USER MANUAL

_KORG MS-20 V

ARTURIA
_The sound explorers

Thanks

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SPECIAL THANKS

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Product version: 1.0.0

Revision date: 7 November 2022

Thank you for purchasing KORG MS-20 V!

This manual covers the features and operation of Arturia's **KORG MS-20 V**, one of our many powerful virtual instruments.

Be sure to register your software as soon as possible! When you purchased KORG MS-20 V, you were sent a serial number and an unlock code by e-mail. These are required during the online registration process.

Special Messages

Specifications Subject to Change:

The information contained in this manual is believed to be correct at the time of printing. However, Arturia reserves the right to change or modify any of the specifications without notice or obligation to update the hardware that has been purchased.

IMPORTANT:

The software, when used in combination with an amplifier, headphones or speakers, may be able to produce sound levels that could cause permanent hearing loss. DO NOT operate for long periods of time at a high level or at a level that is uncomfortable.

If you encounter any hearing loss or ringing in the ears, you should consult an audiologist.

Introduction

Congratulations on your purchase of Arturia's KORG MS-20 V!

We'd like to thank you for purchasing KORG MS-20 V, a virtual instrument recreation of the KORG MS-20: an intuitive and powerful monophonic semi-modular synthesizer with a uniquely beloved sound, one that has graced thousands of hits in all kinds of genres for nearly 50 years.

We've carefully studied and modeled every nuance of the original KORG MS-20 to fully recreate the powerful sound and flexibility of this beloved monosynth. We then took things one step further, by adding expanded features for the modern studio, as well as entirely new sound programming options that take the KORG MS-20 experience to a new level.

As with all of our products, we believe in offering the best of both worlds in a single package and letting you choose how you want to use it. You can choose to focus on the Hardware Panel and get a (slightly improved) vintage KORG MS-20 experience, or explore the Sequencer and Effects Panels and discover sonic and performance possibilities that go well beyond the original synth's capabilities.

Here's to a beautiful blend of the old and the new – and the beautiful music you'll make with it!

Peace, love, and music,

The Arturia team

Be sure to visit the www.arturia.com website for information about all of our other great hardware and software instruments. They have become indispensable, inspiring tools for musicians around the world.

Table Of Contents

1. INTRODUCTION

Arturia would like to thank you for purchasing our modeling synthesizer, KORG MS-20 V. We're confident that it will become a valuable addition to your music production studio.

If you've purchased our products before, you know we take great pride in recreating the sound and feel of the original instruments – and then we add 21st Century features these products might have had, if only the technology had been available at the time. And if this is the first of our products you have owned, well, you're in for a treat!

The original KORG MS-20, the synthesizer upon which this model is based, is a true icon of analog synthesis. It's considered a vital musical tool for thousands and thousands of musicians over nearly a half century, because of its fantastic combination of practical ease of use and extraordinary flexibility. Oh, and it sounds amazing, too.

Before we dive into the wonders of KORG MS-20 V, let's take a quick moment to learn some history. Nowadays, the name KORG is recognized worldwide as an icon of electronic musical instrument design. But not many people know where the name originally came from...

1.1. The quiet genius of Fumio Mieda

Keio Electronic Laboratory Corporation was founded in 1963 by Tokyo entrepreneur Tsutomu Katoh and musician/electrical engineer Tadashi Osanai. Osanai, a famous accordionist in the Tokyo nightclub scene, was frustrated by the quirks of the Wurlitzer Sideman rhythm machine that accompanied him in his solo act. He was sure he could build something that was more reliable, sounded better, and – important to the still-recovering Japanese economy of the early 1960s – far more affordable to Japanese musicians than the expensive imported Wurlitzer.

He convinced Katoh, who owned a nightclub where Osanai performed, to invest in his idea and open a factory with a small, loyal team of talented engineers. It was named for the Keio railroad line that passed by the factory, and its first product, the DoncaMatic DA20 rhythm unit/amplifier/speaker, was a huge success.

A few years after Keio's launch, Katoh was approached by a young engineer named Fumio Mieda. He had been working on a design for a new type of organ, one whose sound he felt would be much more interesting than that of the machines currently on the market. Mieda's idea was to provide control over the nuances of a single organ voice to create a highly expressive solo instrument. Katoh agreed to finance the project, and in 1970 the Prototype 1 was demonstrated to considerable interest. Soon after that, Keio released its first organ, the Keio Organ (or, if you prefer that Katoh Osanai Organ) – the KORG.

The name was put on subsequent instruments, practically none of which were organs. In 1973, Mieda refined his design into a small solo instrument that could sit atop an electric organ and provide a solo voice. This was the miniKORG 700, one of the first two Japanese synthesizers. The other was the Roland SH-1000, which came out at almost exactly the same time. Unlike the Roland, which was a fairly conventional monophonic synthesizer, the miniKORG and its successors took Mieda's ideas for real-time sound shaping – such as the famed Traveller dual filter – and turned them into portable, practical instruments that didn't sound like anything else out there.

This uniqueness wasn't surprising: every component in these instruments was designed by Mieda himself, from scratch.

1.2. The MS-20 and its family

In 1977, as synthesizers were growing in popularity in Japanese electronic music, Keio faced a challenge in the form of the Yamaha CS-10 – a simple monophonic synthesizer that was far less expensive than competing instruments. Mieda took on the challenge of creating a monophonic synth that was affordable enough for a student to buy, but was powerful enough to allow for serious sound design – preferably with more options than the competition. In less than six months, the Keio team – often working late into the night and sleeping in the freezing-cold factory – created four new products that were released in April 1978: the MS-10 and MS-20 synthesizers, the VC-10 keyboard vocoder, and the SQ-10 analog sequencer.

With its semi-modular design – allowing students to patch creatively while still being usable with no patching – the MS-20 was an instant hit. Mieda gave students and musicians lots of fun extra features, from the completely patchable Wheel and Momentary Switch to the External Signal Processor, and carefully designed and placed the patch panel so the cables wouldn't obscure the knobs – a problem for nearly every other modular and semi-modular synth on the market.

At the same time, Mieda came up with extraordinarily effective shortcuts and streamlining techniques to keep the machine affordable – for example, he realized a huge cost savings by repurposing electrical noise in the keyboard circuit to act as a trigger signal! But the cost-saving measure that made history was the KORG 35 filter, a fabulously simple design that could be configured as a low-pass or high-pass filter (the MS-20 got one of each, as a nod to the Traveller design) while using very few components. Its sound was utterly unique and garnered thousands and thousands of fans over the years, and is a major factor in the MS-20's continued popularity.

Some 35 years later, Mr. Mieda consulted with a team of young engineers at Keio (now KORG Inc.) and helped them design the new MS-20 mini and MS-20 FS synthesizers, which have proven every bit as popular as the originals. However, aside from offering a few new features like MIDI input and USB, the synthesizer itself hasn't changed at all – which is awesome if you want total authenticity above all else, but not quite so awesome if you're looking to expand your horizons.

That's where Arturia comes in.

1.3. Why a virtual MS-20?

Unlike some other models we've created, KORG MS-20 V isn't meant to fill a gap left by a rare or expensive synthesizer. The MS-20 has always been available to musicians who want one. It's well-known and well-loved by generations of electronic musicians, and still widely available in hardware form, including both full-sized and smaller-scale 'mini' versions currently being sold by KORG.

So why would Arturia want to create a software MS-20? Simply because our engineers can't simply recreate the sounds of vintage synths – they always have an uncontrollable urge to mess around with them and see what they can add!

As powerful as the original MS-20 was, studios and live rigs in the 21st Century have different needs than those of the 1970s. It's quite possible – even likely – that getting a hardware MS-20 to work seamlessly with a computer-based setup will be costly, fussy, and lacking in some basic functions that modern musicians have come to expect.

With that in mind, Arturia has remained faithful to the original KORG MS-20's sound and functionality, but has then taken its capabilities far beyond anything its creators could have imagined, giving it a new lease on life in the world of plug-ins and DAWs.

Of course, all of these extra features are meaningless if the synth itself doesn't sound awesome and authentic. Fortunately, Arturia has that well under control…

1.4. Arturia's secret ingredient: TAE®

TAE® (True Analog Emulation) is Arturia's outstanding technology dedicated to the digital reproduction of the analog circuits used in vintage synthesizers.

TAE®'s software algorithms result in spot-on emulation of analog hardware. This is why MS-2O V offers an unparalleled quality of sound, as do all of Arturia's virtual synthesizers.

TAE® combines three major advances in the domain of synthesis:

1.4.1. Aliasing-free oscillators

Standard digital synthesizers produce aliasing in high frequencies, especially when using Pulse Width Modulation (PWM) or Frequency Modulation (FM).

TAE® enables the generation of oscillators which are completely free of aliasing in all contexts (PWM, FM...), and at no extra CPU cost.
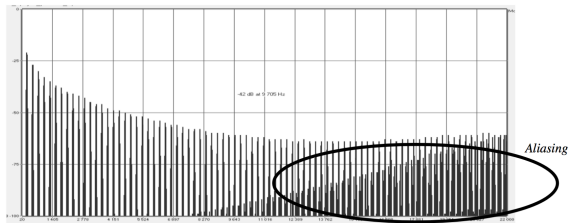
Linear frequency spectrum of a current well-known software synthesizer
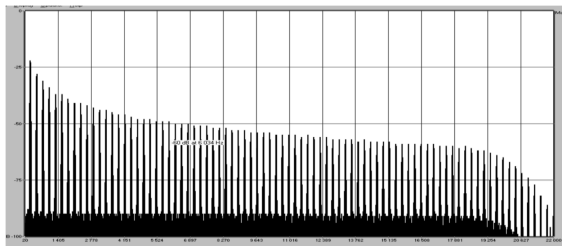
Linear frequency spectrum of an oscillator modeled with TAE®

1.4.2. A better reproduction of analog oscillator waveforms

The waveforms produced by the oscillators in analog synthesizers are affected by the presence of a capacitor in the circuits. The discharge of a capacitor results in a slight 'bend' in the original waveform (most notably for sawtooth, triangular and square waveforms). TAE® reproduces the result of this capacitor discharge in software.

Below is the analysis of a waveform from one of the five original instruments Arturia's software emulates, followed by one made by TAE®. They are both equally deformed by the low-pass and high-pass filtering.
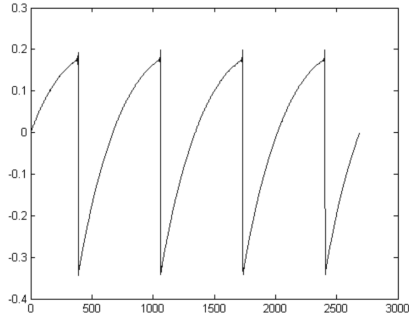
*Temporal representation of the slightly
distorted sawtooth waveform of a
hardware synthesizer*
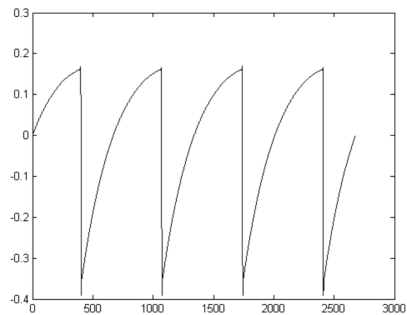
*Temporal representation of that same
synthesizer's sawtooth waveform as
reproduced by TAE®*

What's more, hardware analog oscillators were and are unstable. In fact, their waveforms vary slightly from one period to the next. If we add to this the fact that the starting point for each period (in Trigger mode) can vary with the temperature and other environmental conditions, we see why vintage synthesizers have such a unique character.

TAE® reproduces the instability of oscillators, resulting in a fatter, richer, and overall "bigger" sound.

1.4.3. Direct Filter Circuit Modeling

Due to advances in computer processing power, TAE® can now employ direct filter modeling techniques to achieve unprecedented accuracy in the emulation of a hardware synthesizer's filter. By modeling the operation of the individual hardware components of the filter circuit, the warm nuances synonymous with analog sounds are recreated.

The following graph shows a single example of direct circuit modeling in action. The peaks represent the generation of harmonics at multiples of the resonant frequency when a particular filter is in self-oscillation mode. These harmonics are characteristic of hardware synthesizer filters; they come from the non-linear behavior inherent to their analog circuitry. Anomalies such as these add to the richness and warmth of the sound produced by the filter.

Notice there are two lines on the graph. Those are the superimposed frequency domain plots for one of Arturia's virtual instrument filters, and of the hardware filter it's emulating. They are practically indistinguishable, both on the graph and to the human ear. The direct recreation of this analog circuitry causes the same characteristics of the sound to be present, thus giving the user a truly analog sound.
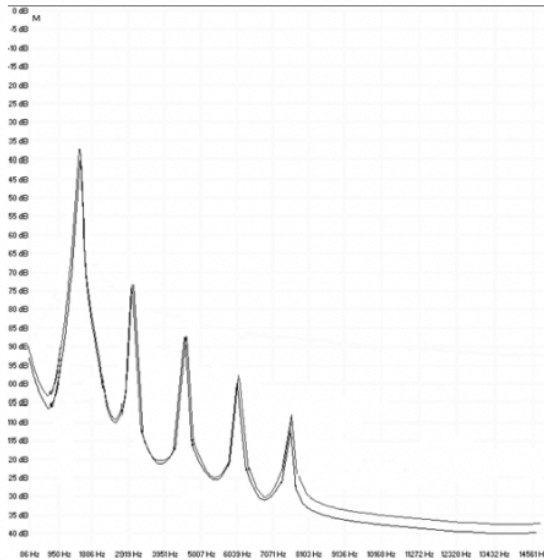
So here's the bottom line: When you bring together a bunch of music lovers who also have a deep understanding of the characteristics of electronic circuits, you wind up with Arturia. And when Arturia decides to dig deep into one of the best-known and most-loved analog synthesizers in history – with the stated intent of bringing it into the new millennium – you wind up with KORG MS-20 V.

We take great satisfaction in knowing this great synthesizer will help you explore previously unknown musical territory, and we can't wait to hear what you do with it!

2. ACTIVATION AND FIRST START

2.1. Register, Activate, and Install KORG MS-20 V

KORG MS-2O V works on computers equipped with Windows 8.1 or later and macOS 1O.13 or later. You can use it as a standalone version or as a plug-in for your favorite DAW (Digital Audio Workstation), in Audio Units, AAX, VST2, or VST3 format.

Before you install or register the software, you'll need to create a My Arturia account here, using an email address and password of your choice: https://www.arturia.com/createanaccount/

While it's possible to handle registration, activation, and other tasks manually online, it's far simpler to download and use the Arturia Software Center app, which can be found here: https://www.arturia.com/support/downloads&manuals

You'll enter your email address and password to set up Arturia Software Center, which acts as a central location for all of your Arturia software registrations and activations. It also helps you install and update your software by keeping tabs on current versions.
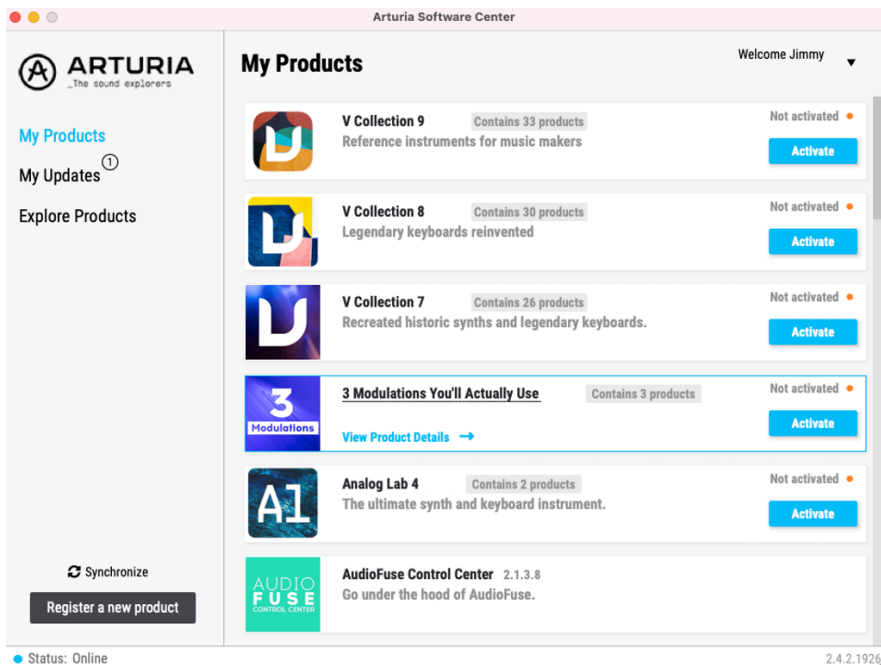
Arturia Software Center

You can register, activate, and install your product inside Arturia Software Center by pressing the **Register a new product** button, and clicking the boxes to **Activate** and then **Install** your software. The registration process will require you to enter the serial number and the unlock code you received when you bought your software.

You can also do this online by logging into your account and then following the instructions here: http://www.arturia.com/register

Once you've registered, activated, and installed KORG MS-20 V, it's time to get it to talk to your computer.

2.2. Initial setup for standalone use

If you would like to use KORG MS-2O V in standalone mode, you will need to ensure that MIDI input and audio input and outputs are being routed properly to and from the software. You'll generally only need to do this once, unless you change your MIDI controller or audio/MIDI interface. The setup process is the same on both Windows and macOS.

> ! This section only applies to those of you who plan to use KORG MS-2O V in standalone mode. If you are only going to use KORG MS-2O V as a plug-in inside a host DAW or other music software, you can safely ignore this section – your host music software handles these settings.

2.2.1. Audio and MIDI settings: Windows

At the top left of the KORG MS-2O V application is a pull-down menu. It contains various setup options.
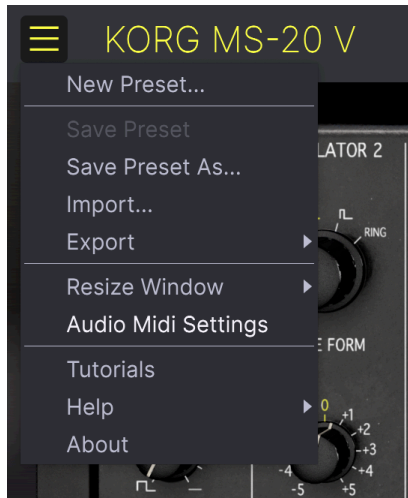
KORG MS-2O V Main Menu

Click on **Audio Midi Settings** to open the following window. This works in the same way on both Windows and macOS, although the names of the devices available to you will depend on the hardware you are using. Remember, this option is only available (and needed) in the standalone version of KORG MS-2O V.
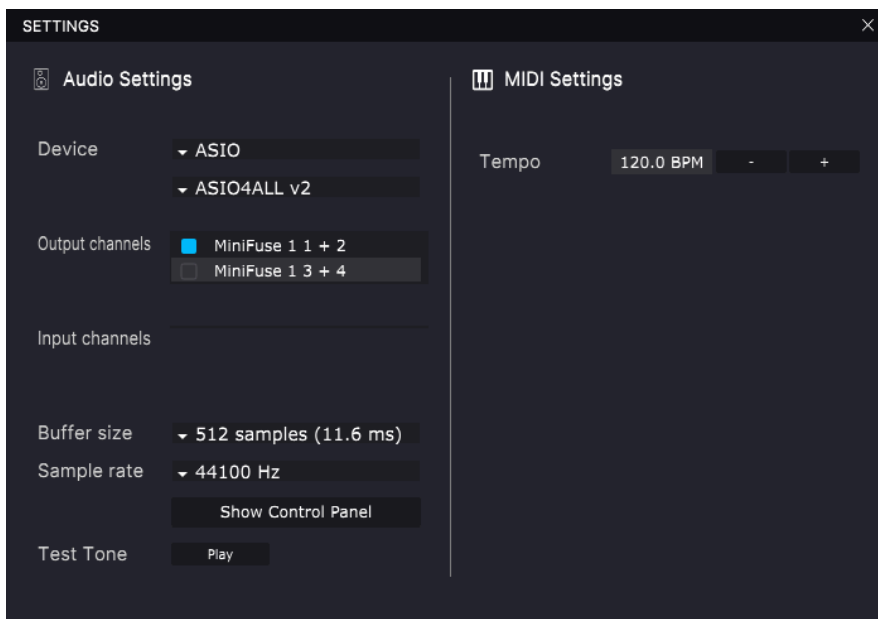
Audio and MIDI Settings for Windows

Starting from the top, you have the following options:

- **Device** selects which audio driver and device will handle playback of KORG MS-2O V. This can be your computer's internal driver, a generic ASIO driver, or an external soundcard or interface driver. The name of your hardware interface may appear in the field below, depending on your selection.

- **Output Channels** lets you select which of the available outputs will be used to route audio out. If you only have two outputs, this selection box will not be shown. If you have more than two, you can select a specific pair of outputs.

- **Input Channels** let you select which of the available inputs that are available when you want to route an external audio signal into the MS-2O V. The **Ext Out** patchpoint can then be used to route external audio inside the plugin (e.g. an external signal processor). Only one input or pair of inputs can be selected.

- The **Buffer Size** menu lets you select the size of the audio buffer your computer uses to calculate sound. The latency in milliseconds is displayed after the buffer size setting.

> ! A smaller buffer means lower latency, i.e. a shorter delay between pressing a key and hearing the note, but loads your CPU more heavily and can cause pops or clicks. A larger buffer means a lower CPU load, as the computer has more time to think, but can result in a noticeable delay between playing a note and hearing it. A fast, modern computer should easily be able to operate at a buffer size of 256 or even 128 samples without clicks If you still get clicks, enlarge the buffer size until they stop.

- The **Sample Rate** menu lets you set the sample rate at which audio is sent out of the instrument.

! The options here will depend on what your audio device can support; nearly every device can operate at 44.1 kHz or 48 kHz, which will be perfectly fine for most applications. If you have a specific need to use a higher sample rate, up to 96 kHz, KORG MS-20 V will happily support that.

- The **Show Control Panel** button will jump to the system control panel for whatever audio device is selected.

! Note that this button is only available in the Windows version.

- **Test Tone** sends a short test tone when you click the **Play** button, to help you troubleshoot audio issues. You can use this feature to confirm that the instrument is routed correctly through your audio interface and that audio is playing back where you expect to hear it (your speakers or headphones, for example).

- The **MIDI Devices** area will display any MIDI devices you have connected to your computer (if any). Click the check box to accept MIDI from the device(s) you want to use to control the instrument. You can select multiple MIDI devices at once with the checkboxes.

! In standalone mode, KORG MS-20 V listens for all MIDI channels, so there's no need to specify a channel.

- **Tempo** sets a base tempo for features inside KORG MS-20 V such as LFO and effects sync. When using KORG MS-20 V as a plug-in, the instrument gets tempo information from your host software.

