

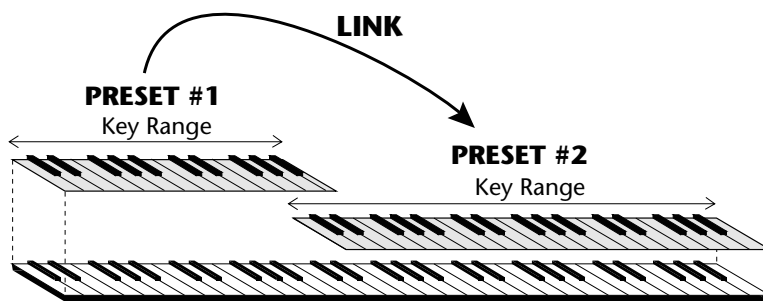
PROGRAMMING BASICS

This chapter explains how Vintage Keys sounds are constructed and contains important background information on how to create your own custom presets.

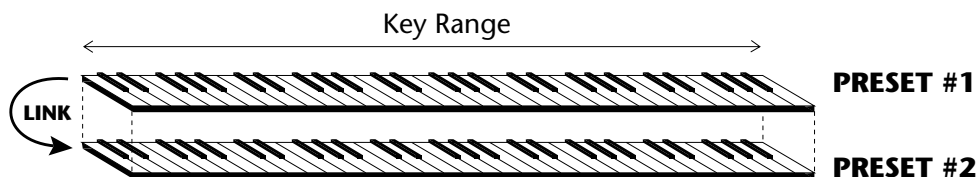
Your initial involvement with Vintage Keys will most likely consist of using the existing presets and selecting MIDI channels. While the factory presets are very good, there are probably some things you would like to change, perhaps the LFO speed, the filter cutoff or the attack time. You may also want to make your own custom presets using complex modulation routings. There are 256 user locations (000-255) available to store your own creations or edited factory presets. Best of all, it's easy to edit or create new presets using the edit menu.

Presets can be made up of both a primary and secondary instrument. Presets can also be “linked” with up to 3 additional presets to create layering or splits.

One way to create a keyboard split is assign an instrument to a specific range and then link it to other presets which fill in the empty keys. Using a combination of 4 linked presets and the primary and secondary instrument ranges, up to 8 keyboard splits can be produced. If linked presets overlap on the same keyboard range, the presets will be doubled or stacked.



CREATING A SPLIT KEYBOARD



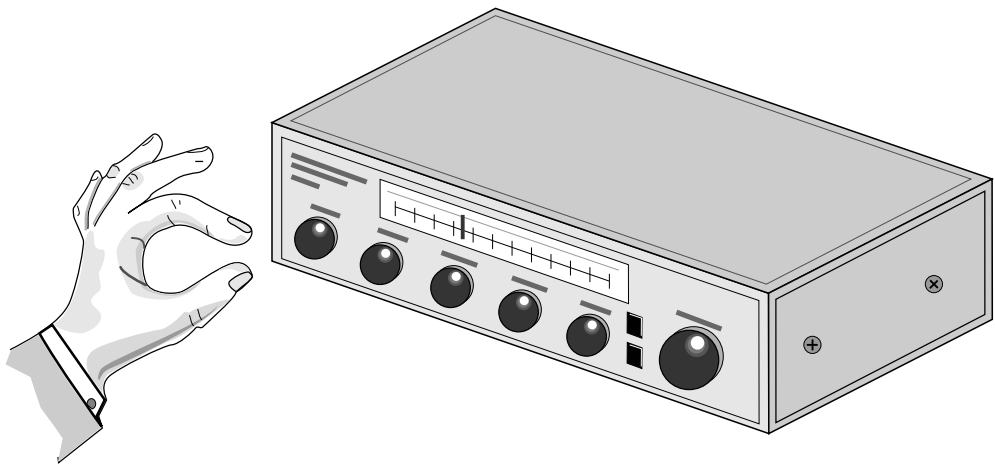
LAYERING TWO PRESETS

These diagrams show how keyboard splits and layers can be created by linking presets. Remember that each preset can consist of both a primary and secondary instrument.

Vintage Keys has an extensive modulation implementation using two multi-wave LFO's (Low Frequency Oscillators), two envelope generators and the ability to respond to multiple MIDI controllers. You can simultaneously route any combination of these control sources to multiple destinations.

