esc	Cancel (and close the dialog)

Parameter Editing

K	increment value, coarse
Shift + K	increment value, fine
M	decrement value, coarse
Shift + M	decrement value, fine
Double Click	set to Default value
Drag on parameter	adjust parameter control position
Mousewheel on Parameter tab	adjust selected parameter control position

Search

F	open Preset Search dialog
Esc	finish Search (and close the dialog)

Undo/Redo

Ctrl + Z	Undo
Ctrl + Y	Redo

Help

Ctrl + H	open HTML Help (in new browser tab)

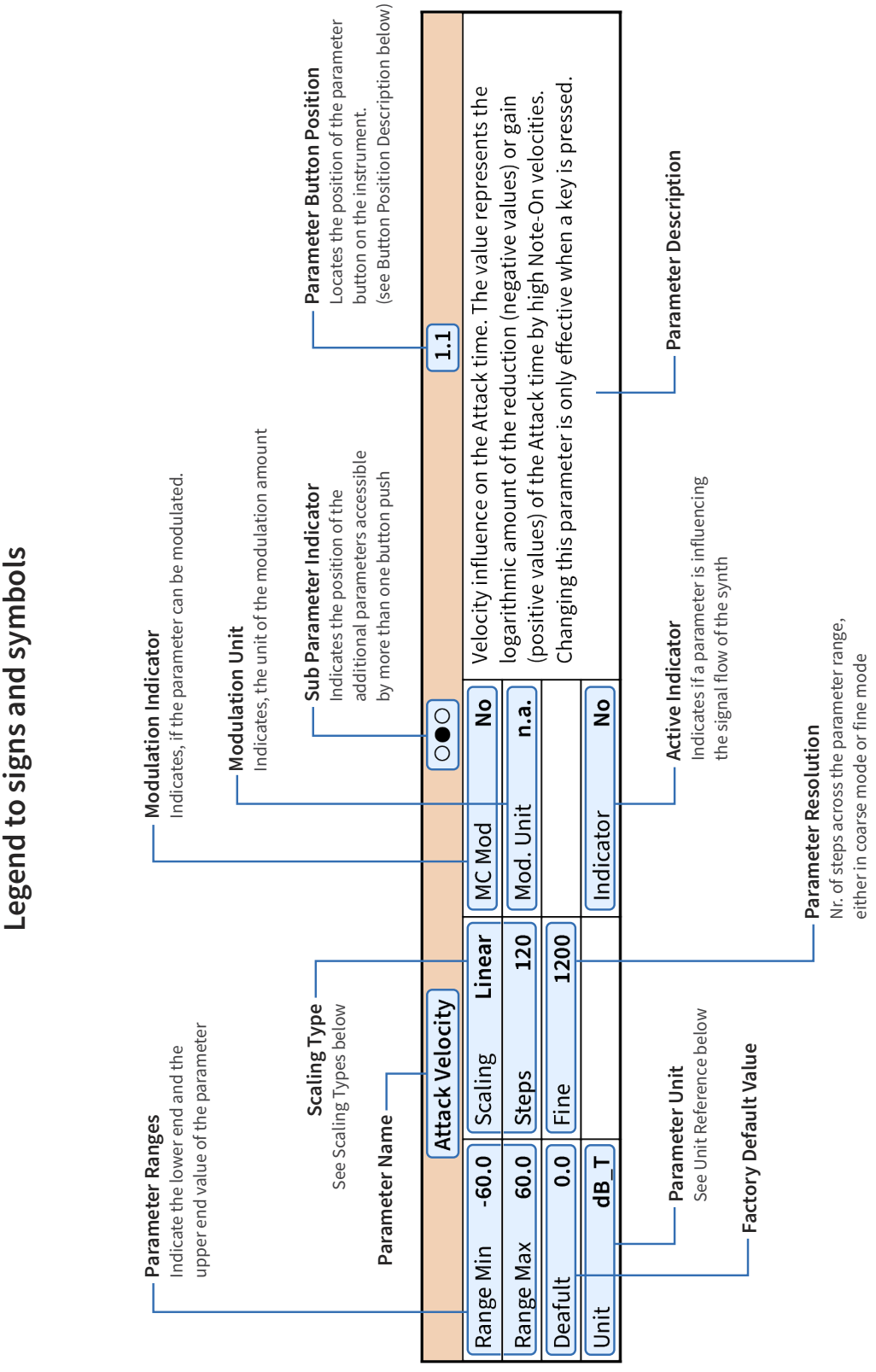
Panning

Space + Drag	temporarily lock the interface (parameters/banks) in order to allow panning gestures on them

Zooming

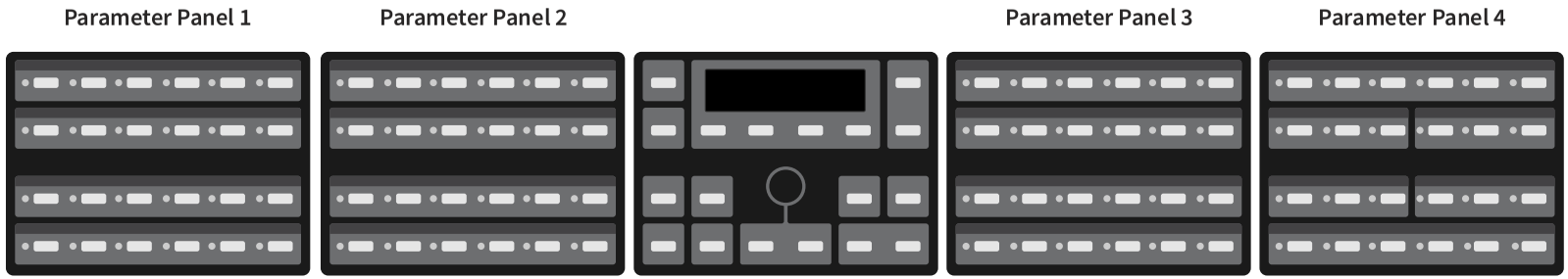
Double Click on background	1st time: zoom to standard position and scale
	2nd time: back to last zoom position and scale
Double Click on group header	1st time: zoom group to fullscreen
	2nd time: back to last zoom position and scale
Mousewheel on main area	adjust zoom level directly

Legend to signs and symbols

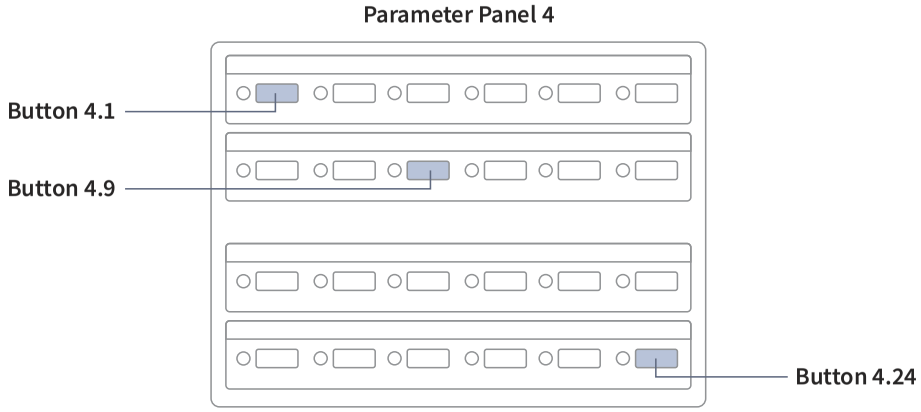


Button Position Description

On each of the 4 Parameter Panels you find 24 Parameter Selection Buttons



Button positions are defined in the format `Panel.Position` where:
`Panel` ranges from 1 to 4 and is associated to the Parameter Panel.
`Position` ranges from 1 to 24 and is associated to the Parameter button position on the panel (1 to 6 for the first line, 7 to 12 for the second line, ...)



Envelope A – 1/2

Parameter Name	Sub. Par.	Button No.

Attack Time					●○○	1.1
Range Min	**0.000**	Scaling	**Expon.**	MC Mod	**Yes**	Time of the (polynomial) Attack segment in milliseconds.
Range Max	**16000**	Steps	**100**	Mod. Unit	**%**	
Default	**0.000**	Fine	**1000**			
Unit	**ms**			Indicator	**No**	

Attack Velocity					○●○	1.1
Range Min	**-60.0**	Scaling	**Linear**	MC Mod	**No**	Velocity influence on the Attack time. The value represents the logarithmic amount of the reduction (negative values) or gain (positive values) of the Attack time by high Note-On velocities. Changing this parameter is only effective when a key is pressed.
Range Max	**60.0**	Steps	**120**	Mod. Unit	**n.a.**	
Default	**0.0**	Fine	**1200**			
Unit	**dB_T**			Indicator	**No**	

Attack Curve					○○●	1.1
Range Min	**-100.0**	Scaling	**Linear**	MC Mod	**Yes**	Curvature of the (polynomial) Attack segment. (negative: decelerating slope, zero: linear, positive: accelerating slope) Changing this parameter is only effective when a key is pressed.
Range Max	**100.0**	Steps	**200**	Mod. Unit	**%**	
Default	**0.0**	Fine	**2000**			
Unit	**%**			Indicator	**No**	

Decay 1 Time					●○	1.2
Range Min	**0.000**	Scaling	**Expon.**	MC Mod	**Yes**	Time of the first (linear) Decay segment in milliseconds.
Range Max	**16000**	Steps	**100**	Mod. Unit	**%**	
Default	**118**	Fine	**1000**			
Unit	**ms**			Indicator	**No**	

Decay 1 Velocity					○●	1.2
Range Min	**-60.0**	Scaling	**Linear**	MC Mod	**No**	Velocity influence on the Decay 1 time. The value represents the logarithmic amount of the reduction (negative values) or gain (positive values) of the Decay 1 time by high Note-On velocities. Changing this parameter is only effective when a key is pressed.
Range Max	**60.0**	Steps	**120**	Mod. Unit	**n.a.**	
Default	**0.0**	Fine	**1200**			
Unit	**dB_T**			Indicator	**No**	

Breakpoint Level						1.3
Range Min	**0.0**	Scaling	**Linear**	MC Mod	**Yes**	Level of the Breakpoint between the two Decay segments.
Range Max	**100**	Steps	**100**	Mod. Unit	**%**	
Default	**50.0**	Fine	**1000**			
Unit	**%**			Indicator	**No**	

Decay 2 Time					●○	1.4
Range Min	**0.000**	Scaling	**Expon.**	MC Mod	**Yes**	Time of the second (exponential) Decay segment in milliseconds.
Range Max	**16000**	Steps	**100**	Mod. Unit	**%**	
Default	**1290**	Fine	**1000**			
Unit	**ms**			Indicator	**No**	

Decay 2 Velocity					○●	1.4
Range Min	**-60.0**	Scaling	**Linear**	MC Mod	**No**	Velocity influence on the Decay 2 time. The value represents the logarithmic amount of the reduction (negative values) or gain (positive values) of the Decay 2 time by high Note-On velocities. Changing this parameter is only effective when a key is pressed.
Range Max	**60.0**	Steps	**120**	Mod. Unit	**n.a.**	
Default	**0.0**	Fine	**1200**			
Unit	**dB_T**			Indicator	**No**	

Envelope A – 2/2

Parameter Name	Sub. Par.	Button No.

Sustain Level					●○	1.5
Range Min	**0.0**	Scaling	**Linear**	MC Mod	**Yes**	Sustain level (target of the second Decay segment).
Range Max	**100.0**	Steps	**100**	Mod. Unit	**%**	
Default	**0.0**	Fine	**1000**			
Unit	**%**			Indicator	**Yes**	

Elevate T - A					○●	1.5
Range Min	**-100.0**	Scaling	**Linear**	MC Mod	**Yes**	Transforms the breakpoints of the Envelope signal, becoming more and more a flat organ-like curve towards the control's edges. At negative values, the Timbre part will be affected, controlling Phase Modulations and Shaper Drives. At positive values, the Amplitude part will be affected.
Range Max	**100.0**	Steps	**200**	Mod. Unit	**%**	
Default	**0.0**	Fine	**2000**			
Unit	**%**			Indicator	**No**	

Release Time					●○	1.6
Range Min	**0.000**	Scaling	**Expon.**	MC Mod	**Yes**	Time of the (exponential) Release segment in milliseconds (infinite at maximum).
Range Max	**inf**	Steps	**101**	Mod. Unit	**%**	
Default	**60.8**	Fine	**1010**			
Unit	**ms**			Indicator	**No**	

Release Velocity					○●	1.6
Range Min	**-60.0**	Scaling	**Linear**	MC Mod	**No**	Velocity influence on the Release time. The value represents the logarithmic amount of the reduction (negative values) or gain (positive values) of the Release time by high Note-Off velocities. Changing this parameter is only effective when a key is released.
Range Max	**60.0**	Steps	**120**	Mod. Unit	**n.a.**	
Default	**0.0**	Fine	**1200**			
Unit	**dB_T**			Indicator	**No**	

Level Velocity						1.10
Range Min	**-60.0**	Scaling	**Linear**	MC Mod	**No**	Influence of the key velocity on the peak, breakpoint and sustain levels of the envelope [maximum dynamic range in dB]. Changing this parameter is only effective when a key is pressed.
Range Max	**60.0**	Steps	**120**	Mod. Unit	**n.a.**	
Default	**30.0**	Fine	**1200**			
Unit	**dB**			Indicator	**No**	

Level Key Trk					●○	1.11
Range Min	**-1.000**	Scaling	**Linear**	MC Mod	**No**	Key tracking of the envelope's peak, breakpoint and sustain levels [dB per semitone]. Positive values: higher levels for higher notes (+1.0 = +12 dB per octave). Negative values: lower levels for higher notes (-1.0 = -12 dB per octave). Origin at C3 = 60 semitones. Changing this parameter is only effective when a key is pressed.
Range Max	**1.000**	Steps	**200**	Mod. Unit	**n.a.**	
Default	**0.000**	Fine	**2000**			
Unit	**dB/st**			Indicator	**No**	

Time Key Trk					○●	1.11
Range Min	**-100.0**	Scaling	**Linear**	MC Mod	**No**	Key tracking of the attack, decay and release times. The value determines time reduction (positive values) or gain (negative values) for higher notes. Changing this parameter is only effective when a key is pressed.
Range Max	**100.0**	Steps	**200**	Mod. Unit	**n.a.**	
Default	**5.0**	Fine	**2000**			
Unit	**%**			Indicator	**No**	

Gain						1.12
Range Min	**-24.00**	Scaling	**Linear**	MC Mod	**Yes**	Gain [in dB] of the envelope signal. As this signal modulates the Oscillator and Shaper A, the Gain influences the level and the amount of phase modulation and distortion.
Range Max	**24.00**	Steps	**96**	Mod. Unit	**dB**	
Default	**0.00**	Fine	**960**			
Unit	**dB**			Indicator	**Yes**	

Envelope C – 1/2

Parameter Name	Sub. Par.	Button No.

Attack Time					●○○○	1.7
Range Min	**0.000**	Scaling	**Expon.**	MC Mod	**Yes**	Time of the (polynomial) Attack segment in milliseconds.
Range Max	**16000**	Steps	**100**	Mod. Unit	**%**	
Default	**0.000**	Fine	**1000**			
Unit	**ms**			Indicator	**No**	

Attack Velocity					○●○○	1.7
Range Min	**-60.0**	Scaling	**Linear**	MC Mod	**No**	Velocity influence on the Attack time. The value represents the logarithmic amount of the reduction (negative values) or gain (positive values) of the Attack time by high Note-On velocities. Changing this parameter is only effective when a key is pressed.
Range Max	**60.0**	Steps	**120**	Mod. Unit	**n.a.**	
Default	**0.0**	Fine	**1200**			
Unit	**dB_T**			Indicator	**No**	

Attack Curve					○○●○	1.7
Range Min	**-100.0**	Scaling	**Linear**	MC Mod	**Yes**	Curvature of the (polynomial) Attack segment. (negative: decelerating slope, zero: linear, positive: accelerating slope) Changing this parameter is only effective when a key is pressed.
Range Max	**100.0**	Steps	**200**	Mod. Unit	**%**	
Default	**0.0**	Fine	**2000**			
Unit	**%**			Indicator	**No**	

Retrig Hardness					○○○●	1.7
Range Min	**0.0**	Scaling	**Linear**	MC Mod	**No**	Determines how much the Envelope signal is forced to start at zero instead of the current level (usually from the Release phase). At 100.0 % the Envelope always starts at zero, independent from the previous signal level. Changing this parameter is only effective when a key is pressed.
Range Max	**100.0**	Steps	**100**	Mod. Unit	**n.a.**	
Default	**0.0**	Fine	**1000**			
Unit	**%**			Indicator	**No**	

Decay 1 Time					●○○	1.8
Range Min	**0.000**	Scaling	**Expon.**	MC Mod	**Yes**	Time of the first (linear) Decay segment in milliseconds.
Range Max	**16000**	Steps	**100**	Mod. Unit	**%**	
Default	**118**	Fine	**1000**			
Unit	**ms**			Indicator	**No**	

Decay 1 Velocity					○●○	1.8
Range Min	**-60.0**	Scaling	**Linear**	MC Mod	**No**	Velocity influence on the Decay 1 time. The value represents the logarithmic amount of the reduction (negative values) or gain (positive values) of the Decay 1 time by high Note-On velocities. Changing this parameter is only effective when a key is pressed.
Range Max	**60.0**	Steps	**120**	Mod. Unit	**n.a.**	
Default	**0.0**	Fine	**1200**			
Unit	**dB_T**			Indicator	**No**	

Breakpoint Level					○○●	1.8
Range Min	**-100.0**	Scaling	**Linear**	MC Mod	**Yes**	Level of the Breakpoint between the two Decay segments.
Range Max	**100.0**	Steps	**200**	Mod. Unit	**%**	
Default	**50.0**	Fine	**2000**			
Unit	**%**			Indicator	**No**	

Decay 2 Time					●○○○	1.9
Range Min	**0.000**	Scaling	**Expon.**	MC Mod	**Yes**	Time of the second (exponential) Decay segment in milliseconds.
Range Max	**16000**	Steps	**100**	Mod. Unit	**%**	
Default	**1290**	Fine	**1000**			
Unit	**ms**			Indicator	**No**	

Envelope C – 2/2

Parameter Name	Sub. Par.	Button No.

Decay 2 Velocity					○●○○	1.9
Range Min	**-60.0**	Scaling	**Linear**	MC Mod	**No**	Velocity influence on the Decay 2 time. The value represents the logarithmic amount of the reduction (negative values) or gain (positive values) of the Decay 2 time by high Note-On velocities. Changing this parameter is only effective when a key is pressed.
Range Max	**60.0**	Steps	**120**	Mod. Unit	**n.a.**	
Default	**0.0**	Fine	**1200**			
Unit	**dB_T**			Indicator	**No**	

Sustain Level					○○●○	1.9
Range Min	**-100.0**	Scaling	**Linear**	MC Mod	**Yes**	Sustain level (bipolar, target of the second Decay segment).
Range Max	**100.0**	Steps	**200**	Mod. Unit	**%**	
Default	**0.0**	Fine	**2000**			
Unit	**%**			Indicator	**Yes**	

Loop					○○○●	1.9
Range Min	**0.0**	Scaling	**Linear**	MC Mod	**Yes**	Determines the presence and decay speed of looped envelope segments (Decay 1 and 2). 0%: no looped segments, normal envelope behavior with an exponential Decay 1 segment. <= 100%: the loop will repeat and approach zero until a pressed key is released. Smaller Loop values produce a faster loop decay. At 100%, the loop will repeat indefinitely. After releasing a pressed key, the normal Release segment will start. The Decay 2 segment is
Range Max	**200.0**	Steps	**200**	Mod. Unit	**%**	
Default	**0.0**	Fine	**2000**			
Unit	**%**			Indicator	**Yes**	

Release Time					●○	1.13
Range Min	**0.000**	Scaling	**Expon.**	MC Mod	**Yes**	Time of the (exponential) Release segment in milliseconds (infinite at maximum).
Range Max	**inf**	Steps	**101**	Mod. Unit	**%**	
Default	**60.8**	Fine	**1010**			
Unit	**ms**			Indicator	**No**	

Release Velocity					○●	1.13
Range Min	**-60.0**	Scaling	**Linear**	MC Mod	**No**	Velocity influence on the Release time. The value represents the logarithmic amount of the reduction (negative values) or gain (positive values) of the Release time by high Note-Off velocities. Changing this parameter is only effective when a key is released.
Range Max	**60.0**	Steps	**120**	Mod. Unit	**n.a.**	
Default	**0.0**	Fine	**1200**			
Unit	**dB_T**			Indicator	**No**	

Level Velocity						1.14
Range Min	**-60.0**	Scaling	**Linear**	MC Mod	**No**	Influence of the key velocity on the peak, breakpoint and sustain levels of the envelope [maximum dynamic range in dB]. Changing this parameter is only effective when a key is pressed.
Range Max	**60.0**	Steps	**120**	Mod. Unit	**n.a.**	
Default	**30.0**	Fine	**1200**			
Unit	**dB**			Indicator	**No**	

Level Key Trk					●○	1.15
Range Min	**-1.000**	Scaling	**Linear**	MC Mod	**No**	Key tracking of the envelope's peak, breakpoint and sustain levels [dB per semitone]. Positive values: higher levels for higher notes (+1.0 = +12 dB per octave). Negative values: lower levels for higher notes (-1.0 = -12 dB per octave). Origin at C3 = 60 semitones. Changing this parameter is only
Range Max	**1.000**	Steps	**200**	Mod. Unit	**n.a.**	
Default	**0.000**	Fine	**2000**			
Unit	**dB/st**			Indicator	**No**	

Time Key Trk					○●	1.15
Range Min	**-100.0**	Scaling	**Linear**	MC Mod	**No**	Key tracking of the attack, decay and release times. The value determines time reduction (positive values) or gain (negative values) for higher notes. Changing this parameter is only effective when a key is pressed.
Range Max	**100.0**	Steps	**200**	Mod. Unit	**n.a.**	
Default	**5.0**	Fine	**2000**			
Unit	**%**			Indicator	**No**	

Envelope B – 1/2

Parameter Name	Sub. Par.	Button No.