2.2.2. Audio and MIDI settings: macOS
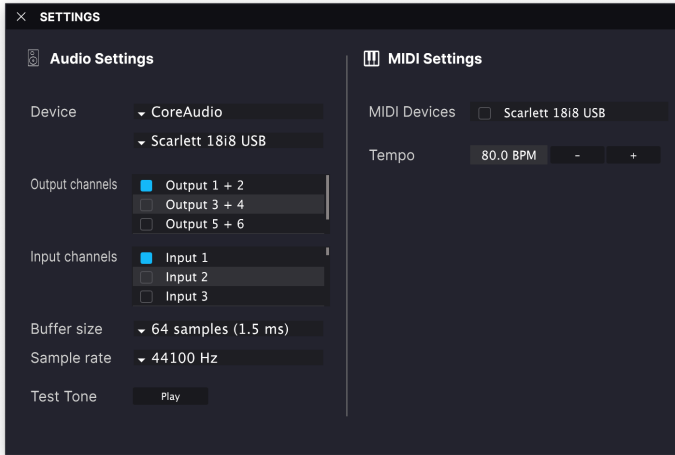
Audio MIDI Settings for macOS

The menu for setting up audio and MIDI devices for macOS is accessed in the same way as for Windows, and the setup process is nearly identical. All options work the same way as described above in the Windows section. The only difference is that all macOS devices, including external audio interfaces, use the CoreAudio driver built into macOS to handle routing. In the second dropdown menu under **Device**, choose the audio device you wish to use.

2.2.3. Using KORG MS-20 V as a plug-in

KORG MS-20 V's interface looks the same in plug-in mode as in standalone mode.

KORG MS-20 V comes in VST2, VST3, Audio Unit (AU), and AAX plug-in formats, for use in all major DAW software such as Ableton Live, Cubase, Logic, Pro Tools, Studio One, and more.

When using KORG MS-20 V as a plug-in, all audio and MIDI device settings are handled by your host music software. Please refer to your host music software's documentation if you have any questions about loading or using plug-ins.

Note that when you load KORG MS-20 V as a plug-in instrument inside your host software, its interface and settings work the same way as in standalone mode (see below), with a few small differences:

- KORG MS-20 V will synchronize to your DAW's host tempo/BPM when sync is required
- You can automate numerous parameters using your DAW's automation system
- You can use more than one instance of KORG MS-20 V in a DAW project (standalone mode can only launch one instance)
- You can run the outputs of KORG MS-20 V through any additional audio effects available to your DAW, such as delay, chorus, filters, etc.
- You can route KORG MS-20 V's audio outputs creatively inside your DAW, using the DAW's own audio routing system.

2.3. Playing KORG MS-20 V for the First Time

Now that you have KORG MS-20 V up and running, let's take it for a quick test drive!

If you haven't done so already, launch KORG MS-20 V as a plug-in or as a standalone instrument. If you have a MIDI controller set up, use it to play some notes on KORG MS-20 V. You might first need to activate your MIDI controllers in the MIDI Settings (see above). You can also your mouse to play the on-screen keyboard or use the keys of your computer keyboard.

The up and down arrows at the top of the instrument let you step through all of KORG MS-20 V's available presets. Try playing a few, and when you find one that you like, try adjusting some of the other on-screen controls to see how they affect the sound.

Play with the controls, and don't worry – nothing is saved unless you specifically save a preset (described later in this User Guide), so there is no risk you'll mess up any of KORG MS-20 V's factory presets.

We hope this chapter has gotten you off to a smooth start. Now that you're up and running, the rest of this guide will help you work your way through all of KORG MS-20 V's features on a section-by-section basis. By the time you reach the end, we hope you'll understand all of KORG MS-20 V's capabilities – and will be using this fantastic instrument to create equally fantastic music!

3. THE USER INTERFACE

In this chapter, we'll walk you through the features of KORG MS-20 V, how to find them and how to use them. As with every Arturia product, we have gone to great lengths to make the use of this software instrument as simple and as much fun as possible, while also striving to make sure you never run out of new things to do with it as your knowledge expands. After reading this chapter, you should be ready to dive into KORG MS-20 V as deep as you like.

Before we do anything else, let's take a look at the whole picture: a bird's eye view of the KORG MS-20 V interface.

3.1. Overview

The full interface of KORG MS-20 V. Don't worry, we'll teach you what all the knobs and cables do.

The KORG MS-20 V interface is dominated by the virtual instrument itself, but we also need to learn about the functions surrounding it:

1. **The Upper Toolbar [p.18]:** This is where you access global settings, work with presets, access the Sequencer and Effects, and open the Side Panel (see below).

2. **The Hardware Panel [p.55]:** Here is where you will likely spend most of your time when playing with KORG MS-20 V. It contains a detailed reproduction of the original KORG MS-20 front panel, with all of the original hardware's controls (plus a few extras). We will go over this panel in the Hardware Panel [p.55] chapter of this guide.

The **virtual keyboard** in the Hardware Panel lets you play a sound without an external MIDI device. Just click on a virtual key to hear the corresponding note, or drag the cursor across the keys to hear a glissando.

The virtual keyboard also displays notes played on an external controller, like the two C Minor chords shown here.

♪ Your computer's keyboard can also play KORG MS-2O V. The top row of letters acts as the black keys on a piano keyboard, the next row of letters acts as the white keys, and the first two keys on the bottom row act as octave shift keys, down/up. Depending on your language, the actual keys may be different – for example, on an English QWERTY keyboard, the octave down key is Z, but on a French AZERTY keyboard it's W.

3. **The Lower Toolbar [p.25]:** This section provides quick access to several useful functions and information displays, including Polyphony settings, Undo/Redo functions and history dropdown, CPU usage (with a hidden MIDI Panic button), and Macro controls.

4. **The Side Panel [p.26]** is normally hidden, and pops out to the right of the main window when the **gear icon** in the Upper Toolbar is clicked. It contains four tabs to access low-level settings, MIDI control assignments, the four Macro controllers, and a set of tutorials.

3.2. The Upper Toolbar
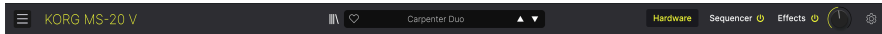
The Upper Toolbar

3.2.1. The KORG MS-20 V menu

In the top left corner of the window, the icon of three horizontal lines labeled KORG MS-20 V leads to a drop-down menu for important global operations.
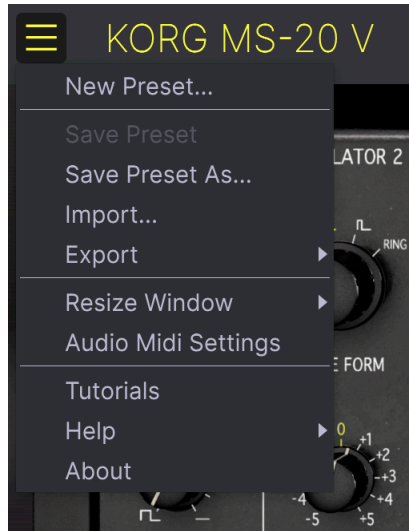
The KORG MS-20 V menu and its various functions (see below)

3.2.1.1. New Preset...

The first option sets KORG MS-20 V to a basic Default preset, a "blank slate" from which you can create your own sound. Note that if you haven't saved the previous preset first, any edits you have made to that preset will be lost.

If you want to return to the sound you had before pressing the New Preset button, try this:
- Use the Undo button in the lower right corner (an arrow pointing up and left). - Use your computer's undo function (Ctrl+Z or Cmd+Z)

3.2.1.2. Save Preset

The next option lets you save a preset. If you select this option, you are presented with a window where you can enter information about the preset. In addition to naming it, you can enter the author name, select a bank where it will be stored, give it a general preset type, and select one or more tags that describe the sound.

> ℹ Note that tags are read and filtered by the Preset Browser, so a wide selection of tags is vital for effective searches later. You can click as many tags as you want, and when in doubt, click more rather than less. If you skimp on tags, your patch might never come up in a search!

You can also enter your own notes in the Comments field, which is handy for more detailed descriptions or performance notes.

3.2.1.3. Save Preset As…

This works in the same way as the Save command, but lets you save a copy of the preset instead of saving over the original. It's useful for creating variations on patches while keeping individual copies of each one.
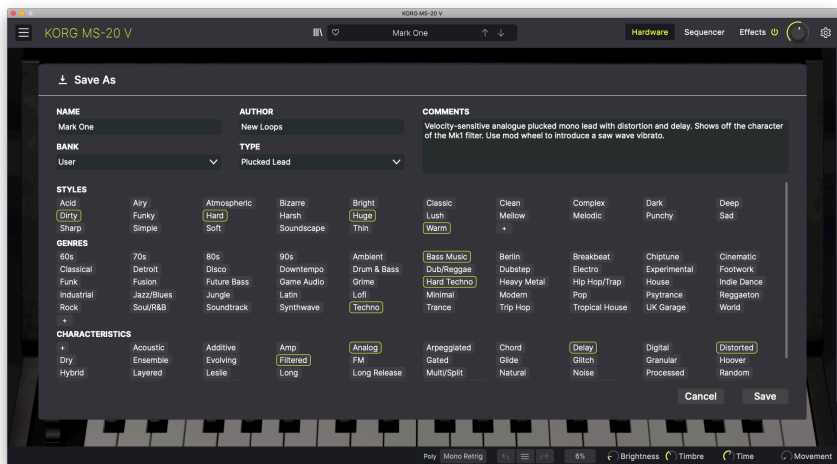
The Save Preset As… pop-up window. Remember, the more tags the better!

> ℹ ! One other critical feature of this pop-up is the Bank selection menu. Not only can you put your new Preset in any existing User Bank, but if you enter a new Bank name, that Bank will be created along with the new Preset. This is how you create new User Banks!

3.2.1.4. Import...

This command lets you import a preset file, which can be either a single preset or an entire bank of presets. Both types are stored in the .msx format.

After selecting this option, the default path to these files will appear in the window, but you can navigate to another folder if needed.

3.2.1.5. Export

You can export and share a single preset, or an entire preset bank, using this command.
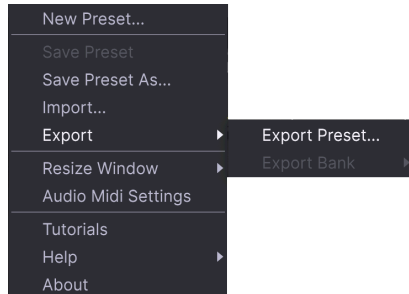
The Export pop-up

- **Export Preset**: Exporting a single preset is handy when you want to share a preset with someone else. The default path to these files will appear in the "save" window, but you can create a folder at another location if you like. The saved preset can be reloaded using the *Import Preset* menu option.
- **Export Bank**: This option can be used to export an entire bank of sounds from the instrument, which is useful for backing up or sharing presets. Saved banks can be reloaded using the **Import Preset** menu option.

3.2.1.6. Resize Window

The KORG MS-20 V window can be resized from 50% to 200% of its default size without any visual artifacts. On a smaller screen, such as a laptop's, you might want to reduce the interface size so it doesn't dominate the display, although some smaller controls might be harder to see and click/drag. On a larger screen or a second monitor, you can increase the size to get a better view of the controls. The controls will work the same at any zoom level.

New Preset...	
Save Preset	
Save Preset As...	
Import...	
Export ▶	
Resize Window ▶	Zoom Out (Cmd -)
Audio Midi Settings	Zoom In (Cmd +)
Tutorials	50%
Help ▶	60%
About	70%
	80%
	90%
	100%
	120%
	140%
	160%
	180%
	✓ 200%
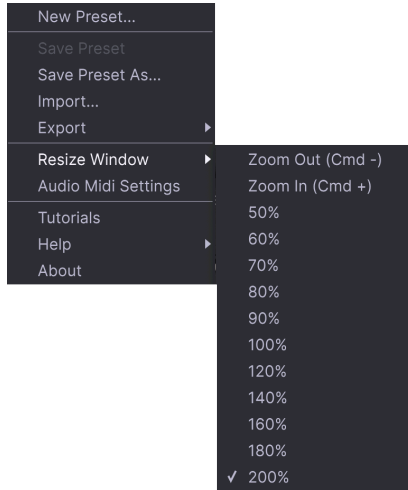
With the keyboard shortcuts shown, you can resize on the fly for various tasks.

ℹ️ While working with KORG MS-20 V, you can also use keyboard shortcuts to quickly adjust the window size. **Ctrl +** and **Ctrl** - (Windows) and **Cmd +** and **Cmd** - (macOS) change the size by one step larger or smaller. Note that in some DAWs, the same key commands may be used for zoom. In this case, the DAW takes priority.

3.2.1.7. Audio Midi Settings

This is where you manage the way the instrument transmits sound and receives MIDI. This menu item only appears in the standalone version, as the plug-in's audio and MIDI settings are handled by its host application. Full details on how to do this, for Windows and macOS, are found here [p.10].

3.2.1.8. Tutorials / Help / About

The Tutorials control opens the Settings Panel (see section 3.x) and displays a set of tutorials to help you learn how to use KORG MS-20 V. The Help button lets you open this User Manual or access Arturia's online FAQ. And if you're curious about who's responsible for this beautiful instrument, click the **About** button. (It will also show you the software version you're currently running.)

3.2.2. Preset Browser

KORG MS-2O V comes packed with lots of useful factory presets, and of course you'll create many more of your own. To help you search through this large preset library, the Preset Browser [p.37] is designed to help you catalog, filter, and search for the perfect preset in just a few clicks. There's a whole chapter on it later on, so for now, we'll focus on the set of functions that you can access directly from the Upper Toolbar.
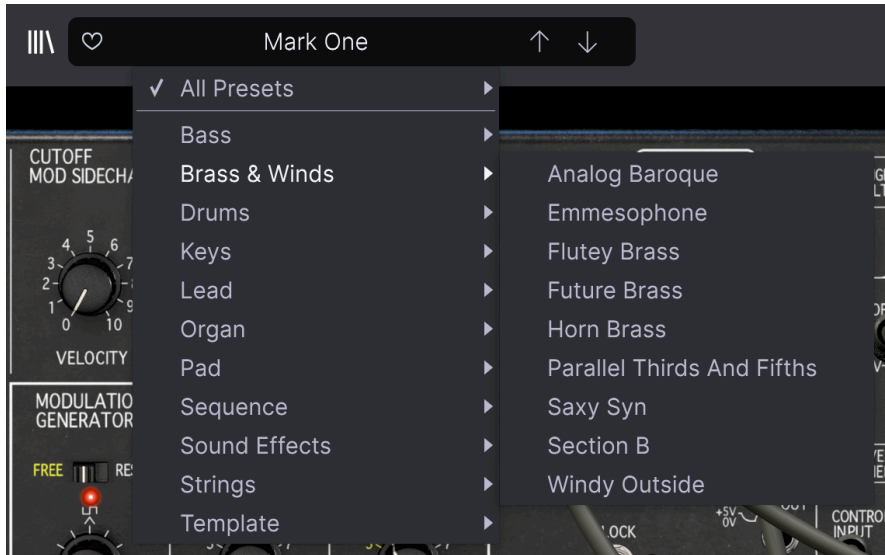
Basic controls for the Preset Browser, as they appear on the Upper Toolbar

This part of the Upper Toolbar (shown above) includes:

1. The **Preset Browser Button** (the icon of four lines that looks like books on a shelf) opens and closes the Preset Browser. This is covered in detail in the next chapter, The Preset Browser [p.37].

2. The **Like** button has a heart icon. Just click it to instantly mark the current preset as a Liked Preset for easy access later.

3. The **Preset Name** is listed next in the toolbar. Clicking on the name opens the Preset Filter. If an asterisk* appears next to the Preset Name, it means that the settings of KORG MS-2O V have been changed so the sound no longer matches the saved preset. It's a reminder to save the edited version if you like it, overwriting the original (**Save**) or with a new name (**Save As...**).

4. The **Preset Filter** (set to "All Presets" in the image above) helps you narrow down your preset search quickly – for example, looking only for presets tagged with *Keys*, *Lead*, or *Pad*. To use this feature, click the Preset Name to open a drop-down menu of various Types (Keys, Lead, Pad, etc.). Hold your mouse over any Type to pop up an alphabetical list of presets (**Brass and Winds** is shown here). Click the one you want or mouse away to close the pop-up.

Selecting a preset will load it, and set the Preset filter to focus on sounds of that Type. You can now use the Arrow Icons to step through the filtered options. To reset the filter and show you all available patches, open the menu and select any preset from the **All Presets** pop-up list.

5. The **Arrow Icons** select the previous or next preset in the filtered list. This is the same as clicking on the Preset Name and selecting the next option in the list, but does it with only one click.

> The Previous and Next arrows can be MIDI mapped. This means you can use buttons on your MIDI Controller to easily step through the available presets without having to use the mouse at all.

3.2.3. Hardware / Sequencer / Effects / Side Panel Access
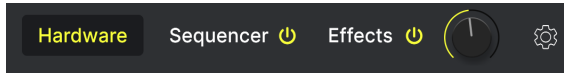
KORG MS-2O V goes well beyond the capabilities of the original hardware – it features its own sequencer and a powerful effects chain. Since the front panel of the original KORG MS-2O doesn't have room for all these extra controls, they've been moved to separate panels that you can hide when they're not needed.

Just press the **Sequencer** or **Effects** buttons in the Upper Toolbar to access these functions, which are covered in detail later in this manual, in the Sequencer Panel [p.77] and Effects Panel [p.80] chapters.

The Sequencer Panel, which we'll cover in Chapter 6

The Effects Panel, which we'll cover in Chapter 7

The last few items on the upper panel are:

- **Sequencer Bypass** and **Effects Bypass** buttons
- A **Global Volume** knob
- The **Side Panel Button (gear icon)**, a gear-shaped icon that opens and closes the Side Panel

3.2.4. Side Panel Settings

The **Side Panel** appears to the right of the main window, offering a selection of less-used global functions that are covered in the Side Panel [p.26] section later in this chapter.

3.3. The Lower Toolbar

The Lower Toolbar runs along the bottom of the KORG MS-2O V user interface and provides quick access to several important parameters and useful bits of information.

The Lower Toolbar, showing a tool tip for a parameter under the cursor

- **1. Parameter Name and Description:** Displays the name and a description of the parameter being edited as you adjust or hover over controls. The current value of the control is listed in a pop-up tool tip that appears next to the control.
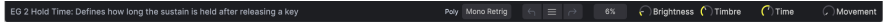
- **2. Poly:** Determines the polyphony. The original KORG MS-2O was monophonic. Here, you can set the software to allow more notes. There are **Mono Retrig** and **Mono Legato** options. The former retriggers the envelopes with every keypress, and the latter only retriggers envelopes if all hands are taken off the keys between notes. Otherwise, legato playing lets the first note's envelopes keep playing.
  The software can play up to 6 notes at a time. However, setting a lower polyphony minimizes the risk of CPU overloads that can lead to stuttering and dropouts, especially when using the MK1 filter. You can experiment to find the setting that works best for you. If you have a relatively new computer, don't be surprised if KORG MS-2O V handles 6 note polyphony smoothly!

- **3. Undo/Redo:** Keeps track of your edits and changes.

  - **Undo (left arrow):** Undoes the last edit.
  - **Redo (right arrow):** Redoes the last edit.
  - **Undo History (center menu icon):** Displays a scrollable pop-up list of recent changes. Click on a change to restore the patch to that state. This will be useful in the event that you've pushed your sound design one or two steps too far, and want to revert to an earlier version.
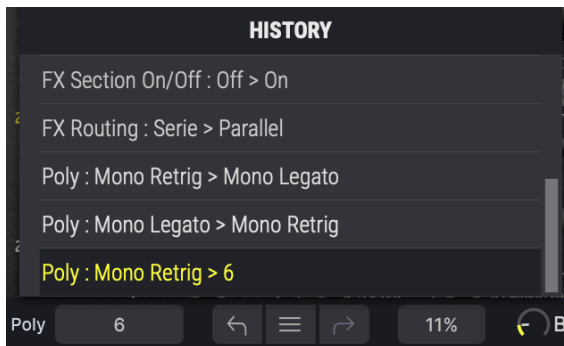
The Undo History pop-up, with the Poly setting and CPU meter on either side of it

- **4. CPU Meter and PANIC Button:** Displays the current CPU usage of the instrument. Clicking on the CPU meter window will send a MIDI **PANIC** message, silencing all currently playing notes and resetting MIDI Control Change values in the event of stuck notes or other issues.

- **5. Macro Knobs:** These four knobs control multiple parameters with a single turn. Assigning parameters to them is handled by the Macros Tab of the Side Panel.

3.4. The Side Panel

The **gear icon** at the top right of the Upper Toolbar opens the **Side Panel**, which in turn contains four tabs covering important subsystems that you won't have to access quickly when you're playing or editing sounds on KORG MS-20 V:

• **Settings**: Global settings such as MIDI receive channels, splits, octave shift, and Poly mode.

• **MIDI**: MIDI Learn functions for use with external controllers.

• **Macro**: Assignments for four Macros that control multiple parameters with a single knob twist.

• **Tutorials**: In-app interactive tutorials, also accessible from the main menu.

Let's look at them from left to right.

3.4.1. Settings Tab

This tab covers settings to control how a Preset responds to incoming MIDI.
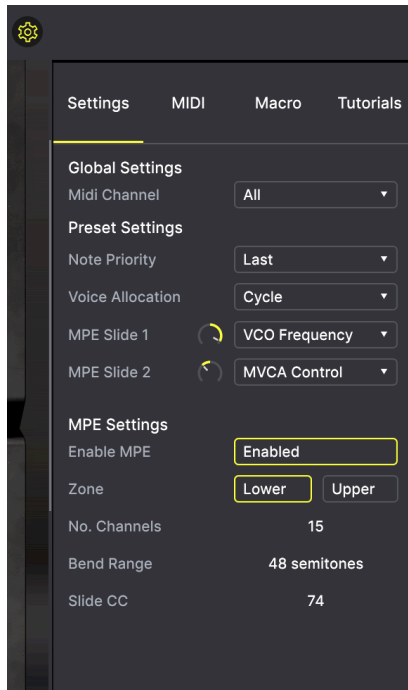
The Side Panel's Settings tab

- **MIDI Channels:** Selects the MIDI channel(s) on which KORG MS-2O V will receive MIDI input. You can select a particular channel, or choose "All" for Omni Mode.

- **Note Priority** Determines which note is heard if Poly is set to Mono Retrig or Mono Legato, and you hold down more than one note on the keyboard. The priority is given to the lowest, the highest, or the last note played. All of these priority choices have been implemented by mono synths throughout history, and some synths allowed the user to choose between them. In the original unit, the keyboard is Mono Legato with High Note priority.

- **Voice Allocation** determines how voices are played in Poly mode. The two choices are **Reassign**, where playing one note repeatedly uses the same voice again and again, and **Cycle**, where each note played triggers a new voice.