MODULATION

Modulation means to *dynamically change* a parameter, whether it be the volume (amplitude modulation), the pitch (frequency modulation), or whatever. Turning the volume control on your home stereo rapidly back and forth would be an example of amplitude modulation. To modulate something we need a modulation *source* and a modulation *destination*. The source is your hand turning the knob, and the destination is the volume control. If we had a device that would automatically turn the volume control, we would also call that device a modulation source. The Vintage Keys is designed so that for each of the variable parameters, such as the volume, there is an initial setting which can be changed by a modulation source. Therefore in the case of volume, we have an initial volume and we can change or modulate that volume with a modulation source. Two main types of modulation sources on Vintage Keys are *Envelope Generators* and *Low Frequency Oscillators*. In the example above, an envelope generator could be routed to automatically turn the volume control as programmed by the envelope. Or, a low frequency oscillator could be routed to automatically turn the volume control up and down in a repeating fashion.



Turning the volume control back and forth on your home stereo is an example of Amplitude Modulation.

MODULATION SOURCES

Vintage Keys uses three kinds of modulation sources.

• KEYBOARD AND VELOCITY MODULATION

Values which are generated at the start of a note and do not change during the note.

Keyboard Key

Which key is pressed.

Key Velocity

How hard the key is pressed.

• REALTIME MODULATION

Values which can be continuously changed during the entire duration of the sound.

Pitch Wheel

A synthesizer pitch bend wheel.

Miscellaneous Controllers (4)

Any type of MIDI controller data.

Keyboard Pressure (mono aftertouch)

Key pressure applied after the key is initially pressed.

Polyphonic Key Pressure

Pressure from a controller capable of generating polyphonic pressure data.

Low Frequency Oscillators (2)

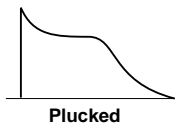
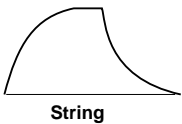
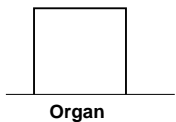
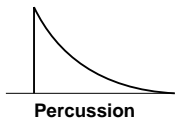
Generate repeating waves.

Envelope Generators (2)

Generate a programmable “contour” which changes over time when a key is pressed.

• FOOTSWITCH MODULATION

Changes a parameter when one of the three footswitches are pressed. The footswitches can be programmed to switch: Sustain (pri/sec/both), Alternate Volume Envelope (pri/sec/both), Alternate Volume Release (pri/sec/both), or Cross-Switch between the primary and secondary instruments.



... The generalized envelope shapes of a few types of sounds are shown above.

ENVELOPE GENERATORS

An envelope can be described as a “contour” which can be used to shape the sound in some way over time. Each channel of the Vintage Keys contains two envelope generators. One of the envelope generators, the Alternate Volume Envelope, controls the volume of the primary or secondary instrument over time and has 5 stages, Attack, Hold, Decay, Sustain, and Release. The other envelope, the Auxiliary Envelope, can be routed to any realtime control destination and is a general purpose envelope. The Auxiliary Envelope has 6 stages: Delay, Attack, Hold, Decay, Sustain, and Release. The time of each stage can be adjusted to create myriad envelope shapes, which in turn shape the sound. The Envelope parameters can be described as follows:

- **Delay**

The time between when a key is played and when the attack phase begins.

- **Attack**

The time it takes to go from zero to the peak (full) level.

- **Hold**

The time the envelope will stay at the peak level before starting the decay phase.