Level Velocity						1.16
Range Min	**0.0**	Scaling	**Linear**	MC Mod	**No**	Influence of the key velocity on the peak, breakpoint and sustain levels of the envelope [maximum dynamic range in dB]. Changing this parameter is only effective when a key is pressed.
Range Max	**60.0**	Steps	**120**	Mod. Unit	**n.a.**	
Default	**30.0**	Fine	**1200**			
Unit	**dB**			Indicator	**No**	

Level Key Trk					●○	1.17
Range Min	**-1.000**	Scaling	**Linear**	MC Mod	**No**	Key tracking of the envelope's peak, breakpoint and sustain levels [dB per semitone]. Positive values: higher levels for higher notes (+1.0 = +12 dB per octave). Negative values: lower levels for higher notes (-1.0 = -12 dB per octave). Origin at C3 = 60 semitones. Changing this parameter is only effective when a key is pressed.
Range Max	**1.000**	Steps	**200**	Mod. Unit	**n.a.**	
Default	**0.000**	Fine	**2000**			
Unit	**dB/st**			Indicator	**No**	

Time Key Trk					○●	1.17
Range Min	**-100.0**	Scaling	**Linear**	MC Mod	**No**	Key tracking of the attack, decay and release times. The value determines time reduction (positive values) or gain (negative values) for higher notes. Changing this parameter is only effective when a key is pressed.
Range Max	**100.0**	Steps	**200**	Mod. Unit	**n.a.**	
Default	**5.0**	Fine	**2000**			
Unit	**%**			Indicator	**No**	

Gain						1.18
Range Min	**-24.0**	Scaling	**Linear**	MC Mod	**Yes**	Gain [in dB] of the envelope signal. As this signal modulates the Oscillator and Shaper A, the Gain influences the level and the amount of phase modulation and distortion.
Range Max	**24.0**	Steps	**96**	Mod. Unit	**dB**	
Default	**0.0**	Fine	**960**			
Unit	**dB**			Indicator	**Yes**	

Attack Time					●○○	1.19
Range Min	**0.000**	Scaling	**Expon.**	MC Mod	**Yes**	Time of the (polynomial) Attack segment in milliseconds.
Range Max	**16000**	Steps	**100**	Mod. Unit	**%**	
Default	**0.000**	Fine	**1000**			
Unit	**ms**			Indicator	**No**	

Attack Velocity					○●○	1.19
Range Min	**-60.0**	Scaling	**Linear**	MC Mod	**No**	Velocity influence on the Attack time. The value represents the logarithmic amount of the reduction (negative values) or gain (positive values) of the Attack time by high Note-On velocities. Changing this parameter is only effective when a key is pressed.
Range Max	**60.0**	Steps	**120**	Mod. Unit	**n.a.**	
Default	**0.0**	Fine	**1200**			
Unit	**dB_T**			Indicator	**No**	

Attack Curve					○○●	1.19
Range Min	**-100.0**	Scaling	**Linear**	MC Mod	**Yes**	Curvature of the (polynomial) Attack segment. (negative: decelerating slope, zero: linear, positive: accelerating slope) Changing this parameter is only effective when a key is pressed.
Range Max	**100.0**	Steps	**200**	Mod. Unit	**%**	
Default	**0.0**	Fine	**2000**			
Unit	**%**			Indicator	**No**	

Decay 1 Time					●○	1.20
Range Min	**0.000**	Scaling	**Expon.**	MC Mod	**Yes**	Time of the first (linear) Decay segment in milliseconds.
Range Max	**16000**	Steps	**100**	Mod. Unit	**%**	
Default	**118**	Fine	**1000**			
Unit	**ms**			Indicator	**No**	

Envelope B – 2/2

Parameter Name	Sub. Par.	Button No.

Decay 1 Velocity					○●	1.20
Range Min	**-60.0**	Scaling	**Linear**	MC Mod	**No**	Velocity influence on the Decay 1 time. The value represents the logarithmic amount of the reduction (negative values) or gain (positive values) of the Decay 1 time by high Note-On velocities. Changing this parameter is only effective when a key is pressed.
Range Max	**60.0**	Steps	**120**	Mod. Unit	**n.a.**	
Default	**0.0**	Fine	**1200**			
Unit	**dB_T**			Indicator	**No**	

Breakpoint Level						1.21
Range Min	**0.0**	Scaling	**Linear**	MC Mod	**Yes**	Level of the Breakpoint between the two Decay segments.
Range Max	**100.0**	Steps	**100**	Mod. Unit	**%**	
Default	**50.0**	Fine	**1000**			
Unit	**%**			Indicator	**No**	

Decay 2 Time					●○	1.22
Range Min	**0.000**	Scaling	**Expon.**	MC Mod	**Yes**	Time of the second (exponential) Decay segment in milliseconds.
Range Max	**16000**	Steps	**100**	Mod. Unit	**%**	
Default	**1290**	Fine	**1000**			
Unit	**ms**			Indicator	**No**	

Decay 2 Velocity					○●	1.22
Range Min	**-60.0**	Scaling	**Linear**	MC Mod	**No**	Velocity influence on the Decay 2 time. The value represents the logarithmic amount of the reduction (negative values) or gain (positive values) of the Decay 2 time by high Note-On velocities. Changing this parameter is only effective when a key is pressed.
Range Max	**60.0**	Steps	**120**	Mod. Unit	**n.a.**	
Default	**0.0**	Fine	**1200**			
Unit	**dB_T**			Indicator	**No**	

Sustain Level					●○	1.23
Range Min	**0.0**	Scaling	**Linear**	MC Mod	**Yes**	Sustain level (target of the second Decay segment).
Range Max	**100.0**	Steps	**100**	Mod. Unit	**%**	
Default	**0.0**	Fine	**1000**			
Unit	**%**			Indicator	**Yes**	

Elevate T - A					○●	1.23
Range Min	**-100.0**	Scaling	**Linear**	MC Mod	**Yes**	Transforms the breakpoints of the Envelope signal, becoming more and more a flat organ-like curve towards the control's edges. At negative values, the Timbre part will be affected, controlling Phase Modulations and Shaper Drives. At positive values, the Amplitude part will be affected.
Range Max	**100.0**	Steps	**200**	Mod. Unit	**%**	
Default	**0.0**	Fine	**2000**			
Unit	**%**			Indicator	**No**	

Release Time					●○	1.24
Range Min	**0.000**	Scaling	**Expon.**	MC Mod	**Yes**	Time of the (exponential) Release segment in milliseconds (infinite at maximum).
Range Max	**inf**	Steps	**101**	Mod. Unit	**%**	
Default	**60.8**	Fine	**1010**			
Unit	**ms**			Indicator	**No**	

Release Velocity					○●	1.24
Range Min	**-60.0**	Scaling	**Linear**	MC Mod	**No**	Velocity influence on the Release time. The value represents the logarithmic amount of the reduction (negative values) or gain (positive values) of the Release time by high Note-Off velocities. Changing this parameter is only effective when a key is released.
Range Max	**60.0**	Steps	**120**	Mod. Unit	**n.a.**	
Default	**0.0**	Fine	**1200**			
Unit	**dB_T**			Indicator	**No**	

Oscillator A – 1/2

Parameter Name	Sub. Par.	Button No.

Pitch					●○○	2.1
Range Min	**-20.00**	Scaling	**Linear**	MC Mod	**Yes**	Pitch (logarithmic frequency) of Oscillator A at C3 (MIDI note 60) [in semitones, based on MIDI note numbers]. The range below zero is shaped in the way that -20 corresponds to 0 Hz.
Range Max	**130.00**	Steps	**150**	Mod. Unit	**st**	
Default	**60.00**	Fine	**15000**			
Unit	**st**			Indicator	**No**	

Pitch - Env C					○●○	2.1
Range Min	**-80.00**	Scaling	**Linear**	MC Mod	**Yes**	Amount of pitch modulation by Envelope C [in semitones].
Range Max	**80.00**	Steps	**160**	Mod. Unit	**st**	
Default	**0.00**	Fine	**16000**			
Unit	**st**			Indicator	**No**	

Pitch - Key Trk					○○●	2.1
Range Min	**0.00**	Scaling	**Linear**	MC Mod	**Yes**	Key tracking of the oscillator pitch. It's the scaling factor between the key position of a received MIDI note (relative to C3 = 60 semitones) and the pitch of the oscillator. At 100.0 %, the pitch follows the equal-tempered scale (when the Scale group is equal-tempered as well). At values larger than 100.0 %, the tuning will be stretched.
Range Max	**200.00**	Steps	**200**	Mod. Unit	**%**	
Default	**100.00**	Fine	**20000**			
Unit	**%**			Indicator	**No**	

Fluctuation					●○	2.2
Range Min	**0.0**	Scaling	**Linear**	MC Mod	**Yes**	Fluctuation of the oscillator frequency. If the parameter is set larger than 0.0 %, the frequency is changed at the beginning of each oscillation period by a random amount. At 100.0 %, the maximum frequency variation is +/- 95 %.
Range Max	**100.0**	Steps	**100**	Mod. Unit	**%**	
Default	**0.0**	Fine	**1000**			
Unit	**%**			Indicator	**Yes**	

Fluct - Env C					○●	2.2
Range Min	**0.0**	Scaling	**Linear**	MC Mod	**Yes**	Amount of modulation of the frequency fluctuation by Envelope C. At zero, the modulation stays constant, at higher values, the envelope applies a time-variant attenuation.
Range Max	**100.0**	Steps	**100**	Mod. Unit	**%**	
Default	**0.0**	Fine	**1000**			
Unit	**%**			Indicator	**No**	

Phase					●○	2.3
Range Min	**-180.0**	Scaling	**Linear**	MC Mod	**Yes**	Start phase [in degrees]. The Oscillator will be set to this phase position with each Note-On.
Range Max	**180.0**	Steps	**72**	Mod. Unit	**deg**	
Default	**0.0**	Fine	**3600**			
Unit	**deg**			Indicator	**Yes**	

Reset					○●	2.3
Range Min	**off**	Scaling	**n.a.**	MC Mod	**n.a.**	If enabled, the Oscillator will reset its phase everytime the envelopes start (in the corresponding voice). If disabled, the Oscillator is in free-running mode. Changing this parameter is only effective when a key is pressed.
Range Max	**on**	Steps	**n.a.**	Mod. Unit	**n.a.**	
Default	**n.a.**	Fine	**n.a.**			
Unit	**n.a.**			Indicator	**No**	

PM Self					●○○	2.4
Range Min	**-100.0**	Scaling	**Linear**	MC Mod	**Yes**	Amount of phase modulation by Oscillator & Shaper A (local feedback).
Range Max	**100.0**	Steps	**200**	Mod. Unit	**%**	
Default	**0.0**	Fine	**2000**			
Unit	**%**			Indicator	**Yes**	

Oscillator A – 2/2

Parameter Name	Sub. Par.	Button No.

PM Self - Env A					○●○	2.4
Range Min	**100.0**	Scaling	**Linear**	MC Mod	**Yes**	Envelope (A) amount for the phase modulation by Oscillator & Shaper A (local feedback). At zero, the modulation stays constant, at higher values, the envelope applies a time-variant attenuation.
Range Max	**0**	Steps	**100**	Mod. Unit	**%**	
Default	**0.0**	Fine	**1000**			
Unit	**%**			Indicator	**No**	

PM Self - Shaper					○○●	2.4
Range Min	**-100.0**	Scaling	**Linear**	MC Mod	**Yes**	Mix amount of Shaper A in the signal being used for phase modulation (self). At zero, the output signal of Oscillator A is used. At negative values, the signal from the Shaper is inverted.
Range Max	**100.0**	Steps	**200**	Mod. Unit	**%**	
Default	**0.0**	Fine	**2000**			
Unit	**%**			Indicator	**No**	

PM B					●○○	2.5
Range Min	**-100.0**	Scaling	**Linear**	MC Mod	**Yes**	Amount of phase modulation by Oscillator & Shaper B (cross feedback).
Range Max	**100.0**	Steps	**200**	Mod. Unit	**%**	
Default	**0.0**	Fine	**2000**			
Unit	**%**			Indicator	**Yes**	

PM B - Env B					○●○	2.5
Range Min	**-100.0**	Scaling	**Linear**	MC Mod	**Yes**	Envelope (B) amount for the phase modulation by Oscillator & Shaper B (cross feedback). At zero, the modulation stays constant, at higher values, the envelope applies a time-variant attenuation.
Range Max	**0.0**	Steps	**100**	Mod. Unit	**%**	
Default	**0.0**	Fine	**1000**			
Unit	**%**			Indicator	**No**	

PM B - Shaper					○○●	2.5
Range Min	**-100.0**	Scaling	**Linear**	MC Mod	**Yes**	Mix amount of Shaper B in the signal being used for phase modulation (B -> A). At zero, the output signal of Oscillator B is used. At negative values, the signal from the Shaper is inverted.
Range Max	**100.0**	Steps	**200**	Mod. Unit	**%**	
Default	**0.0**	Fine	**2000**			
Unit	**%**			Indicator	**No**	

PM FB					●○○	2.6
Range Min	**-100.0**	Scaling	**Linear**	MC Mod	**Yes**	Amount of phase modulation by the Feedback signal.
Range Max	**100.0**	Steps	**200**	Mod. Unit	**%**	
Default	**0.0**	Fine	**2000**			
Unit	**%**			Indicator	**Yes**	

PM FB - Env C					○●○	2.6
Range Min	**0.0**	Scaling	**Linear**	MC Mod	**Yes**	Envelope (C) amount for the phase modulation by the Feedback signal. At zero, the modulation stays constant, at higher values, the envelope applies a time-variant attenuation.
Range Max	**100.0**	Steps	**100**	Mod. Unit	**%**	
Default	**0.0**	Fine	**1000**			
Unit	**%**			Indicator	**No**	

Chirp					○○●	2.6
Range Min	**20.0**	Scaling	**Linear**	MC Mod	**Yes**	Cutoff frequency [in semitones] of the low-pass filter in the phase modulation (PM) signal path. The filter can be used to reduce the “chirping” (high-frequency ringing and aliasing noise) that occurs with stronger phase modulations. ... [full info on Page 99]
Range Max	**140.0**	Steps	**120**	Mod. Unit	**st**	
Default	**120.0**	Fine	**1200**			
Unit	**st**			Indicator	**No**	

Shaper A

Parameter Name	Sub. Par.	Button No.

Drive					●○	2.7
Range Min	**0.0**	Scaling	**Linear**	MC Mod	**Yes**	Input gain [in dB] of the sine shaper stage. Higher gains will create more distortion and harmonics.
Range Max	**50.0**	Steps	**100**	Mod. Unit	**dB**	
Default	**10.0**	Fine	**500**			
Unit	**dB**			Indicator	**No**	

Drive - Env A					○●	2.7
Range Min	**0.0**	Scaling	**Linear**	MC Mod	**Yes**	Envelope (A) amount for the Drive factor. At zero, the gain stays constant, at higher values, the envelope applies a time-variant attenuation.
Range Max	**100.0**	Steps	**100**	Mod. Unit	**%**	
Default	**0.0**	Fine	**1000**			
Unit	**%**			Indicator	**No**	

Fold						2.8
Range Min	**0.0**	Scaling	**Linear**	MC Mod	**Yes**	Amount of folding back of the shaper curve for high input amplitudes. 0.0 %: flat saturation, no folding 100.0 %: fully folded back (periodic sine curve) A higher amount of folding leads to a softer but more nasal sound.
Range Max	**100.0**	Steps	**100**	Mod. Unit	**%**	
Default	**50.0**	Fine	**1000**			
Unit	**%**			Indicator	**No**	

Asymmetry						2.9
Range Min	**0.0**	Scaling	**Linear**	MC Mod	**Yes**	Asymmetry of the shaper curve, generating even (2nd, 4th, ...) harmonics. At higher values it becomes a parabolic curve that shifts the frequency of the fundamental to its double.
Range Max	**100.0**	Steps	**100**	Mod. Unit	**%**	
Default	**0.0**	Fine	**1000**			
Unit	**%**			Indicator	**No**	

Mix						2.1
Range Min	**-100.0**	Scaling	**Linear**	MC Mod	**Yes**	Mix amount of Shaper A in the signal sent to the Filters and to the Output Mixer. At zero, it is the input signal of the Shaper - behind FB Mix. At negative values, the signal from the Shaper is inverted.
Range Max	**100.0**	Steps	**200**	Mod. Unit	**%**	
Default	**0.0**	Fine	**2000**			
Unit	**%**			Indicator	**Yes**	

FB Mix					●○	2.11
Range Min	**0.0**	Scaling	**Linear**	MC Mod	**Yes**	Crossfades between Oscillator & Shaper A (at zero) and the Feedback signal for the signal A.
Range Max	**100.0**	Steps	**100**	Mod. Unit	**%**	
Default	**0.0**	Fine	**1000**			
Unit	**%**			Indicator	**Yes**	

FB - Gate-Env C					○●	2.11
Range Min	**-100.0**	Scaling	**Linear**	MC Mod	**Yes**	Envelope (C) amount for the Feedback Mix. At zero, only a Gate signal is applied, at higher values, Envelope C is faded in. At negative values, the Gate signal is faded out, allowing for permanent feedback at the minimum.
Range Max	**100.0**	Steps	**200**	Mod. Unit	**%**	
Default	**0.0**	Fine	**2000**			
Unit	**%**			Indicator	**No**	

Ring Mod						2.12
Range Min	**0.0**	Scaling	**Linear**	MC Mod	**Yes**	Mix amount of the ring modulation between both Oscillators & Shapers.
Range Max	**100.0**	Steps	**100**	Mod. Unit	**%**	
Default	**0.0**	Fine	**1000**			
Unit	**%**			Indicator	**Yes**	

Shaper B

Parameter Name | Sub. Par. | Button No.

Drive					●○	2.13
Range Min	**0.0**	Scaling	**Linear**	MC Mod	**Yes**	Input gain [in dB] of the sine shaper stage. Higher gains will create more distortion and harmonics.
Range Max	**50.0**	Steps	**100**	Mod. Unit	**dB**	
Default	**10.0**	Fine	**500**			
Unit	**dB**			Indicator	**No**	

Drive - Env B					○●	2.13
Range Min	**0.0**	Scaling	**Linear**	MC Mod	**Yes**	Envelope (B) amount for the Drive factor. At zero, the gain stays constant, at higher values, the envelope applies a time-variant attenuation.
Range Max	**100.0**	Steps	**100**	Mod. Unit	**%**	
Default	**0.0**	Fine	**1000**			
Unit	**%**			Indicator	**No**	

Fold						2.14
Range Min	**0.0**	Scaling	**Linear**	MC Mod	**Yes**	Amount of folding back of the shaper curve for high input amplitudes. 0.0 %: flat saturation, no folding 100.0 %: fully folded back (periodic sine curve) A higher amount of folding leads to a softer but more nasal sound.
Range Max	**100.0**	Steps	**100**	Mod. Unit	**%**	
Default	**50.0**	Fine	**1000**			
Unit	**%**			Indicator	**No**	

Asymmetry						2.15
Range Min	**0.0**	Scaling	**Linear**	MC Mod	**Yes**	Asymmetry of the shaper curve, generating even (2nd, 4th, ...) harmonics. At higher values it becomes a parabolic curve that shifts the frequency of the fundamental to its double.
Range Max	**100.0**	Steps	**100**	Mod. Unit	**%**	
Default	**0.0**	Fine	**1000**			
Unit	**%**			Indicator	**No**	

Mix						2.16
Range Min	**-100.0**	Scaling	**Linear**	MC Mod	**Yes**	Mix amount of Shaper B in the signal sent to the Filters and to the Output Mixer. At zero, it is the input signal of the Shaper - behind FB Mix. At negative values, the signal from the Shaper is inverted.
Range Max	**100.0**	Steps	**200**	Mod. Unit	**%**	
Default	**0.0**	Fine	**2000**			
Unit	**%**			Indicator	**Yes**	

FB Mix					●○	2.17
Range Min	**0.0**	Scaling	**Linear**	MC Mod	**Yes**	Crossfades between Oscillator & Shaper B (at zero) and the Feedback signal for the signal B.
Range Max	**100.0**	Steps	**100**	Mod. Unit	**%**	
Default	**0.0**	Fine	**1000**			
Unit	**%**			Indicator	**Yes**	

FB - Gate-Env C					○●	2.17
Range Min	**-100.0**	Scaling	**Linear**	MC Mod	**Yes**	Envelope (C) amount for the Feedback Mix. At zero, only a Gate signal is applied, at higher values, Envelope C is faded in. At negative values, the Gate signal is faded out, allowing for permanent feedback at the minimum.
Range Max	**100.0**	Steps	**200**	Mod. Unit	**%**	
Default	**0.0**	Fine	**2000**			
Unit	**%**			Indicator	**No**	

Ring Mod						2.18
Range Min	**0.0**	Scaling	**Linear**	MC Mod	**Yes**	Mix amount of the ring modulation between both Oscillators & Shapers.
Range Max	**100.0**	Steps	**100**	Mod. Unit	**%**	
Default	**0.0**	Fine	**1000**			
Unit	**%**			Indicator	**Yes**	

Oscillator B – 1/2

Parameter Name	Sub. Par.	Button No.