- **MPE Slide 1 and MPE Slide 2:** Using the pop-up menu, you can select which modulation destination(s) will receive MPE 'Slide' messages, then set their positive or negative amounts with the associated dial.
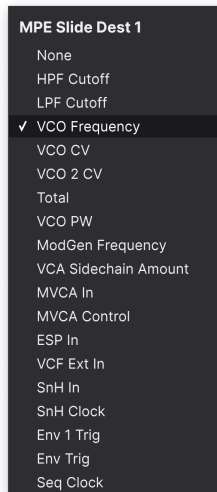
Pop-up menu for the MPE
Slide settings

- **MPE Settings** Enables or disables MPE. When enabled, a drop-down menu for basic MPE functions appears. For many players, this raises the question: what exactly *is* MPE?

3.4.1.1. MPE: MIDI Polyphonic Expression

MPE (MIDI Polyphonic Expression) is a relatively new addition to MIDI, which adapts control data for modern controllers that deliver multi-dimensional expression data for each finger. Here are the basics:

A number of new controllers offer five 'dimensions' of touch sensitivity. In addition to the usual *velocity* and *release velocity* per key, there are also *X* (side-to-side movement, sometimes called *Glide*), *Y* (back-and-forth movement, sometimes called *Slide*), and *Z* (pressure, also called *aftertouch*).

The five dimensions of MPE, shown on a conventional piano keyboard

On a fully implemented MPE controller you can

- hit a key and release it with variable velocity
- move a finger from side to side in order to create pitch bend or vibrato
- slide a finger on top of a key away from you or toward you (the key acts like a data slider)
- press harder or softer on the key

You can do all the above at the same time, with each key sending information that doesn't depend on what's happening on any other key!

Imagine a whole keyboard where every key is a pressure-sensitive joystick, and you'll start to get the idea.

You don't have to use all of these parameters at once, of course, but the ability to alter one note inside a chord in various ways can bring out amazing expressive possibilities. The KORG MS-2O was monophonic, of course, but if we make it polyphonic, why not give it some 21st Century expressiveness?

If you obtain an MPE controller, you'll have to research precisely how it sends these different types of data. In this manual we'll just cover what KORG MS-2O V's particular settings do.

- You can decide how many MIDI Channels it will watch (MPE uses a Master Channel for global MIDI messages, and assigns other channels to each voice as it plays)
- You can set the range of each finger's pitch bend (48 semitones is the default for most controllers)
- You can adjust which MIDI Control Change number is sent for Slide (the default is CC 74, filter cutoff frequency). Note that you can select two different MPE Slide destinations and scale each one positively or negatively.

If you have a non-MPE controller, don't worry! You can still get all of the nuance of the original KORG MS-2O when you play it – and then some, since the original's keyboard didn't sense dynamics at all!

3.4.2. MIDI Tab

This is where KORG MS-20 V may be placed in MIDI Learn mode. In this mode, all MIDI-assignable parameters on the Hardware Panel are highlighted and you can map physical controls on your MIDI controller to them. A typical example might be to map a real expression pedal to the Master Volume control, or a physical knob on the MIDI controller to the Frequency knob of the Filter section.

The Side Panel's MIDI tab

MIDI Controller

Generic MIDI Controller

KeyLab 25

KeyLab 49

KeyLab 61

KeyLab 88

✓ MiniLab mkII

MicroLab

MiniLab

KeyLab Essential

KeyLab mkII

KeyLab mkII 88

The MIDI Controller menu

At the top right of the MIDI tab is the **MIDI Controller** drop-down menu, where you can select templates for many Arturia MIDI controllers. These map physical controls to many "most wanted" parameters in KORG MS-20 V for a plug-and-play experience. A Generic template is also provided for third-party MIDI controllers.

3.4.2.2. MIDI Config Menu
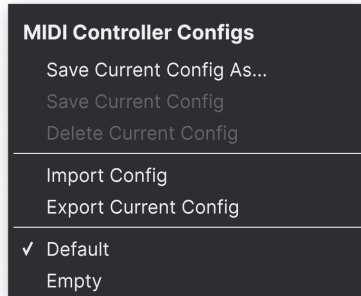
The MIDI Config menu

The **MIDI Config** drop-down lets you manage different sets of MIDI maps for controlling KORG MS-2O V from MIDI hardware. You can Save/Save As the current MIDI assignment setup, Delete it, Import a configuration file, or Export the currently active one.

This is a quick way to set up different hardware MIDI keyboards or controllers with KORG MS-2O V, without having to build all the assignments from scratch each time you swap hardware.

For example, if you have multiple hardware controllers (small live keyboard, large studio keyboard, pad controller, etc.), you can create a profile for each of them, save them, and then quickly load them here. This saves you from having to redo the MIDI mapping assignments from scratch each time you swap hardware.

Two options in this menu are especially powerful:

- **Default:** Gives you a starting point with predetermined controller assignments.
- **Empty:** Removes the assignments of all controls.

3.4.2.3. Assigning and Unassigning Controls

Click the **Learn** button in the MIDI tab to put KORG MS-2O V into Learn mode. Controls available for assignment are purple. Controls that are already assigned are red, but can be reassigned if desired. The screenshot below shows the assigned and unassigned controls for KORG MS-2O V's Default configuration.

When MIDI Learn is active, available parameters are purple and already-assigned parameters are red.

Click any purple control and its name will appear in the list. Now, move a control or operate a switch on your MIDI controller. The corresponding control onscreen will turn red and the assigned MIDI CC number will appear in the list to the left of the parameter name.

To unassign a control onscreen, control-click or right-click it. Alternative methods of assignment are available in the MIDI Parameter Menu [p.33] described below.

3.4.2.4. MIDI Channel/CC, Min and Max Values

The first two columns in every MIDI assignment list the MIDI Channel (**Ch**) and MIDI Control Change number (**CC**) for the assignment. Up to 16 Channels are available on any MIDI stream, and the 127 possible MIDI Control Change numbers, while freely assignable, follow certain conventions on most instruments. For example, Modulation Wheel is almost always MIDI CC 1, Master Volume is CC 7, and Sustain Pedal is CC 64.

The **Min** and **Max** value columns for each parameter in the list let you scale the amount by which a parameter in KORG MS-2O V changes in response to a physical control movement. For example, you may wish to limit the range of a filter sweep, even though you're probably going to turn the knob all the way during a live performance.

Drag up or down on a value to change it. Values for some parameters are expressed as percentages from 0.00% to 100%, while other parameters have values in appropriate units (dB for levels, ms for times, etc.) Setting the maximum lower than the minimum reverses the polarity of the physical controller, i.e. turning it *up* will turn the assigned parameter *down*.

Switches that only have two positions (On/Off, etc.) would normally be assigned to buttons on your controller, but it's possible to toggle those with a fader or another control if you like.

3.4.2.5. MIDI Parameter Menu

Control-clicking or right-clicking on any item in the list of assigned parameters brings up a convenient menu with the following options, which can be different for each parameter.
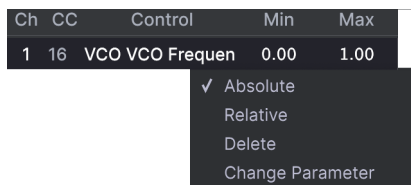
*Right-clicking a parameter gives you
these options*

- **Absolute:** The assigned parameter in KORG MS-20 V tracks the literal value your physical controller is sending out.
- **Relative:** The assigned parameter in KORG MS-20 V will go up or down from its current value in response to physical controller movements. This is often useful when using endless 360-degree encoders that don't have physical motion limits.
- **Delete:** Removes the assignment and turns the corresponding onscreen control purple again.
- **Change Parameter:** Brings up a large sub-menu of every assignable parameter in KORG MS-20 V. This lets you change the assignment of the current CC/physical control manually, and is useful when you know exactly the destination you're looking for.

3.4.2.6. Reserved MIDI CC numbers

Certain MIDI Continuous Controller (CC) numbers are reserved and cannot be reassigned to other controls. These are:

- Pitch Bend
- Aftertouch (Channel Pressure)
- All Notes Off (CC #123)

All other MIDI CC numbers may be freely assigned to control any parameter in KORG MS-20 V.

3.4.3. Macro Tab

This tab handles assignments for the four Macro knobs on the right side of the Lower Toolbar. You can assign multiple parameters to each one, then use MIDI Learn [p.29] to assign the Macro itself to a physical control if you want.
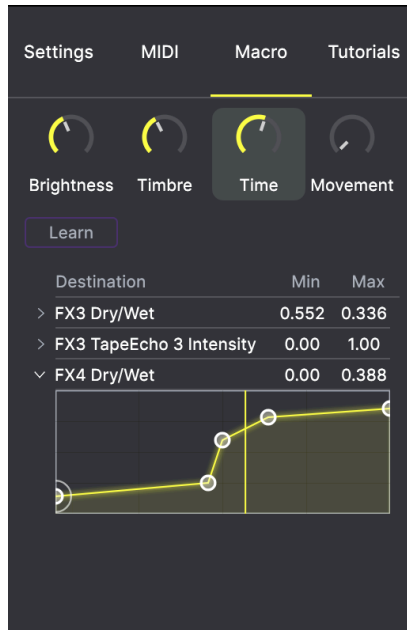
The Side Panel's Macro Tab

> Macros are saved at the Preset level.

3.4.3.1. Macro Slots

Click one of the Macro knobs to select which Macros you want to work with. The default names are *Brightness*, *Timbre*, *Time*, and *Movement*, but you can rename them by double-clicking the name field. The knob above the name corresponds to the knob of the same name in the Lower Toolbar.

3.4.3.2. Making Macros

Click the **Learn** button in the Macro tab and you will see that the process works much like MIDI assignments – available destinations turn purple and ones already assigned turn red. Click on a purple control onscreen and its name will appear on the list.

To remove a parameter from the Macro, right-click its name in the list and select **Delete**. Parameters under Macro control have **Min** and **Max** values and may be scaled by dragging up or down directly on the number, just as is done with MIDI assignments. To reverse the polarity of a parameter (i.e. have it go down when you turn the Macro knob up and vice-versa), set the minimum value higher than the maximum.

> ℹ There are no rules for naming and assigning parameters to Macros. Keep in mind, though, that while it may seem funny to name a Macro "Chartreuse", that might not be terribly useful when you're playing the patch in a recording session next year. When in doubt, go for clarity!

3.4.3.3. Macro Curves

Beyond simple scaling, you can customize a curve that determines how each parameter under the Macro's control proceeds from its minimum to maximum value and back when you turn the Macro knob. Click the > icon next to the parameter name to open the curve window.
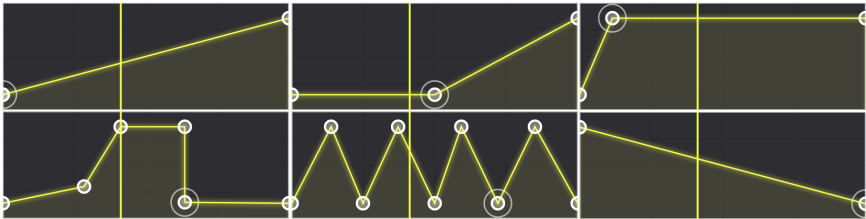
Some example Macro curves

Click on the curve to add a breakpoint, represented by a small circle. You can then drag the point and the curve segments between it and its nearest neighbors will change accordingly. Right- or control-click on a point to remove it. The first and last breakpoints cannot be removed.

> ♪ A simple diagonal line would produce a linear curve, but the potential fun here is to make things non-linear.

3.4.4. Tutorials
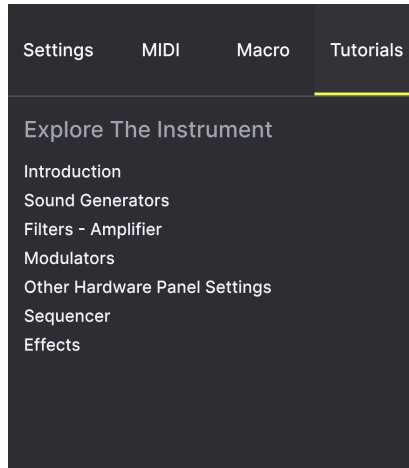
The Side Panel's Tutorials tab

In this tab, which can also be opened by selecting **Tutorials** from the KORG MS-20 V menu, you can click on titles for the individual chapters, which in turn will take you through different areas of KORG MS-20 V in steps. The parts of the panel to focus on are highlighted as you go.

> ℹ If you're editing a Preset, make sure to save it before opening the Tutorials, because doing so will load a new Preset and overwrite your changes. The Tutorials also take over the Side Panel space when in use.
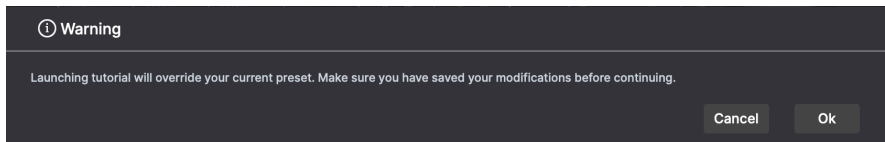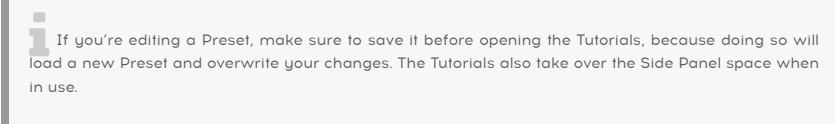
Warning pop-up when launching a tutorial

4. THE PRESET BROWSER

The Preset Browser is how you search, load, and manage sounds in KORG MS-20 V. It has different views but they all access the same banks of Presets.

To access the search view, click the browser button (the icon looks a bit like books on a library shelf). To close the browser, click the X that appears in its place.

The browser has four main areas:
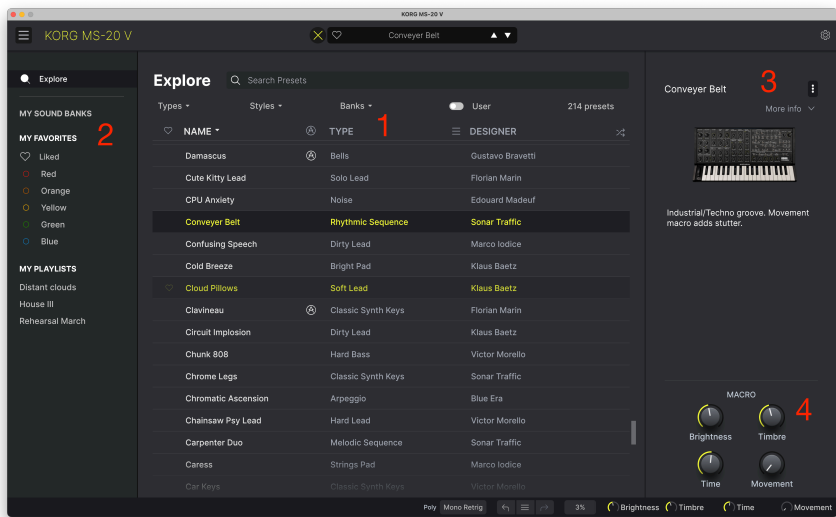
The full Preset Browser window

Number	Area	Description
1.	Search and Results [p.38]	Search Presets with text strings, and by tags for Type and Style.
2.	Sidebar [p.43]	Manage Banks, Favorites, and Playlists.
3.	Preset Info [p.46]	Summary of Bank and Tags, Designer name, and description info for current Preset.
4.	Macro Knobs [p.49]	Large size duplicates of Macro knobs in Lower Toolbar.

4.1. Search and Results

Click on the Search field at the top and enter any search term. The browser will filter your search in two ways: First, by matching letters in the Preset name. Then, if your search term is close to that of a Type or Style [p.39] it will include results fitting those tags as well.

The Results list beneath shows all Presets that fit your search. Click the X icon at right to clear your search terms.
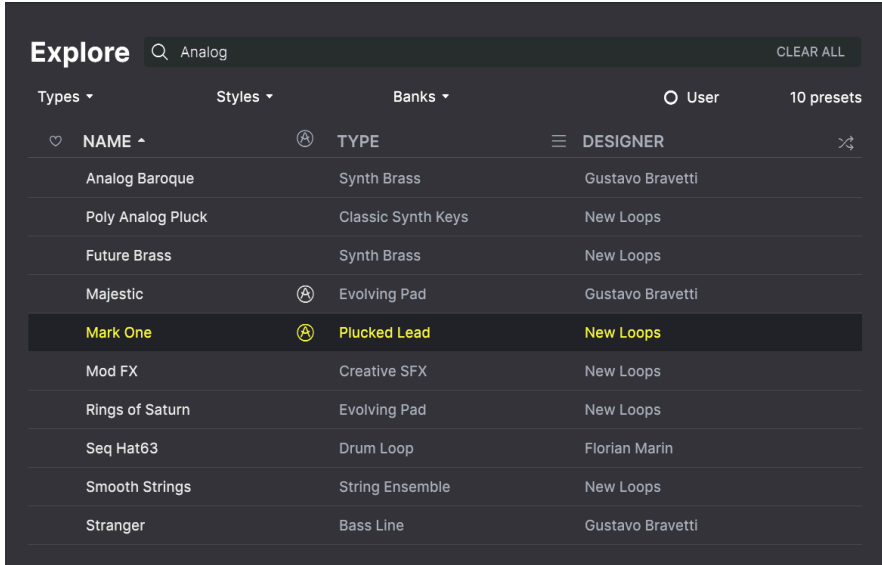
Filter by typing text in the Search field

4.2. Using Tags as a Filter

You can narrow (and sometimes expand) your search using different tags. There are two kinds of tags: *Types* and *Styles*. You can filter by one, the other, or both.

4.2.1. Types

Types are categories of instruments and musical roles: bass, leads, strings, pads, organs, and more. With a clear search bar, click the **Types** button to bring up a list of types. Notice that each type also has several sub-types:
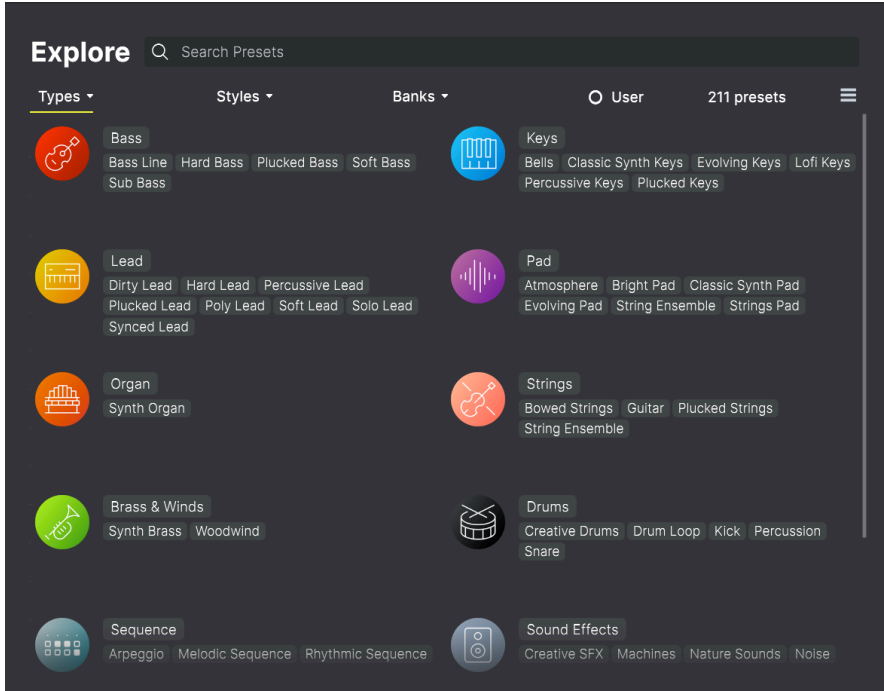
Click any one of them, and the results will show only Presets that match that tag. You can also select multiple Types using Cmd-click (macOS) or Ctrl-click (Windows). For example, if you aren't sure whether the Preset you're looking for was tagged with Keys or Pad, select both to broaden the search.

Results columns can be inverted by clicking the arrow buttons to the right of their titles (Name, Type, Designer).

4.2.2. Styles

Styles refine your search according to further musical attributes. Accessed by the **Styles** button, this area has three further subdivisions:

- *Genres*: Identifiable musical genres such as decades, Trance, Techno, Synthwave, Disco, etc.
- *Styles*: General "vibe" such as Atmospheric, Dirty, Clean, Complex, Mellow, etc.
- *Characteristics*: Sonic attributes such as Analog, Evolving, Distorted, Dry, Rise, etc.

Explore   🔍 Search Presets

Types ▾   Styles ▾   Banks ▾   ⬤ User   214 presets ≡

GENRES	STYLES	CHARACTERISTICS

GENRES
Psytrance Techno Trance Berlin
Drum & Bass Dubstep Hard Techno
House Industrial Ambient
Experimental Cinematic Soundtrack
Synthwave Electro 70s 80s
90s Jazz/Blues Rock Soul/R&B
Trip Hop Bass Music Minimal Funk
Downtempo Pop Lofi Chiptune
Game Audio Modern Disco Fusion
Hip Hop/Trap Future Bass Breakbeat
Grime Dub/Reggae Footwork
Indie Dance UK Garage 60s
Detroit Reggaeton World Jungle
Classical

STYLES
Dark Acid Dirty Airy Hard
Huge Punchy Sharp Bizarre
Harsh Atmospheric Soft Warm
Simple Melodic Sad Bright
Mellow Deep Funky Complex
Classic Soundscape Thin Clean

CHARACTERISTICS
Reverb Distorted Analog Evolving
Noise Solo Rise Slow Attack
Synth Delay Filtered
Sequence/Loop Vibrato Hoover
Acoustic Amp Dry Ensemble
Arpeggiated Synced Short
Transient Gated Long Processed
Glide FM Stab Random Glitch
Granular Digital Layered Reese
Chord Natural

Click on any tag to select it. Click again (or right-click) on any selected tag to de-select it. Notice that when you select a tag, several other tags usually disappear. This is because the browser is narrowing your search by a process of elimination. De-select any tag to remove that criterion and widen the search without having to start all over again.

4.2.3. Banks

Next to the **Types** and **Styles** buttons is the **Banks** button, which lets you do your search (using all the methods above) within the factory bank or user banks.

4.3. Search Results window

Click the **Show Results** button if you cannot already see your list of results. Click the sort arrow to reverse the alphabetical order of any column.

4.3.1. Sorting the Preset Order

Click the **NAME** header in first column of the Results list to sort Presets in ascending or descending alphabetical order.

Click the **TYPE** header in the second column to do the same thing by Type.

Click the **Arturia logo** to the left of **TYPE** to bring factory-featured Presets to the top of the list. These will appear just under any Presets you have liked [p.42].