- **Decay**

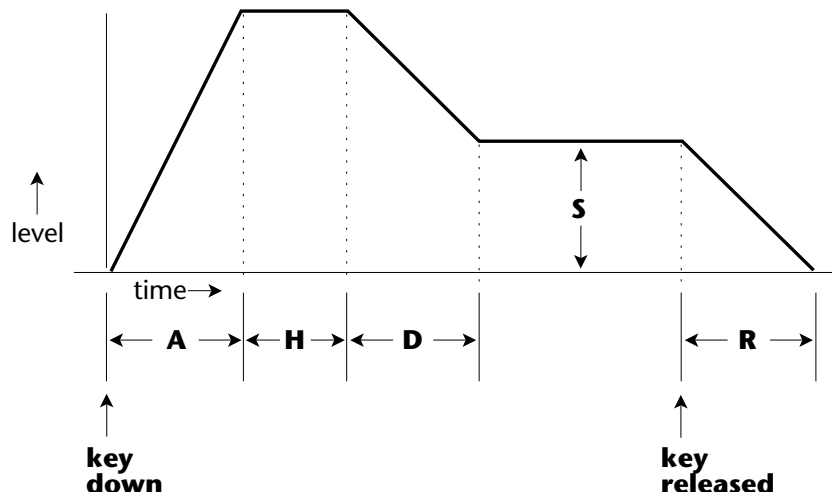
The time it takes the envelope to go from the peak level to the sustain level.

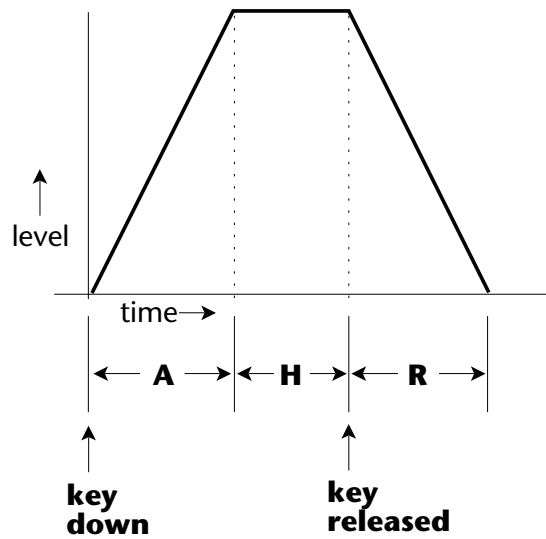
- **Sustain**

The level at which the envelope remains as long as a key is held down.

- **Release**

The time it takes the envelope to fall to the zero level after the key is released.



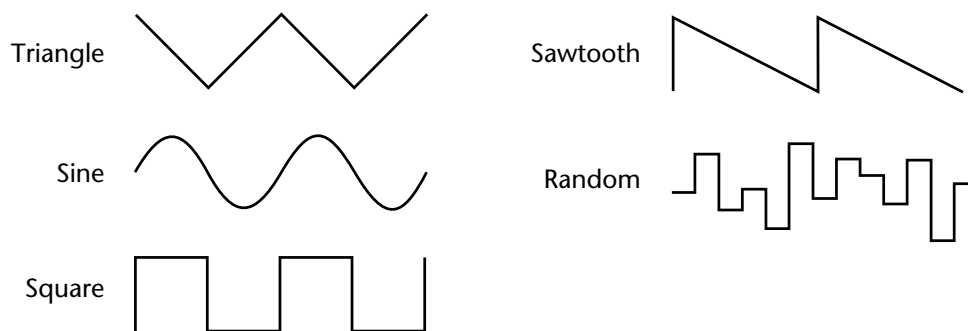


If the key is released during the Hold (H) phase, the Release phase begins.

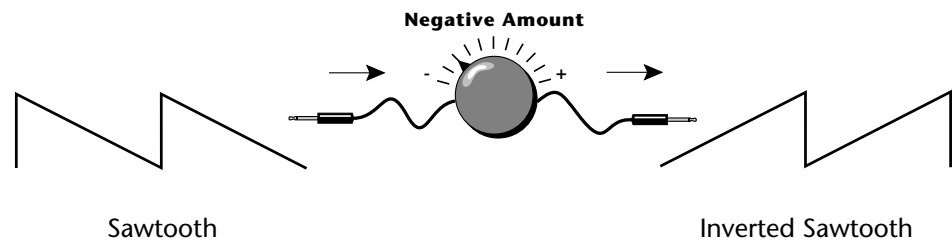
LOW FREQUENCY OSCILLATORS (LFOS)

A Low Frequency Oscillator is simply a wave which repeats at a slow rate. The Vintage Keys has two multi-wave LFOS for each of its 32 channels. The LFO waveforms are: Triangle, Sine, Square, Sawtooth, and Random, which is a random “sample and hold” type of wave.