Pitch					●○○	2.19
Range Min	**-20.00**	Scaling	**Linear**	MC Mod	**Yes**	Pitch (logarithmic frequency) of Oscillator B at C3 (MIDI note 60) [in semitones, based on MIDI note numbers]. The range below zero is shaped in the way that -20 corresponds to 0 Hz.
Range Max	**130.00**	Steps	**150**	Mod. Unit	**st**	
Default	**60.00**	Fine	**15000**			
Unit	**st**			Indicator	**No**	

Pitch - Env C					○●○	2.19
Range Min	**-80.00**	Scaling	**Linear**	MC Mod	**Yes**	Amount of pitch modulation by Envelope C [in semitones].
Range Max	**80.00**	Steps	**160**	Mod. Unit	**st**	
Default	**0.00**	Fine	**16000**			
Unit	**st**			Indicator	**No**	

Pitch - Key Trk					○○●	2.19
Range Min	**0.00**	Scaling	**Linear**	MC Mod	**Yes**	Key tracking of the oscillator pitch. It's the scaling factor between the key position of a received MIDI note (relative to C3 = 60 semitones) and the pitch of the oscillator. At 100.0 %, the pitch follows the equal-tempered scale (when the Scale group is equal-tempered as well). At values larger than 100.0 %, the tuning will be stretched.
Range Max	**200.00**	Steps	**200**	Mod. Unit	**%**	
Default	**100.00**	Fine	**20000**			
Unit	**%**			Indicator	**No**	

Fluctuation					●○	2.20
Range Min	**0.00**	Scaling	**Linear**	MC Mod	**Yes**	Fluctuation of the oscillator frequency. If the parameter is set larger than 0.0 %, the frequency is changed at the beginning of each oscillation period by a random amount. At 100.0 %, the maximum frequency variation is +/- 95 %.
Range Max	**100.00**	Steps	**100**	Mod. Unit	**%**	
Default	**0.00**	Fine	**1000**			
Unit	**%**			Indicator	**Yes**	

Fluct - Env C					○●	2.20
Range Min	**0.00**	Scaling	**Linear**	MC Mod	**Yes**	Amount of modulation of the frequency fluctuation by Envelope C. At zero, the modulation stays constant, at higher values, the envelope applies a time-variant attenuation.
Range Max	**100.00**	Steps	**100**	Mod. Unit	**%**	
Default	**0.00**	Fine	**1000**			
Unit	**%**			Indicator	**No**	

Phase					●○	2.21
Range Min	**180.0**	Scaling	**Linear**	MC Mod	**Yes**	Start phase [in degrees]. The Oscillator will be set to this phase position with each Note-On.
Range Max	**180.0**	Steps	**72**	Mod. Unit	**deg**	
Default	**0.0**	Fine	**3600**			
Unit	**deg**			Indicator	**Yes**	

Reset					○●	2.21
Range Min	**off**	Scaling	**n.a.**	MC Mod	**n.a.**	If enabled, the Oscillator will reset its phase everytime the envelopes start (in the corresponding voice). If disabled, the Oscillator is in free-running mode. Changing this parameter is only effective when a key is pressed.
Range Max	**on**	Steps	**n.a.**	Mod. Unit	**n.a.**	
Default	**n.a.**	Fine	**n.a.**			
Unit	**n.a.**			Indicator	**No**	

PM Self					●○○	2.22
Range Min	**-100.0**	Scaling	**Linear**	MC Mod	**Yes**	Amount of phase modulation by Oscillator & Shaper B (local feedback).
Range Max	**100.0**	Steps	**200**	Mod. Unit	**%**	
Default	**0.0**	Fine	**2000**			
Unit	**%**			Indicator	**Yes**	

Oscillator B – 2/2

Parameter Name				Sub. Par.		Button No.
PM Self - Env B				○●○		2.22
Range Min	**0.0**	Scaling	**Linear**	MC Mod	**Yes**	Envelope (B) amount for the phase modulation by Oscillator & Shaper B (local feedback). At zero, the modulation stays constant, at higher values, the envelope applies a time-variant attenuation.
Range Max	**100.0**	Steps	**100**	Mod. Unit	**%**	
Default	**0.0**	Fine	**1000**			
Unit	**%**			Indicator	**No**	

PM Self - Shaper				○○●		2.22
Range Min	**-100.0**	Scaling	**Linear**	MC Mod	**Yes**	Mix amount of Shaper B in the signal being used for phase modulation (self). At zero, the output signal of Oscillator B is used. At negative values, the signal from the Shaper is inverted.
Range Max	**100.0**	Steps	**200**	Mod. Unit	**%**	
Default	**0.0**	Fine	**2000**			
Unit	**%**			Indicator	**No**	

PM A				●○○		2.23
Range Min	**-100.0**	Scaling	**Linear**	MC Mod	**Yes**	Amount of phase modulation by Oscillator & Shaper A (cross feedback).
Range Max	**100.0**	Steps	**200**	Mod. Unit	**%**	
Default	**0.0**	Fine	**2000**			
Unit	**%**			Indicator	**Yes**	

PM A - Env A				○●○		2.23
Range Min	**0.0**	Scaling	**Linear**	MC Mod	**Yes**	Envelope (A) amount for the phase modulation by Oscillator & Shaper A (cross feedback). At zero, the modulation stays constant, at higher values, the envelope applies a time-variant attenuation.
Range Max	**100.0**	Steps	**100**	Mod. Unit	**%**	
Default	**0.0**	Fine	**1000**			
Unit	**%**			Indicator	**No**	

PM A - Shaper				○○●		2.23
Range Min	**-100.0**	Scaling	**Linear**	MC Mod	**Yes**	Mix amount of Shaper A in the signal being used for phase modulation (A -> B). At zero, the output signal of Oscillator A is used. At negative values, the signal from the Shaper is inverted.
Range Max	**100.0**	Steps	**200**	Mod. Unit	**%**	
Default	**0.0**	Fine	**2000**			
Unit	**%**			Indicator	**No**	

PM FB				●○○		2.24
Range Min	**-100.0**	Scaling	**Linear**	MC Mod	**Yes**	Amount of phase modulation by the Feedback signal.
Range Max	**100.0**	Steps	**200**	Mod. Unit	**%**	
Default	**0.0**	Fine	**2000**			
Unit	**%**			Indicator	**Yes**	

PM FB - Env C				○●○		2.24
Range Min	**0.0**	Scaling	**Linear**	MC Mod	**Yes**	Envelope (C) amount for the phase modulation by the Feedback signal. At zero, the modulation stays constant, at higher values, the envelope applies a time-variant attenuation.
Range Max	**100.0**	Steps	**100**	Mod. Unit	**%**	
Default	**0.0**	Fine	**1000**			
Unit	**%**			Indicator	**No**	

Chirp				○○●		2.24
Range Min	**20.0**	Scaling	**Linear**	MC Mod	**Yes**	Cutoff frequency [in semitones] of the low-pass filter in the phase modulation (PM) signal path. The filter can be used to reduce the “chirping” (high-frequency ringing and aliasing noise) that occurs with stronger phase modulations. ... [full info on Page 99]
Range Max	**140.0**	Steps	**120**	Mod. Unit	**st**	
Default	**120.0**	Fine	**1200**			
Unit	**st**			Indicator	**No**	

Feedback Mixer – 1/2

Parameter Name	Sub. Par.	Button No.

A/B II					●○	3.1
Range Min	**-100.0**	Scaling	**Linear**	MC Mod	**Yes**	Level of the signal from branch A or B of the other Part. (Only available when using Layer mode.)
Range Max	**100.0**	Steps	**200**	Mod. Unit	**%**	
Default	**0.0**	Fine	**2000**			
Unit	**%**			Indicator	**Yes**	

A - B					○●	3.1
Range Min	**0.0**	Scaling	**Linear**	MC Mod	**Yes**	Crossfades between branch A and B of the other Part. (Only available when using Layer mode.)
Range Max	**100.0**	Steps	**100**	Mod. Unit	**%**	
Default	**0.0**	Fine	**1000**			
Unit	**%**			Indicator	**No**	

Comb Filter					●○	3.2
Range Min	**-100.0**	Scaling	**Linear**	MC Mod	**Yes**	Feedback mix factor for the output of the Comb Filter.
Range Max	**100.0**	Steps	**200**	Mod. Unit	**%**	
Default	**0.0**	Fine	**2000**			
Unit	**%**			Indicator	**Yes**	

Comb - From I – II					○●	3.2
Range Min	**0.0**	Scaling	**Linear**	MC Mod	**Yes**	Crossfades to the Comb Filter signal of the other Part. (Only available when using Layer mode.)
Range Max	**100.0**	Steps	**100**	Mod. Unit	**%**	
Default	**0.0**	Fine	**1000**			
Unit	**%**			Indicator	**No**	

SV Filter					●○	3.3
Range Min	**-100.0**	Scaling	**Linear**	MC Mod	**Yes**	Feedback mix factor for the output of the State Variable Filter.
Range Max	**100.0**	Steps	**200**	Mod. Unit	**%**	
Default	**0.0**	Fine	**2000**			
Unit	**%**			Indicator	**Yes**	

SV Filter - From I – II					○●	3.3
Range Min	**0.0**	Scaling	**Linear**	MC Mod	**Yes**	Crossfades to the State Variable Filter signal of the other Part. (Only available when using Layer mode.)
Range Max	**100.0**	Steps	**100**	Mod. Unit	**%**	
Default	**0.0**	Fine	**1000**			
Unit	**%**			Indicator	**No**	

Effects					●○○	3.4
Range Min	**-100.0**	Scaling	**Linear**	MC Mod	**Yes**	Feedback mix factor for the output of the Effects chain. The reverb amount in the feedback can be set by the \"Reverb Amount\" fader independently. Since the signal is monophonic, such feedback will cause intermodulation between the voices.
Range Max	**100.0**	Steps	**200**	Mod. Unit	**%**	
Default	**0.0**	Fine	**2000**			
Unit	**%**			Indicator	**Yes**	

Reverb Mix					○●○	3.4
Range Min	**0.0**	Scaling	**Linear**	MC Mod	**Yes**	Controls the amount of reverb in the feedback independently from the Mix in the Reverb section. 0.0 %: dry, no reverb signal 50.0 %: mix of 50 % dry and 50 % wet signal 100.0 %: wet, 100.0 % reverb signal
Range Max	**100.0**	Steps	**100**	Mod. Unit	**%**	
Default	**50.0**	Fine	**1000**			
Unit	**%**			Indicator	**No**	

Feedback Mixer – 2/2

Parameter Name	Sub. Par.	Button No.

Effects - From I – II					○○●	3.4
Range Min	**0.0**	Scaling	**Linear**	MC Mod	**Yes**	Crossfades to the Effects signal of the other Part.
Range Max	**100.0**	Steps	**100**	Mod. Unit	**%**	
Default	**0.0**	Fine	**1000**			
Unit	**%**			Indicator	**No**	

Drive					●○○	3.5
Range Min	**0.0**	Scaling	**Linear**	MC Mod	**Yes**	Input gain [in dB] of the sine shaper stage. Higher gains will create more distortion and harmonics.
Range Max	**70.0**	Steps	**140**	Mod. Unit	**dB**	
Default	**20.0**	Fine	**700**			
Unit	**dB**			Indicator	**No**	

Fold					○●○	3.5
Range Min	**0.0**	Scaling	**Linear**	MC Mod	**Yes**	Amount of folding back of the shaper curve for high input amplitudes. 0.0 %: flat saturation, no folding 100.0 %: fully folded back (periodic sine curve) A higher amount of folding leads to a softer but more nasal sound.
Range Max	**100.0**	Steps	**100**	Mod. Unit	**%**	
Default	**50.0**	Fine	**1000**			
Unit	**%**			Indicator	**No**	

Asymmetry					○○●	3.5
Range Min	**0.0**	Scaling	**Linear**	MC Mod	**Yes**	Asymmetry of the shaper curve, generating even (2nd, 4th, ...) harmonics. At higher values, it becomes a parabolic curve that shifts the frequency of the fundamental to its double.
Range Max	**100.0**	Steps	**100**	Mod. Unit	**%**	
Default	**0.0**	Fine	**1000**			
Unit	**%**			Indicator	**No**	

Level					●○	3.6
Range Min	**- inf**	Scaling	**Parab. G**	MC Mod	**Yes**	Level of the (global) Feedback mix [in dB].
Range Max	**12.0**	Steps	**100**	Mod. Unit	**%**	
Default	**-4.77**	Fine	**1000**			
Unit	**dB**			Indicator	**No**	

Level - Key Trk					○●	3.6
Range Min	**-1.000**	Scaling	**Linear**	MC Mod	**No**	Key scaling of the feedback level [in dB per semitone]. positive values: higher level for higher notes (+ 1.0 = + 12 dB per octave) negative values: lower level for higher notes (- 1.0 = - 12 dB per octave) origin at C3 = 60 semitones
Range Max	**1.000**	Steps	**200**	Mod. Unit	**n.a.**	
Default	**0.000**	Fine	**2000**			
Unit	**dB/st**			Indicator	**No**	

Comb Filter – 1/2

Parameter Name Sub. Par. Button No.

A - B						3.7
Range Min	**0.0**	Scaling	**Linear**	MC Mod	**Yes**	The signal for the Comb Filter as a crossfade between the outputs of Oscillator & Shaper A and Oscillator & Shaper B.
Range Max	**100.0**	Steps	**100**	Mod. Unit	**%**	
Default	**0.0**	Fine	**1000**			
Unit	**%**			Indicator	**No**	

Pitch					●○○	3.8
Range Min	**0.00**	Scaling	**Linear**	MC Mod	**Yes**	Coarse pitch of the Comb Filter (delay) at C3 (MIDI note 60) [in semitones, based on MIDI note numbers].
Range Max	**120.00**	Steps	**120**	Mod. Unit	**st**	
Default	**60.00**	Fine	**12000**			
Unit	**st**			Indicator	**No**	

Pitch - Env C					○●○	3.8
Range Min	**-80.00**	Scaling	**Linear**	MC Mod	**Yes**	Amount of modulation of the Comb Filter pitch by Envelope C [in semitones].
Range Max	**80.00**	Steps	**160**	Mod. Unit	**st**	
Default	**0.00**	Fine	**16000**			
Unit	**st**			Indicator	**No**	

Pitch - Key Trk					○○●	3.8
Range Min	**0.00**	Scaling	**Linear**	MC Mod	**Yes**	Key scaling of the tuning of the Comb Filter (delay). 0.0 %: same tuning for all keys 100.0 %: full tracking with keys, origin at C3 = 60 semitones
Range Max	**200.00**	Steps	**200**	Mod. Unit	**%**	
Default	**100.00**	Fine	**20000**			
Unit	**%**			Indicator	**No**	

Decay					●○○	3.9
Range Min	**-100000**	Scaling	**Expon.**	MC Mod	**Yes**	Amount of the internal feedback noticeable as the decay time of the impulse response [logarithmic scaling]. At negative values, the feedback signal is inverted, which shifts the fundamental resonance down by one octave.
Range Max	**100000**	Steps	**200**	Mod. Unit	**%**	
Default	**0.000**	Fine	**2000**			
Unit	**ms**			Indicator	**Yes**	

Decay - Gate					○●○	3.9
Range Min	**0.0**	Scaling	**Linear**	MC Mod	**Yes**	Amount of gating applied to the decay time. It reduces the decay time when the key is released (Note-off). 0.0 % same decay time in the release phase 100.0 %: the decay time is set to zero at the release of the key
Range Max	**100.0**	Steps	**100**	Mod. Unit	**%**	
Default	**0.0**	Fine	**1000**			
Unit	**%**			Indicator	**No**	

Decay - Key Trk					○○●	3.9
Range Min	**0.0**	Scaling	**Linear**	MC Mod	**Yes**	Key scaling of the decay time. 0.0 %: equal time for all keys 100.0 %: shortening to half time per octave, origin at C3 = 60 semitones
Range Max	**100.0**	Steps	**100**	Mod. Unit	**%**	
Default	**33.0**	Fine	**1000**			
Unit	**%**			Indicator	**No**	

Allpass - Tune					●○○○	3.10
Range Min	**0.0**	Scaling	**Linear**	MC Mod	**Yes**	Center frequency of the 2-pole allpass filter [in semitones]. It is the frequency where the phase is shifted by 180 degrees. The allpass is in series with the delay. At the maximum position (140 semitones), the allpass has no effect.
Range Max	**140.0**	Steps	**140**	Mod. Unit	**st**	
Default	**140.0**	Fine	**1400**			
Unit	**st**			Indicator	**No**	

Comb Filter – 2/2

Parameter Name	Sub. Par.	Button No.

Allpass - Env C					○●○○	3.10
Range Min	**-80.0**	Scaling	**Linear**	MC Mod	**Yes**	Amount of modulation of the allpass center frequency by Envelope C [in semitones].
Range Max	**80.0**	Steps	**160**	Mod. Unit	**st**	
Default	**0.0**	Fine	**1600**			
Unit	**st**			Indicator	**No**	

Allpass - Key Trk					○○●○	3.10
Range Min	**0.0**	Scaling	**Linear**	MC Mod	**Yes**	Key scaling of the allpass filter frequency. 0.0 %: same tuning for all keys 100.0 %: full tracking with the keys, origin at C3 = 60 semitones
Range Max	**200.0**	Steps	**200**	Mod. Unit	**%**	
Default	**100.0**	Fine	**2000**			
Unit	**%**			Indicator	**No**	

Allpass - Reson					○○○●	3.10
Range Min	**0.0**	Scaling	**Linear**	MC Mod	**Yes**	Resonance of the 2-pole allpass. Determines how much the phase shift increases around the center frequency.
Range Max	**100.0**	Steps	**100**	Mod. Unit	**%**	
Default	**50.0**	Fine	**1000**			
Unit	**%**			Indicator	**No**	

Hi Cut					●○○	3.11
Range Min	**40.0**	Scaling	**Linear**	MC Mod	**Yes**	Cutoff frequency [in semitones] of the lowpass filter that damps the higher frequencies in the comb filter's signal path.
Range Max	**140.0**	Steps	**100**	Mod. Unit	**st**	
Default	**140.0**	Fine	**1000**			
Unit	**st**			Indicator	**No**	

Hi Cut - Env C					○●○	3.11
Range Min	**-100.0**	Scaling	**Linear**	MC Mod	**Yes**	Amount of modulation of the cutoff frequency of the lowpass filter by Envelope C [in semitones].
Range Max	**100.0**	Steps	**200**	Mod. Unit	**st**	
Default	**0.0**	Fine	**2000**			
Unit	**st**			Indicator	**No**	

Hi Cut - Key Trk					○○●	3.11
Range Min	**0.0**	Scaling	**Linear**	MC Mod	**Yes**	Key scaling of the lowpass cutoff frequency. 0.0 %: same cutoff for all keys 100.0 %: full tracking with the keys, origin at C3 = 60 semitones
Range Max	**200.0**	Steps	**200**	Mod. Unit	**%**	
Default	**100.0**	Fine	**2000**			
Unit	**%**			Indicator	**No**	

PM					●○	3.12
Range Min	**-100.0**	Scaling	**Linear**	MC Mod	**Yes**	Amount of (phase) modulation of the comb filter pitch (delay time) by the output signals of Oscillator & Shaper A and B, with the PM A-B knob determining their mix.
Range Max	**100.0**	Steps	**200**	Mod. Unit	**%**	
Default	**0.0**	Fine	**2000**			
Unit	**%**			Indicator	**Yes**	

PM - A-B					○●	3.12
Range Min	**0.0**	Scaling	**Linear**	MC Mod	**Yes**	The (phase) modulation signal for the Comb Filter as a crossfade between the outputs of Oscillator & Shaper A and Oscillator & Shaper B.
Range Max	**100.0**	Steps	**100**	Mod. Unit	**%**	
Default	**0.0**	Fine	**1000**			
Unit	**%**			Indicator	**No**	

State Variable Filter – 1/2

Parameter Name	Sub. Par.	Button No.

A - B						3.13
Range Min	**0.0**	Scaling	**Linear**	MC Mod	**Yes**	The signal for the State Variable Filter as a crossfade between the outputs of Oscillator & Shaper A and Oscillator & Shaper B.
Range Max	**100.0**	Steps	**100**	Mod. Unit	**%**	
Default	**0.0**	Fine	**1000**			
Unit	**%**			Indicator	**No**	

Comb Mix						3.14
Range Min	**-100.0**	Scaling	**Linear**	MC Mod	**Yes**	The input signal for the State Variable Filter as mix of the signals from the A-B mixer and from the Comb Filter. Negative mix amounts will create different Comb Filter (cancellation) effects.
Range Max	**100.0**	Steps	**200**	Mod. Unit	**%**	
Default	**0.0**	Fine	**2000**			
Unit	**%**			Indicator	**Yes**	

Cutoff					●○○	3.15
Range Min	**20.0**	Scaling	**Linear**	MC Mod	**Yes**	Static value of the filter cutoff frequency at C3 [in semitones], applies to both stages of the filter. The offsets between their individual cutoffs is controlled by \"Spread\".
Range Max	**140.0**	Steps	**120**	Mod. Unit	**st**	
Default	**80.0**	Fine	**1200**			
Unit	**st**			Indicator	**No**	

Cutoff - Env C					○●○	3.15
Range Min	**-100.0**	Scaling	**Linear**	MC Mod	**Yes**	Amount of cutoff modulation by Envelope C [in semitones].
Range Max	**100.0**	Steps	**200**	Mod. Unit	**st**	
Default	**0.0**	Fine	**2000**			
Unit	**st**			Indicator	**No**	

Cutoff - Key Trk					○○●	3.15
Range Min	**0.0**	Scaling	**Linear**	MC Mod	**Yes**	Key scaling of the filter cutoffs. 0.0 %: no influence 100.0 %: full tracking with the keys, origin at C3 = 60 semitones
Range Max	**200.0**	Steps	**200**	Mod. Unit	**%**	
Default	**100.0**	Fine	**2000**			
Unit	**%**			Indicator	**No**	

Resonance					●○○	3.16
Range Min	**0.0**	Scaling	**Linear**	MC Mod	**Yes**	Amount of filter resonance, creating peaks at the cutoff frequencies.
Range Max	**100.0**	Steps	**100**	Mod. Unit	**%**	
Default	**50.0**	Fine	**1000**			
Unit	**%**			Indicator	**No**	

Reson - Env C					○●○	3.16
Range Min	**-100.0**	Scaling	**Linear**	MC Mod	**Yes**	Amount of resonance modulation by Envelope C.
Range Max	**100.0**	Steps	**200**	Mod. Unit	**%**	
Default	**0.0**	Fine	**2000**			
Unit	**%**			Indicator	**No**	

Reson - Key Trk					○○●	3.16
Range Min	**-100.0**	Scaling	**Linear**	MC Mod	**Yes**	Key scaling of the filter resonance. 0.0 %: no influence -100.0 %: full but inverted tracking with keys 100.0 %: full tracking with the keys, origin at C3 = 60 semitones
Range Max	**100.0**	Steps	**200**	Mod. Unit	**%**	
Default	**0.0**	Fine	**2000**			
Unit	**%**			Indicator	**No**	

State Variable Filter – 2/2

Parameter Name	Sub. Par.	Button No.