The third column has two header options: **DESIGNER** and **BANK**. Click the icon with three lines to choose between the two. Then click either header name as with the other two columns to switch the alphabetical order.
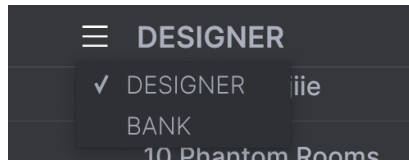
4.3.2. Clearing Tags

Just above the Types, Styles, and Banks buttons, you will see labels for all the active tags in a search. Click the X next to any one to remove it (and thus broaden the results). Click **Clear ALL** to remove all tags.
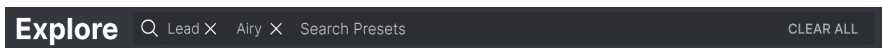
4.3.3. Liking Presets

As you explore and create Presets you can mark them as Liked by clicking the **heart** next to their names. later, click on the heart icon to put all of your favorites at the top of the Results list.
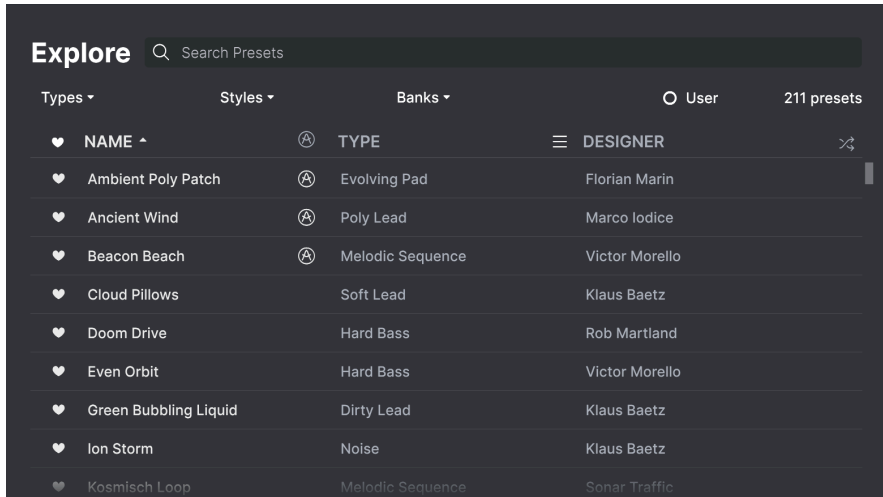
Use as many of the sorting and filtering features as you need and you will find the exact sound you want every time.

4.4. Sidebar

The leftmost section of the Preset Browser determines what is displayed in the Search and Results [p.38] section.

The topmost option is:
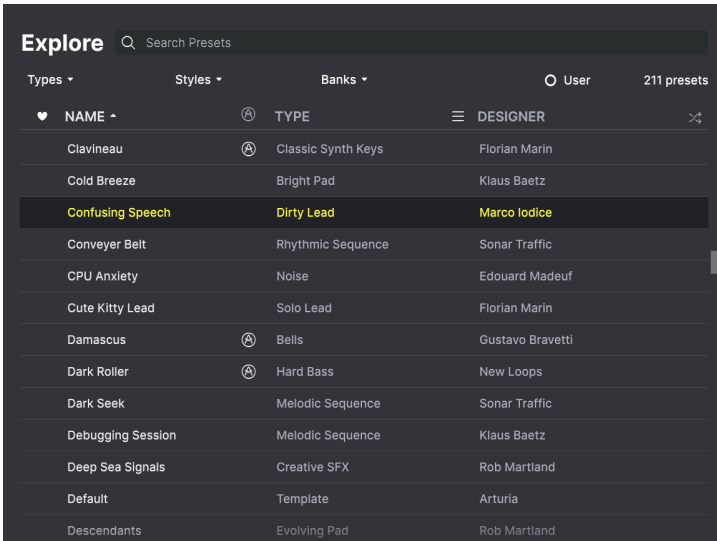
The **Explore** section is the default, letting you search the current bank of Presets loaded into KORG MS-20 V as we did in the previous section.

4.4.1. My Sound Banks

Clicking **My Sound Banks** brings up a window with all of the currently available Sound Banks, starting with the Factory bank. User banks appear next to it, and can be deleted, renamed, or exported by right-clicking them.
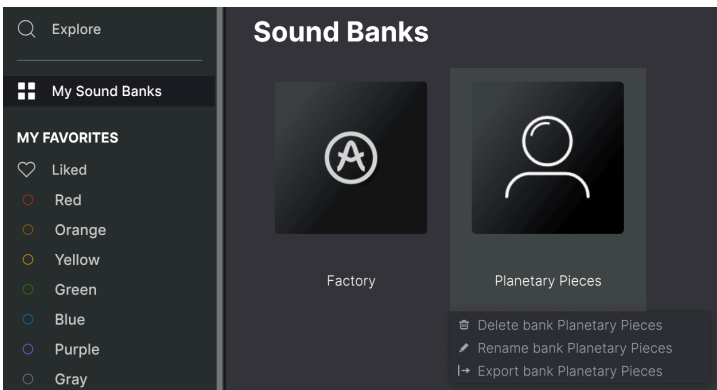
4.4.2. My Favorites

The middle part of the Sidebar has a menu called **My Favorites**, which allows you to color-code certain groups of Presets for easy access. It also includes the **Liked** group, so you can quickly find Presets you've marked with the heart icon.

To decide which colors you'd like to display, hover over **My Favorites** and click **Edit**. Then use the buttons to select which colors you'd like to see or hide, and then click **Done**.

Please note, that you can also rename these favorites into Bass, Leads, et cetera. Just right-click on the favorite and enter a new name.
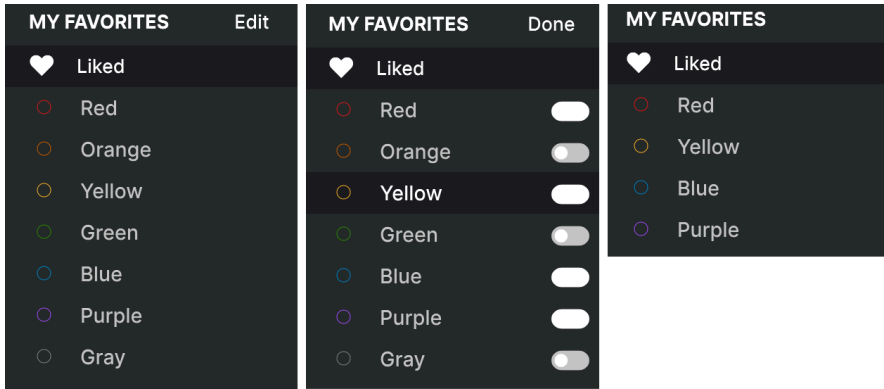
To add Presets to a particular set of Favorites, simply drag and drop them over the appropriate color. Then click on the color itself to display your grouping.
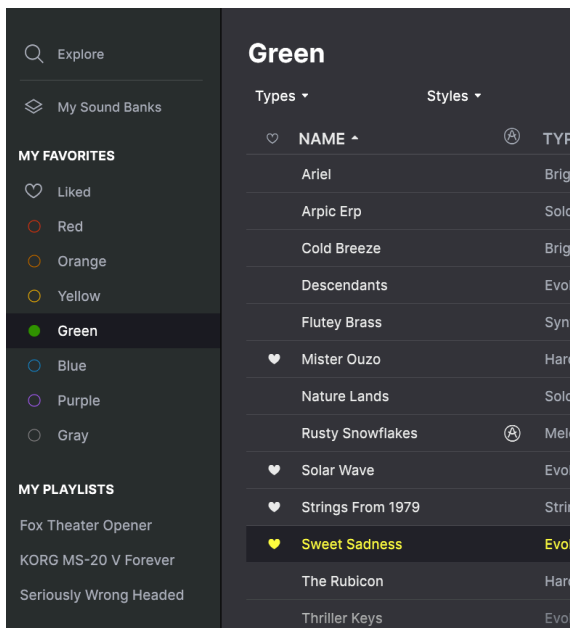
4.4.3. My Playlists
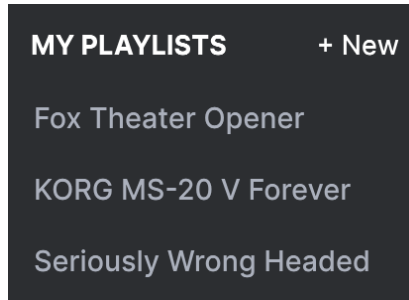
The bottom part of the sidebar displays any Playlists you have created or imported. Playlists are a very powerful management tool for set lists for gigs. Learn more about them in the Playlists section [p.50] below.

4.5. Preset Info Section

The right side of the browser window shows specific information about each Preset. The information for User Presets (but not Factory ones) may be changed here: Name, Type, Favorite, etc.
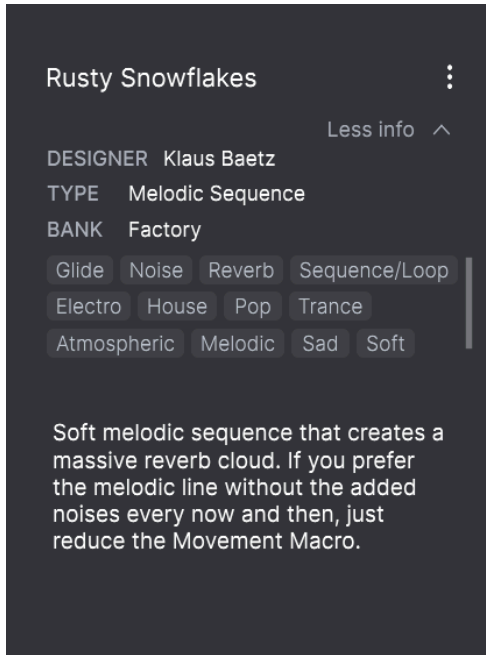
To make the desired changes, you can type in the text fields, use one of the pull-down menus to change the Bank or Type, and click the + sign to add or delete Styles.

Types and Styles changes you make here are reflected in searches. For example, if you remove the "Funky" Style tag and then save that Preset, it will not show up in future searches for Funky sounds.

Clicking on the three-dots icon at the top right pops up a menu with organizational options for the Preset.
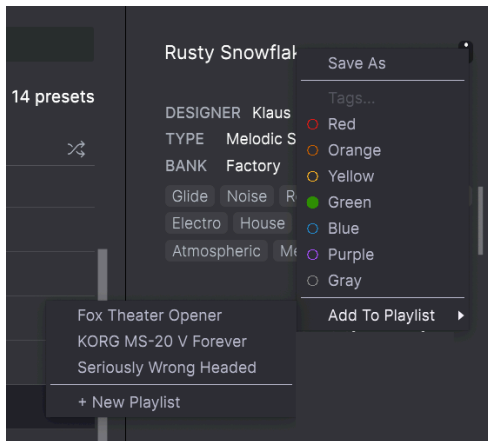
Options include **Save Preset**, **Save Preset As**, **Delete Preset**, and **Add to Playlist**, complete with an option to create a new Playlist. The lines with color icons allow you to add the Preset to a particular group of Favorites, which is described above.

4.5.1. Editing Info for Multiple Presets

If you'd like to move several Presets to a different bank while preparing for a performance, or enter a single comment for several Presets at the same time, it's easy to do. Simply hold command (macOS) or ctrl (Windows) and click the names of the Presets you want to change in the Results list. Then enter the comments, change the Bank or Type, etc., and save the Preset.
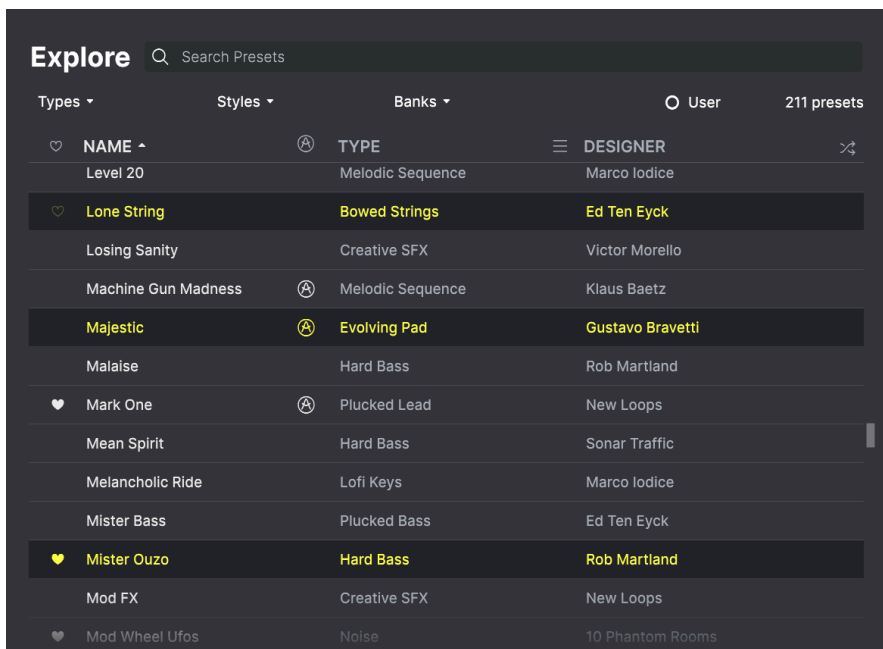
4.6. Preset Selection: Other Methods

Click on the Preset name in the center of the Upper Toolbar to bring up a drop-down menu. The first option in this menu is **All Presets**, and it brings up a submenu of literally every Preset in the current bank.

Below this are options that correspond to the Type tags. Each of these brings up a submenu of all Presets of its Type.

If you have an active search by Type and/or Style, the up/down arrows to the right of the Preset name will step through only the results that conform to your search.

However, "All Presets" in the drop-down menu always ignores those criteria. Likewise for the Type choices below the line – they always include all Presets within that Type.

4.7. Macro Knobs

These are simply larger duplicates of the Macro knobs in the Lower Toolbar. Move one and its partner moves with it.

Assigning parameters to Macros is covered in the Macro Tab [p.34] section of Chapter 3.

4.8. Playlists

Playlists are a way to collect Presets into different groups for different purposes, such as a set list for a particular performance or a batch of Presets related to a particular studio project. Within a Playlist, Presets can be reordered and grouped into Songs, a handy addition to a set list.

The subheading **My Playlists** appears under **My Favorites** in the Sidebar. However, when you first start using KORG MS-20 V, you'll have no Playlists yet, and **My Playlists** won't be there yet. To make it appear, you'll have to create your first Playlist.

4.8.1. Create your first Playlist

To get started, drag any Preset to the Sidebar. The **My Playlists** heading will appear, along with a **+ New** icon. Drop the Preset onto the **+ New** icon, and you will then be given a pop-up to name your first Playlist. Once you've created one Playlist, the **My Playlists** heading will become a permanent part of the Sidebar.
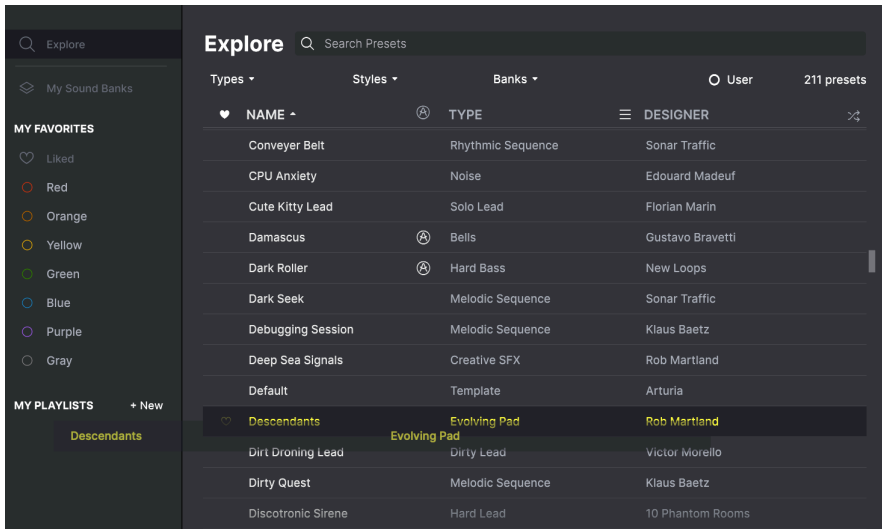
4.8.2. Add a Playlist

To add a Playlist, hover your mouse over the **My Playlists** heading and click the **+ New** icon when it appears.
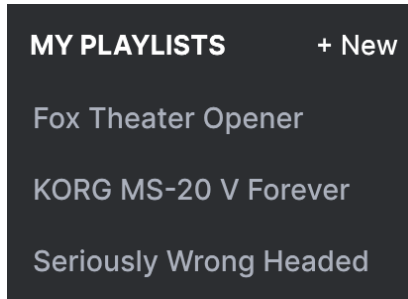
Give the Playlist a name and it will appear in the Playlists menu in the Sidebar.

Once you've created some Playlists, right-clicking on a Playlist name will pop up a set of options – you can **Rename**, **Delete**, or **Export** the Playlist to your computer, as a file with the .aplst extension.
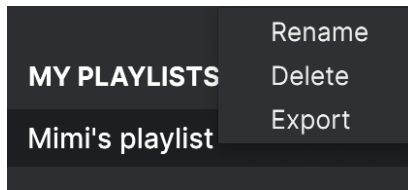
4.8.3. Add a Preset

You can use all of the options in the Explore window to locate Presets for your Playlist. When you find a desired Preset, click-drag it onto the Playlist name.
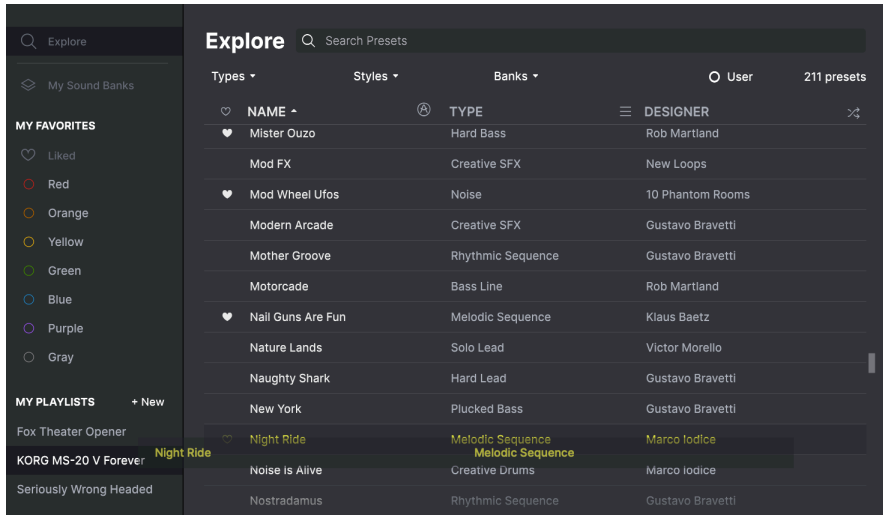
Click and drag from the Search Results list onto one of the playlists

To view the contents of a playlist, click on the playlist name.

4.8.4. Re-order the Presets

Presets may be reorganized within a Playlist. For example, to move a Preset from slot 3 to slot 4, drag and drop the Preset to the desired location.
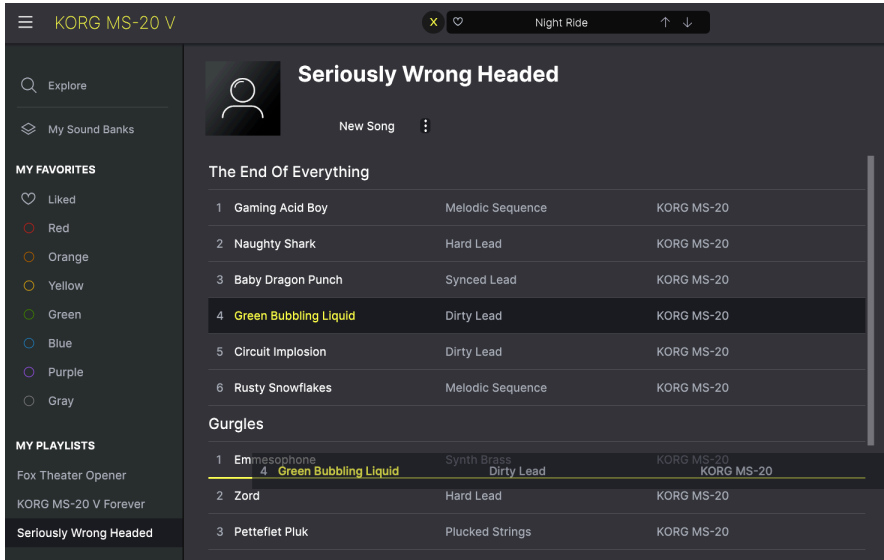
The yellow line indicates the final destination of the Preset you're dragging.

This will move other Presets up in the list to accommodate the new location of the Preset you just moved. A bright yellow line will briefly appear at the "insert point."

4.8.5. Remove a Preset

To delete a Preset from a playlist, right-click on its name to bring up a pop-up menu.
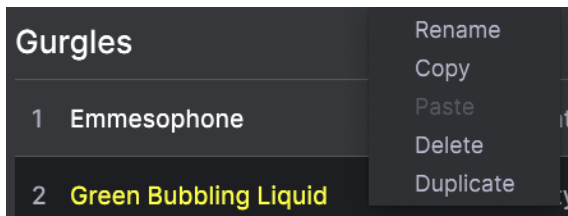
This menu also includes **Rename**, **Copy**, **Paste**, and **Duplicate** options. More management options are described below.

4.8.6. New Song and Playlist Management

The **New Song** button creates a new Song at the bottom of the Playlist. You can name it, then click and drag it to position it in the Playlist and add Presets to it in the desired order.

To access other Playlist management options, click on the three dots icon next to the **New Song** button. This brings up a pull-down menu:
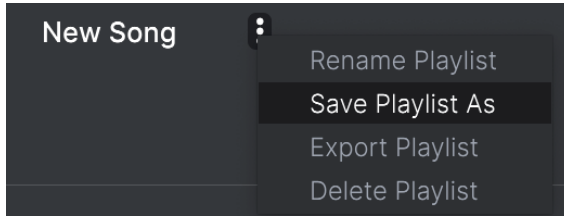
- **Rename Playlist**: Renames the current Playlist without making a copy.
- **Save Playlist As**: Creates a duplicate of the playlist with "Copy" appended to the name. You can change the name before saving.
- **Export Playlist**: Exports your Playlist to a location on your computer, with the filename extension "aplst."
- **Delete Playlist**: Deletes the current Playlist but does *not* delete any of the Presets in it.

The Hardware Panel, set to the Default Template Preset

Now that we've figured out what all the controls around the edges do, you're probably eager to get to the main event – the controls we use for sound creation on KORG MS-20 V, both original and modern. These are found on the **Hardware Panel**, as shown above.

> ℹ️ As we carry out our tour, we'll be using a lot of synth terminology that you might not be familiar with if you're new to this sort of thing. To get yourself up to speed, check out The Basics of Subtractive Synthesis [p.112] later in this manual.

The Hardware Panel has all of the original MS-20's controls in their usual places. In addition to those, it has a number of extra parameters with controls of their own, integrated into the original hardware design. As we tour the Hardware Panel from left to right (mostly), we'll learn what each control does.