By examining the diagram of the LFO waveforms, you can see how the LFO will affect a modulation destination. Suppose we are modulating the pitch of an instrument. The sine wave looks smooth, and will smoothly change the pitch. The square wave changes abruptly, and will abruptly change the pitch from one pitch to another. The sawtooth wave smoothly decreases, then abruptly changes back up. The sound’s pitch will follow the same course. Controlling the pitch of an instrument is an easy way to hear the effects of the LFO waves.

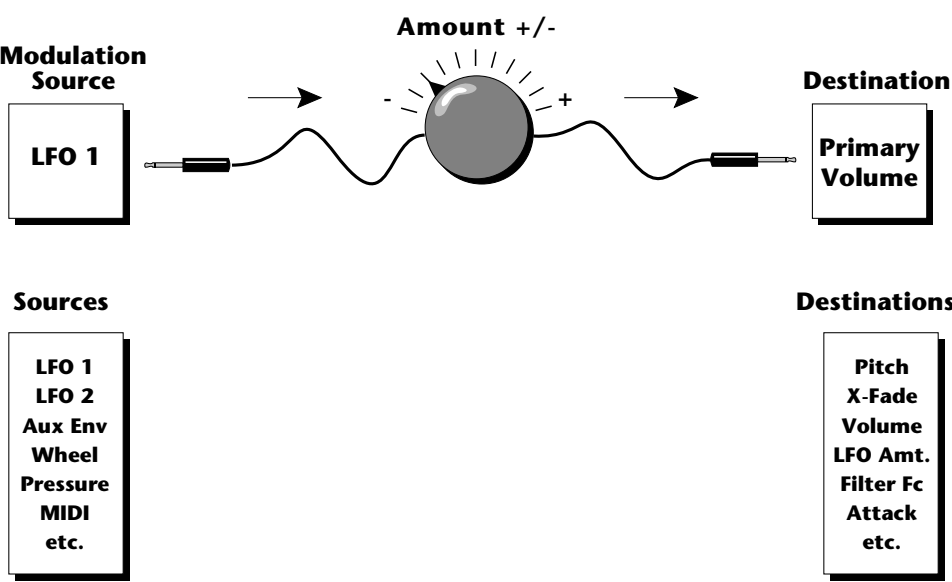


When the amount of an LFO is a negative value, the LFO shape will be inverted. For example, inverting the sawtooth wave produces a wave that smoothly increases, then instantly resets down.



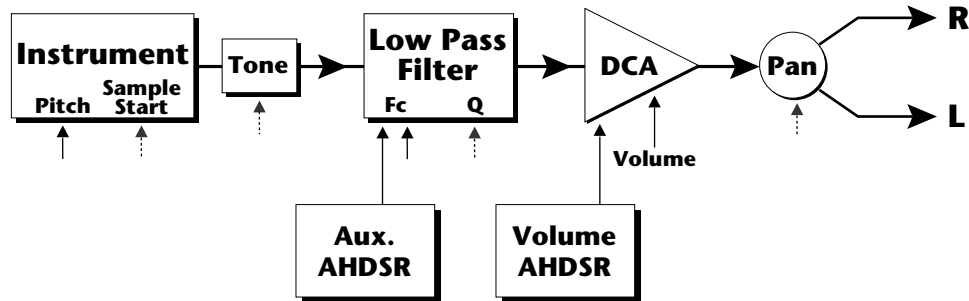
MIDIPATCH

Connecting a modulation source to a destination is called a *patch*. Vintage Keys lets you connect the modulation sources in almost any possible way to the modulation destinations. You can even modulate other modulators. Each patch also has an amount parameter which determines “how much” modulation is applied to the destination. The modulation amount can be positive or negative and will either add or subtract from the initial value. Keyboard and velocity sources can be simultaneously patched to any 6 of the 42 destinations for each preset. Realtime modulation sources can be simultaneously patched to any 8 of the 30 destinations for each preset.



FILTER MODULATION

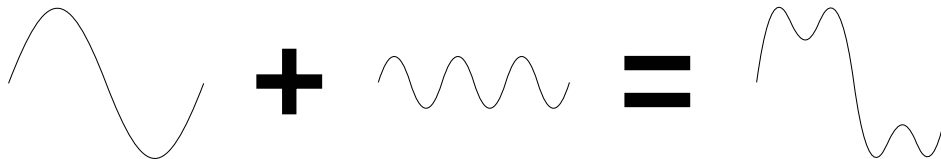
Vintage Keys contains two low pass filters for each of its 32 channels. The block diagram of a single channel is shown below.