Spread					●○○	3.17
Range Min	**-60.0**	Scaling	**Linear**	MC Mod	**Yes**	Amount of splitting of the cutoffs of the two 2-pole filters. Half of the value is applied as a positive offset to the adjusted cutoff for the first stage and as a negative offset for the second stage [in semitones]. The split reduces the strong resonance peak in the 4-pole mode and allows filter curves with two formants. In bandpass/bandreject mode it controls the width of the band.
Range Max	**60.0**	Steps	**120**	Mod. Unit	**st**	
Default	**12.0**	Fine	**1200**			
Unit	**st**			Indicator	**No**	

L - B - H					○●○	3.17
Range Min	**0.0**	Scaling	**Linear**	MC Mod	**Yes**	Crossfades between the lowpass, bandpass and highpass outputs of the two filter stages. (first stage -> second stage: LP -> LP, BP -> LP, HP -> LP, HP -> BP, HP -> HP)
Range Max	**100.0**	Steps	**100**	Mod. Unit	**%**	
Default	**0.0**	Fine	**1000**			
Unit	**%**			Indicator	**No**	

Parallel					○○●	3.17
Range Min	**-100.0**	Scaling	**Linear**	MC Mod	**Yes**	At zero, the two 2-pole filter stages are in series forming a 4-pole filter. Positive values crossfade from the serial structure to a parallel structure where the filter outputs are added. In bandpass mode (L-B-H = 50.0%), the parallel structure with a negative Spread works as a band-reject filter. Negative values also crossfade to a parallel structure, but here the lower filter is subtracted, which leads to phase cancellations.
Range Max	**100.0**	Steps	**200**	Mod. Unit	**%**	
Default	**0.0**	Fine	**2000**			
Unit	**%**			Indicator	**No**	

FM					●○	3.18
Range Min	**-100.0**	Scaling	**Linear**	MC Mod	**Yes**	Amount of modulation of the cutoff frequencies by the output signals of Oscillator & Shaper A and B, with the FM A-B knob determining their mix. The amount is relative to the cutoff frequency.
Range Max	**100.0**	Steps	**200**	Mod. Unit	**%**	
Default	**0.0**	Fine	**2000**			
Unit	**%**			Indicator	**Yes**	

FM - A-B					○●	3.18
Range Min	**0.0**	Scaling	**Linear**	MC Mod	**Yes**	The signal for the FM (cutoff frequency modulation) of the State Variable Filter as a crossfade between the outputs of Oscillator & Shaper A and Oscillator & Shaper B.
Range Max	**100.0**	Steps	**100**	Mod. Unit	**%**	
Default	**0.0**	Fine	**1000**			
Unit	**%**			Indicator	**No**	

Output Mixer – 1/2

Parameter Name	Sub. Par.	Button No.

A - Level					●○	3.19
Range Min	**-100.0**	Scaling	**Linear**	MC Mod	**Yes**	Output mix factor for the signal from Oscillator & Shaper A.
Range Max	**100.0**	Steps	**200**	Mod. Unit	**%**	
Default	**0.0**	Fine	**2000**			
Unit	**%**			Indicator	**Yes**	

A - Pan					○●	3.19
Range Min	**-100.0**	Scaling	**Linear**	MC Mod	**Yes**	Pan position of the signal from Oscillator & Shaper A in the output mix.
Range Max	**100.0**	Steps	**200**	Mod. Unit	**%**	
Default	**0.0**	Fine	**2000**			
Unit	**%**			Indicator	**No**	

B - Level					●○	3.20
Range Min	**-100.0**	Scaling	**Linear**	MC Mod	**Yes**	Output mix factor for the signal from Oscillator & Shaper B.
Range Max	**100.0**	Steps	**200**	Mod. Unit	**%**	
Default	**0.0**	Fine	**2000**			
Unit	**%**			Indicator	**Yes**	

B - Pan					○●	3.20
Range Min	**-100.0**	Scaling	**Linear**	MC Mod	**Yes**	Pan position of the signal from Oscillator & Shaper B in the output mix.
Range Max	**100.0**	Steps	**200**	Mod. Unit	**%**	
Default	**0.0**	Fine	**2000**			
Unit	**%**			Indicator	**No**	

Comb - Level					●○	3.21
Range Min	**-100.0**	Scaling	**Linear**	MC Mod	**Yes**	Output mix factor for the signal from the Comb Filter.
Range Max	**100.0**	Steps	**200**	Mod. Unit	**%**	
Default	**0.0**	Fine	**2000**			
Unit	**%**			Indicator	**Yes**	

Comb - Pan					○●	3.21
Range Min	**-100.0**	Scaling	**Linear**	MC Mod	**Yes**	Pan position of the signal from the Comb Filter in the output mix.
Range Max	**100.0**	Steps	**200**	Mod. Unit	**%**	
Default	**0.0**	Fine	**2000**			
Unit	**%**			Indicator	**No**	

SV Filter - Level					●○	3.22
Range Min	**-100.0**	Scaling	**Linear**	MC Mod	**Yes**	Output mix factor for the signal from the State Variable Filter.
Range Max	**100.0**	Steps	**200**	Mod. Unit	**%**	
Default	**0.0**	Fine	**2000**			
Unit	**%**			Indicator	**Yes**	

SV Filter - Pan					○●	3.22
Range Min	**-100.0**	Scaling	**Linear**	MC Mod	**Yes**	Pan position of the signal from the State Variable Filter in the output mix.
Range Max	**100.0**	Steps	**200**	Mod. Unit	**%**	
Default	**0.0**	Fine	**2000**			
Unit	**%**			Indicator	**No**	

Output Mixer – 2/2

Parameter Name	Sub. Par.	Button No.

Drive					●○○	3.23
Range Min	**0.0**	Scaling	**Linear**	MC Mod	**Yes**	Input gain [in dB] of the sine shaper stage. Higher gains will create more distortion and harmonics.
Range Max	**50.0**	Steps	**100**	Mod. Unit	**dB**	
Default	**0.0**	Fine	**500**			
Unit	**dB**			Indicator	**No**	

Fold					○●○	3.23
Range Min	**0.0**	Scaling	**Linear**	MC Mod	**Yes**	Amount of folding back of the shaper curve for high input amplitudes. 0.0 %: flat saturation, no folding 100.0 %: fully folded back (periodic sine curve) A higher amount of folding leads to a softer but more nasal sound.
Range Max	**100.0**	Steps	**100**	Mod. Unit	**%**	
Default	**50.0**	Fine	**1000**			
Unit	**%**			Indicator	**No**	

Asymmetry					○○●	3.23
Range Min	**0.0**	Scaling	**Linear**	MC Mod	**Yes**	Asymmetry of the shaper curve, generating even (2nd, 4th, ...) harmonics. At higher values, it becomes a parabolic curve that shifts the frequency of the fundamental to its double.
Range Max	**100.0**	Steps	**100**	Mod. Unit	**%**	
Default	**0.0**	Fine	**1000**			
Unit	**%**			Indicator	**No**	

Level					●○○	3.24
Range Min	**-inf**	Scaling	**Parab. G**	MC Mod	**Yes**	Master output level [in dB] of the synth. The output signal will be processed by the (monophonic) chain of effects.
Range Max	**12.0**	Steps	**100**	Mod. Unit	**%**	
Default	**-4.77**	Fine	**1000**			
Unit	**dB**			Indicator	**No**	

Key Pan					○●○	3.24
Range Min	**-100.0**	Scaling	**Linear**	MC Mod	**No**	Amount of key panning for each note (referring to the key position relative to the center at F#3 = 66 semitones). At zero, each note is centered before being passed to the panning section in the mix. At maximum, low notes will be panned to the left, high notes to the right. At minimum, the opposite effect applies.
Range Max	**100.0**	Steps	**200**	Mod. Unit	**n.a.**	
Default	**0.0**	Fine	**2000**			
Unit	**%**			Indicator	**No**	

To FX I – II					○○●	3.24
Range Min	**0.0**	Scaling	**Linear**	MC Mod	**Yes**	Determines how much of the Output Mixer signal is sent to the Effects section of the other Part. At 100.0 % the signal will be sent to the other Part exclusively.
Range Max	**100.0**	Steps	**100**	Mod. Unit	**%**	
Default	**0.0**	Fine	**1000**			
Unit	**%**			Indicator	**Yes**	

Flanger – 1/2

Parameter Name Sub. Par. Button No.

Rate						4.1
Range Min	**0.000**	Scaling	**Parab.**	MC Mod	**Yes**	Frequency of the LFO and rate of the envelope. Both can be modulation sources for the delay times and the allpass center frequencies.
Range Max	**10.00**	Steps	**100**	Mod. Unit	**%**	
Default	**1.005**	Fine	**1000**			
Unit	**Hz**			Indicator	**No**	

Envelope					●○	4.2
Range Min	**0.0**	Scaling	**Linear**	MC Mod	**Yes**	Crossfades between the signals of the LFO and the envelope as modulation sources for the delay times and the allpass center frequencies.
Range Max	**100.0**	Steps	**100**	Mod. Unit	**%**	
Default	**0.0**	Fine	**1000**			
Unit	**%**			Indicator	**Yes**	

Phase					○●	4.2
Range Min	**0.0**	Scaling	**Linear**	MC Mod	**Yes**	Phase offset between the LFO signals modulating the delay times in the left and the right channel.
Range Max	**180.0**	Steps	**180**	Mod. Unit	**deg**	
Default	**90.0**	Fine	**1800**			
Unit	**deg**			Indicator	**No**	

Time Mod					●○○	4.3
Range Min	**-100**	Scaling	**Parab.**	MC Mod	**Yes**	Relative amount of the modulation of the delay times by the LFO and/or the envelope.
Range Max	**100**	Steps	**200**	Mod. Unit	**%**	
Default	**0.000**	Fine	**2000**			
Unit	**%**			Indicator	**No**	

Time					○●○	4.3
Range Min	**0.000**	Scaling	**Parab.**	MC Mod	**Yes**	Mean value of the delay times in the left and right channel. The \"Stereo\" parameter allows to create a time offset between the channels. When the time of the Flanger is set to zero, the overall effect is determined by the phase shifting of the allpass.
Range Max	**50.0**	Steps	**125**	Mod. Unit	**%**	
Default	**5.02**	Fine	**1250**			
Unit	**ms**			Indicator	**No**	

Stereo					○○●	4.3
Range Min	**-50.0**	Scaling	**Linear**	MC Mod	**Yes**	Sets the ratio between the delay times of the left and of the right channel [the value shows the offset to 100.0 %]. In the center position, the offset is zero and both delay times are equal.
Range Max	**50.0**	Steps	**100**	Mod. Unit	**%**	
Default	**0.0**	Fine	**1000**			
Unit	**%**			Indicator	**No**	

Allpass Mod					●○	4.4
Range Min	**-100.0**	Scaling	**Linear**	MC Mod	**Yes**	Relative amount of the modulation of the allpass center frequencies by the LFO and/or the envelope. The allpass creates the effect of a phaser.
Range Max	**100.0**	Steps	**200**	Mod. Unit	**%**	
Default	**0.0**	Fine	**2000**			
Unit	**%**			Indicator	**No**	

Allpass Tune					○●	4.4
Range Min	**0.0**	Scaling	**Linear**	MC Mod	**Yes**	Mean center frequency of the 4-pole allpass filters which are in series with the delays. Their frequency-dependant phase shifts can create a \"Phaser\" effect. The phase shift is minimized by setting this control to its maximum. When the time of the flange is set to zero, the allpass becomes the dominant part.
Range Max	**140.0**	Steps	**140**	Mod. Unit	**st**	
Default	**140.0**	Fine	**1400**			
Unit	**st**			Indicator	**No**	

Flanger – 2/2

Parameter Name	Sub. Par.	Button No.

Feedback					●○○	4.5
Range Min	**-100.0**	Scaling	**Linear**	MC Mod	**Yes**	Amount of the internal feedback. At negative values, the feedback is inverted and will emphasize other frequencies than in the non-inverted mode.
Range Max	**100.0**	Steps	**200**	Mod. Unit	**%**	
Default	**0.0**	Fine	**2000**			
Unit	**%**			Indicator	**No**	

Cross FB					○●○	4.5
Range Min	**-100.0**	Scaling	**Linear**	MC Mod	**Yes**	Amount of the cross feedback between the left and the right channel, increasing the complexity of the resulting signal. At negative values, the cross feedback is inverted and will emphasize other frequencies than in the non-inverted mode. 0.0 %: no cross feedback +/- 100.0 %: all feedback is cross feedback
Range Max	**100.0**	Steps	**200**	Mod. Unit	**%**	
Default	**50.0**	Fine	**2000**			
Unit	**%**			Indicator	**No**	

Hi Cut					○○●	4.5
Range Min	**60.0**	Scaling	**Linear**	MC Mod	**Yes**	Cutoff frequency [in semitones] of the filter that damps the higher frequencies of the delayed signal.
Range Max	**140.0**	Steps	**80**	Mod. Unit	**st**	
Default	**120.0**	Fine	**800**			
Unit	**st**			Indicator	**No**	

Mix					●○	4.6
Range Min	**-100.0**	Scaling	**Linear**	MC Mod	**Yes**	Crossfades between the dry signal and the delayed signal. At negative values, the delayed signal is inverted.
Range Max	**100.0**	Steps	**200**	Mod. Unit	**%**	
Default	**0.0**	Fine	**2000**			
Unit	**%**			Indicator	**Yes**	

Tremolo					○●	4.6
Range Min	**0.0**	Scaling	**Linear**	MC Mod	**Yes**	Determines the amount of amplitude modulation by the Flanger's stereo LFO. It is applied after the Mix stage of the Flanger. The Rate and Phase parameters control the frequency and stereo spreading of this effect.
Range Max	**100.0**	Steps	**100**	Mod. Unit	**%**	
Default	**0.0**	Fine	**1000**			
Unit	**%**			Indicator	**Yes**	

Cabinet

Parameter Name Sub. Par. Button No.

Drive					●○○	4.7
Range Min	**0.0**	Scaling	**Linear**	MC Mod	**Yes**	Gain [in dB] for the input signal. Higher gains will increase the amount of distortion/saturation.
Range Max	**50.0**	Steps	**100**	Mod. Unit	**dB**	
Default	**20.0**	Fine	**500**			
Unit	**dB**			Indicator	**No**	

Fold					○●○	4.7
Range Min	**0.0**	Scaling	**Linear**	MC Mod	**Yes**	Amount of folding back of the shaper curve for high input amplitudes. 0.0 %: flat saturation, no folding 100.0 %: fully folded back (periodic sine curve) A higher amount of folding leads to a softer but more nasal sound.
Range Max	**100.0**	Steps	**100**	Mod. Unit	**%**	
Default	**25.0**	Fine	**1000**			
Unit	**%**			Indicator	**No**	

Asymmetry					○○●	4.7
Range Min	**0.0**	Scaling	**Linear**	MC Mod	**Yes**	Asymmetry of the shaper curve, generating even (2nd, 4th, ...) harmonics. At higher values, it becomes a parabolic curve that shifts the frequency of the fundamental to its double.
Range Max	**100.0**	Steps	**100**	Mod. Unit	**%**	
Default	**25.0**	Fine	**1000**			
Unit	**%**			Indicator	**No**	

Tilt					●○○	4.8
Range Min	**-100.0**	Scaling	**Linear**	MC Mod	**Yes**	Controls two inverted shelving EQs before and after the distortion stage. Negative: more distortions at high frequencies Positive: more distortions at low frequencies
Range Max	**100.0**	Steps	**200**	Mod. Unit	**%**	
Default	**-20.0**	Fine	**2000**			
Unit	**%**			Indicator	**No**	

Hi Cut					○●○	4.8
Range Min	**60.0**	Scaling	**Linear**	MC Mod	**Yes**	Cutoff frequency [in semitones] of the lowpass filter at the output.
Range Max	**140.0**	Steps	**80**	Mod. Unit	**st**	
Default	**110.0**	Fine	**800**			
Unit	**st**			Indicator	**No**	

Lo Cut					○○●	4.8
Range Min	**20.0**	Scaling	**Linear**	MC Mod	**Yes**	Cutoff frequency [in semitones] of the highpass filter at the input.
Range Max	**100.0**	Steps	**80**	Mod. Unit	**st**	
Default	**30.0**	Fine	**800**			
Unit	**st**			Indicator	**No**	

Mix					●○	4.9
Range Min	**0.0**	Scaling	**Linear**	MC Mod	**Yes**	Crossfades between the dry signal and the saturated signal.
Range Max	**100.0**	Steps	**100**	Mod. Unit	**%**	
Default	**0.0**	Fine	**1000**			
Unit	**%**			Indicator	**Yes**	

Cab Level					○●	4.9
Range Min	**-50.0**	Scaling	**Linear**	MC Mod	**Yes**	Output level [in dB] of the saturation effect before it is mixed with the dry signal.
Range Max	**0.0**	Steps	**50**	Mod. Unit	**dB**	
Default	**-14**	Fine	**500**			
Unit	**dB**			Indicator	**No**	

Gap Filter

Parameter Name	Sub. Par.	Button No.

Center					●○	4.10
Range Min	**24.0**	Scaling	**Linear**	MC Mod	**Yes**	Shifts the mean cutoff frequency of both 4-pole filters on both channels up or down [in semitones].
Range Max	**120.0**	Steps	**96**	Mod. Unit	**st**	
Default	**72.0**	Fine	**960**			
Unit	**st**			Indicator	**No**	

Stereo					○●	4.10
Range Min	**-36.00**	Scaling	**Linear**	MC Mod	**Yes**	Sets the difference between the center frequencies of the left and of the right channel [in semitones].
Range Max	**36.00**	Steps	**144**	Mod. Unit	**st**	
Default	**0.00**	Fine	**1440**			
Unit	**st**			Indicator	**No**	

Gap					●○○	4.11
Range Min	**0.0**	Scaling	**Linear**	MC Mod	**Yes**	Offset between the cutoffs of the lowpass and the highpass [in semitones]. When the filters are running in parallel (Mix > 0.0), the Gap determines the width of the attenuated band, in serial mode (Mix < 0.0), the Gap determines the width of the passed band.
Range Max	**96.0**	Steps	**96**	Mod. Unit	**st**	
Default	**12.0**	Fine	**960**			
Unit	**st**			Indicator	**No**	

Balance					○●○	4.11
Range Min	**-100.0**	Scaling	**Linear**	MC Mod	**Yes**	Balance between the levels of the ranges above and below the gap. In the center position both ranges are equally weighted. Negative values boost the lower range and attenuate the higher range, positive values have the opposite effect.
Range Max	**100.0**	Steps	**200**	Mod. Unit	**%**	
Default	**0.0**	Fine	**2000**			
Unit	**%**			Indicator	**No**	

Resonance					○○●	4.11
Range Min	**0.0**	Scaling	**Linear**	MC Mod	**Yes**	Resonance of both filters. Higher values create two resonance peaks at the upper and lower end of the gap.
Range Max	**100.0**	Steps	**100**	Mod. Unit	**%**	
Default	**50.0**	Fine	**1000**			
Unit	**%**			Indicator	**No**	

Mix						4.12
Range Min	**-100.0**	Scaling	**Linear**	MC Mod	**Yes**	Crossfades between the dry signal and the filtered signal. At positive values, the filter runs in parallel (band reject) mode, at negative values, it is a bandpass filter (in serial mode).
Range Max	**100.0**	Steps	**200**	Mod. Unit	**%**	
Default	**0.0**	Fine	**2000**			
Unit	**%**			Indicator	**Yes**	

Echo

Parameter Name	Sub. Par.	Button No.