The **Patch Panel**, where new signals can be routed with virtual patch cables, is to the right of the Hardware Panel, and we'll cover it in detail after we discuss the primary controls.

5.1. General Display Conventions and Features

The Hardware Panel has a few handy extra features and display conventions:

Note how turning a knob causes the numbers to change color. This is a handy visual reference that some users find easier than a knob marking to recognize quickly. Every switch's currently active setting is displayed in color.

Some knobs have common 'default' settings. Double-clicking a knob returns it to that setting. For example, double-clicking **VCO 2 Pitch** returns its value to zero.

When you hover over a control that has influence over other controls, yellow LEDs will light up next to them all, so you can see what your connection will affect. For example, hover your mouse over the **PWM IN** on the Patch Panel, and see the yellow dot appear beside the PW Modulation **MG/EXT** control.

Now let's get started!

5.2. The Oscillator Section

The two VCOs and pitch modulation controls

The KORG MS-20 V signal path begins with a pair of *voltage-controlled oscillators* (**VCOs**), which provide the 'raw material' for our sound. In this first section of the Hardware Panel, we have not only all of the controls for the VCOs themselves, but also for the various ways in which the pitch of our sound can be modulated.

5.2.1. The Oscillators: VCO 1 and VCO 2

The KORG MS-20 V signal path begins with a pair of *voltage-controlled oscillators* (**VCOs**), which provide the 'raw material' for our sound. The two VCOs have slightly different function sets.

OSCILLATOR 1 has controls for:

- **Waveform** selects the output wave. The choices are *triangle*, *sawtooth*, variable-width *pulse*, and white *noise*.

- **PW** (Pulse Width) varies the width of the pulse wave, from 50% (Square) to 0.00% (silence). Unlike the original hardware, KORG MS-20 V offers Pulse Width Modulation (PWM).

> PW and PWM also affect the triangle wave in a subtle way, providing a gentle timbral change that is a lot more subtle than what you hear on the pulse wave. Try it!

- **Scale** defines the base octave/pitch of the VCO, (32', 16', 8', 4')

> Why are these numbers given in feet? Octave settings are measured in feet because they originated with organ pipes, whose pitch would drop by an octave if the pipe length was doubled. Many synthesizers today use feet for octave designations – 64', 32', 16', 8', 4', and 2' – although this parameter might be called Scale, Octave, Range, etc.

OSCILLATOR 2 has controls for:

- **Waveform** selects the output wave. The choices are *sawtooth*, *square*, narrow *pulse*, and *ring modulation*.

> Ring modulation is a common form of sound generation, where the two oscillators are input to a circuit that includes four diodes in a ring (hence the name). The output frequencies are the sum and difference of the input frequencies, which don't follow the pitch and harmonic structure of the inputs. While you can use the Patch Panel to create wide variations with clanging metallic tones, varying the **Pitch** of VCO 2 will produce dramatic pulsating sounds that remain in tune.

- **Pitch** sets the interval by which VCO 2's pitch differs from VCO 1's (-13.0 to +13.0 semitones). Note that the knob has much finer control when Pitch is near 0, so slight detuning can be very carefully adjusted. Double-click the knob to reset to 0.00 semitones.

- **Scale** defines the base octave/pitch of the VCO. (16', 8', 4', 2') This is the same range as VCO 1, but an octave higher.

There are two switches that add new VCO features:

VCO 1 > VCO 2 Sync forces VCO 1 to restart its waveform cycle every time VCO 2 does. This creates unusual waveforms with unique combinations of harmonics. Slight modulation of VCO 2's frequency causes dramatically sweeping timbral changes.

Unison activates the Unison function, which plays multiple voices with each keypress in Mono Legato or Mono Retrig modes.
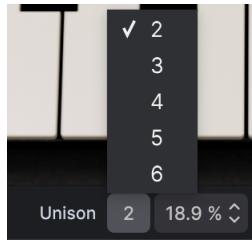
With Unison set to On, a special menu appears in the Lower Toolbar, where the number of unison voices can be selected. The amount of detuning between voices can be set from 0.100% (nearly perfect tuning) to 100% (detuning by up to a semitone).

> ℹ CPU usage is higher in Unison mode and directly related to the number of voices playing.

> ℹ Using Unison with MK1 filter requires high CPU processing power. For setups that can't afford it, it's better to use the MK2 filter.

5.2.2. The VCO Mixer

The **VCO Mixer** has individual knobs for the level of VCO 1 and VCO 2 before they are sent to the Filter section.

5.2.3. Pitch Modulation

These controls set how KORG MS-20 V's VCO pitches can be externally modulated. All of them default to minimum values when double-clicked.

Looking at these controls, you'll notice that many of them are labeled **MG/EXT**, **MG/T.EXT**, **EG1/EXT**, or **EG2/EXT**.

These controls set the amount of modulation control that comes from a default source – either the Modulation Generator (or **MG**, Korg's name for LFO, also known as Low Frequency Oscillator) or one of the two Envelopes (**EG1** or **EG2**) – or an external source set in the Patch Panel (see below). **EXT** refers to signals patched into the appropriate input, such as **FREQ** or **PWM IN**; **T.EXT** specifically means the **TOTAL** input, which can simultaneously process both VCO Frequencies and both VCF Cutoff Frequencies in varying amounts.

Portamento sets a 'glide time' from one pitch to the next as notes are played. (4 ms to 2.570 seconds)

Pitch Modulation has two different amount knobs: one for the MG or **TOTAL** modulation input, and the other for EG1 or the **FREQ** input. The second control can be applied to VCO 1, VCO 2, or both at once – a new feature for KORG MS-20 V.

The modulation FM assign switch allows you to do FM on a single oscillator. Example: using VCO1 output to modulate VCO2 only.

5.2.4. Pulse Width Modulation

PW Modulation (a feature added by Arturia) controls the amount of Pulse Width Modulation applied by the MG or the external signal patched to **PWM IN**.

5.3. The Filter Section

The two VCFs and cutoff frequency modulation controls

KORG MS-20 V has two resonant *voltage-controlled filters* (**VCFs**) in series: a Highpass Filter (**HPF**) followed by a Lowpass Filter (**LPF**).

Each filter has controls for **Cutoff Frequency** and **Peak** (resonance).

In addition, there are two important function switches:

LINK determines if the two filters' Cutoff knobs can be controlled together by moving either one. (Same direction, Opposite direction, or O for no Link)

MK1/MK2 selects the type of filter circuit model used in the Preset.

> **i** Over the course of its product life, the MS-20 was built with two different filter designs. The first was the Korg 35, a deceptively simple circuit developed by designer Fumio Mieda to provide a raw, aggressive character using the fewest possible parts for the most affordable result. The second was an OTA (Operational Transconductance Amplifier) circuit with a far smoother and more 'civilized' tone, especially at high resonance (Peak) settings.

The KORG 35 filter model gets as close to the real hardware as it does, because it is computationally intensive – so much so that if you set the switch to MK1 when using Poly or Unison modes, you get a pop-up warning that you might be taking your computer into dangerous territory:

CPU WARNING

Do not show again

The MKI filter is a model of the KORG-35 chip, a highly nonlinear circuit, requiring intense CPU processing. While it can be great to test the limits of your processing power, it is recommended to use it in monophonic to limit its CPU consumption.

Switch to monophonic mod

Stay in polyphonic mode

> ℹ The MK1 KORG 35 filter chip has a highly unique personality with has less subs, more noise, and it's rawer and grittier when distorting but also less screamy.

> ℹ The MK2 OTA chip sports more subs and a cleaner, screamier resonance.

Please note, that the MK1 filter is more CPU intense than MK2.

5.3.1. Cutoff Frequency Modulation

There are two sets of controls for Cutoff Modulation on the two filters. As with the VCOs' Pitch and PW modulation, these can be controlled from a combination of the MG, EG2, the **TOTAL** CV input, or either of the two **Cutoff Freq** CV inputs.

5.4. The Modulation Section

*Controls for the Modulation Generator,
Envelope Generators, and other
modulators*

This section controls the various pre-wired modulation sources in KORG MS-20 V – the
Modulation Generator, the two Envelope Generators, and a couple of extra modulation
routings that weren't present on the original MS-20 hardware. Any of these can be manually
routed or defeated with the right Patch Panel connections.

5.4.1. The Modulation Generator

The **Modulation Generator** (**MG**) is KORG's name for a *low-frequency oscillator* (*LFO*), an oscillator that runs at a frequency well below human hearing. Even though we can't hear it directly, It can be used as a cycling form of modulation. For example, if we route the MG to Pitch Modulation, it will create vibrato.

Controls include:

- **Free/Reset**: This switch controls the retriggering behavior of the MG as KORG MS-2O V is played. When set to Free (this is the setting in the original MS-2O), the MG doesn't retrigger (i.e., reset itself to the beginning of its waveform) as keys are pressed, but 'runs free' on its own. When set to Reset, the MG starts over at the beginning of its waveform whenever a key is pressed. This difference in behavior is especially audible when playing polyphonically.

- **Waveform**: The MG Waveform doesn't offer a choice of fixed shapes: instead, it's continuously variable. It outputs two waveforms – at the center of its travel, these are a triangle and a square. The triangle is internally wired and doesn't need a patch cable, but the square wave is available from the Patch Panel. Turning this knob gradually changes the output waveform – from sawtooth to triangle to ramp (upward sawtooth), and from narrow pulse width (mostly 'up') to square to narrow pulse width (mostly 'down').

- **Frequency** sets the rate of the MG cycle. Next to it, there's a button with a musical note – this sets the type of sync to an external MIDI clock source. A pop-up asks for the type of sync desired: Hertz (0.093 to 17.8 Hz) or three types of Sync for straight time, triplets, or dotted note values. (8 bars to 1/32 note). When any Sync option is enabled, the red LED by the button lights up.
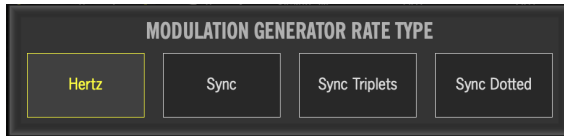
- **EG1/EXT** controls the MG Frequency from either Envelope Generator 1 or an external CV source.

5.4.2. The Envelope Generators

An **Envelope Generator** is a control voltage that starts, changes, and then stops, according to settings for several *stages* that it passes through. Both of KORG MS-2O V's Envelope Generators are variations on the traditional *ADSR* (*Attack*, *Decay*, *Sustain*, *Release*) type. Double-clicking on any control sets it to a default value – generally the shortest possible time a stage can provide, and maximum Sustain.

Envelope Generator 1 (**EG1**) is by default routed to Pitch Modulation, MG Frequency, and secondary VCA (available in the patchbay). It has three stages:

- **Delay Time**: The Delay time is just what it sounds like: a time delay between pressing a key and the start of the Attack. (O ms to 13.3OO seconds)

- **Attack Time** is the time that the sound will take to reach its maximum volume once we start the envelope. (3 ms to 6O.8OO seconds)

- **Release Time** is the time that the sound will take to drop back to silence once we stop the envelope. (51 ms to 7O.4OO seconds)

Between the end of the Attack and the beginning of the Release, EG1 will *sustain* at its maximum value.

There's also a **Trig/Gate/Loop** switch to determine the trigger behavior of EG1:

- **Trig** means that the envelope will complete its full cycle once a key is pressed, even if it's held down.

- **Gate** means that the Delay and Attack will proceed normally, but will then sustain until the key is released and then go through Release. This is how the original MS-20 behaves.

- **Loop** means that EG1 will go through its whole cycle without sustaining, and at the end of the Release stage, will retrigger the envelope at the start of the Decay stage. This lets EG1 act as a sort of second MG with a waveshape defined by the envelope stages.

EG2 has five stages:

- **Hold Time** seems at first to be placed a little bit strangely on the front panel – the Hold stage actually comes between Sustain and Release, and is an added time that the envelope stays at the Sustain level between when the key is released and when the Release stage begins. This can turn the envelope into a sort of extra gate signal. (Classic 0 ms to 29.800 sec)

- **Attack Time** is the time that the sound will take to reach its maximum volume once we start the envelope. (Classic 24 ms to 14.000 sec; Modern 1 ms to 20.000 sec)

- **Decay Time** is the time that the sound will take to drop from its maximum volume to the Sustain level. (Classic 32 ms to 16.000 sec; Modern 1 ms to 20.000 sec)

- **Sustain Level** is the volume level that the sound will reach when a key is held down long enough to get through the Attack and Decay.

- **Release Time** is the time that the sound will take to drop back to silence once we stop the envelope. (Classic 30 ms to 25.000 sec; Modern 1 ms to 20.000 sec)

EG2 is by default routed to main VCA (volume) aswell as both filter Cutoff modulation.

Note that the Attack, Decay, and Release times have two ranges: Classic, as on the original MS-20, and Modern, with a wider range. These are selected with the **Classic/Modern** switch. Also note that in Modern mode, Hold Time is replaced by **Decay Curve**, which adjusts the curve shape of the Decay stage.

The control range is -20.0 to 20.0 with a default of -4.00. At negative values, the Decay is sharply percussive, most easily heard when the Sustain is set very low. At positive values, the Decay is gentler – in fact, at very high values, it's essentially flat, creating a 'two-step' effect where a steady level at a fixed Decay time drops to the Sustain level.

5.4.3. Cutoff Mod Sidechain and Amplifier Modulation

The original MS-20 used EG2 for its loudness envelope, had no modulation options. In fact, it had no controls at all for its *voltage-controlled amplifier* (*VCA*) – just a front panel graphic showing where the VCA was in the signal chain. Naturally, we don't like wasted space on our virtual instruments' front panels, so we've added a couple of cool new features to KORG MS-20 V!

Cutoff Mod Sidechain allows for dynamic control of the Cutoff Frequency of both filters by MIDI velocity data, so notes become brighter as you play harder.

Amplifier Modulation lets the overall level be controlled by the MG or by any CV sent to the **EG2 Sidechain** input on the Patch Panel.

5.5. The Patch Panel
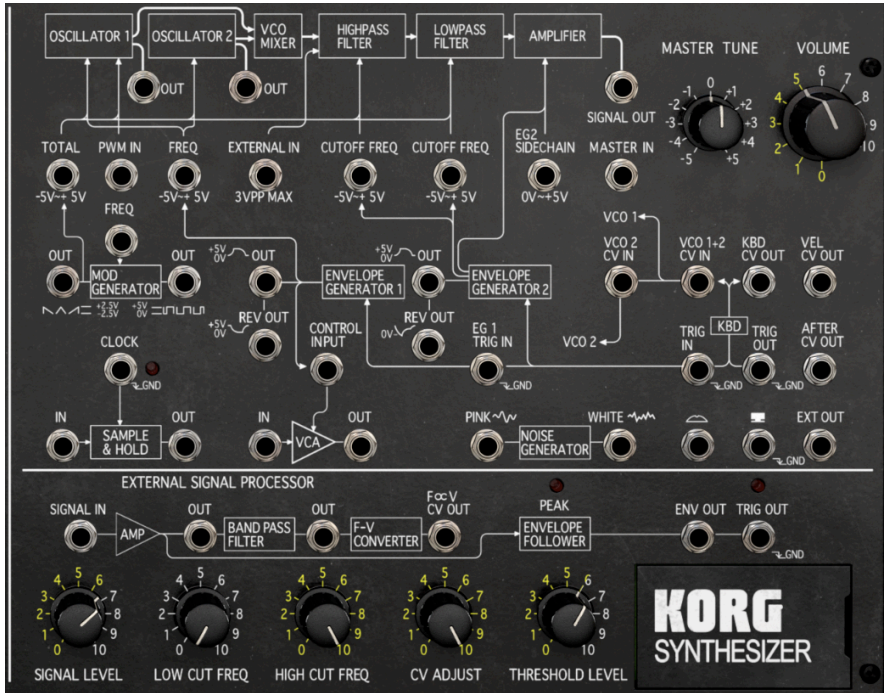
As on the original MS-2O, KORG MS-2O V has a patch panel where you can alter or add to the possibilities of the basic signal path, with more elaborate routings and a few extra utilities. We'll go through the subsections of the Patch Panel from top to bottom.

5.5.1. Working with virtual patch cables

First, however, we have to address a very important question: how do you plug cables into a virtual patch panel on your computer monitor?

Theoretically you could try shoving patch cables into your monitor. Don't do this; we assure you that it won't work, and it will probably void your monitor's warranty. Instead, our virtual patch panel uses virtual cables! Here's how they work.

5.5.1.1. Creating a cable connection

Making a cable connection is as easy as click, drag, and drop!

In this example, we're creating a connection from EG2's **OUT** to the VCO **FREQ** input:
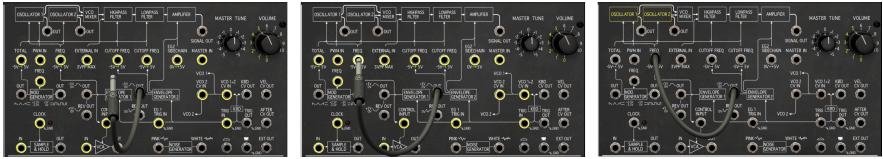
Creating, moving, and inserting a cable

To create a cable, click-hold on either the input or output patch point that you want to connect it to, and drag away from it. A cable will appear, and all of the places where the other end can connect will be highlighted in yellow.

To connect the other end, hover the tip of the cable plug over your intended destination, which will be highlighted in a brighter yellow. Drop it, and it will be connected.

5.5.1.2. Moving and deleting cables

To move a cable or delete it, just click and drag to unplug its *destination* (not its source – see below!). Then, you can either move it to a new patch point, or delete it by dropping it where there's no nearby patch point. You can also remove a cable by right-clicking on a patch point.

5.5.1.3. Creating mults

A *multiple* (or *mult*) is a very handy utility for modular or semi-modular synthesizers. It's just a splitter for CV or audio signals – one input, multiple outputs.

The original MS-20 didn't have any front-panel mults, but KORG MS-20 V has as many as you want! Here's how to make a mult.

Click and drag from the *source* of your intended connection: a second cable will appear, quite close to the first. (This is why you can't move or delete a cable from its source – you'll make a mult instead!) Then drag it to the new destination and plug it in. Now the signal will go to both places.

> ℹ Note that a mult can split and duplicate signals, but it can't mix them, so you can't send multiple sources to a single destination.

Connecting mults can get out of hand...

As you can see, you can create a fair number of mults - in fact, you can connect one output to every eligible input on the entire front panel (15 of them!).

> ℹ Note that because mults are all stacked on one another, the graphics at the source get kind of messy after about four connections, but they'll all work properly.

Now that we know how to work with these virtual cables, let's learn about where we can hook them up.

5.5.2. The signal chain and its modulation inputs
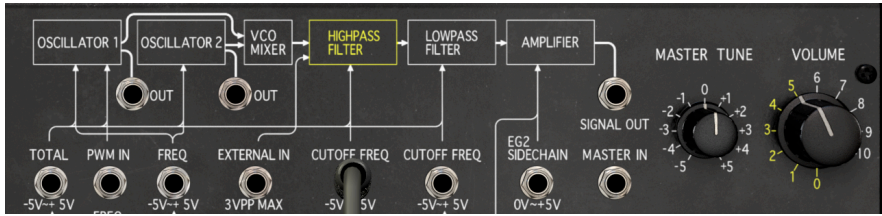
Starting at the top, we see a graphical representation of the audio *signal path* of a KORG MS-2O V voice, from VCO to output. Along the way, there are various patch points where external control voltages can be inserted to take over control of the various modules.

Note that the various patch points often have voltage ranges under them. These correspond to the original markings on the MS-2O. Our virtual synth doesn't deal in literal voltage; these markings now indicate whether the patch point is looking for a signal that is *unipolar* (all voltage values above O) or *bipolar* (voltages can be positive or negative).

In order, the CV patch points are:

- **TOTAL** affects both VCOs and both VCFs, all at once. The knobs that are labelled **MG/T.EXT** can then be used to control the amount of modulation applied to each of these destinations: VCO1+2 Pitch, HPF cutoff, and LPF cutoff.

- **PWM IN** controls the Pulse Width of OSC1. The **MG/EXT** knob (in the PW Modulation section) can then affect the amount of modulation applied.

- **FREQ**: controls the frequency of both VCOs.

- **EXTERNAL IN** is an external audio signal input (generally made available within your DAW) that can be mixed with the VCOs before entering the Filters. This jack can also be used to create audio feedbacks within the synth (e.g. Signal Out –> External In)

- Highpass and Lowpass Filter **CUTOFF FREQ** have separate modulation CV patch points.

- **EG2 SIDECHAIN** allows the levels of EG2 to be modulated by another CV. (That's what a *sidechain* is.)

There are also three places where audio signals can be tapped from the signal chain itself for use elsewhere: the outputs of both VCOs (features added by Arturia) and the final **SIGNAL OUT**. There is also a **MASTER IN**, a patch point not available on the original MS-2O (neither was **SIGNAL OUT**).

Finally, this section of the Patch Panel has the **Master Tune** and **Volume** controls for the entire synthesizer.

5.5.3. MG and EG routings
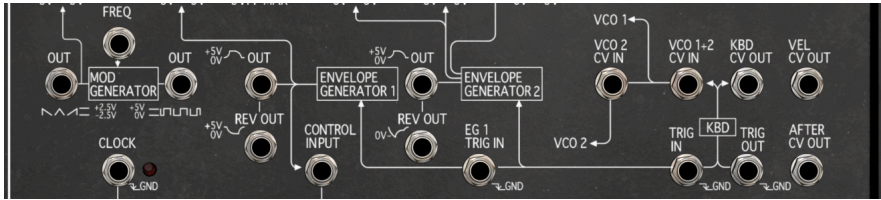
In addition to their internally wired connections, the MG and both EGs can be used in many ways, based on the patch points available here.

- The KORG MS-20's original MG – and KORG MS-20 V's MG – have two outputs available on the Patch Panel, both of which have waveforms that can be smoothly changed in symmetry using the **Waveform** knob. One output can morph from a (downward) sawtooth to a triangle to a ramp (upward sawtooth), and the other is a pulse wave whose width can be changed from nearly 0% to nearly 100%, with 50% (a square wave) in the middle.
  Note that the triangle output is bipolar, but the pulse output is unipolar – a useful distinction for many kinds of sound design. We also added a **Freq** CV input to control the MG Frequency.

- EG1 is by default routed directly to the VCO **Freq** CV input, to the **CONTROL INPUT** of the Patch Panel's VCA, and to two patchable outputs – a standard **OUT** and an inverted **REV OUT**.
  Note that both of these envelope outputs are unipolar positive: the **REV OUT** signal sits at a positive voltage and drops to 0V when triggered.

- EG2 is by default wired to both **Cutoff Frequency** in addition to its hard-wired control of the VCA. It also has an **OUT** (another Arturia novelty) and **REV OUT**, but in this case, the inverted output is unipolar *negative*.