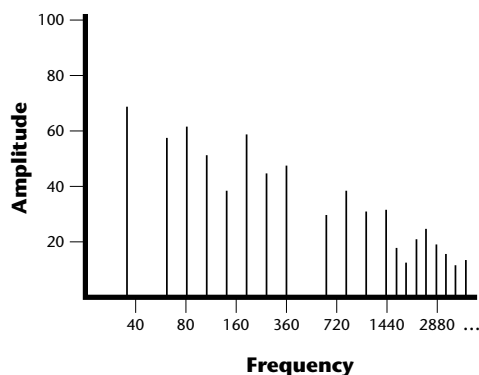
The **Tone** filter is a simple tone control and can be used to brighten or darken the tone of an instrument. The **Low Pass** filter is a powerful synthesizer filter which can dramatically alter the sound of an instrument.

WHAT IS A FILTER?

To understand how a filter works we need to understand what makes up a sound wave. A sine wave is the simplest form of sound wave. Any waveform except a sine wave can be analyzed as a mix of sine waves at specific frequencies and amplitudes.

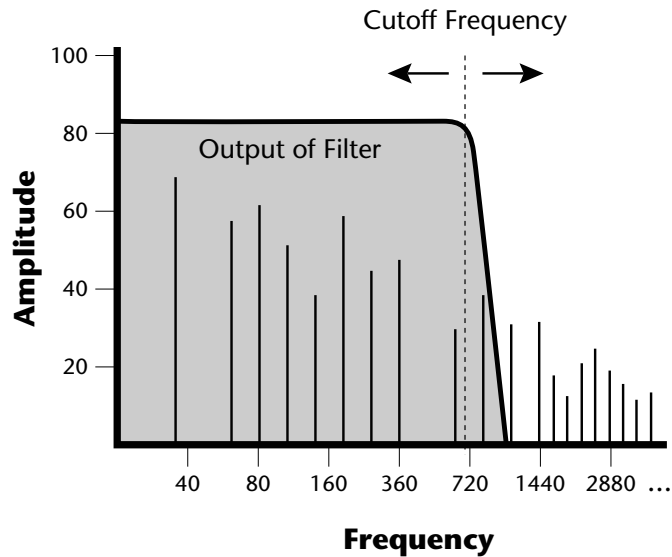


One way to represent complex waveforms is to use a chart with frequency on one axis and amplitude on the other. Each vertical line of the chart represents one sine wave at a specific amplitude.



••• When the filter F_c is 000 all sound will be cut off. The initial filter F_c and all F_c modulators ADD algebraically to determine the actual F_c . If you are not getting sound, adjust the initial F_c or reduce the amount of modulation. Careful adjustment of all the filter parameters is the secret to getting great sounds.

Most of the instruments in Vintage Keys are complex waves containing many sine waves of various amplitudes and frequencies. A **filter** is a device which allows us to remove certain components of a sound depending on its frequency. For example, a Low Pass Filter, like the one in Vintage Keys, lets the *low frequencies pass* and removes only the high frequencies.

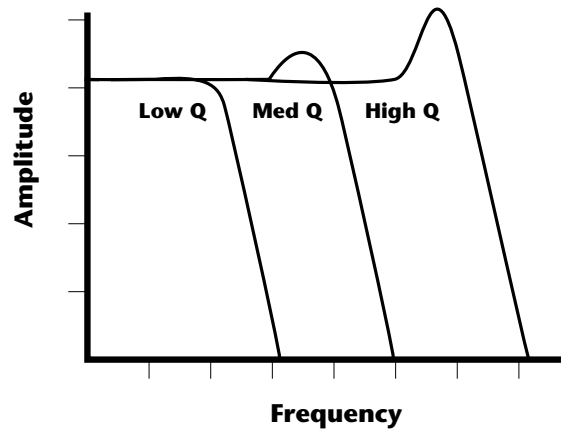


The point at which the frequencies begin to be cut is called the **Cutoff Frequency** (or F_c for short). A filter that let only the high frequencies pass would be called a High Pass filter. Using a filter, we now have a way to control the harmonic content of a sampled sound. As it turns out, a low pass filter can simulate the response of many natural sounds.