Time					●○	4.13
Range Min	**0.000**	Scaling	**Parab.**	MC Mod	**Yes**	Mean delay time [in milliseconds]. (As there can be an offset between the left and right channel, this control shows the mean time.)
Range Max	**2000**	Steps	**200**	Mod. Unit	**%**	
Default	**375**	Fine	**2000**			
Unit	**ms**			Indicator	**No**	

Stereo					○●	4.13
Range Min	**-33.00**	Scaling	**Linear**	MC Mod	**Yes**	Sets the ratio between the delay times of the left and of the right channel [the value shows the offset to 100.0 %]. In the center position, the offset is zero and both delay times are equal.
Range Max	**33.00**	Steps	**132**	Mod. Unit	**%**	
Default	**0.00**	Fine	**1320**			
Unit	**%**			Indicator	**No**	

Feedback					●○○	4.14
Range Min	**0.0**	Scaling	**Linear**	MC Mod	**Yes**	Amount of internal feedback.
Range Max	**100.0**	Steps	**100**	Mod. Unit	**%**	
Default	**50.0**	Fine	**1000**			
Unit	**%**			Indicator	**No**	

Cross FB					○●○	4.14
Range Min	**0.0**	Scaling	**Linear**	MC Mod	**Yes**	Amount of the cross feedback between the left and right channel. 0.0 %: no cross feedback 100.0 %: all feedback is cross feedback
Range Max	**100.0**	Steps	**100**	Mod. Unit	**%**	
Default	**50.0**	Fine	**1000**			
Unit	**%**			Indicator	**No**	

Hi Cut					○○●	4.14
Range Min	**60**	Scaling	**Linear**	MC Mod	**Yes**	Cutoff frequency [in semitones] of the filter that damps the higher frequencies of the delayed signal.
Range Max	**140**	Steps	**80**	Mod. Unit	**st**	
Default	**120**	Fine	**800**			
Unit	**st**			Indicator	**No**	

Mix					●○	4.15
Range Min	**0.0**	Scaling	**Linear**	MC Mod	**Yes**	Crossfades between the dry signal and the delayed signal.
Range Max	**100.0**	Steps	**100**	Mod. Unit	**%**	
Default	**0.0**	Fine	**1000**			
Unit	**%**			Indicator	**Yes**	

Send					○●	4.15
Range Min	**0.0**	Scaling	**Linear**	MC Mod	**Yes**	Level control at the input of the effect signal path. In contrast to the Echo Mix parameter, the Delay feedback will still be audible when setting the Send parameter to zero.
Range Max	**100.0**	Steps	**100**	Mod. Unit	**%**	
Default	**100.0**	Fine	**1000**			
Unit	**%**			Indicator	**No**	

Reverb

Parameter Name	Sub. Par.	Button No.

Size					●○	4.16
Range Min	**0.0**	Scaling	**Linear**	MC Mod	**Yes**	The room size and reverb time are set here.
Range Max	**100.0**	Steps	**100**	Mod. Unit	**%**	
Default	**33.0**	Fine	**1000**			
Unit	**%**			Indicator	**No**	

Pre Delay					○●	4.16
Range Min	**0.0**	Scaling	**Linear**	MC Mod	**Yes**	Pre delay time, shifting the late reflections. This has a profound effect on the perceived room size.
Range Max	**100.0**	Steps	**100**	Mod. Unit	**%**	
Default	**33.0**	Fine	**1000**			
Unit	**%**			Indicator	**No**	

Color					●○	4.17
Range Min	**0.0**	Scaling	**Linear**	MC Mod	**Yes**	Pre delay time, shifting the late reflections. This has a profound effect on the perceived room size.
Range Max	**100.0**	Steps	**100**	Mod. Unit	**%**	
Default	**50.0**	Fine	**1000**			
Unit	**%**			Indicator	**No**	

Chorus					○●	4.17
Range Min	**0.0**	Scaling	**Linear**	MC Mod	**Yes**	This controls the internal modulation of the reverberation delays. At higher amounts, there is more movement and the diffusion is smoother. At lower amounts, the reverb becomes more static and metallic.
Range Max	**100.0**	Steps	**100**	Mod. Unit	**%**	
Default	**25.0**	Fine	**1000**			
Unit	**%**			Indicator	**No**	

Mix					●○	4.18
Range Min	**0.0**	Scaling	**Linear**	MC Mod	**Yes**	Crossfades between the dry signal and the reverberation signal.
Range Max	**100.0**	Steps	**100**	Mod. Unit	**%**	
Default	**0.0**	Fine	**1000**			
Unit	**%**			Indicator	**Yes**	

Send					○●	4.18
Range Min	**0.0**	Scaling	**Linear**	MC Mod	**Yes**	Level control at the input of the effect signal path. In contrast to the Reverb Mix parameter, the Reverb feedback will still be audible when setting the Send parameter to zero.
Range Max	**100.0**	Steps	**100**	Mod. Unit	**%**	
Default	**100.0**	Fine	**1000**			
Unit	**%**			Indicator	**No**	

Macro Controls – 1/2

Parameter Name	Sub. Par.	Button No.

(A)					●○	4.19
Range Min	**0.0**	Scaling	**Linear**	MC Mod	**No**	The info text of Macro Control A is user-definable and defaults to an empty string.
Range Max	**100.0**	Steps	**100**	Mod. Unit	**n.a.**	
Default	**50.0**	Fine	**1000**			
Unit	**%**			Indicator	**No**	

(A) Smoothing					○●	4.19 ("more..")
Range Min	**0.0**	Scaling	**Expon.**	MC Mod	**No**	Sets the smoothing time [in milliseconds] for modulations on target parameters assigned to Macro Control A. At zero, assigned target parameters will follow the Macro Control immediately.
Range Max	**16000**	Steps	**100**	Mod. Unit	**n.a.**	
Default	**12.1**	Fine	**1000**			
Unit	**ms**			Indicator	**No**	

(B)					●○	4.20
Range Min	**0.0**	Scaling	**Linear**	MC Mod	**No**	The info text of Macro Control B is user-definable and defaults to an empty string.
Range Max	**100.0**	Steps	**100**	Mod. Unit	**n.a.**	
Default	**50.0**	Fine	**1000**			
Unit	**%**			Indicator	**No**	

(B) Smoothing					○●	4.20 ("more..")
Range Min	**0.0**	Scaling	**Expon.**	MC Mod	**No**	Sets the smoothing time [in milliseconds] for modulations on target parameters assigned to Macro Control B. At zero, assigned target parameters will follow the Macro Control immediately.
Range Max	**16000**	Steps	**100**	Mod. Unit	**n.a.**	
Default	**12.1**	Fine	**1000**			
Unit	**ms**			Indicator	**No**	

(C)					●○	4.21
Range Min	**0.0**	Scaling	**Linear**	MC Mod	**No**	The info text of Macro Control C is user-definable and defaults to an empty string.
Range Max	**100.0**	Steps	**100**	Mod. Unit	**n.a.**	
Default	**50.0**	Fine	**1000**			
Unit	**%**			Indicator	**No**	

(C) Smoothing					○●	4.21 ("more..")
Range Min	**0.0**	Scaling	**Expon.**	MC Mod	**No**	Sets the smoothing time [in milliseconds] for modulations on target parameters assigned to Macro Control C. At zero, assigned target parameters will follow the Macro Control immediately.
Range Max	**16000**	Steps	**100**	Mod. Unit	**n.a.**	
Default	**12.1**	Fine	**1000**			
Unit	**ms**			Indicator	**No**	

(D)					●○	4.22
Range Min	**0.0**	Scaling	**Linear**	MC Mod	**No**	The info text of Macro Control D is user-definable and defaults to an empty string.
Range Max	**100**	Steps	**100**	Mod. Unit	**n.a.**	
Default	**50**	Fine	**1000**			
Unit	**%**			Indicator	**No**	

(D) Smoothing					○●	4.22 ("more..")
Range Min	**0.0**	Scaling	**Expon.**	MC Mod	**No**	Sets the smoothing time [in milliseconds] for modulations on target parameters assigned to Macro Control D. At zero, assigned target parameters will follow the Macro Control immediately.
Range Max	**16000**	Steps	**100**	Mod. Unit	**n.a.**	
Default	**12.1**	Fine	**1000**			
Unit	**ms**			Indicator	**No**	

Parameter Name	Sub. Par.	Button No.

(E)					●○	4.23
Range Min	**0.0**	Scaling	**Linear**	MC Mod	**No**	The info text of Macro Control E is user-definable and defaults to an empty string.
Range Max	**100.0**	Steps	**100**	Mod. Unit	**n.a.**	
Default	**50.0**	Fine	**1000**			
Unit	**%**			Indicator	**No**	

(E) Smoothing					●○	4.23 ("more..")
Range Min	**0.0**	Scaling	**Expon.**	MC Mod	**No**	Sets the smoothing time [in milliseconds] for modulations on target parameters assigned to Macro Control E. At zero, assigned target parameters will follow the Macro Control immediately.
Range Max	**16000**	Steps	**100**	Mod. Unit	**n.a.**	
Default	**12.1**	Fine	**1000**			
Unit	**ms**			Indicator	**No**	

(F)					●○	4.24
Range Min	**0.0**	Scaling	**Linear**	MC Mod	**No**	The info text of Macro Control F is user-definable and defaults to an empty string.
Range Max	**100.0**	Steps	**100**	Mod. Unit	**n.a.**	
Default	**50.0**	Fine	**1000**			
Unit	**%**			Indicator	**No**	

(F) Smoothing					●○	4.24 ("more..")
Range Min	**0.0**	Scaling	**Expon.**	MC Mod	**No**	Sets the smoothing time [in milliseconds] for modulations on target parameters assigned to Macro Control F. At zero, assigned target parameters will follow the Macro Control immediately.
Range Max	**16000**	Steps	**100**	Mod. Unit	**n.a.**	
Default	**12.1**	Fine	**1000**			
Unit	**ms**			Indicator	**No**	

Hardware Sources – 1/3

Parameter Name Sub. Par. Button No.

Pedal 1					○●	4.19– 4.24 (“Select” + Encoder)
Range Min	**0.0**	Scaling	**Linear**	MC Mod	**No**	This control is the parameter representation of the \"Pedal 1\" Hardware Source. If a pedal is connected, it will directly follow the external control. If the source's return behavior is set to \"Center\", the parameter will be bipolar.
Range Max	**100.0**	Steps	**100**	Mod. Unit	**n.a.**	
Default	**0.0**	Fine	**1000**			
Unit	**%**			Indicator	**No**	

Pedal 1 Send					○●	4.19– 4.24 (“Select” + Encoder)
Range Min	**0.0**	Scaling	**Linear**	MC Mod	**No**	When Local is disabled in the MIDI Settings, this control is the parameter representation of the \"Pedal 1\" Hardware Source. It reflects changes that will be sent via MIDI without affecting the Synth. This parameter will be visible next to the internal representation of \"Pedal 1\" (which reflects changes from the User Interface or MIDI Input, only affecting the Synth). Editing the actual \"Pedal 1\" parameter will not be reflected.
Range Max	**100.0**	Steps	**100**	Mod. Unit	**n.a.**	
Default	**0.0**	Fine	**1000**			
Unit	**%**			Indicator	**No**	

Pedal 2					○●	4.19– 4.24 (“Select” + Encoder)
Range Min	**0.0**	Scaling	**Linear**	MC Mod	**No**	This control is the parameter representation of the \"Pedal 2\" Hardware Source. If a pedal is connected, it will directly follow the external control. If the source's return behavior is set to \"Center\", the parameter will be bipolar.
Range Max	**100.0**	Steps	**100**	Mod. Unit	**n.a.**	
Default	**0.0**	Fine	**1000**			
Unit	**%**			Indicator	**No**	

Pedal 2 Send					○●	4.19– 4.24 (“Select” + Encoder)
Range Min	**0.0**	Scaling	**Linear**	MC Mod	**No**	When Local is disabled in the MIDI Settings, this control is the parameter representation of the \"Pedal 2\" Hardware Source. It reflects changes that will be sent via MIDI without affecting the Synth. This parameter will be visible next to the internal representation of \"Pedal 2\" (which reflects changes from the User Interface or MIDI Input, only affecting the Synth). Editing the actual \"Pedal 2\" parameter will not be reflected.
Range Max	**100.0**	Steps	**100**	Mod. Unit	**n.a.**	
Default	**0.0**	Fine	**1000**			
Unit	**%**			Indicator	**No**	

Pedal 3					○●	4.19– 4.24 (“Select” + Encoder)
Range Min	**0.0**	Scaling	**Linear**	MC Mod	**No**	This control is the parameter representation of the \"Pedal 3\" Hardware Source. If a pedal is connected, it will directly follow the external control. If the source's return behavior is set to \"Center\", the parameter will be bipolar.
Range Max	**100.0**	Steps	**100**	Mod. Unit	**n.a.**	
Default	**0.0**	Fine	**1000**			
Unit	**%**			Indicator	**No**	

Pedal 3 Send					○●	4.19– 4.24(“Select” + Encoder)
Range Min	**0.0**	Scaling	**Linear**	MC Mod	**No**	When Local is disabled in the MIDI Settings, this control is the parameter representation of the \"Pedal 3\" Hardware Source. It reflects changes that will be sent via MIDI without affecting the Synth. This parameter will be visible next to the internal representation of \"Pedal 3\" (which reflects changes from the User Interface or MIDI Input, only affecting the Synth). Editing the actual \"Pedal 3\" parameter will not be reflected.
Range Max	**100.0**	Steps	**100**	Mod. Unit	**n.a.**	
Default	**0.0**	Fine	**1000**			
Unit	**%**			Indicator	**No**	

Pedal 4					○●	4.19– 4.24 (“Select” + Encoder)
Range Min	**0.0**	Scaling	**Linear**	MC Mod	**No**	This control is the parameter representation of the \"Pedal 4\" Hardware Source. If a pedal is connected, it will directly follow the external control. If the source's return behavior is set to \"Center\", the parameter will be bipolar.
Range Max	**100.0**	Steps	**100**	Mod. Unit	**n.a.**	
Default	**0.0**	Fine	**1000**			
Unit	**%**			Indicator	**No**	

Hardware Sources – 2/3

Parameter Name Sub. Par. Button No.

Pedal 4 Send					○●	4.19– 4.24 (“Select” + Encoder)
Range Min	**0.0**	Scaling	**Linear**	MC Mod	**No**	When Local is disabled in the MIDI Settings, this control is the parameter representation of the \"Pedal 4\" Hardware Source. It reflects changes that will be sent via MIDI without affecting the Synth. This parameter will be visible next to the internal representation of \"Pedal 4\" (which reflects changes from the User Interface or MIDI Input, only affecting the Synth). Editing the actual \"Pedal 1\" parameter will not be reflected.
Range Max	**100.0**	Steps	**100**	Mod. Unit	**n.a.**	
Default	**0.0**	Fine	**1000**			
Unit	**%**			Indicator	**No**	

Bender					○●	4.19– 4.24 (“Select” + Encoder)
Range Min	**-100.0**	Scaling	**Linear**	MC Mod	**No**	This control is the parameter representation of the \"Bender\" Hardware Source. If a pedal is connected, it will directly follow the Bender.
Range Max	**100.0**	Steps	**200**	Mod. Unit	**n.a.**	
Default	**0.0**	Fine	**2000**			
Unit	**%**			Indicator	**No**	

Bender Send					○●	4.19– 4.24 (“Select” + Encoder)
Range Min	**-100.0**	Scaling	**Linear**	MC Mod	**No**	When Local is disabled in the MIDI Settings, this control is the parameter representation of the \"Bender\" Hardware Source. It reflects changes that will be sent via MIDI without affecting the Synth. This parameter will be visible next to the internal representation of \"Bender\" (which reflects changes from the User Interface or MIDI Input, only affecting the Synth). Editing the actual \"Bender\" parameter will not be reflected.
Range Max	**100.0**	Steps	**200**	Mod. Unit	**n.a.**	
Default	**0.0**	Fine	**2000**			
Unit	**%**			Indicator	**No**	

Aftertouch					○●	4.19– 4.24 (“Select” + Encoder)
Range Min	**0.0**	Scaling	**Linear**	MC Mod	**No**	This control is the parameter representation of the \"Aftertouch\" Hardware Source. It will directly follow aftertouch gestures.
Range Max	**100.0**	Steps	**100**	Mod. Unit	**n.a.**	
Default	**0.0**	Fine	**1000**			
Unit	**%**			Indicator	**No**	

Aftertouch Send					○●	4.19– 4.24 (“Select” + Encoder)
Range Min	**0.0**	Scaling	**Linear**	MC Mod	**No**	When Local is disabled in the MIDI Settings, this control is the parameter representation of the \"Aftertouch\" Hardware Source. It reflects changes that will be sent via MIDI without affecting the Synth. This parameter will be visible next to the internal representation of \"Aftertouch\" (which reflects changes from the User Interface or MIDI Input, only affecting the Synth). Editing the actual \"Aftertouch\" parameter will not be reflected.
Range Max	**100.0**	Steps	**100**	Mod. Unit	**n.a.**	
Default	**0.0**	Fine	**1000**			
Unit	**%**			Indicator	**No**	

Ribbon 1					○●	4.19– 4.24 (“Select” + Encoder)
Range Min	**0.0**	Scaling	**Linear**	MC Mod	**No**	This control is the parameter representation of the \"Ribbon 1\" Hardware Source. If a pedal is connected, it will directly follow the Ribbon and vice versa. If the source's return behavior is set to \"Center\", the parameter will be bipolar.
Range Max	**100.0**	Steps	**100**	Mod. Unit	**n.a.**	
Default	**0.0**	Fine	**1000**			
Unit	**%**			Indicator	**No**	

Ribbon 1 Send					○●	4.19– 4.24 (“Select” + Encoder)
Range Min	**0.0**	Scaling	**Linear**	MC Mod	**No**	When Local is disabled in the MIDI Settings, this control is the parameter representation of the \"Ribbonl 1\" Hardware Source. It reflects changes that will be sent via MIDI without affecting the Synth. This parameter will be visible next to the internal representation of \"Ribbon 1\" (which reflects changes from the User Interface or MIDI Input, only affecting the Synth). Editing the actual \"Ribbon 1\" parameter will not be reflected.
Range Max	**100.0**	Steps	**100**	Mod. Unit	**n.a.**	
Default	**0.0**	Fine	**1000**			
Unit	**%**			Indicator	**No**	

Hardware Sources – 3/3

Parameter Name Sub. Par. Button No.

Ribbon 2					○●	4.19– 4.24 (“Select” + Encoder)
Range Min	**0.0**	Scaling	**Linear**	MC Mod	**No**	This control is the parameter representation of the \"Ribbon 2\" Hardware Source. If a pedal is connected, it will directly follow the Ribbon and vice versa. If the source's return behavior is set to \"Center\", the parameter will be bipolar.
Range Max	**100.0**	Steps	**100**	Mod. Unit	**n.a.**	
Default	**0.0**	Fine	**1000**			
Unit	**%**			Indicator	**No**	

Ribbon 2 Send					○●	4.19– 4.24 (“Select” + Encoder)
Range Min	**0.0**	Scaling	**Linear**	MC Mod	**No**	When Local is disabled in the MIDI Settings, this control is the parameter representation of the \"Ribbon 2\" Hardware Source. It reflects changes that will be sent via MIDI without affecting the Synth. This parameter will be visible next to the internal representation of \"Ribbon 2\" (which reflects changes from the User Interface or MIDI Input, only affecting the Synth). Editing the actual \"Ribbon 2\" parameter will not be reflected.
Range Max	**100.0**	Steps	**100**	Mod. Unit	**n.a.**	
Default	**0.0**	Fine	**1000**			
Unit	**%**			Indicator	**No**	

Ribbon 3					○●	4.19– 4.24 (“Select” + Encoder)
Range Min	**0.0**	Scaling	**Linear**	MC Mod	**No**	This control is the parameter representation of the \"Ribbon 3\" Hardware Source. If a pedal is connected, it will directly follow the Ribbon and vice versa. If the source's return behavior is set to \"Center\", the parameter will be bipolar.
Range Max	**100.0**	Steps	**100**	Mod. Unit	**n.a.**	
Default	**0.0**	Fine	**1000**			
Unit	**%**			Indicator	**No**	

Ribbon 3 Send					○●	4.19– 4.24 (“Select” + Encoder)
Range Min	**0.0**	Scaling	**Linear**	MC Mod	**No**	When Local is disabled in the MIDI Settings, this control is the parameter representation of the \"Ribbon 3\" Hardware Source. It reflects changes that will be sent via MIDI without affecting the Synth. This parameter will be visible next to the internal representation of \"Ribbon 3\" (which reflects changes from the User Interface or MIDI Input, only affecting the Synth). Editing the actual \"Ribbon 3\" parameter will not be reflected.
Range Max	**100.0**	Steps	**100**	Mod. Unit	**n.a.**	
Default	**0.0**	Fine	**1000**			
Unit	**%**			Indicator	**No**	

Ribbon 4					○●	4.19– 4.24 (“Select” + Encoder)
Range Min	**0.0**	Scaling	**Linear**	MC Mod	**No**	This control is the parameter representation of the \"Ribbon 4\" Hardware Source. If a pedal is connected, it will directly follow the Ribbon and vice versa. If the source's return behavior is set to \"Center\", the parameter will be bipolar.
Range Max	**100.0**	Steps	**100**	Mod. Unit	**n.a.**	
Default	**0.0**	Fine	**1000**			
Unit	**%**			Indicator	**No**	

Ribbon 4 Send					○●	4.19– 4.24 (“Select” + Encoder)
Range Min	**0.0**	Scaling	**Linear**	MC Mod	**No**	When Local is disabled in the MIDI Settings, this control is the parameter representation of the \"Ribbon 4\" Hardware Source. It reflects changes that will be sent via MIDI without affecting the Synth. This parameter will be visible next to the internal representation of \"Ribbon 4\" (which reflects changes from the User Interface or MIDI Input, only affecting the Synth). Editing the actual \"Ribbon 4\" parameter will not be reflected.
Range Max	**100.0**	Steps	**100**	Mod. Unit	**n.a.**	
Default	**0.0**	Fine	**1000**			
Unit	**%**			Indicator	**No**	

Parameter Name | Sub. Par. | Button No.