5.5.4. Keyboard and Modulation CV patch points
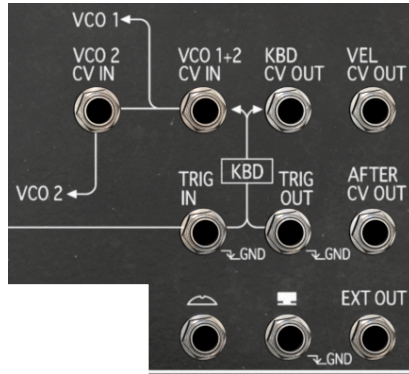
This set of patch points expands considerably on the original MS-20's capabilities, adding CVs derived from MIDI messages to the internal 'analog' sources.

The **KBD** section has a **KBD CV OUT** for pitch and a **TRIG OUT** for trigger signals at the press of each key. The hard-wired routings to the VCOs and EGs have input taps along the way for **VCO 1+2 CV IN** and **VCO2 CV IN**, as well as an external **TRIG IN** and a dedicated **EG1 TRIG IN**.

In addition, there are MIDI-based control outputs: **VEL CV OUT** for velocity data and **AFTER CV OUT** for aftertouch.

At the bottom are CV outputs for the **Wheel** and **Momentary Switch**, as well as an **EXT OUT**. Note that the Wheel CV, when not patched elsewhere, provides vibrato (+/- 1 semitone).

MIDI Modulation Wheel (CC 1) messages for the purpose of VCO vibrato.

5.5.5. Sample & Hold, VCA, and Noise Generator

KORG MS-20 V has three modules on the Patch Panel that aren't hard-wired. They can be patched into Presets wherever they'll be useful.

- **Sample & Hold** is a circuit that takes in a smoothly varying voltage at the **IN** patch point and *samples* it (remembers the voltage value) whenever it gets a pulse at the **CLOCK** input. That voltage is sent to the **OUT**, and stays at that level until the next clock pulse causes the input to be sampled again. Most commonly, Sample & Hold is fed by a noise source, so that it outputs a random voltage that changes every time it gets a clock pulse. Computer bleeps, anyone?

  The original circuit in the MS20, presented as Sample & Hold, is in reality a *Track and Hold* circuit. It takes a varying voltage at the **IN** patch point. This voltage is tracked if the voltage at the **CLOCK** input is above a certain value, and held as soon as the **CLOCK** voltage drops below this value. The tracked or held signal is sent to the **OUT** patch point.

  An example could be patching the **REV OUT** of the **ENVELOPE GENERATOR 1** to **CLOCK** and **MOD GENERATOR OUT** to the **SAMPLE & HOLD IN**. When the envelope is triggered, the voltage at **CLOCK** starts high, so the envelope will be tracked, i.e. the **SAMPLE & HOLD OUT** will be the varying **MOD GENERATOR OUT** voltage. At some point, depending on the **ATTACK TIME** of **ENVELOPE GENERATOR 1**, the **CLOCK** will be low, and the **IN** voltage at that moment will be held.

- The **VCA** module is not just useful as a volume control – it can also change the level of a control voltage in an automated way. In either case, the signal at the **IN** is modulated by the **CONTROL INPUT** before being sent to the **OUT**.

- The **Noise Generator** provides either **Pink** or **White** noise as either an audio source or a control voltage. White noise has an equal representation of all frequencies at once, while Pink noise is weighted toward the low end to line up with human hearing perception.

5.6. External Signal Processor

The **External Signal Processor** (**ESP**) is a processing chain for external audio signals. Fumio Mieda, lead designer of the original MS-20, thought it might be fun for guitarists or other musicians to run signals through the MS-20 architecture, as well as actually play the MS-20 from their instrument.

To do this, the signal from the instrument is input to the ESP (**SIGNAL IN**), run through an Amplifier to get a good volume for future processing (**Signal Level**), then routed through a Bandpass Filter to remove extreme low (**Low Cut Freq**) and high (**High Cut Freq**) frequencies that could adversely affect the later elements in the chain. Note that the audio signal can be tapped after the Amplifier or Bandpass Filter with the appropriate **OUT** patch points.

The next module is the **Frequency-to-Voltage (F-V) Converter**. This analyzes the frequency of the incoming signal and creates a control voltage from it that tracks the pitch of the instrument. The output is provided at the **F-V CV OUT** patch point. The actual voltage that's output from there is fine-tuned with the **CV Adjust** knob. That provides the pitch information the synthesizer needs.

To control the synth pitch, you can plug **F-V CV OUT** to **VCO 1+2 CV IN**.

To start and stop notes (and provide a semblance of dynamics and envelope shape), the original signal from the Amplifier is split and routed to an **Envelope Follower**, which creates a voltage based on the loudness it sees at its input (**ENV OUT**). In addition, when the signal input reaches a level determined by the **Threshold Level** knob, it sends a **TRIG OUT** to start the note playing.

In practice, the ESP requires a great deal of careful playing and pitch stability, but it can produce some truly fun results – and you don't even need an external instrument to use it! It's perfectly happy listening to signals from elsewhere in the synth and processing them. Experiment!

5.7. Dispersion Controls

Just when we think we're done with the Hardware Panel, we realize that there's something hidden in the corner! When we hover over the KORG logo, we see a hint of a small circuit board with six trimpots that's revealed when we click on it.

This is a feature that's designed to take the KORG MS-20 V model's authentic analog character in a cool new direction: **Voice Dispersion**.

Like all analog synthesizers, the MS-20 was never perfectly stable except under strictly controlled conditions. Its tuning and circuit characteristics would change with warmup time, temperature changes in the room, and other factors. Normally, these effects were only noticeable when they had a direct impact on performance, for example relative tuning of VCO 1 and VCO 2.

Because the MS-20 was monophonic, there was nothing for its one voice to be compared against in terms of tuning and stability – but what happens when you model a monophonic synth and then give it the option for polyphony? If you're Arturia, you give the user control over what a polyphonic version of the synth might have sounded like if its circuits had a tendency to drift – in other words, Voice Dispersion.

The hidden Dispersion Control panel has a set of six trimpots, to represent the Dispersion for six types of circuits: VCO pitch stability, Pulse Width uniformity, envelope parameters, filter cutoff from voice to voice, filter resonance alignment, and overall stability of modulation routings. Each of these trimpots goes from a perfect 0.00 to a totally out-of-whack 1.00, so you can make your own particular KORG MS-20 sound as filthy as you want – but have the calibration snap back to perfection just by switching to a new Preset.

How cool is that?

6. THE SEQUENCER PANEL

As if its wide range of features and patchable options weren't enough, KORG MS-20 V also features a built-in sequencer with a variety of useful options. Clicking on the **Sequencer** button in the Upper Toolbar puts the Sequencer Panel onscreen, pushing the Hardware Panel down to make room for it. You can scroll down to the Hardware Panel and tweak your Preset while the sequencer runs.

6.1. Overview

Let's take a closer look at the Sequencer Panel:
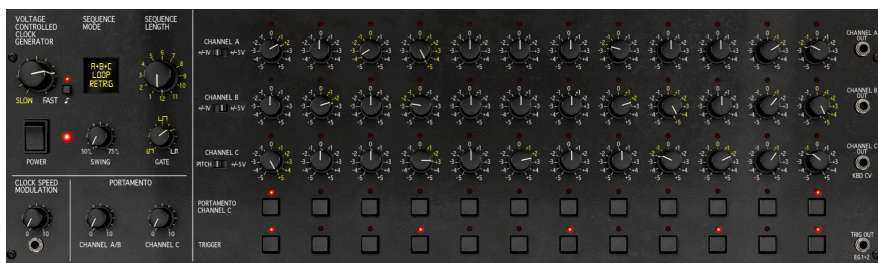
This is an analog-style 12-step sequencer with three Channels: A, B, and C. Each Channel has its own set of adjustable parameters, both globally and per Step. In addition, the left side of the Sequencer Panel offers a set of global controls that affect all three Channels at once; we'll look at those first.

6.1.1. Global Controls

The following global controls cover the Sequencer Panel's overall settings:

- **Voltage Controlled Clock Generator**: Sets the speed of the sequence. The button with the musical note opens a pop-up to determine whether and how the sequence will sync to your DAW's tempo.
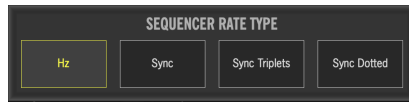
The choices are: **Hz** (no tempo sync) or **Sync** / **Sync Triplets** / **Sync Dotted** for various note lengths. The control's range is 0.100 Hz to 100 Hz in Hz mode, and 8 bars to 1.32 note in any of the Sync rate types.

Under this control and the **Power** button (which turns off the sequencer, just as the Upper Toolbar Sequencer power button does), an associated control for **Clock Speed Modulation** allows for external CV control of the sequencer speed.

- **Sequence Mode**: Sets the way in which the sequencer will play through its steps. Clicking on the display pops up this menu:
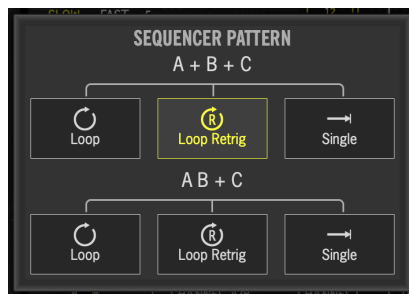
There are six available Pattern types. The first three are labeled **A + B + C**, which means that the three Channels run in parallel, each one sending its own CV per Step. The last three are labeled **AB + C**, which means that Channels A and B are now chained together to make a sequence with twice as many steps, while Channel C continues to run on its own.

Each Pattern can run in **Loop** mode, which means that the sequence cycles uninterrupted, regardless of when keys are pressed; **Loop Retrig** mode, where the sequence resets to the first step every time a key is pressed; and **Single**, which means that a keypress causes the sequence to play once and then stop.

- **Sequence Length**: sets the number of Steps in the sequence from 1 to 12. Double-clicking the knob sets it to 8 steps.

- **Swing**: sets the amount of swing in the sequence timing, from 50% (no swing) to 75% (heavy swing). Double-clicking the knob sets it to 50%.

> ℹ️ If you're not used to using Swing in a sequence, start out with a value of about 67%. This is a common Swing value and will sound familiar and catchy.

- **Gate**: sets the Gate length for each step. Think of the Gate length as a sort of 'pulse width' – if each step is a cycle of a pulse wave, then the Gate length sets how much of that step length will have the note turned on. A short Gate length will make each note very short and clipped, while a long Gate length means that each note will last almost as long as the Step is. Gate length is expressed in percentage of the Step length. The knob has a range of 5.00% to 95.0%, and double-clicking it will set it to 50%.

- **Portamento** can be set separately for **Channel A/B** and **Channel C**. Thanks to the strong influence of sequencers like that in the famous Roland TB-303, musicians have come to enjoy the ability to slide between the pitches of steps rather than simply jumping from one to the next. This helps sequences feel more expressive and less robotic, and is a common feature in many genres of electronic dance music. The Portamento time can be set from 0.010 seconds to 2.82 seconds. Portamento is only added to those steps where the Portamento switch has been pressed.

6.1.2. Channel Controls

The sequencer is designed to work like a conventional analog sequencer from the days of modular synthesizers. Each Step has a **CV Mapping** knob to set the CV being output, in terms of an offset from the base voltage (usually determined by the key being pressed).

While the CV Mapping knobs are labeled from -5 to +5, with 0 being the default value that's set when you double-click a knob, the actual value being output depends on the **Channel Range** switches for each channel, allowing for finer or coarser CV control as needed.

For Channels A and B, the two ranges are +/-1V and +/-5V. Channel C offers a choice of +/-5V or **Pitch**, a melody-friendly setting with a range of +/- 12 semitones (one octave) quantized to precise semitone steps.

A set of **Portamento Channel C** buttons control whether Portamento is turned on or off for each Step of Channel C.

A set of **Trigger** buttons control whether each step sends its voltage or not, allowing for sparse and syncopated patterns.

6.1.3. CV Outputs

On the far right, there are CV outputs for each Channel, allowing the various voltage offsets to be patched to any appropriate parameter.

The **KBD CV** label on the **CHANNEL C OUT** indicates that when nothing is plugged into the patch point, the hard-wired behavior is for Channel C to control the pitch of the sequence, with each Step offset above or below the key being pressed. This lets you transpose a sequence based on what notes you play.

There's also an output labeled **TRIG OUT EG1+2**. This routes active Trigger signals where desired. When nothing is plugged in, the Trigger signals are routed to the Envelope Generators to play notes.

The Sequencer Panel might seem simple, but that simplicity lets you get into using it quickly, and you'll soon discover for yourself all the interesting ways a sequential CV can be used to add motion and complexity to each Preset.

7. THE EFFECTS PANEL

Pressing the **Effects** button on the Upper Toolbar causes the **Effects Panel** to appear above the Hardware Panel. As with the Sequencer Panel, you can scroll down to tweak your sound while the Effects Panel is displayed, although the onscreen keyboard/wheel/button are unavailable.

The Effects Panel

The Effects Panel lets you add up to four different effects (**FX**) to a preset. These can be chosen from a set of 16 different effect types, and routed in various ways suitable to the patch.

There are a couple of worthwhile general functions that apply to the tab and its individual effects. We'll cover those before getting to meet the effects themselves.

7.1. Effects Routing

Guitarists are used to having their effects pedals in long chains, and audio engineers are used to having effects on Auxiliary buses so each input channel can be routed to them in different amounts. Both approaches have their advantages, and the Effects tab allows you to choose between them for each preset.

Effects Routing

The two available routings are **Series** and **Parallel**, chosen by clicking the buttons above the graphic.

- **Series** is similar to how a guitar pedal chain works: The input signal is sent to FX 1, then FX 2, then FX 3, then to the output. This is important because in Series routing, FX 2 processes both the wet and dry sound from FX 1, and then FX 3 processes the combined wet and dry sounds from FX 1 and FX 2. Any guitarist can tell you that effects ordering is critical – for example, distortion through reverb doesn't sound much like reverb through distortion! This provides an extra layer of creativity for shaping your sound if you wish.

- **Parallel** is similar to how a mixing console works: the input signal is routed to two separate audio buses, one with FX 1 and 3, the other with FX 2 and 4. Each of these buses has its own level control as they are mixed back together and sent to the output. Since each of the FX has its own **DRY/WET** setting, so the relative amounts of processed (*wet*) to unprocessed (*dry*) sound can be adjusted to taste for each effect. In Parallel routing, effect order is still important but a bit easier to work with; the order of FX 1/3 is important, and so is the order of FX 2/4, but the two pairs don't affect one another.

> ℹ️ Certain effects are usually used in Series mode, as you'll want them entirely processed by what comes before them. A good example is distortion, which not only goes before most other effects but is also run 100% wet. Others, like reverb, are usually placed in Parallel mode so that each instrument can be affected by them without influence from the others. There are no set rules – feel free to experiment!

7.2. Presets

Every one of the FX has its own menu of **Presets** that drops down when clicked:

As is common elsewhere in KORG MS-20 V, the option to **Save** an edited preset under the same name, or **Save As** a new name.

7.3. FX Sync

As with other time-related operations in KORG MS-20 V, some of the effects offer a variety of sync options. When these are available, you can click the down arrow next to the parameter, which shows the current choice, and change it from this little pop-up:

The options are:

- **Hertz**: no sync – time is set in Hertz (Hz), cycles per second

- **Sync**: sync to values of notes or bars

- **Sync Triplets**: sync to triplet values of notes or bars

- **Sync Dotted**: sync to dotted values of notes or bars

> ℹ️ Note that these parameter ranges will be different for every FX type – never be afraid to experiment!

7.4. Meet The FX Types

Each of the four FX can be bypassed with the power button at the top left corner of its window. Next to that is the name of the FX type. Click on that to get a pop-up menu of all the available effects.

Take note of the **Copy FX** icon in the top right corner of the pop-up. If you have one of your FX set up just as you like it but you want to put it elsewhere in the signal routing, click the **Copy FX** icon to get a little drop-down menu of the three other FX in the chain. Click the FX slot where you want to copy your current effect and settings.

If you're sure you don't need anything in a particular slot, you can select **None** in the top left corner. Still, even though "none" might sometimes be the right choice for a certain preset, it's not very much fun. So let's learn about your 16 other options: the FX Types.

7.4.1. Delay

DELAY is a generic term for any effect that makes a copy of an input sound and repeats it a short time later. There are several delay FX in KORG MS-20 V, and this first one is a good-sounding digital delay for all kinds of applications.

- **TIME** is the time between echoes. It can be set without sync or with different types of sync, as explained in FX Sync [p.83]. (2 ms to 2 seconds, or 1/32 bar to 8 bars)

- **FINE** is a fine-tuning of the basic Time. Sometimes, having a time just slightly off other synchronized effects can give a sense of richness to the overall sound. (-50 to +50 ms)

- **FEEDBACK** is how much of the delayed sound gets fed back to the input. This produces repeating echoes that fade away, rather than a single delayed copy of the input sound (called *slapback*, useful for some cases). High feedback settings lead to longer trails of echo. (0.00 to 1.00)

- **STEREO SPREAD** controls how much the echoes spread out in the stereo soundstage, from full mono to massive panning. (0.00 to 1.00)

- **HP FREQ** and **LP FREQ** control two filters that shape the tone of the delayed sound. Darker echoes die away with less 'clutter' in the audio, and brighter echoes carry a lingering sense of presence. (HP Freq 20 Hz to 10000 Hz, LP Freq 250 Hz to 20000 Hz)

- **PING PONG** is an effect where echoes alternate between the left and right sides of the stereo field. This effect is easy to overuse, and can cause listener fatigue, but when combined with very subtle echoes it can produce a beautiful sense of extra space.

7.4.2. Tape Echo

Tape Echo is a type of delay characteristic of early tape-based delay machines such as the Maestro Echoplex and Roland Space Echo. Input sounds are recorded to a loop of tape with one or more playback heads to create the echoes. Because tape loops can be unstable and shift in pitch and timbre, they produce an effect that is warmer and less 'precise' than a conventional digital delay.

- **TIME** is the time between echoes, which has a narrower range than the Delay FX because of the limitations of tape. It can be set without sync or with different types of sync, as explained in FX Sync [p.83]. (10 ms to 1 second, or 1/32 bar to 8 bars)

- **FINE** is a fine-tuning of the basic Time. Sometimes, having a time just slightly off other synchronized effects can give a sense of richness to the overall sound. (-50 to +50 ms)

- **INPUT VOL** is an adjustment of the input gain, not only to make the sound louder or softer, but to gently saturate the tape and produce a warm character at higher settings. (-12 dB to +12 dB)

- **INTENSITY** is another word for feedback – the intensity and persistence of the echoes. The parameter ranges from 0.00 (slapback) to 1.20. Settings above 1.00 can cause the echoes to be louder than the input. This phenomenon is called *runaway* and leads to an ever-increasing audio level that will eventually overload, then distort, then clip... and will keep getting louder until it eventually destroys your headphones, your speakers, and your ears. Please use it responsibly and be ready to turn it down.

- **STEREO SPREAD** provides a sense of spaciousness by having one side of the stereo image have a slightly different delay time than the other. (0.00 to 0.20)

- **PING PONG** is an effect where echoes alternate between the left and right sides of the stereo field.

7.4.3. Pitch Shift Delay

Pitch Shift Delay is a classic effect dating back to the early years of digital audio processing, popularized by the Eventide Harmonizer. It works like a conventional delay, but in addition to being fed back to create echoes, the delayed audio signals are subjected to a pitch shift, either up or down.

- **TIME** is the time between echoes. It can be set without sync or with different types of sync, as explained in FX Sync [p.83]. (16 ms to 2 seconds, or 1/32 bar to 8 bars)

- **STEREO OFFSET** is a positive or negative time difference between the left and right Time settings. This produces a realistic widening of the sound due to a psychoacoustic phenomenon called the *Haas Effect*. (-50 to +50 ms)

- **FEEDBACK** is how much of the delayed sound gets fed back to the input. Settings range from 0.00 (slapback) to 1.00 (infinite repeats without runaway).

- **STEREO DETUNE** controls how different the left and right channels' pitches are. (-100 to +100 cents, where 100 cents equals one semitone)

- **PITCH SHIFT** is the base amount that echoes are shifted by. As they repeat, they will be shifted repeatedly, producing an endless spiral upward or downward in pitch. Very subtle amounts can produce a feeling of anticipation (up) or relaxation (down); larger amounts can produce strange, inharmonic results or smoother and more musical 'boom' or 'shimmer' (try setting it to octaves). Pitch shift can be set to 24 semitones (2 octaves) up or down.

- **SPRAY** sets up a 'scattering' effect across the soundstage for each successive echo, with slightly randomized echo times. It's especially noticeable at higher amounts of pitch shift. (0.00 to 500 ms)

- **HP FREQ** and **LP FREQ** control two filters that shape the tone of the delayed sound. Darker echoes die away with less 'clutter' in the audio, and brighter echoes carry a lingering sense of presence. (HP Freq 20 Hz to 10000 Hz, LP Freq 250 Hz to 20000 Hz)

7.4.4. Reverb

Reverb (or *reverberation*) is the sound of a space – a recording studio, a concert hall, a stairwell, a tiled bathroom, the inside of an empty oil tanker, you name it. Reverb is often considered the most essential effect for the KORG MS-20, and so there's an easy-to-use one as our first choice for KORG MS-20 V.

- **SIZE** is the overall size of the space, a general sense of how open it is. (0.100 to 1.50)

- **PREDELAY** is how long it takes for the first reflected sound to come back to our ears. Longer predelays imply a larger space. (0.00 to 0.20 seconds)

- **DECAY** is how long the reverb takes to decay to silence. It interacts with Size to define the shape of the ambience. (0.00 to 0.925)

- **DAMPING** is how quickly high-frequency sounds roll off before low-frequency sounds in the space. More damping implies a space full of objects or materials that absorb highs first: carpets, ornate wood, even people. Less damping implies a more 'ringy' space with concrete or tile walls. (0.00 to 1.00)

- **STEREO WIDTH** is just what it sounds like: how wide the reverberant image is. It may seem strange to want anything less than full stereo, but remember that old spring and plate reverbs were all mono, as were the earliest 'echo chambers' in studios. Sometimes less width means more depth. (0.00 to 0.500)

- **INPUT HP** rolls off the low frequencies of the input before it hits the reverb. This takes out low-end mud and makes the reverb brighter-sounding. Like any high-pass filter, this one has a cutoff frequency setting: 30 Hz to 10000 Hz.

- **INPUT LP** rolls off the high frequencies of the input before it hits the reverb. This softens the overall sound and removes overly tinny treble effects. Its cutoff frequency ranges from 100 Hz to 20000 Hz.

7.4.5. Distortion

Distortion offers the most options of any KORG MS-20 V FX type. It might seem strange to you that all this effort should be put into a 'fuzzbox', but electronic musicians have known for years that there are many different kinds of signal distortion, each with its unique sonic signature – and they can transform sounds in ways ranging from subtle warmth to an all-out audio thunderstorm! This effect can be supplemented by a multi-mode filter that can be applied either before or after the distortion.

Nearly all of the FX parameters are common to all 16 distortion types:

- **DRIVE** controls the amount of overdrive pushing the input signal through the processor. It has a very wide range, from slight saturation to massive boost. (0.00 to 48.0 dB)

- **TONE**: This control, found only in the **Overdrive** type, adjusts the frequency response of the overdrive from mellow to bright. (0.00 to 1.00)

- The **AUTO** button engages automatic gain compensation to prevent *unintended* overload peaks. (Yes, those happen, even when you're using distortion.)

- **OUT GAIN** sets the output gain of the distorted sound, either lower (to prevent clipping) or higher (to add power) than the input level. (-24.0 to 3.00 dB)

The filter controls are:

- **CUTOFF** sets the filter cutoff frequency. (20.0-20000 Hz)

- **RESONANCE** controls the filter's resonant peak. (0.500 to 15.0)

- The **FILTER TYPE** pop-up sets the filter to Low Pass, High Pass, or Band Pass.

- The **PRE/POST** pop-up controls whether the filtering takes place before or after the distortion.

- **DARK** tames the extreme high-end content that some of the distortion types can produce.

A pop-up menu lets you select from among 16 different types of distortion.

Some of these algorithms come from familiar types of analog distortion – examples include gradually increasing amounts of gain (**Overdrive**, **Exponential**, **Soft Clip**, **Distortion**, **Hard Clip**), **Tape** saturation, and **Germanium** transistor preamp tone.

Other distortions are more digital in character – in addition to **Wavefolder** and **Dual Fold**, which 'fold over' the peaks of waveforms to create more harmonics, there are unusual types such as **Asymmetrical**, **Wiggle**, **Stairs**, **Howl**, **Core**, **Push**, and **Climb**.

Want to know how all these funky shapes sound? Try them for yourself!

7.4.6. Bitcrusher

A bitcrusher does what it sounds like: it crushes bits! This FX simulates the 'dirty' audio of old digital converters, whose bit depth and sample rate were limited by the power of current processors. It gives you anything from a slight lo-fi haze to utter destruction of your precious sound.

- **BIT DEPTH**: Sets the resolution of the output from 16 bits (CD quality) down to 1.5 bits (barely recognizable as audio).

- **DOWNSAMPLE**: sets the ratio by which the instrument's internal sample rate is divided, from 1.00 x (highest quality) to 80.0 x (trashed). The more downsampling, the more *aliasing* affects the sound, with inharmonic frequencies 'folding down' below the highest frequency the bitcrusher can deliver.

7.4.7. Compressor

The **Compressor** is used to control the dynamic range of a sound: it reduces the difference between the softest and loudest levels a sound can have.

Audio that goes above a certain **Threshold** is automatically turned down a bit. The amount it's turned down is the **Ratio**. Ratio of what? If a sound would have gone 6 dB above the threshold but the compressor only lets it rise 2 dB, that's a 3:1 ratio. If a sound would have gone 20 dB above the threshold but it can only go up 1 dB, that's a 20:1 ratio.

While this does lower dynamic range, it also lowers the overall level of the signal. The compressor then adds *makeup gain* to bring the average level of the signal up to where it was before the processing. The loudest sounds stay about where they were, but the softest ones are all louder.

Sometimes it's practically or musically useful for compression to not start or end immediately when a signal passes the threshold. For instance, it might be nice to let the snappy attack of a drum come through before the compressor controls the rest of its sound, or to have the compressor not turn on and off rapidly as new notes are played. In these cases, the compressor will have controls for **Attack** and **Release** to delay the onset or finish of compression.

Sometimes it's useful to blend the dry sound with the compressed sound, making the compression an added effect rather than a 100% control of dynamics. You can do this with the **DRY/WET** slider.

- **ATTACK** controls the onset of the compression. (0.010 to 1000 ms)

- **RELEASE** controls how quickly the compression 'lets go' of the audio. (1.00 to 2000 ms)

- **THRESHOLD** controls the level at which compression begins. (-60 to +20 dB)

- **OUTPUT GAIN** controls how much gain will be added or removed from the output. (-36 to +36 dB)

- **RATIO** The ratio of uncompressed to compressed level changes. (1.00 to 100)

> At 1.00, no compression occurs. Most of the range of the **RATIO** knob happens between 1.00 and 20.0; this covers everything from very light and musical to more forceful compression. Above 20, compression becomes *limiting*, where the idea is to prevent a signal from never going above a certain amount. Hard limiting can have a strong effect on the sound, which might or might not be useful. The top of the range is 100 to 1, which is effectively *brickwall limiting*, where no signal is ever allowed to go above a certain level. This is often used for digital mastering to prevent clipping.

- **MAKEUP** is an automatic makeup gain control that you might find works very well for you.

7.4.8. Multiband
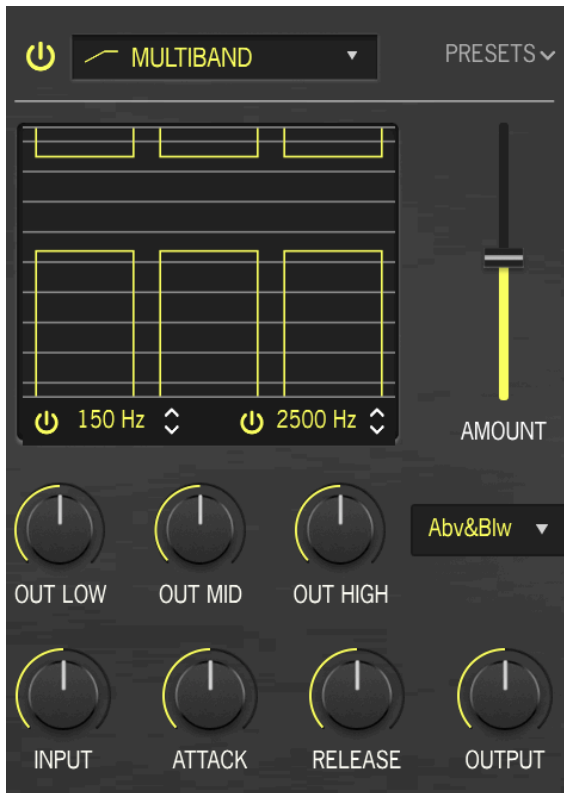
A multiband compressor works like a series of regular compressors, but each one works on a separate range of frequencies (*band*). First used in hardware to allow mastering engineers to squeeze the absolute maximum level out of recordings, these compressors are now used for subtle sculpting, sound design, special effects, and much more.

As you can see in the screenshot above, the display shows controls for three different frequency bands from left to right. The crossover frequencies for the boundaries between the low and mid bands (30-3000 Hz), and for the mid and high bands (300-15000 Hz), are shown below the display. If the low and/or high bands are turned off, the compressor will cover two bands, or the full range of frequencies.

Each band's compressor can work to compress signals above one threshold and/or expand signals below another threshold. The bar graphics control the threshold and ratio for each band/compressor/expander.

Set the threshold amount by clicking and dragging the top/bottom edges of a bar – a pop-up tooltip will show the current value. Set the ratio by clicking and dragging up and down inside a bar; the density of horizontal lines will increase until it becomes solid as the ratio goes up. For ratios under 1:1 (expansion), the lines will be further apart than the 1:1 reference lines shown outside the bars.

- **AMOUNT**: Rather than wet/dry mix, this FX type has an Amount control.

- **OUT LOW**, **OUT MID**, and **OUT HIGH** control the makeup gain for each of the three bands.

- **INPUT** and **OUTPUT** control the overall input and output gain.

- **ATTACK** and **RELEASE** adjust the onset and removal of compression (-1.0 to 1.0)

A drop-down menu lets you choose between combined compression and expansion (**ABOVE & BELOW**) and compression alone (**BELOW ONLY**).

7.4.9. Chorus

Chorus is an effect first developed in the mind-1970s by Roland for the Jazz Chorus amplifier and CE-1 pedal. In a chorus, the dry signal is mixed with one or more slightly delayed copies of itself (called *voices*), whose amount of delay is gently varied by an LFO to create a sense of thickness.

- **RATE** controls the speed of the LFO, which is the most important parameter when adjusting the sound of the chorus. Several famous chorus pedals have had nothing more than a Rate control! (0.1 to 5.0 Hz)

- **DEPTH** controls the relative spacing of the delayed voices, with longer delays leading to thicker, more detuned sounds. (0.00 to 10.0 ms)

- **DELAY** is the length of the basic delay, which is modulated by the LFO and spread out by the Depth knob. It changes the character of the sound, and is a relatively recent addition to chorus pedal designs. (0.600 to 20.0 ms)

- **FEEDBACK**, as the name implies, feeds back some of the delayed signal to be delayed again. This creates a noticeable metallic 'ringing' tone that makes the chorus sound more like a flanger. (0.00 to 0.900)

- **LFO Wave Shape** lets you choose between a sine wave and triangle wave for the LFO, which produces a distinctly different set of motion to the sound.

- **MONO/STEREO** chooses whether or not the delay voices are output on the far left and right sides of the stereo field.

- **VOICES** chooses whether the dry signal is followed by one, two, or three delayed copies. This is an important setting, because the overall power of the chorus effect needs to be adjusted to the preset and the song. Sometimes one voice is all you need for a tiny bit of thickening or vibrato, but three voices is overwhelming. (Of course, getting overwhelmed can be fun, too.)

7.4.10. Chorus JUN-6
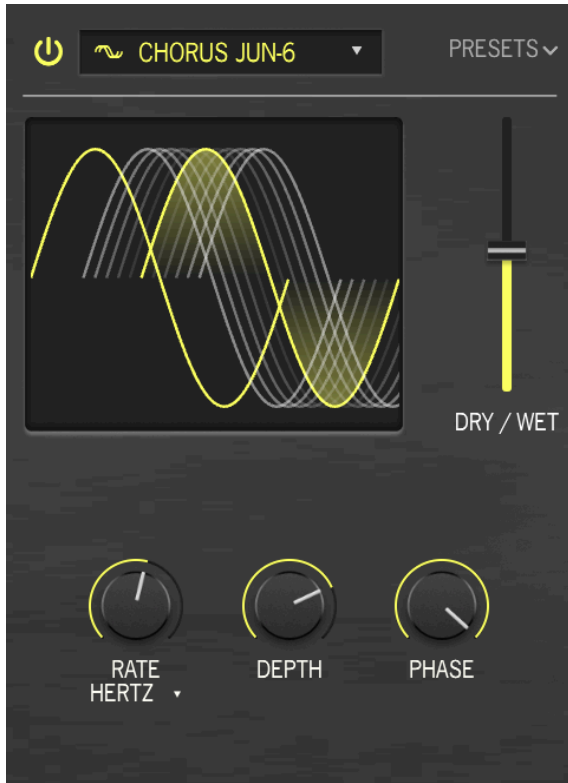
One of the most famous chorus effects is the one built into the Roland JUNO-6 synthesizer and its successors. Designed to thicken the sound of the single VCO, this 2-voice stereo chorus' controls were kept extremely simple: just three buttons for three presets, I, II, and I+II. This version provides bit more control while saving the rich timbre of the original.

- **RATE** is the speed of the LFO that varies the delay time. It can be set without sync or with different types of sync, as explained in FX Sync [p.83]. (0.05 to 15 Hz, or 1/32 bar to 4 bars)

- **DEPTH** is the amount of variance in the set delay time. (0.00 to 10.0 ms)

- **PHASE** allows the phase of one voice to be offset from the other by up to 180°. The two voices are sent to the left and right sides of the stereo field for a wider effect.

> Note that if a stereo patch where Phase is turned all the way up is mixed to mono, the two sides will cancel each other out and the chorus will disappear – a common and annoying discovery for guitarists whose stereo chorus pedals always worked this way!

7.4.11. Stereo Pan

Stereo Pan lets you automatically control and move the stereo position of each voice, to provide motion and breadth.

- **AMOUNT**: Rather than wet/dry mix, this FX type has an Amount control to control the width of the panning effect. (0.00% to 100%)

- **RATE** controls the movement of sounds in the stereo field. It can be set without sync or with different types of sync, as explained in FX Sync [p.83]. (0.100 to 20.0 Hz, or 1/32 bar to 8 bars)

- **MONO BASS** and **CUTOFF**: Sometimes, autopanning very low sounds can cause a mix to feel seasick and unbalanced. Clicking Mono Bass keeps low frequencies centered, and Cutoff controls the highest frequency that's mono. (50.0 to 200 Hz)

- **Pan Mode (LINEAR/NATURAL)** lets you choose between two types of pan motion, either of which might sound better with any particular preset. Use your ears!

- **INVERT** inverts the LFO output. The sound is the same, but if another Stereo Pan is set up in Parallel routing, inverting one LFO and synchronizing the two panners produces centered effects that widen and shrink the stereo field, as one panner moves the sound left while the other moves the sound right.

7.4.12. Phaser

The **Phaser** or *phase shifter* is not a time-delay effect, although it can sound like one. The dry signal is mixed with copies of itself that have been sent through a set of *all-pass filters*. Why would anyone need a filter that doesn't filter anything? Because another property of filtering is that regardless of what frequencies you do or don't remove, filters introduce a *phase shift* with respect to the original input. Each pair of these filters (called *poles* or *stages*) will create a notch in the frequency spectrum, whose relative movement to other notches can be varied with an LFO. The resulting effect has many fewer notches than flanging, and a much different sonic character.

- **RATE** is the speed of the LFO that varies the delay time. It can be set without sync or with different types of sync, as explained in FX Sync [p.83]. (0.10 to 10 Hz, or 1/32 bar to 4 bars)

- **FREQUENCY** varies the overall position of the cluster of notch filters. Best heard with Stereo turned down, Frequency causes the overall tonality of the phasing to go from fairly dark to quite bright. (30 to 15000 Hz)

- **FEEDBACK** controls how much of the phase-shifted audio is fed back into the input to be phased again, intensifying the effect and giving it a resonant character. (0.00 to 0.990)

- **LFO AMOUNT** sets the depth of the LFO's modulation control. Turn it down for a more subtle movement and up for more dramatic effects. (0.00 to 1.00)

- **N POLES** controls how many poles the circuit will have. Each two poles adds another notch to the frequency response, letting you design simpler or more dramatic sounds. (2 to 12, for 1 to 6 notches)

- **STEREO** spreads out the effect with a slight time delay between the left and right sides. It can go from very slight spread to a ping-pong effect. (0.00 to 180)

- **LFO Wave** is selected from the waveform button on the display. It opens a drop-down menu of six different waveforms, each of which will produce a significantly different phasing.

7.4.13. Flanger

The **Flanger** is the most intense of the time/modulation effects. It originally came from audio engineers gently pressing on the flange (rim) of a moving tape reel to slow down the playback a tiny bit. When combined with the original sound, this effect produced *comb filtering*, a set of regularly spaced notches in the frequency response that look like the teeth of a comb. Varying the pressure on the flange would cause the notches to move, producing the effect we hear as flanging. Later, analog delays controlled by an LFO were used to create the same sort of effect.

- **RATE** is the speed of the LFO that varies the delay time. It can be set without sync or with different types of sync, as explained in FX Sync [p.83]. (0.010 to 10 Hz, or 1/32 bar to 8 bars)

- **DELAY** is the length of the basic delay, which is modulated by the LFO and spread out by the Depth knob. Flanger delays are the shortest of any modulation pedal – longer delays become chorus, then echo. Originally called *Manual* on early flangers, this parameter sets the overall tonality of the flange from bright to dark. (0.001 to 10.0 ms)

- **DEPTH** is the amount of variance in the set delay time. (0.00 to 10.0 ms)

- **FEEDBACK** controls the amount of delayed sound fed back into the input to be delayed again. Unlike chorus, where feedback is an unusual added control that's best used sparingly, Feedback on a flanger is essential to creating its distinctive resonant timbre. (0.00 to 0/990)

- **HP FREQ** and **LP FREQ** control two filters that shape the tone of the delayed sound. This control, unusual on a flanger, allows the effect to focus on a particular tonal range or to ignore extreme lows and highs. (HP Freq 30 Hz to 800 Hz, LP Freq 1000 Hz to 20000 Hz)

- **MONO/STEREO** chooses whether or not the delay voices are output on the far left and right sides of the stereo field.

- **LFO Waveform and Feedback polarity**: These two buttons appear on the flanger display. One changes the LFO waveform from a sine to a triangle, producing a dramatically different flange; the other inverts the polarity of the feedback, producing two different tonal spectra.

7.4.14. BL-20 Flanger

The **BL-20 Flanger** is based on the sound of Arturia's Flanger BL-20 plug-in, which is in turn based on the sound of a rare but beautiful-sounding hardware flanger from the 1970s. It doesn't provide all of the BL-20's capabilities, but it still sounds amazing!

- **RATE** is the speed of the LFO that varies the delay time. It can be set without sync or with different types of sync, as explained in FX Sync [p.83]. (0.017 to 5.00 Hz, or 1/32 bar to 8 bars)

- **DEPTH** sets how much the internal LFO modulates the delay time. (0.00 to 1.00)

- **DELAY** is the length of the basic delay, which is modulated by the LFO and spread out by the Depth knob. (0.00 to 1.00)

- **FEEDBACK** controls the amount of delayed sound fed back into the input to be delayed again. Unlike chorus, where feedback is an unusual added control that's best used sparingly, Feedback on a flanger is essential to creating its distinctive resonant timbre. (0.00 to 0/990)

- **WIDE**: This button flips the LFO modulation in the right channel, making the flange sound wider and more three-dimensional... but beware of summing the two sides to mono, or the flanging will cancel itself out!

- **MONO INPUT**: This switch selects whether the circuit's input is mono or stereo.

7.4.15. Multi Filter

Sometimes it's nice to have an extra filter handy for tweaking your tone before it gets to the output. The **Multi Filter** FX gives you five to choose from!

- **Filter Type** is selected from the dropdown menu by clicking the arrow next to the type name. Types include: lowpass (**LP**), highpass (**HP**), bandpass (**BP**), feedback comb filter (**CombFB**), and feed forward comb filter (**CombFF**). The comb filters simulate the behavior of a flanger with two different tonal qualities – CombFB produces a series of evenly spaced peaks, and CombFF produces evenly-spaced notches.

> ℹ️ Evenly spaced? You can see on the display that they're not. Well, actually they are – by *frequency*, not by octave. The display is scaled in octaves, and each octave is *double* the frequency of the one below it. As a result, the display shows a series of peaks that gradually get closer together.

- **CUTOFF**: sets the cutoff frequency from 20.0 Hz to 20000 Hz (LP, HP, BP) or 2000 Hz (CombFB, CombFF)

- **RESONANCE**: sets the resonance of the filter. (0.500 to 15.0)

7.4.16. Parametric Equalizer
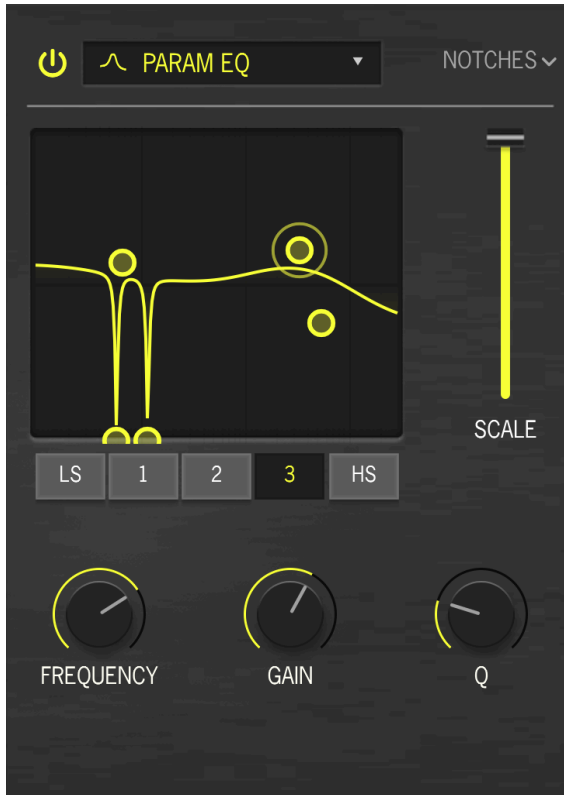
A **Parametric Equalizer** lets you sculpt tone very precisely, as opposed to the very broad tonal strokes you get from a graphic equalizer or the tone controls on a guitar or amp. It can be used to gently or surgically boost or cut certain frequencies to alter a track's overall sound or remove problem frequencies.

Each of the five bands has its own controls for the center frequency, amount of boost or cut, and bandwidth (Q). These can be dialed in on the knobs for the selected band. Frequency and gain for each band can also be set by clicking and dragging the mouse.

- **SCALE**: Rather than wet/dry mix, this FX type has a Scale control.

- **Band Select**: Selects the band being adjusted. The Parametric EQ has five bands: **LS** (a *low shelf*, where every frequency below the set one is raised or lowered by a certain amount), three *peaking* bands with full control over all parameters, and **HS** (a *high shelf* that works in the same way as the low shelf).

- **FREQUENCY** sets the center frequency of each band: 50.0-500 Hz for LS, 40.0-20000 Hz for the three peaking bands, and 1000-10000 Hz for HS.

- **GAIN** sets the amount of boost or cut. (-15.0 to 15.0 dB)

- **Q** sets the bandwidth of the peak or steepness of the shelf. (0.100 to 2.00 for LS and HS, 0.100 to 15.0 for the three peaking bands)

> **i** In the screenshot above, the Parametric EQ has been set to tightly notch out hum at 60 and 120 Hz, gently boost the lows and lower the highs, and provide a broad bump in the upper mids.

7.5. The end (for now)

And with that, we've concluded our tour of KORG MS-20 V, and now it's time to get programming!

Even though you've learned enough to find your way around KORG MS-20 V, you might want to learn a bit more about the basic synthesis principles behind it, especially if you're new to subtractive synthesis. If so, head over to the next chapter.

8. THE BASICS OF SUBTRACTIVE SYNTHESIS

There are many forms of synthesis available today. The most common form, *subtractive synthesis*, was pioneered on the first commercial synthesizers in the 1960s and has become a guideline for the designers of many synths that came afterward. If you learn the basics of subtractive synthesis, you'll find yourself able to find your way around the vast majority of synthesizers – even new ones based on digital processes like sampling, ROM playback, wavetable scanning, and vector synthesis.

While the original KORG MS-20 (and therefore, naturally, also the KORG MS-20 V model) has a few unique elements to its architecture, it still serves as an excellent platform for learning the basics of how synthesizers work.

8.1. The Signal Path and its elements: VCO, VCF, VCA

When we talk about the *signal path* of a synthesizer, we're referring to the path that sound takes from its moment of creation until it leaves the synthesizer to be heard. While there are endless variations, the basic signal path looks like this:

- First, we must create the basic waveform of the sound, with a certain harmonic structure. We do that with an *oscillator*.