Pedal 1 to @MC:A					●○	4.19 (Soft Button 4, Line 1)
Range Min	**-100.0**	Scaling	**Linear**	MC Mod	**No**	Determines the influence of Pedal 1 on Macro Control A. If the pedal is set to a returning mode, the amount can be adjusted continuously, otherwise it will be switch-like. Continuous amounts can be set [in percent] and can cover the whole range of the Macro Control in both directions (-100.0 ... 100.0 %).
Range Max	**100.0**	Steps	**200**	Mod. Unit	**n.a.**	
Default	**0.0**	Fine	**2000**			
Unit	**%**			Indicator	**No**	

Pedal 1 to @MC:B					●○	4.20 (Soft Button 4, Line 1)
Range Min	**-100.0**	Scaling	**Linear**	MC Mod	**No**	Determines the influence of Pedal 1 on Macro Control B. If the pedal is set to a returning mode, the amount can be adjusted continuously, otherwise it will be switch-like. Continuous amounts can be set [in percent] and can cover the whole range of the Macro Control in both directions (-100.0 ... 100.0 %).
Range Max	**100.0**	Steps	**200**	Mod. Unit	**n.a.**	
Default	**0.0**	Fine	**2000**			
Unit	**%**			Indicator	**No**	

Pedal 1 to @MC:C					●○	4.21 (Soft Button 4, Line 1)
Range Min	**-100.0**	Scaling	**Linear**	MC Mod	**No**	Determines the influence of Pedal 1 on Macro Control C. If the pedal is set to a returning mode, the amount can be adjusted continuously, otherwise it will be switch-like. Continuous amounts can be set [in percent] and can cover the whole range of the Macro Control in both directions (-100.0 ... 100.0 %).
Range Max	**100.0**	Steps	**200**	Mod. Unit	**n.a.**	
Default	**0.0**	Fine	**2000**			
Unit	**%**			Indicator	**No**	

Pedal 1 to @MC:D					●○	4.22 (Soft Button 4, Line 1)
Range Min	**-100.0**	Scaling	**Linear**	MC Mod	**No**	Determines the influence of Pedal 1 on Macro Control D. If the pedal is set to a returning mode, the amount can be adjusted continuously, otherwise it will be switch-like. Continuous amounts can be set [in percent] and can cover the whole range of the Macro Control in both directions (-100.0 ... 100.0 %).
Range Max	**100.0**	Steps	**200**	Mod. Unit	**n.a.**	
Default	**0.0**	Fine	**2000**			
Unit	**%**			Indicator	**No**	

Pedal 1 to @MC:E					●○	4.23 (Soft Button 4, Line 1)
Range Min	**-100.0**	Scaling	**Linear**	MC Mod	**No**	Determines the influence of Pedal 1 on Macro Control E. If the pedal is set to a returning mode, the amount can be adjusted continuously, otherwise it will be switch-like. Continuous amounts can be set [in percent] and can cover the whole range of the Macro Control in both directions (-100.0 ... 100.0 %).
Range Max	**100.0**	Steps	**200**	Mod. Unit	**n.a.**	
Default	**0.0**	Fine	**2000**			
Unit	**%**			Indicator	**No**	

Pedal 1 to @MC:F					●○	4.24 (Soft Button 4, Line 1)
Range Min	**-100.0**	Scaling	**Linear**	MC Mod	**No**	Determines the influence of Pedal 1 on Macro Control F. If the pedal is set to a returning mode, the amount can be adjusted continuously, otherwise it will be switch-like. Continuous amounts can be set [in percent] and can cover the whole range of the Macro Control in both directions (-100.0 ... 100.0 %).
Range Max	**100.0**	Steps	**200**	Mod. Unit	**n.a.**	
Default	**0.0**	Fine	**2000**			
Unit	**%**			Indicator	**No**	

Pedal 2 to @MC:A					●○	4.19 (Soft Button 4, Line 2)
Range Min	**-100.0**	Scaling	**Linear**	MC Mod	**No**	Determines the influence of Pedal 2 on Macro Control A. If the pedal is set to a returning mode, the amount can be adjusted continuously, otherwise it will be switch-like. Continuous amounts can be set [in percent] and can cover the whole range of the Macro Control in both directions (-100.0 ... 100.0 %).
Range Max	**100.0**	Steps	**200**	Mod. Unit	**n.a.**	
Default	**0.0**	Fine	**2000**			
Unit	**%**			Indicator	**No**	

Pedal 2 to @MC:B					●○	4.20 (Soft Button 4, Line 2)
Range Min	**-100.0**	Scaling	**Linear**	MC Mod	**No**	Determines the influence of Pedal 2 on Macro Control B. If the pedal is set to a returning mode, the amount can be adjusted continuously, otherwise it will be switch-like. Continuous amounts can be set [in percent] and can cover the whole range of the Macro Control in both directions (-100.0 ... 100.0 %).
Range Max	**100.0**	Steps	**200**	Mod. Unit	**n.a.**	
Default	**0.0**	Fine	**2000**			
Unit	**%**			Indicator	**No**	

Parameter Name Sub. Par. Button No.

Pedal 2 to @MC:C					●○	4.21 (Soft Button 4, Line 2)
Range Min	**-100.0**	Scaling	**Linear**	MC Mod	**No**	Determines the influence of Pedal 2 on Macro Control C. If the pedal is set to a returning mode, the amount can be adjusted continuously, otherwise it will be switch-like. Continuous amounts can be set [in percent] and can cover the whole range of the Macro Control in both directions (-100.0 ... 100.0 %).
Range Max	**100.0**	Steps	**200**	Mod. Unit	**n.a.**	
Default	**0.0**	Fine	**2000**			
Unit	**%**			Indicator	**No**	

Pedal 2 to @MC:D					●○	4.22 (Soft Button 4, Line 2)
Range Min	**-100.0**	Scaling	**Linear**	MC Mod	**No**	Determines the influence of Pedal 2 on Macro Control D. If the pedal is set to a returning mode, the amount can be adjusted continuously, otherwise it will be switch-like. Continuous amounts can be set [in percent] and can cover the whole range of the Macro Control in both directions (-100.0 ... 100.0 %).
Range Max	**100.0**	Steps	**200**	Mod. Unit	**n.a.**	
Default	**0.0**	Fine	**2000**			
Unit	**%**			Indicator	**No**	

Pedal 2 to @MC:E					●○	4.23 (Soft Button 4, Line 2)
Range Min	**-100.0**	Scaling	**Linear**	MC Mod	**No**	Determines the influence of Pedal 2 on Macro Control E. If the pedal is set to a returning mode, the amount can be adjusted continuously, otherwise it will be switch-like. Continuous amounts can be set [in percent] and can cover the whole range of the Macro Control in both directions (-100.0 ... 100.0 %).
Range Max	**100.0**	Steps	**200**	Mod. Unit	**n.a.**	
Default	**0.0**	Fine	**2000**			
Unit	**%**			Indicator	**No**	

Pedal 2 to @MC:F					●○	4.24 (Soft Button 4, Line 2)
Range Min	**-100.0**	Scaling	**Linear**	MC Mod	**No**	Determines the influence of Pedal 2 on Macro Control F. If the pedal is set to a returning mode, the amount can be adjusted continuously, otherwise it will be switch-like. Continuous amounts can be set [in percent] and can cover the whole range of the Macro Control in both directions (-100.0 ... 100.0 %).
Range Max	**100.0**	Steps	**200**	Mod. Unit	**n.a.**	
Default	**0.0**	Fine	**2000**			
Unit	**%**			Indicator	**No**	

Pedal 3 to @MC:A					●○	4.19 (Soft Button 4, Line 3)
Range Min	**-100.0**	Scaling	**Linear**	MC Mod	**No**	Determines the influence of Pedal 3 on Macro Control A. If the pedal is set to a returning mode, the amount can be adjusted continuously, otherwise it will be switch-like. Continuous amounts can be set [in percent] and can cover the whole range of the Macro Control in both directions (-100.0 ... 100.0 %).
Range Max	**100.0**	Steps	**200**	Mod. Unit	**n.a.**	
Default	**0.0**	Fine	**2000**			
Unit	**%**			Indicator	**No**	

Pedal 3 to @MC:B					●○	4.20 (Soft Button 4, Line 3)
Range Min	**-100.0**	Scaling	**Linear**	MC Mod	**No**	Determines the influence of Pedal 3 on Macro Control B. If the pedal is set to a returning mode, the amount can be adjusted continuously, otherwise it will be switch-like. Continuous amounts can be set [in percent] and can cover the whole range of the Macro Control in both directions (-100.0 ... 100.0 %).
Range Max	**100.0**	Steps	**200**	Mod. Unit	**n.a.**	
Default	**0.0**	Fine	**2000**			
Unit	**%**			Indicator	**No**	

Pedal 3 to @MC:C					●○	4.21 (Soft Button 4, Line 3)
Range Min	**-100.0**	Scaling	**Linear**	MC Mod	**No**	Determines the influence of Pedal 3 on Macro Control C. If the pedal is set to a returning mode, the amount can be adjusted continuously, otherwise it will be switch-like. Continuous amounts can be set [in percent] and can cover the whole range of the Macro Control in both directions (-100.0 ... 100.0 %).
Range Max	**100.0**	Steps	**200**	Mod. Unit	**n.a.**	
Default	**0.0**	Fine	**2000**			
Unit	**%**			Indicator	**No**	

Pedal 3 to @MC:D					●○	4.22 (Soft Button 4, Line 3)
Range Min	**-100.0**	Scaling	**Linear**	MC Mod	**No**	Determines the influence of Pedal 3 on Macro Control D. If the pedal is set to a returning mode, the amount can be adjusted continuously, otherwise it will be switch-like. Continuous amounts can be set [in percent] and can cover the whole range of the Macro Control in both directions (-100.0 ... 100.0 %).
Range Max	**100.0**	Steps	**200**	Mod. Unit	**n.a.**	
Default	**0.0**	Fine	**2000**			
Unit	**%**			Indicator	**No**	

Parameter Name Sub. Par. Button No.

Pedal 3 to @MC:E						4.23 (Soft Button 4, Line 3)
Range Min	**-100.0**	Scaling	**Linear**	MC Mod	**No**	Determines the influence of Pedal 3 on Macro Control E. If the pedal is set to a returning mode, the amount can be adjusted continuously, otherwise it will be switch-like. Continuous amounts can be set [in percent] and can cover the whole range of the Macro Control in both directions (-100.0 ... 100.0 %).
Range Max	**100.0**	Steps	**200**	Mod. Unit	**n.a.**	
Default	**0.0**	Fine	**2000**			
Unit	**%**			Indicator	**No**	

Pedal 3 to @MC:F						4.24 (Soft Button 4, Line 3)
Range Min	**-100.0**	Scaling	**Linear**	MC Mod	**No**	Determines the influence of Pedal 3 on Macro Control F. If the pedal is set to a returning mode, the amount can be adjusted continuously, otherwise it will be switch-like. Continuous amounts can be set [in percent] and can cover the whole range of the Macro Control in both directions (-100.0 ... 100.0 %).
Range Max	**100.0**	Steps	**200**	Mod. Unit	**n.a.**	
Default	**0.0**	Fine	**2000**			
Unit	**%**			Indicator	**No**	

Pedal 4 to @MC:A						4.19 (Soft Button 4, Line 4)
Range Min	**-100.0**	Scaling	**Linear**	MC Mod	**No**	Determines the influence of Pedal 4 on Macro Control A. If the pedal is set to a returning mode, the amount can be adjusted continuously, otherwise it will be switch-like. Continuous amounts can be set [in percent] and can cover the whole range of the Macro Control in both directions (-100.0 ... 100.0 %).
Range Max	**100.0**	Steps	**200**	Mod. Unit	**n.a.**	
Default	**0.0**	Fine	**2000**			
Unit	**%**			Indicator	**No**	

Pedal 4 to @MC:B						4.20 (Soft Button 4, Line 4)
Range Min	**-100.0**	Scaling	**Linear**	MC Mod	**No**	Determines the influence of Pedal 4 on Macro Control B. If the pedal is set to a returning mode, the amount can be adjusted continuously, otherwise it will be switch-like. Continuous amounts can be set [in percent] and can cover the whole range of the Macro Control in both directions (-100.0 ... 100.0 %).
Range Max	**100.0**	Steps	**200**	Mod. Unit	**n.a.**	
Default	**0.0**	Fine	**2000**			
Unit	**%**			Indicator	**No**	

Pedal 4 to @MC:C						4.21 (Soft Button 4, Line 4)
Range Min	**-100.0**	Scaling	**Linear**	MC Mod	**No**	Determines the influence of Pedal 4 on Macro Control C. If the pedal is set to a returning mode, the amount can be adjusted continuously, otherwise it will be switch-like. Continuous amounts can be set [in percent] and can cover the whole range of the Macro Control in both directions (-100.0 ... 100.0 %).
Range Max	**100.0**	Steps	**200**	Mod. Unit	**n.a.**	
Default	**0.0**	Fine	**2000**			
Unit	**%**			Indicator	**No**	

Pedal 4 to @MC:D						4.22 (Soft Button 4, Line 4)
Range Min	**-100.0**	Scaling	**Linear**	MC Mod	**No**	Determines the influence of Pedal 4 on Macro Control D. If the pedal is set to a returning mode, the amount can be adjusted continuously, otherwise it will be switch-like. Continuous amounts can be set [in percent] and can cover the whole range of the Macro Control in both directions (-100.0 ... 100.0 %).
Range Max	**100.0**	Steps	**200**	Mod. Unit	**n.a.**	
Default	**0.0**	Fine	**2000**			
Unit	**%**			Indicator	**No**	

Pedal 4 to @MC:E						4.23 (Soft Button 4, Line 4)
Range Min	**-100.0**	Scaling	**Linear**	MC Mod	**No**	Determines the influence of Pedal 4 on Macro Control E. If the pedal is set to a returning mode, the amount can be adjusted continuously, otherwise it will be switch-like. Continuous amounts can be set [in percent] and can cover the whole range of the Macro Control in both directions (-100.0 ... 100.0 %).
Range Max	**100.0**	Steps	**200**	Mod. Unit	**n.a.**	
Default	**0.0**	Fine	**2000**			
Unit	**%**			Indicator	**No**	

Pedal 4 to @MC:F						4.24 (Soft Button 4, Line 4)
Range Min	**-100.0**	Scaling	**Linear**	MC Mod	**No**	Determines the influence of Pedal 4 on Macro Control F. If the pedal is set to a returning mode, the amount can be adjusted continuously, otherwise it will be switch-like. Continuous amounts can be set [in percent] and can cover the whole range of the Macro Control in both directions (-100.0 ... 100.0 %).
Range Max	**100.0**	Steps	**200**	Mod. Unit	**n.a.**	
Default	**0.0**	Fine	**2000**			
Unit	**%**			Indicator	**No**	

Parameter Name Sub. Par. Button No.

Bender to @MC:A						4.19 (Soft Button 4, Line 5)
Range Min	**-100.0**	Scaling	**Linear**	MC Mod	**No**	Determines the influence of the Bender on Macro Control A. The amount can be adjusted continuously [in percent] and can cover the whole range of the Macro Control in both directions (-100.0 ... 100.0 %). The bipolar range of the Bender is mapped to the unipolar range of the Macro Control by an amount of 50 %.
Range Max	**100.0**	Steps	**200**	Mod. Unit	**n.a.**	
Default	**0.0**	Fine	**2000**			
Unit	**%**			Indicator	**No**	

Bender to @MC:B						4.20 (Soft Button 4, Line 5)
Range Min	**-100.0**	Scaling	**Linear**	MC Mod	**No**	Determines the influence of the Bender on Macro Control B. The amount can be adjusted continuously [in percent] and can cover the whole range of the Macro Control in both directions (-100.0 ... 100.0 %). The bipolar range of the Bender is mapped to the unipolar range of the Macro Control by an amount of 50 %.
Range Max	**100.0**	Steps	**200**	Mod. Unit	**n.a.**	
Default	**0.0**	Fine	**2000**			
Unit	**%**			Indicator	**No**	

Bender to @MC:C						4.21 (Soft Button 4, Line 5)
Range Min	**-100.0**	Scaling	**Linear**	MC Mod	**No**	Determines the influence of the Bender on Macro Control C. The amount can be adjusted continuously [in percent] and can cover the whole range of the Macro Control in both directions (-100.0 ... 100.0 %). The bipolar range of the Bender is mapped to the unipolar range of the Macro Control by an amount of 50 %.
Range Max	**100.0**	Steps	**200**	Mod. Unit	**n.a.**	
Default	**0.0**	Fine	**2000**			
Unit	**%**			Indicator	**No**	

Bender to @MC:D						4.22 (Soft Button 4, Line 5)
Range Min	**-100.0**	Scaling	**Linear**	MC Mod	**No**	Determines the influence of the Bender on Macro Control D. The amount can be adjusted continuously [in percent] and can cover the whole range of the Macro Control in both directions (-100.0 ... 100.0 %). The bipolar range of the Bender is mapped to the unipolar range of the Macro Control by an amount of 50 %.
Range Max	**100.0**	Steps	**200**	Mod. Unit	**n.a.**	
Default	**0.0**	Fine	**2000**			
Unit	**%**			Indicator	**No**	

Bender to @MC:E						4.23 (Soft Button 4, Line 5)
Range Min	**-100.0**	Scaling	**Linear**	MC Mod	**No**	Determines the influence of the Bender on Macro Control E. The amount can be adjusted continuously [in percent] and can cover the whole range of the Macro Control in both directions (-100.0 ... 100.0 %). The bipolar range of the Bender is mapped to the unipolar range of the Macro Control by an amount of 50 %.
Range Max	**100.0**	Steps	**200**	Mod. Unit	**n.a.**	
Default	**0.0**	Fine	**2000**			
Unit	**%**			Indicator	**No**	

Bender to @MC:F						4.24 (Soft Button 4, Line 5)
Range Min	**-100.0**	Scaling	**Linear**	MC Mod	**No**	Determines the influence of the Bender on Macro Control F. The amount can be adjusted continuously [in percent] and can cover the whole range of the Macro Control in both directions (-100.0 ... 100.0 %). The bipolar range of the Bender is mapped to the unipolar range of the Macro Control by an amount of 50 %.
Range Max	**100.0**	Steps	**200**	Mod. Unit	**n.a.**	
Default	**0.0**	Fine	**2000**			
Unit	**%**			Indicator	**No**	

Aftertouch to @MC:A						4.19 (Soft Button 4, Line 6)
Range Min	**-100.0**	Scaling	**Linear**	MC Mod	**No**	Determines the influence of the Aftertouch on Macro Control A. The amount can be adjusted continuously [in percent] and can cover the whole range of the Macro Control in both directions (-100.0 ... 100.0 %).
Range Max	**100.0**	Steps	**200**	Mod. Unit	**n.a.**	
Default	**0.0**	Fine	**2000**			
Unit	**%**			Indicator	**No**	

Aftertouch to @MC:B						4.20 (Soft Button 4, Line 6)
Range Min	**-100.0**	Scaling	**Linear**	MC Mod	**No**	Determines the influence of the Aftertouch on Macro Control B. The amount can be adjusted continuously [in percent] and can cover the whole range of the Macro Control in both directions (-100.0 ... 100.0 %).
Range Max	**100.0**	Steps	**200**	Mod. Unit	**n.a.**	
Default	**0.0**	Fine	**2000**			
Unit	**%**			Indicator	**No**	

Parameter Name Sub. Par. Button No.

Aftertouch to @MC:C						4.21 (Soft Button 4, Line 6)
Range Min	**-100.0**	Scaling	**Linear**	MC Mod	**No**	Determines the influence of the Aftertouch on Macro Control C. The amount can be adjusted continuously [in percent] and can cover the whole range of the Macro Control in both directions (-100.0 ... 100.0 %).
Range Max	**100.0**	Steps	**200**	Mod. Unit	**n.a.**	
Default	**0.0**	Fine	**2000**			
Unit	**%**			Indicator	**No**	

Aftertouch to @MC:D						4.22 (Soft Button 4, Line 6)
Range Min	**-100.0**	Scaling	**Linear**	MC Mod	**No**	Determines the influence of the Aftertouch on Macro Control D. The amount can be adjusted continuously [in percent] and can cover the whole range of the Macro Control in both directions (-100.0 ... 100.0 %).
Range Max	**100.0**	Steps	**200**	Mod. Unit	**n.a.**	
Default	**0.0**	Fine	**2000**			
Unit	**%**			Indicator	**No**	

Aftertouch to @MC:E						4.23 (Soft Button 4, Line 6)
Range Min	**-100.0**	Scaling	**Linear**	MC Mod	**No**	Determines the influence of the Aftertouch on Macro Control E. The amount can be adjusted continuously [in percent] and can cover the whole range of the Macro Control in both directions (-100.0 ... 100.0 %).
Range Max	**100.0**	Steps	**200**	Mod. Unit	**n.a.**	
Default	**0.0**	Fine	**2000**			
Unit	**%**			Indicator	**No**	

Aftertouch to @MC:F						4.24 (Soft Button 4, Line 6)
Range Min	**-100.0**	Scaling	**Linear**	MC Mod	**No**	Determines the influence of the Aftertouch on Macro Control F. The amount can be adjusted continuously [in percent] and can cover the whole range of the Macro Control in both directions (-100.0 ... 100.0 %).
Range Max	**100.0**	Steps	**200**	Mod. Unit	**n.a.**	
Default	**0.0**	Fine	**2000**			
Unit	**%**			Indicator	**No**	

Ribbon 1 to @MC:A						4.19 (Soft Button 4, Line 7)
Range Min	**-100.0**	Scaling	**Linear**	MC Mod	**No**	Determines the influence of Ribbon 1 on Macro Control A. If the ribbon is set to a returning mode, the amount can be adjusted continuously, otherwise it will be switch-like. Continuous amounts can be set [in percent] and can cover the whole range of the Macro Control in both directions (-100.0 ... 100.0 %).
Range Max	**100.0**	Steps	**200**	Mod. Unit	**n.a.**	
Default	**0.0**	Fine	**2000**			
Unit	**%**			Indicator	**No**	

Ribbon 1 to @MC:B						4.20 (Soft Button 4, Line 7)
Range Min	**-100.0**	Scaling	**Linear**	MC Mod	**No**	Determines the influence of Ribbon 1 on Macro Control B. If the ribbon is set to a returning mode, the amount can be adjusted continuously, otherwise it will be switch-like. Continuous amounts can be set [in percent] and can cover the whole range of the Macro Control in both directions (-100.0 ... 100.0 %).
Range Max	**100.0**	Steps	**200**	Mod. Unit	**n.a.**	
Default	**0.0**	Fine	**2000**			
Unit	**%**			Indicator	**No**	

Ribbon 1 to @MC:C						4.21 (Soft Button 4, Line 7)
Range Min	**-100.0**	Scaling	**Linear**	MC Mod	**No**	Determines the influence of Ribbon 1 on Macro Control C. If the ribbon is set to a returning mode, the amount can be adjusted continuously, otherwise it will be switch-like. Continuous amounts can be set [in percent] and can cover the whole range of the Macro Control in both directions (-100.0 ... 100.0 %).
Range Max	**100.0**	Steps	**200**	Mod. Unit	**n.a.**	
Default	**0.0**	Fine	**2000**			
Unit	**%**			Indicator	**No**	

Ribbon 1 to @MC:D						4.22 (Soft Button 4, Line 7)
Range Min	**-100.0**	Scaling	**Linear**	MC Mod	**No**	Determines the influence of Ribbon 1 on Macro Control D. If the ribbon is set to a returning mode, the amount can be adjusted continuously, otherwise it will be switch-like. Continuous amounts can be set [in percent] and can cover the whole range of the Macro Control in both directions (-100.0 ... 100.0 %).
Range Max	**100.0**	Steps	**200**	Mod. Unit	**n.a.**	
Default	**0.0**	Fine	**2000**			
Unit	**%**			Indicator	**No**	

Parameter Name Sub. Par. Button No.