- Next, we shape the tone of this waveform by altering its harmonic content over time. We do that with a *filter*.

- Finally, we shape the amplitude (loudness) of the waveform to create individual notes. We do that with an *amplifier*.

In analog synthesizers like the KORG MS-20, these three elements can have their properties changed in real time by electrical signals called *control voltages*. We therefore say that these elements are *voltage controlled*. Let's learn about them now, one by one.

### 8.1.1. The Voltage Controlled Oscillator (VCO)

The VCO is where we create the initial waveform that we then sculpt to form our synthesized sound.

The main properties of a VCO are:

- The **frequency**, which determines the *pitch* that we hear. You can set the frequency of the oscillator with two controllers:

- First, we set the *octave* of the oscillator. On various synthesizers, it may be named **Frequency**, **Coarse Frequency**, **Octave**, or (as on the MS-20) **Scale**. On the MS-20, as with many early synthesizers, octaves are marked in feet.

> Why would you mark octaves in feet? Because when developing synthesizers, many manufacturers indicated octaves the same way they were indicated on electric organs, which in turn got their settings from pipe organs: by the length of the pipes. Doubling the length would drop the pitch by one octave: 2', 4', 8', 16', etc.

- Second, the **Detune** setting (on the MS-20, **Pitch**) allows you to tune the oscillator more precisely, from tiny amounts to intervals like a fourth or fifth.

- The **waveform**, which determines the harmonic richness of the audio signal. On KORG MS-20 V, three waveforms are available:

- The **sawtooth** presents the richest audio signal of the 4 waveforms (it contains all of the harmonics at decreasing volume levels in higher frequencies). Its sound is ideal for brass sounds, percussive bass sounds, or rich accompaniments. In the case of KORG MS-20 V, a sawtooth wave is available on both VCOs and the MG.
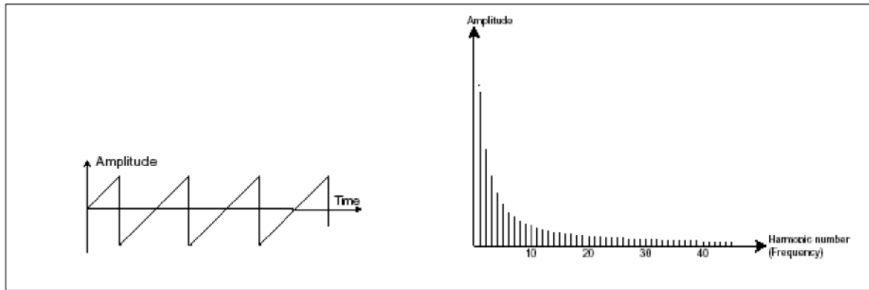

Shape and harmonic content of a sawtooth wave

- The **pulse** possesses a hollower sound than the sawtooth (it only contains odd harmonics). Nonetheless, its rich sound (notably at lower frequencies) can be used for bass sounds that will come out well in the mix (the pulse oscillator is often set an octave below that of the sawtooth), 'woody' sounds (like a clarinet, if the square signal is filtered), etc.
  A **square** wave is a special kind of pulse wave, where the voltage is 'high' half the time and 'low' half the time.
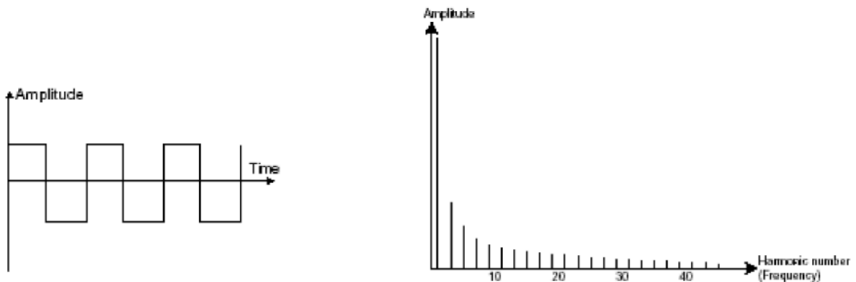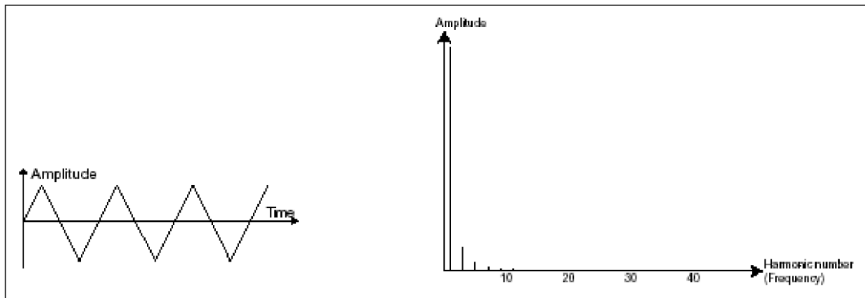

Shape and harmonic content of a square wave (a pulse wave with 50% pulse width)

- **Pulse Width** (**PW**), also called the *duty cycle*, refers to how much of its cycle a pulse wave spends 'up' vs. how much it spends 'down'. A square wave has a pulse width of 50%. Changing the pulse width causes a change in harmonic content to make the sound "thinner".
  Pulse Width Modulation (**PWM**) changes the pulse width over time, causing a sweeping change in harmonic content. The change can be controlled with an envelope to have it happen once per note, or an LFO to have it happen in a repeating cycle.
  On KORG MS-20 V, a pulse wave is available on both VCOs and the MG, but VCO1 has only two fixed pulse widths available, while the MG's pulse width is variable and VC)1's pulse width has PWM.
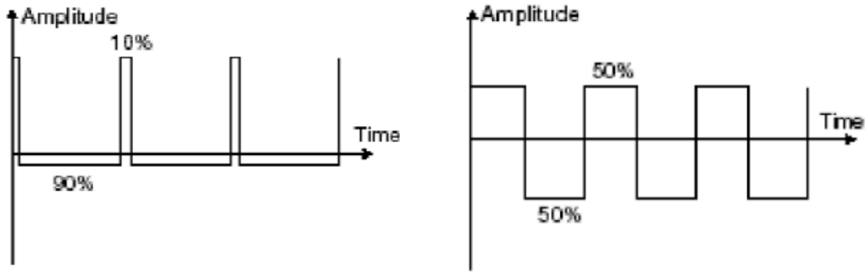
Pulse waves with different pulse widths

- The **triangle** is a wave with few (and only odd) harmonics. It's a very soft sound that's useful for creating sub basses, flute sounds, etc. In the case of KORG MS-20 V, VCO1 has a triangle wave option and the MG can be set to a triangle wave.
  Unlike many classic analog synthesizers, KORG MS-20 V allows you change the symmetry ('pulse width') of the triangle wave as well as the pulse wave on both the MG and VCO1. This adds many interesting timbral possibilities, as a completely asymmetric triangle wave becomes a sawtooth – and now you can have any shape in between the two.

Shape and harmonic content of a triangle wave

> The **sine** is the purest of all waveforms: it has only one harmonic, the *fundamental*, and nothing higher. This waveform wasn't available in the original MS-20, and isn't available in the KORG MS-20 V either, but we are mentioning it for completeness as it's often an option on an LFO.
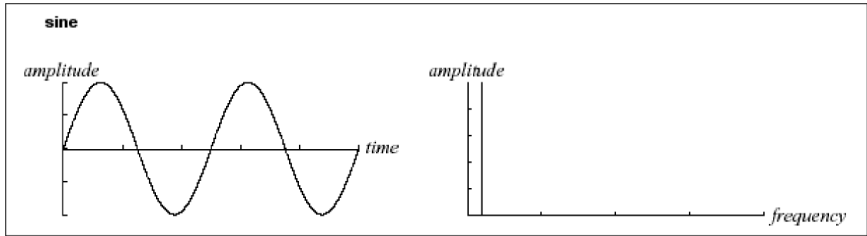
Shape and harmonic content of a sine wave

- If a VCO has a **Sync** control, activating it causes one VCO to *synchronize* with another. We do this because if VCO1 is synced to VCO2, then every time VCO2 starts a new wave cycle, VCO1 is forced to restart as well... and that forced restart makes VCO1 generate a waveform that's impossible to create any other way, with rich and complex harmonics. Changing the frequency of VCO2 causes the shape of VCO1 to change, which produces powerful sweeping timbres with a rough or sharp quality.
KORG MS-20 V has oscillator sync as an added option; the original MS-20 didn't have this feature.

> ℹ ! Note that this is not the same kind of sync as *tempo sync*, where things like Sub Oscillator Speed or Delay Time can be synced with the tempo of your song.

- A **ring modulator** can be created when an oscillator modulates another oscillator. On KORG MS-20 V, **Ring** is one of the available settings on VCO 2. The ring modulator combines the VCO sounds and outputs the *sum* and *difference* of their frequencies. If one VCO's frequency is set very slow, it produces tremolo; if the frequency is increased, it creates powerful and clangorous extra harmonics that are great for bells and other metallic sounds.
In the case of KORG MS-20 V, ring modulation can be selected as the 'waveform' of VCO2, and can be blended with VCO1 in the VCO Mixer.
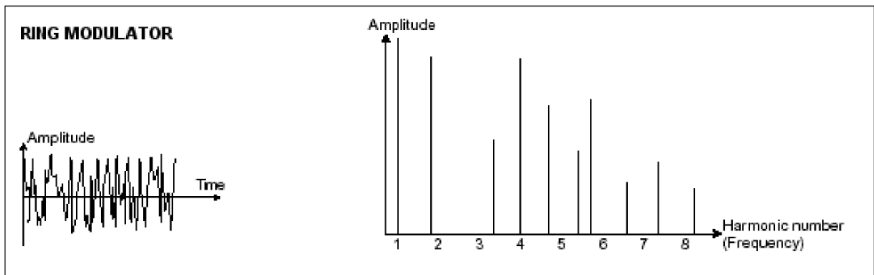
Ring modulation: frequencies of two input sine waves and the resulting output waves.

- There's one more sound source available on KORG MS-20 V: **Noise**. Noise is a combination of all frequencies at the same time. When the distribution of frequencies is equal, we call that *white noise*. Changing the frequency distribution changes the *color* of the noise. A common alternative to white noise is *pink noise*, which has more lower frequencies than higher ones and sounds more "natural" to the human ear. Noise can also be used as a control voltage signal to alter the behavior of other modules.

On modular synthesizers, a noise source is usually a separate module. On internally-wired synths, noise can be a choice of one VCO's waveform, a separately mixable part of one VCO's output, or a separate source that is mixed in later. On KORG MS-20 V, VCO1 has white noise as a selectable waveform, and on the Patch Panel there's a separate Noise Generator that can supply white or pink noise as needed.

8.1.2. The Voltage Controlled Filter (VCF)

The waveform from a VCO can change over time in some ways (e.g. sync or PWM), but the real power to shape its tonal content comes when its output is sent to a VCF. The filter lets us change the harmonic content of the waveform over time in predictable ways that shape its overall tonality. In analog synthesizers, the VCF is often considered the most important sonic element, as its character colors nearly every sound the synthesizer makes.

Depending on its settings, a filter removes (subtracts) certain ranges of frequencies from the sound. That's where the term *subtractive synthesis* comes from!

The main parameters of a VCF are:

- The **Cutoff Frequency**, sometimes called **Cutoff** or even just **Frequency**, is the frequency where the filter starts to remove audio. It's the primary control for all types of filters.

> ℹ️ ! Cutoff is considered by many to be the single most important control on the entire synthesizer – in fact, and on some synths its knob is deliberately made much larger than all other knobs so it's quick to get at. The MS-20's Cutoff Frequency knobs are in fact larger than most other controls, the same size as the (also quite important) VCO Waveform, VCO Scale, and Volume knobs.

- The **Filter Type** controls whether frequencies are removed above, below, or around the cutoff frequency.

On the KORG MS-20V, you have access to three filter types:

- The **Lowpass Filter** (**LPF**) removes frequencies above the cutoff frequency. Lowering the cutoff causes a sound to become "warmer" or "duller" as high frequencies are gradually removed. The LPF is by far the most common filter type, and many synthesizers only have an LPF.
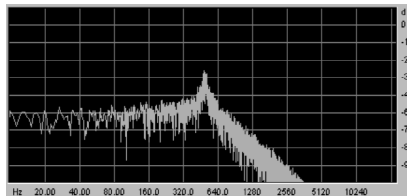
The low-pass filter

- The **Highpass Filter** (**HPF**) removes frequencies below the cutoff. Raising the cutoff makes a sound get 'brighter' or 'thinner'. This is useful for removing low frequencies from sounds that would otherwise be too bass-heavy. It's somewhat common for a synthesizer to have an HPF before the LPF, as the MS-20 does. (You won't find a synthesizer with only an HPF; they're not that useful for making conventional sounds on their own.)
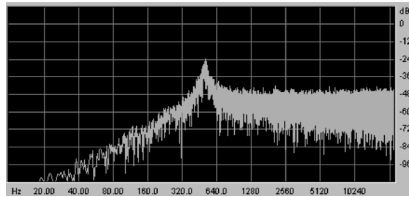
The high-pass filter

- The **Bandpass Filter** (**BPF**) technically isn't a filter of its own on the MS-20 or KORG MS-20 V. It's what you get when you put the two filters, HPF and LPF, in series and adjust their cutoffs so that only a certain band of frequencies around the cutoff (called the *center frequency* here) gets through.
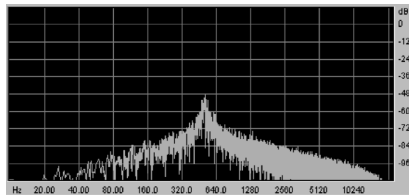
The band-pass filter

- The **Slope** determines how quickly sound is attenuated as you move away from the cutoff frequency. A shallow slope is gentler at removing frequencies than a steep slope. Slopes are measured in decibels of attenuation per octave past the cutoff frequency. The most common filter slopes are the relatively gentle 12 dB/octave and (as on the MS-20) the more aggressive 24 dB/octave.

- The **Resonance**, (sometimes called **Emphasis**, **Peak**, or even just **Q**) determines how the filter adds harmonic content right at the cutoff frequency.

Resonance is a natural property of filter circuits. As you turn it up, the cutoff frequency itself is strongly emphasized over the frequencies on either side of it, bringing out a precise tone over the sound of the VCOs. If you turn the resonance up high enough, the filter will begin to *self-oscillate*, creating a sine wave "whistle" right at the cutoff frequency, with the VCO sound nearly or completely gone. If you set up the filter cutoff to follow the keyboard's pitch, you can "play" the filter as a sound source.
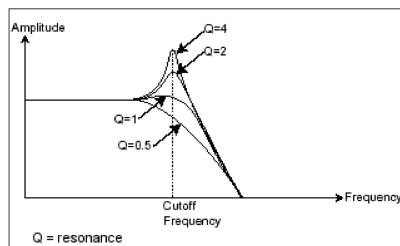
Resonance

8.1.3. The Voltage Controlled Amplifier (VCA) and the full signal path

The VCA receives the audio signal coming from the VCF (or directly from the oscillators, if they bypass the VCF) to adjust the signal volume.

Many synthesizers have only an overall VCA volume control, or no direct controls at all. They rely on the VCA envelope to start and stop notes and control their loudness over time. The KORG MS-20 VCA had no controls at all, just a picture on the front panel, but an **Amplifier Modulation** control has been added to MS-20 V.

When we put all the pieces together, our signal path looks like this:

The KORG MS-20 V signal path

8.2. Modulation: making the sound change

We now have a sound we can change in various ways – we can alter its pitch, its waveform and harmonics, its overall frequency spectrum, and its loudness. All we have to do is turn *all* the knobs at once in *just* the right way, to create *every* note we want to play, right?

Fortunately, there are elements built into the synthesizer that we can set up to do all of this for us automatically, by sending control voltages to each element in the signal path. We call these changes *modulation*, and there are a few simple modulators that do most of our work.

8.2.1. The envelope generator

The **envelope generator** is a control voltage that starts, changes, and then stops, according to settings for several *stages* that it passes through.

The most common envelope type is the ADSR:

- The **Attack** is the time that the sound will take to reach its maximum volume once we start the envelope

- The **Decay** is the time that the sound will take to drop from its maximum volume to the Sustain level

- The **Sustain** is the volume level that the sound will reach when a key is held down long enough to get through the Attack and Sustain

- The **Release** is the time that the sound will take to drop back to silence once we stop the envelope.
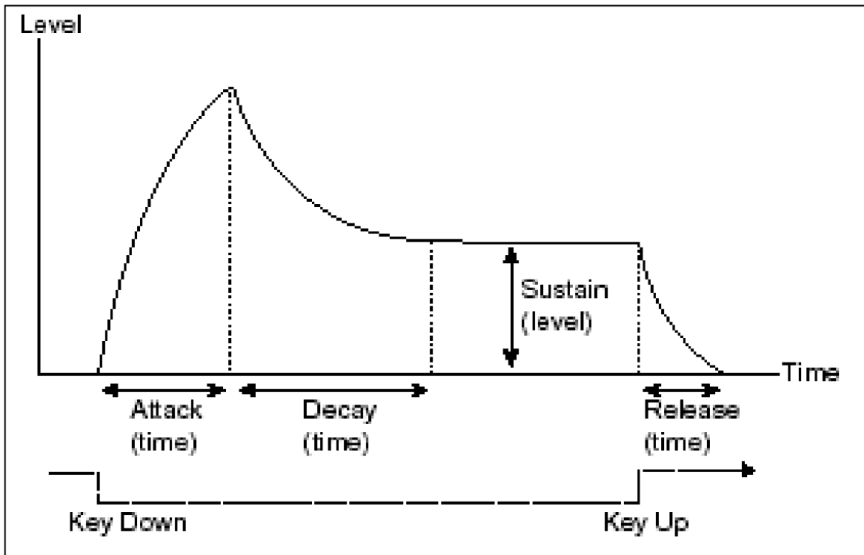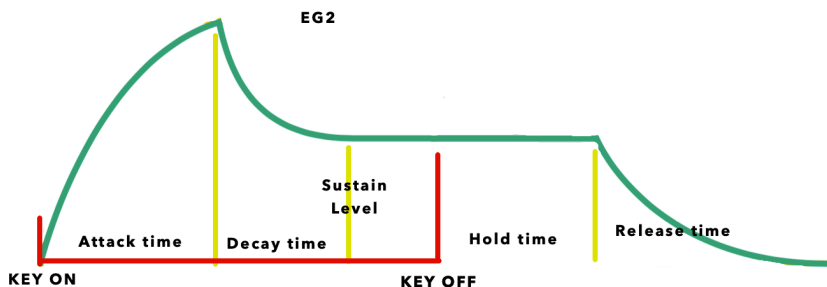

ADSR envelope

Interestingly, the MS-20 has two Envelope Generators (**EG**), and neither of them is a traditional ADSR!
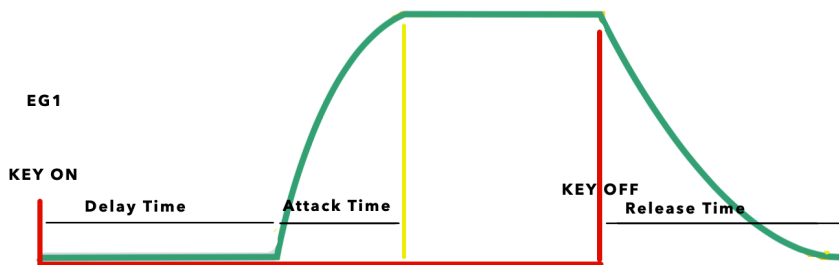
MS-2O EG1: Delay, Attack, Release

EG1 has three stages: **Delay**, **Attack**, and **Release**. The Delay time is just what it sounds like: a time delay between pressing a key and the start of the Attack.

MS-2O EG2: Attack, Decay, Sustain, Hold, Release

EG2 has five stages: **Hold**, **Attack**, **Decay**, **Sustain**, and **Release**. The Hold time is an added time that the envelope stays at the Sustain level between when the key is released and when the Release stage begins.

8.2.2. The keyboard

The usual way we start and stop a note is to play the keyboard. On an analog synthesizer, the keyboard sends at least two signals: a control voltage to set the frequency of the VCOs (so they play the right pitch), and a *gate* signal that opens when the key is pressed and closes when it's released. When we play a note, the attack and decay happen, followed by the sustain. When we let go of the key, then the release happens. These signals shape the volume of a note (starting and stopping it) and its tone over time (to simulate the behavior of acoustic instruments, etc). Naturally, on KORG MS-2O V, these signals come from a MIDI controller.

8.2.3. The Low Frequency Oscillator (LFO)

The LFO is just another VCO with most or all of the same parameters. The main difference is that its range of frequencies drops well below 20 Hz, the lower limit of human hearing. When a waveform's frequency is that low, you can't hear it anymore, but you can use it to control (modulate) the behavior of other parts of the synth in a cyclic and predictable way.

The KORG MS-20 has one LFO, which in KORG-speak is named the **Modulation Generator** (**MG**).

The simplest examples are when an LFO is applied directly to each of our signal path modules:

- If we apply the LFO to the VCO frequency, the pitch we hear goes up and down and we have *vibrato*.

- If we apply the LFO to the VCF cutoff, it goes up and down in an effect similar to a *wah-wah* pedal.

- If we apply the LFO to the VCA level, the volume goes up and down and we have *tremolo*.

The KORG MS-20's original MG – and KORG MS-20 V's MG – have two outputs available on the patch panel, both of which have waveforms that can be smoothly changed in symmetry using the **Waveform** knob. One output can morph from a ramp wave to a triangle to a sawtooth, and the other is a pulse wave whose width can be changed from nearly 0% to nearly 100%, with 50% (a square wave) in the middle. Interestingly, the triangle output is bipolar, but the pulse output is unipolar – a useful distinction in many cases.

8.3. Seeing the whole picture...

Here's a diagram of a complete synthesis voice on the Korg MS-20 V, courtesy of the front panel:

A complete KORG MS-20 synthesis voice, with the signal path and all modulators

- 2 VCOs with selectable triangle, sawtooth, square (with and without PWM), narrow pulse, noise, and/or ring modulation, with MG or EG1 controlling the pitch and/or PWM

- 1 VCO mixer (mixing of the 2 VCO and the noise module towards the lowpass and highpass filters)

- 2 VCFs, a HPF followed by an LPF, with the MG, EG2, or an external signal controlling the cutoff of both

- 1 VCA with (in the software version) modulation from the MG, as well as EG2 control over loudness

- 1 MG (LFO) with a continuously variable waveshape and two different waveform outputs

The Patch Panel adds a lot of extra modulation and audio signal routings, and three standalone modules:

- 1 Noise Generator capable of producing pink and white noise

- 1 Sample & Hold (a processor that's useful for creating stepped voltages from smoothly varying ones – commonly used for turning noise into a random voltage)

- 1 External Signal Processor

Put it all together and you have a synthesizer that's been inspiring sonic exploration for decades.

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