Ribbon 1 to @MC:E						4.23 (Soft Button 4, Line 7)
Range Min	**-100.0**	Scaling	**Linear**	MC Mod	**No**	Determines the influence of Ribbon 1 on Macro Control E. If the ribbon is set to a returning mode, the amount can be adjusted continuously, otherwise it will be switch-like. Continuous amounts can be set [in percent] and can cover the whole range of the Macro Control in both directions (-100.0 ... 100.0 %).
Range Max	**100.0**	Steps	**200**	Mod. Unit	**n.a.**	
Default	**0.0**	Fine	**2000**			
Unit	**%**			Indicator	**No**	

Ribbon 1 to @MC:F						4.24 (Soft Button 4, Line 7)
Range Min	**-100.0**	Scaling	**Linear**	MC Mod	**No**	Determines the influence of Ribbon 1 on Macro Control F. If the ribbon is set to a returning mode, the amount can be adjusted continuously, otherwise it will be switch-like. Continuous amounts can be set [in percent] and can cover the whole range of the Macro Control in both directions (-100.0 ... 100.0 %).
Range Max	**100.0**	Steps	**200**	Mod. Unit	**n.a.**	
Default	**0.0**	Fine	**2000**			
Unit	**%**			Indicator	**No**	

Ribbon 2 to @MC:A						4.19 (Soft Button 4, Line 8)
Range Min	**-100.0**	Scaling	**Linear**	MC Mod	**No**	Determines the influence of Ribbon 2 on Macro Control A. If the ribbon is set to a returning mode, the amount can be adjusted continuously, otherwise it will be switch-like. Continuous amounts can be set [in percent] and can cover the whole range of the Macro Control in both directions (-100.0 ... 100.0 %).
Range Max	**100.0**	Steps	**200**	Mod. Unit	**n.a.**	
Default	**0.0**	Fine	**2000**			
Unit	**%**			Indicator	**No**	

Ribbon 2 to @MC:B						4.20 (Soft Button 4, Line 8)
Range Min	**-100.0**	Scaling	**Linear**	MC Mod	**No**	Determines the influence of Ribbon 2 on Macro Control B. If the ribbon is set to a returning mode, the amount can be adjusted continuously, otherwise it will be switch-like. Continuous amounts can be set [in percent] and can cover the whole range of the Macro Control in both directions (-100.0 ... 100.0 %).
Range Max	**100.0**	Steps	**200**	Mod. Unit	**n.a.**	
Default	**0.0**	Fine	**2000**			
Unit	**%**			Indicator	**No**	

Ribbon 2 to @MC:C						4.21 (Soft Button 4, Line 8)
Range Min	**-100.0**	Scaling	**Linear**	MC Mod	**No**	Determines the influence of Ribbon 2 on Macro Control C. If the ribbon is set to a returning mode, the amount can be adjusted continuously, otherwise it will be switch-like. Continuous amounts can be set [in percent] and can cover the whole range of the Macro Control in both directions (-100.0 ... 100.0 %).
Range Max	**100.0**	Steps	**200**	Mod. Unit	**n.a.**	
Default	**0.0**	Fine	**2000**			
Unit	**%**			Indicator	**No**	

Ribbon 2 to @MC:D						4.22 (Soft Button 4, Line 8)
Range Min	**-100.0**	Scaling	**Linear**	MC Mod	**No**	Determines the influence of Ribbon 2 on Macro Control D. If the ribbon is set to a returning mode, the amount can be adjusted continuously, otherwise it will be switch-like. Continuous amounts can be set [in percent] and can cover the whole range of the Macro Control in both directions (-100.0 ... 100.0 %).
Range Max	**100.0**	Steps	**200**	Mod. Unit	**n.a.**	
Default	**0.0**	Fine	**2000**			
Unit	**%**			Indicator	**No**	

Ribbon 2 to @MC:E						4.23 (Soft Button 4, Line 8)
Range Min	**-100.0**	Scaling	**Linear**	MC Mod	**No**	Determines the influence of Ribbon 2 on Macro Control E. If the ribbon is set to a returning mode, the amount can be adjusted continuously, otherwise it will be switch-like. Continuous amounts can be set [in percent] and can cover the whole range of the Macro Control in both directions (-100.0 ... 100.0 %).
Range Max	**100.0**	Steps	**200**	Mod. Unit	**n.a.**	
Default	**0.0**	Fine	**2000**			
Unit	**%**			Indicator	**No**	

Ribbon 2 to @MC:F						4.24 (Soft Button 4, Line 8)
Range Min	**-100.0**	Scaling	**Linear**	MC Mod	**No**	Determines the influence of Ribbon 2 on Macro Control F. If the ribbon is set to a returning mode, the amount can be adjusted continuously, otherwise it will be switch-like. Continuous amounts can be set [in percent] and can cover the whole range of the Macro Control in both directions (-100.0 ... 100.0 %).
Range Max	**100.0**	Steps	**200**	Mod. Unit	**n.a.**	
Default	**0.0**	Fine	**2000**			
Unit	**%**			Indicator	**No**	

Parameter Name Sub. Par. Button No.

Ribbon 3 to @MC:A						4.19 (Soft Button 4, Line 9)
Range Min	**-100.0**	Scaling	**Linear**	MC Mod	**No**	Determines the influence of Ribbon 3 on Macro Control A. If the ribbon is set to a returning mode, the amount can be adjusted continuously, otherwise it will be switch-like. Continuous amounts can be set [in percent] and can cover the whole range of the Macro Control in both directions (-100.0 ... 100.0 %).
Range Max	**100.0**	Steps	**200**	Mod. Unit	**n.a.**	
Default	**0.0**	Fine	**2000**			
Unit	**%**			Indicator	**No**	

Ribbon 3 to @MC:B						4.20 (Soft Button 4, Line 9)
Range Min	**-100.0**	Scaling	**Linear**	MC Mod	**No**	Determines the influence of Ribbon 3 on Macro Control B. If the ribbon is set to a returning mode, the amount can be adjusted continuously, otherwise it will be switch-like. Continuous amounts can be set [in percent] and can cover the whole range of the Macro Control in both directions (-100.0 ... 100.0 %).
Range Max	**100.0**	Steps	**200**	Mod. Unit	**n.a.**	
Default	**0.0**	Fine	**2000**			
Unit	**%**			Indicator	**No**	

Ribbon 3 to @MC:C						4.21 (Soft Button 4, Line 9)
Range Min	**-100.0**	Scaling	**Linear**	MC Mod	**No**	Determines the influence of Ribbon 3 on Macro Control C. If the ribbon is set to a returning mode, the amount can be adjusted continuously, otherwise it will be switch-like. Continuous amounts can be set [in percent] and can cover the whole range of the Macro Control in both directions (-100.0 ... 100.0 %).
Range Max	**100.0**	Steps	**200**	Mod. Unit	**n.a.**	
Default	**0.0**	Fine	**2000**			
Unit	**%**			Indicator	**No**	

Ribbon 3 to @MC:D						4.22 (Soft Button 4, Line 9)
Range Min	**-100.0**	Scaling	**Linear**	MC Mod	**No**	Determines the influence of Ribbon 3 on Macro Control D. If the ribbon is set to a returning mode, the amount can be adjusted continuously, otherwise it will be switch-like. Continuous amounts can be set [in percent] and can cover the whole range of the Macro Control in both directions (-100.0 ... 100.0 %).
Range Max	**100.0**	Steps	**200**	Mod. Unit	**n.a.**	
Default	**0.0**	Fine	**2000**			
Unit	**%**			Indicator	**No**	

Ribbon 3 to @MC:E						4.23(Soft Button 4, Line 9)
Range Min	**-100.0**	Scaling	**Linear**	MC Mod	**No**	Determines the influence of Ribbon 3 on Macro Control E. If the ribbon is set to a returning mode, the amount can be adjusted continuously, otherwise it will be switch-like. Continuous amounts can be set [in percent] and can cover the whole range of the Macro Control in both directions (-100.0 ... 100.0 %).
Range Max	**100.0**	Steps	**200**	Mod. Unit	**n.a.**	
Default	**0.0**	Fine	**2000**			
Unit	**%**			Indicator	**No**	

Ribbon 3 to @MC:F						4.24 (Soft Button 4, Line 9)
Range Min	**-100.0**	Scaling	**Linear**	MC Mod	**No**	Determines the influence of Ribbon 3 on Macro Control F. If the ribbon is set to a returning mode, the amount can be adjusted continuously, otherwise it will be switch-like. Continuous amounts can be set [in percent] and can cover the whole range of the Macro Control in both directions (-100.0 ... 100.0 %).
Range Max	**100.0**	Steps	**200**	Mod. Unit	**n.a.**	
Default	**0.0**	Fine	**2000**			
Unit	**%**			Indicator	**No**	

Ribbon 4 to @MC:A						4.19 (Soft Button 4, Line 10)
Range Min	**-100.0**	Scaling	**Linear**	MC Mod	**No**	Determines the influence of Ribbon 4 on Macro Control A. If the ribbon is set to a returning mode, the amount can be adjusted continuously, otherwise it will be switch-like. Continuous amounts can be set [in percent] and can cover the whole range of the Macro Control in both directions (-100.0 ... 100.0 %).
Range Max	**100.0**	Steps	**200**	Mod. Unit	**n.a.**	
Default	**0.0**	Fine	**2000**			
Unit	**%**			Indicator	**No**	

Ribbon 4 to @MC:B						4.20 (Soft Button 4, Line 10)
Range Min	**-100.0**	Scaling	**Linear**	MC Mod	**No**	Determines the influence of Ribbon 4 on Macro Control B. If the ribbon is set to a returning mode, the amount can be adjusted continuously, otherwise it will be switch-like. Continuous amounts can be set [in percent] and can cover the whole range of the Macro Control in both directions (-100.0 ... 100.0 %).
Range Max	**100.0**	Steps	**200**	Mod. Unit	**n.a.**	
Default	**0.0**	Fine	**2000**			
Unit	**%**			Indicator	**No**	

Parameter Name Sub. Par. Button No.

Ribbon 4 to @MC:C						4.21 (Soft Button 4, Line 10)
Range Min	**-100.0**	Scaling	**Linear**	MC Mod	**No**	Determines the influence of Ribbon 4 on Macro Control C. If the ribbon is set to a returning mode, the amount can be adjusted continuously, otherwise it will be switch-like. Continuous amounts can be set [in percent] and can cover the whole range of the Macro Control in both directions (-100.0 ... 100.0 %).
Range Max	**100.0**	Steps	**200**	Mod. Unit	**n.a.**	
Default	**0.0**	Fine	**2000**			
Unit	**%**			Indicator	**No**	

Ribbon 4 to @MC:D						4.22 (Soft Button 4, Line 10)
Range Min	**-100.0**	Scaling	**Linear**	MC Mod	**No**	Determines the influence of Ribbon 4 on Macro Control D. If the ribbon is set to a returning mode, the amount can be adjusted continuously, otherwise it will be switch-like. Continuous amounts can be set [in percent] and can cover the whole range of the Macro Control in both directions (-100.0 ... 100.0 %).
Range Max	**100.0**	Steps	**200**	Mod. Unit	**n.a.**	
Default	**0.0**	Fine	**2000**			
Unit	**%**			Indicator	**No**	

Ribbon 4 to @MC:E						4.23 (Soft Button 4, Line 10)
Range Min	**-100.0**	Scaling	**Linear**	MC Mod	**No**	Determines the influence of Ribbon 4 on Macro Control E. If the ribbon is set to a returning mode, the amount can be adjusted continuously, otherwise it will be switch-like. Continuous amounts can be set [in percent] and can cover the whole range of the Macro Control in both directions (-100.0 ... 100.0 %).
Range Max	**100.0**	Steps	**200**	Mod. Unit	**n.a.**	
Default	**0.0**	Fine	**2000**			
Unit	**%**			Indicator	**No**	

Ribbon 4 to @MC:F						4.24 (Soft Button 4, Line 10)
Range Min	**-100.0**	Scaling	**Linear**	MC Mod	**No**	Determines the influence of Ribbon 4 on Macro Control F. If the ribbon is set to a returning mode, the amount can be adjusted continuously, otherwise it will be switch-like. Continuous amounts can be set [in percent] and can cover the whole range of the Macro Control in both directions (-100.0 ... 100.0 %).
Range Max	**100.0**	Steps	**200**	Mod. Unit	**n.a.**	
Default	**0.0**	Fine	**2000**			
Unit	**%**			Indicator	**No**	

Mono

Parameter Name	Sub. Par.	Button No.

Enable						Sound, Soft Button 3 [Voices..], Soft Button 2 [Mono..]
Range Min	**off**	Scaling	**n.a.**	MC Mod	**No**	When enabled, only one voice will be assigned, even when multiple keys are pressed.
Range Max	**on**	Steps	**n.a.**	Mod. Unit	**n.a.**	
Default	**n.a**	Fine	**n.a.**			
Unit	**n.a.**			Indicator	**Yes**	

Key Priority						Sound, Soft Button 3 [Voices..], Soft Button 2 [Mono..]
Range Min	**lowest**	Scaling	**n.a.**	MC Mod	**No**	When pressing multiple keys in Mono mode, they are sorted according to the priority set by this parameter. The key matching the priority determines the pitch of the Mono voice.
Range Max	**highest**	Steps	**2**	Mod. Unit	**n.a.**	
Default	**latest**	Fine	**n.a.**			
Unit	**priority**			Indicator	**No**	

Glide Time						Sound, Soft Button 3 [Voices..], Soft Button 2 [Mono..]
Range Min	**0.000**	Scaling	**Expon.**	MC Mod	**Yes**	In Legato mode this time can be used to smooth the transitions of the pitches.
Range Max	**16000**	Steps	**100**	Mod. Unit	**%**	
Default	**0.000**	Fine	**1000**			
Unit	**ms**			Indicator	**No**	

Legato						Sound, Soft Button 3 [Voices..], Soft Button 2 [Mono..]
Range Min	**none**	Scaling	**n.a.**	MC Mod	**No**	When a new key matches the Priority, it will take over. When the priorized key is released the second priorized key takes over. Envelopes will start if the state of this parameter allows for it. Glide will be applied if the state of this parameter allows for it.
Range Max	**Env. Gl.**	Steps	**3**	Mod. Unit	**n.a.**	
Default	**Env. Gl.**	Fine	**n.a.**			
Unit	**n.a.**			Indicator	**Yes**	

Unison

Parameter Name Sub. Par. Button No.

Voices						Sound, Soft Button 3 [Voices..], Soft Button 4 [Unison..]
Range Min	**1 (off)**	Scaling	**Integer**	MC Mod	**No**	Number of unison voices that will be assigned to a key. At 1, the unison effect is disabled.
Range Max	**24**	Steps	**23**	Mod. Unit	**n.a.**	
Default	**1 (off)**	Fine	**23**			
Unit	**voices**			Indicator	**Yes**	

Detune						Sound, Soft Button 3 [Voices..], Soft Button 4 [Unison..]
Range Min	**0.000**	Scaling	**Linear**	MC Mod	**Yes**	Spreading of the pitches of the unison voices [in semitones]. The Fine mode allows for adjustments in steps of 0.001 semitones (0.1 cents).
Range Max	**24.000**	Steps	**240**	Mod. Unit	**st**	
Default	**1200**	Fine	**24000**			
Unit	**st**			Indicator	**No**	

Phase						Sound, Soft Button 3 [Voices..], Soft Button 4 [Unison..]
Range Min	**0.0**	Scaling	**Linear**	MC Mod	**Yes**	Spreading the (Oscillators') start phases of the unison voices to get different phase cancellations at the beginning of a note. The value is the phase range [in degrees] covered by a group of unison voices.
Range Max	**360.0**	Steps	**72**	Mod. Unit	**deg**	
Default	**0**	Fine	**3600**			
Unit	**deg**			Indicator	**No**	

Pan						Sound, Soft Button 3 [Voices..], Soft Button 4 [Unison..]
Range Min	**0.0**	Scaling	**Linear**	MC Mod	**Yes**	Voice panning inside of a group of unison voices. At 100.0 %, the voices are spread over the full stereo base.
Range Max	**100.0**	Steps	**100**	Mod. Unit	**%**	
Default	**0**	Fine	**1000**			
Unit	**%**			Indicator	**No**	

Master

Parameter Name Sub. Par. Button No.

Master Volume						Sound, Soft Button 4 [Master..] (Soft Button 4)
Range Min	**- inf**	Scaling	**Parab. G.**	MC Mod	**Yes**	Master volume [in dB], applied at the end of the effect chain, before the soft clipper.
Range Max	**12**	Steps	**100**	Mod. Unit	**%**	
Default	**0.000**	Fine	**1000**			
Unit	**dB**			Indicator	**No**	

Master Tune						Sound, Soft Button 4 [Master..] (Soft Button 4)
Range Min	**-48.00**	Scaling	**Linear**	MC Mod	**Yes**	Global pitch transposition [in semitones].
Range Max	**48.00**	Steps	**96**	Mod. Unit	**st**	
Default	**0.00**	Fine	**9600**			
Unit	**st**			Indicator	**No**	

FX Pan						Sound, Soft Button 4 [Master..] (Soft Button 4)
Range Min	**-100.0**	Scaling	**Linear**	MC Mod	**Yes**	Panning of the dual effect chain. The stereo signals of both \"FX \" Parts can be panned against each other:
Range Max	**100.0**	Steps	**200**	Mod. Unit	**%**	
Default	**0.0**	Fine	**2000**			
Unit	**%**			Indicator	**No**	

Serial FX						Sound, Soft Button 4 [Master..] (Soft Button 4)
Range Min	**-100.0**	Scaling	**Linear**	MC Mod	**Yes**	The output of an FX chain can be routed to the input of the other FX chain, thus creating a series of 10 effects (not available in Single Sounds). Negative values: the FX II output signals are routed to FX I (with absolute amount) 0.0%: no routing of signals between the FX chains Positive values: the FX I output signals are routed to FX II (with absolute amount)
Range Max	**100.0**	Steps	**200**	Mod. Unit	**%**	
Default	**0.0**	Fine	**2000**			
Unit	**%**			Indicator	**No**	

FX Mix I – II						Sound, Soft Button 4 [Master..] (Soft Button 4)
Range Min	**0.0**	Scaling	**Linear**	MC Mod	**Yes**	Crossfades between both FX chains I and II (only available in Single sounds). 0.0%: only the output signal of FX I remains in the mix 100.0%: only the output signal of FX II remains in the mix
Range Max	**100.0**	Steps	**100**	Mod. Unit	**%**	
Default	**0.0**	Fine	**1000**			
Unit	**%**			Indicator	**No**	

Scale – 1/2

Parameter Name Sub. Par. Button No.

Base Key						Sound, Soft Button 1 [Scale..] (Soft Button 4)
Range Min	**C**	Scaling	**Integer**	MC Mod	**No**	Sets the base key for the custom scale. The scale is defined for the eleven keys above the base key and will be applied to all octaves accordingly.
Range Max	**B**	Steps	**11**	Mod. Unit	**n.a.**	
Default	**C**	Fine	**11**			
Unit	**note**			Indicator	**No**	

Offset +0						Sound, Soft Button 1 [Scale..] (Soft Button 4)
Range Min	**-1200.0**	Scaling	**Linear**	MC Mod	**Yes**	Offset of the base key [in cents]. At zero, the interval to the base key would be perfect identity.
Range Max	**1200.0**	Steps	**420**	Mod. Unit	**%**	
Default	**0.0**	Fine	**4200**			
Unit	**ct**			Indicator	**No**	

Offset +1						Sound, Soft Button 1 [Scale..] (Soft Button 4)
Range Min	**-1200**	Scaling	**Linear**	MC Mod	**Yes**	Offset of the first key following the base key [in cents]. At zero, the interval to the base key would be the minor second of the equally tempered scale.
Range Max	**1200**	Steps	**420**	Mod. Unit	**%**	
Default	**0**	Fine	**4200**			
Unit	**ct**			Indicator	**No**	

Offset +2						Sound, Soft Button 1 [Scale..] (Soft Button 4)
Range Min	**-1200**	Scaling	**Linear**	MC Mod	**Yes**	Offset of the second key following the base key [in cents]. At zero, the interval to the base key would be the major second of the equally tempered scale.
Range Max	**1200**	Steps	**420**	Mod. Unit	**%**	
Default	**0**	Fine	**4200**			
Unit	**ct**			Indicator	**No**	

Offset +3						Sound, Soft Button 1 [Scale..] (Soft Button 4)
Range Min	**-1200**	Scaling	**Linear**	MC Mod	**Yes**	Offset of the third key following the base key [in cents]. At zero, the interval to the base key would be the minor third of the equally tempered scale.
Range Max	**1200**	Steps	**420**	Mod. Unit	**%**	
Default	**0**	Fine	**4200**			
Unit	**ct**			Indicator	**No**	

Offset +4						Sound, Soft Button 1 [Scale..] (Soft Button 4)
Range Min	**-1200**	Scaling	**Linear**	MC Mod	**Yes**	Offset of the fourth key following the base key [in cents]. At zero, the interval to the base key would be the major third of the equally tempered scale.
Range Max	**1200**	Steps	**420**	Mod. Unit	**%**	
Default	**0**	Fine	**4200**			
Unit	**ct**			Indicator	**No**	

Offset +5						Sound, Soft Button 1 [Scale..] (Soft Button 4)
Range Min	**-1200**	Scaling	**Linear**	MC Mod	**Yes**	Offset of the fifth key following the base key [in cents]. At zero, the interval to the base key would be the fourth of the equally tempered scale.
Range Max	**1200**	Steps	**420**	Mod. Unit	**%**	
Default	**0**	Fine	**4200**			
Unit	**ct**			Indicator	**No**	

Offset +6						Sound, Soft Button 1 [Scale..] (Soft Button 4)
Range Min	**-1200**	Scaling	**Linear**	MC Mod	**Yes**	Offset of the sixth key following the base key [in cents]. At zero, the interval to the base key would be the tritone of the equally tempered scale.
Range Max	**1200**	Steps	**420**	Mod. Unit	**%**	
Default	**0**	Fine	**4200**			
Unit	**ct**			Indicator	**No**	

Scale – 2/2

Parameter Name Sub. Par. Button No.

Offset +7						Sound, Soft Button 1 [Scale..] (Soft Button 4)
Range Min	**-1200**	Scaling	**Linear**	MC Mod	**Yes**	Offset of the seventh key following the base key [in cents]. At zero,the interval to the base key would be the fifth of the equally tempered scale.
Range Max	**1200**	Steps	**420**	Mod. Unit	**%**	
Default	**0**	Fine	**4200**			
Unit	**ct**			Indicator	**No**	

Offset +8						Sound, Soft Button 1 [Scale..] (Soft Button 4)
Range Min	**-1200**	Scaling	**Linear**	MC Mod	**Yes**	Offset of the eighth key following the base key [in cents]. At zero, the interval to the base key would be the minor sixth of the equally tempered scale.
Range Max	**1200**	Steps	**420**	Mod. Unit	**%**	
Default	**0**	Fine	**4200**			
Unit	**ct**			Indicator	**No**	

Offset +9						Sound, Soft Button 1 [Scale..] (Soft Button 4)
Range Min	**-1200**	Scaling	**Linear**	MC Mod	**Yes**	Offset of the ninth key following the base key [in cents]. At zero, the interval to the base key would be the major sixth of the equally tempered scale.
Range Max	**1200**	Steps	**420**	Mod. Unit	**%**	
Default	**0**	Fine	**4200**			
Unit	**ct**			Indicator	**No**	

Offset +10						Sound, Soft Button 1 [Scale..] (Soft Button 4)
Range Min	**-1200**	Scaling	**Linear**	MC Mod	**Yes**	Offset of the tenth key following the base key [in cents]. At zero, the interval to the base key would be the minor seventh of the equally tempered scale.
Range Max	**1200**	Steps	**420**	Mod. Unit	**%**	
Default	**0**	Fine	**4200**			
Unit	**ct**			Indicator	**No**	

Offset +11						Sound, Soft Button 1 [Scale..] (Soft Button 4)
Range Min	**-1200**	Scaling	**Linear**	MC Mod	**Yes**	Offset of the eleventh key following the base key [in cents]. At zero, the interval to the base key would be the major seventh of the equally tempered scale.
Range Max	**1200**	Steps	**420**	Mod. Unit	**%**	
Default	**0**	Fine	**4200**			
Unit	**ct**			Indicator	**No**	

Part

Parameter Name Sub. Par. Button No.

Part Volume						Sound, Soft Button 2 (Soft Button 4)
Range Min	**-inf**	Scaling	**Parab. G.**	MC Mod	**Yes**	Part volume [in dB], available when using Split or Layer mode. Applied at the end of the corresponding effect chain, before the Master Volume.
Range Max	**12**	Steps	**100**	Mod. Unit	**%**	
Default	**0.000**	Fine	**1000**			
Unit	**dB**			Indicator	**No**	

Part Tune						Sound, Soft Button 2 (Soft Button 4)
Range Min	**-48.00**	Scaling	**Linear**	MC Mod	**Yes**	Part pitch transposition [in semitones], available when using Split or Layer mode. Applied for the corresponding Part only.
Range Max	**48.00**	Steps	**96**	Mod. Unit	**st**	
Default	**0**	Fine	**9600**			
Unit	**st**			Indicator	**No**	

Part Mute						Sound, Dec – Inc Button
Range Min	**mute**	Scaling	**n.a.**	MC Mod	**No**	Part mute, available when using Split or Layer mode. When enabled, the corresponding Part will be muted.
Range Max	**unmute**	Steps	**1**	Mod. Unit	**n.a.**	
Default	**unmute**	Fine	**n.a.**			
Unit	**n.a.**			Indicator	**No**	

Fade From						Sound, Soft Button 2 (Soft Button 4)
Range Min	**C1**	Scaling	**Integer**	MC Mod	**No**	Available when using Layer mode. For Part I the full level range spans from the lowest key (C1) to the key set by this parameter. This key defines the breakpoint where the fade-out begins. The fade-out width is adjustable by the \"Fade Range\" parameter. For Part II the full level range spans from the highest key (C6) to the key set here.
Range Max	**C6**	Steps	**60**	Mod. Unit	**n.a.**	
Default	**C1**	Fine	**n.a.**			
Unit	**note**			Indicator	**No**	

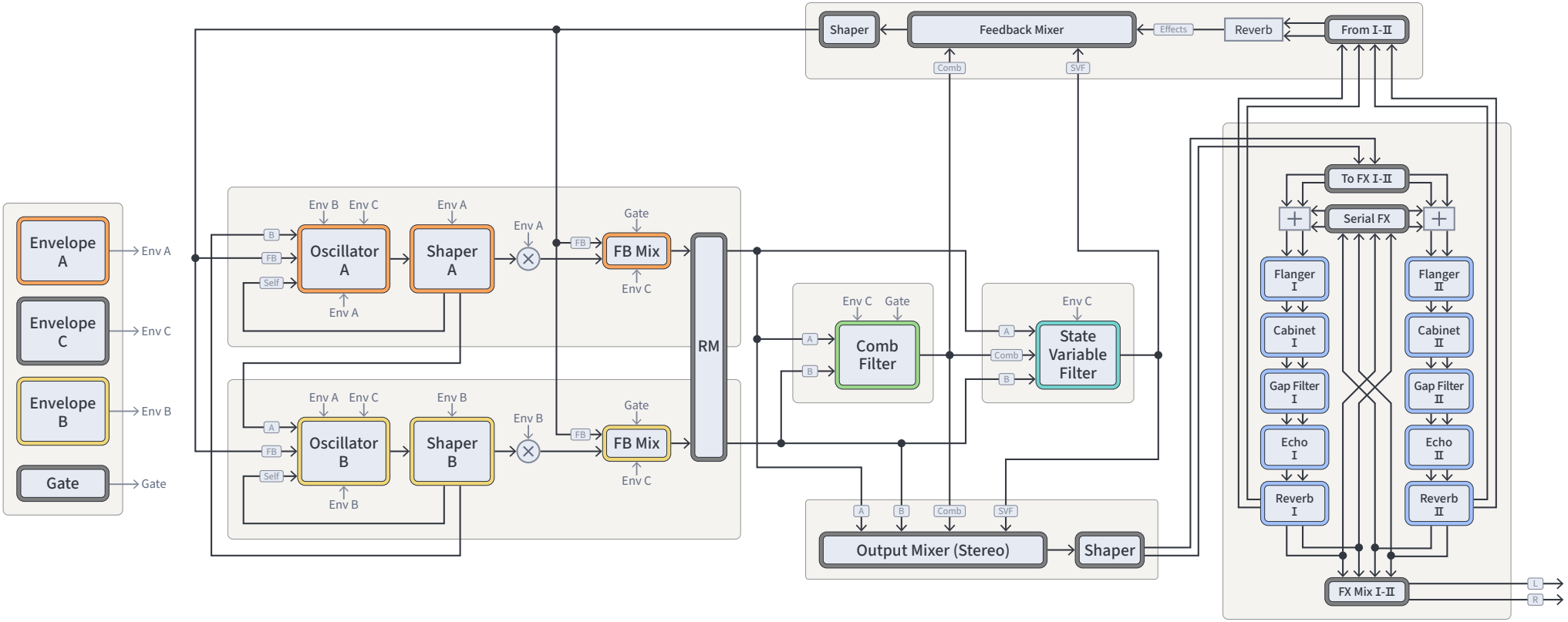
Fade Range						Sound, Soft Button 2 (Soft Button 4)
Range Min	**0.0**	Scaling	**Linear**	MC Mod	**No**	Available when using Layer mode. This parameter adjusts the width of a key range [in semitones] where the level of a Part is faded out. For Part I the fade-out applies to keys above the breakpoint set by \"Fade From\". For Part II the fade-out applies to keys below the breakpoint set by \"Fade From\". With a Fade Range of zero the Part is muted for all keys beyond the breakpoint, which is the default behavior.
Range Max	**60.0**	Steps	**60**	Mod. Unit	**n.a.**	
Default	**0.0**	Fine	**600**			
Unit	**st**			Indicator	**No**	

Split

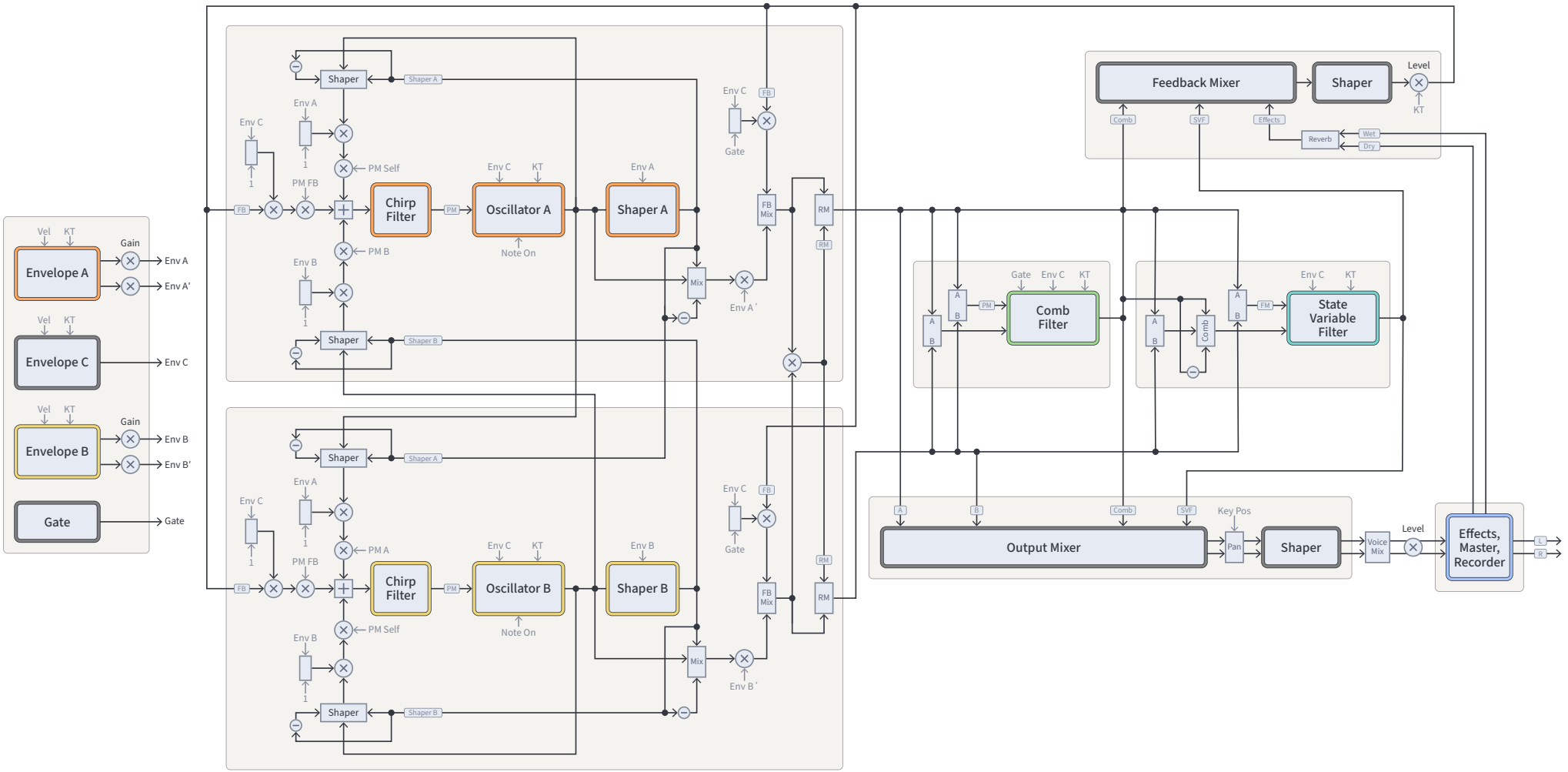
Parameter Name Sub. Par. Button No.

Split Point						(in Split Mode) Sound + Encoder
Range Min	**C1**	Scaling	**Linear**	MC Mod	**Yes**	Determines the split position of a sound as a key number. Keys from the lower end up to the Split Point will be associated to Part I, keys from the Split Point up to the upper end will be associated to Part II. When linked, both split positions are sticked together and the Split Point behaves as one global parameter applying to both Parts.
Range Max	**B5**	Steps	**60**	Mod. Unit	**st**	
Default	**F#3**	Fine	**n.a.**			
Unit	**note**			Indicator	**No**	

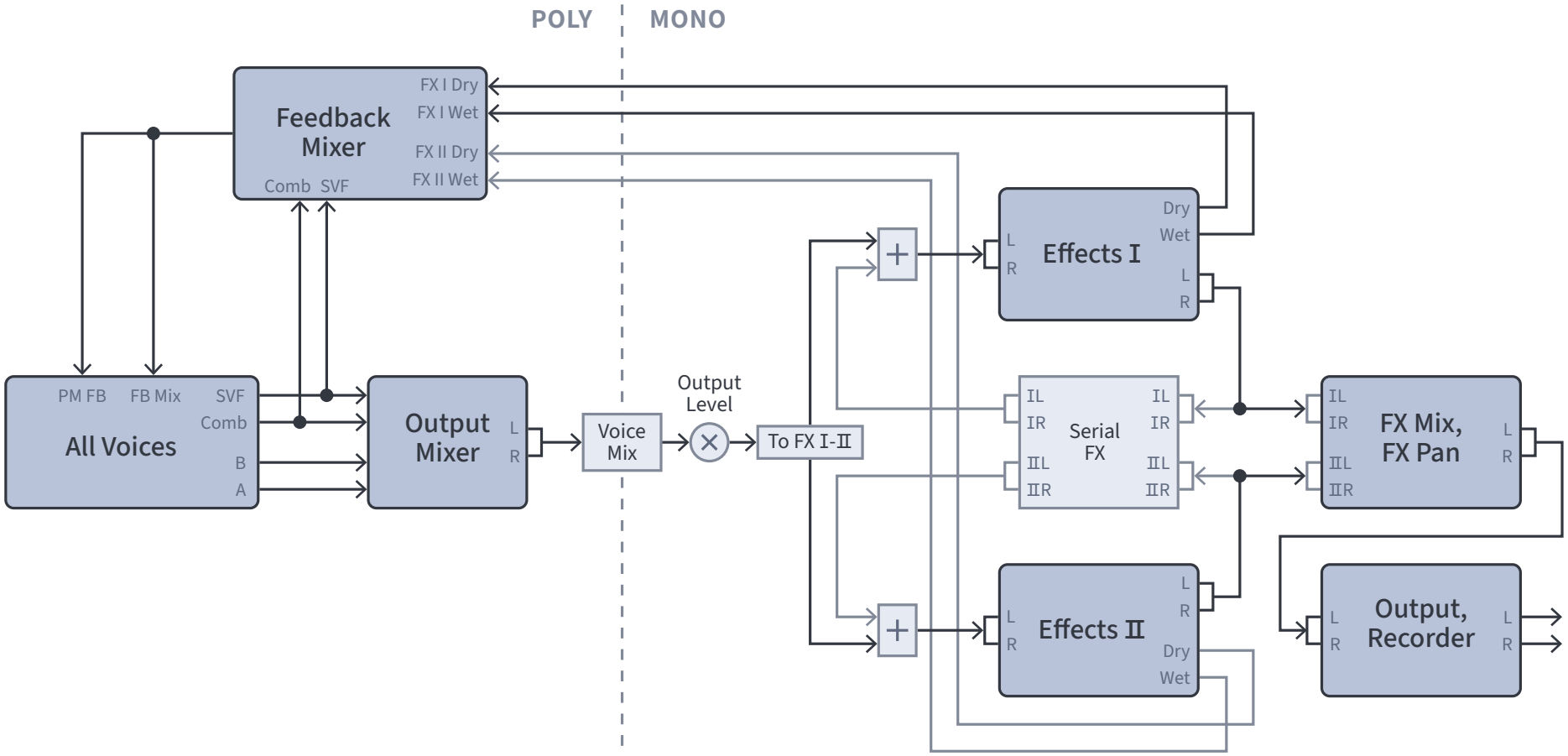
Signal Flow - Single Sound



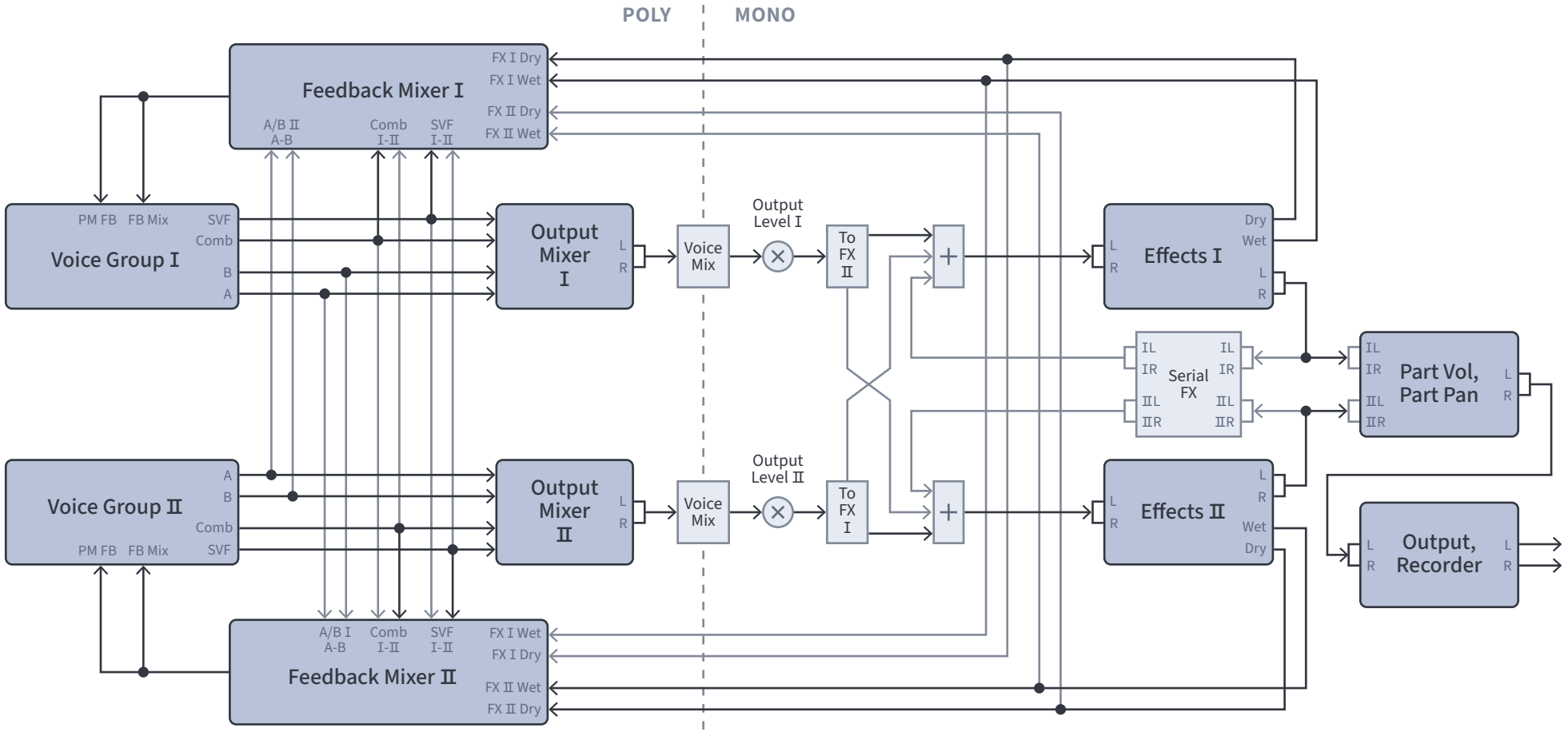
Detailed Signal Flow - Single Sound



Overview - Single Sound



Overview - Layer Sound



Overview - Split Sound