For example, when a piano string is struck by its hammer, there are initially a lot of high frequencies present. If the same note is played softer, there will be fewer of the high frequencies generated by the string. We can simulate this effect by routing the velocity of the keyboard to control the amount of high frequencies that the low pass filter lets through. The result is expressive, natural control over the sound.

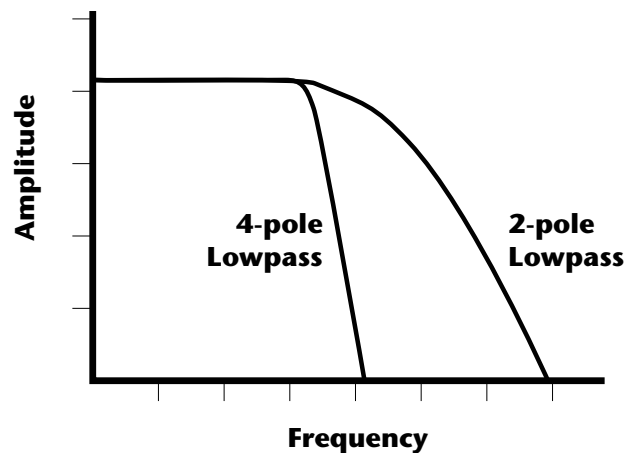
The auxiliary envelope generator is commonly used to control the cutoff frequency of the low pass filter. This allows the frequency content to be varied dynamically over the course of the note. Dynamic filtering coupled with all the different instruments available, makes for almost endless possibilities in the final sound. Any modulation source can be used to modulate the filter.

Another control on the low pass filter is called Q or resonance. Turning up the Q of the filter tends to emphasize the frequencies around the cutoff frequency. The chart below shows how different amounts of Q affect the filter response. In terms of sound, frequencies around the cutoff will tend to “ring” with high Q settings. If the filter is swept back and forth slowly with a high Q, various overtones will be “picked out” of the sound and amplified as the resonant peak sweeps over them. Bells and gongs are real world examples of sounds which have a high Q.



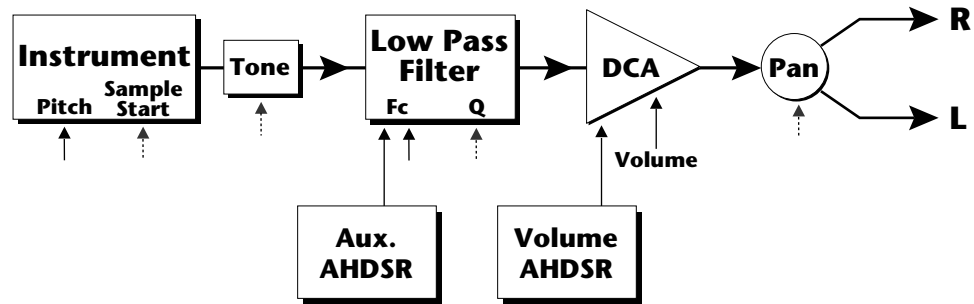
Turning up the “Q” will emphasize the frequencies around the cutoff point.

Another parameter on the low pass filter is the number of poles it contains. The filters on Vintage Keys can be either 2-pole or 4-pole filters. The number of poles in a filter describes the steepness of its slope. The more poles the steeper the slope. 2 and 4 pole filters have a very different sound. In general, the 2-pole filter will have a buzzy sound and the 4-pole filter has a stronger filtering action. In terms of vintage synthesizers, Oberheim synthesizers were famous for their 2-pole filter; Moog, ARP and E-mu synthesizers were famous for their distinctive 4-pole filters.



VINTAGE KEYS SIGNAL FLOW

Going back to the block diagram for a single channel we can re-examine the complete signal path.



Instrument

This is the sampled sound wave. The pitch of the instrument can be modulated by any modulation source. The sample start point can only be modulated by a velocity or key source (see the next page).

Tone

Tone is a simple tone control which can be used to brighten or mute the sound. Tone can only be modulated by a velocity or key source (see the next page). Key velocity is commonly used to modulate the tone so that the harder you play, the brighter the sound becomes.

Low Pass Filter

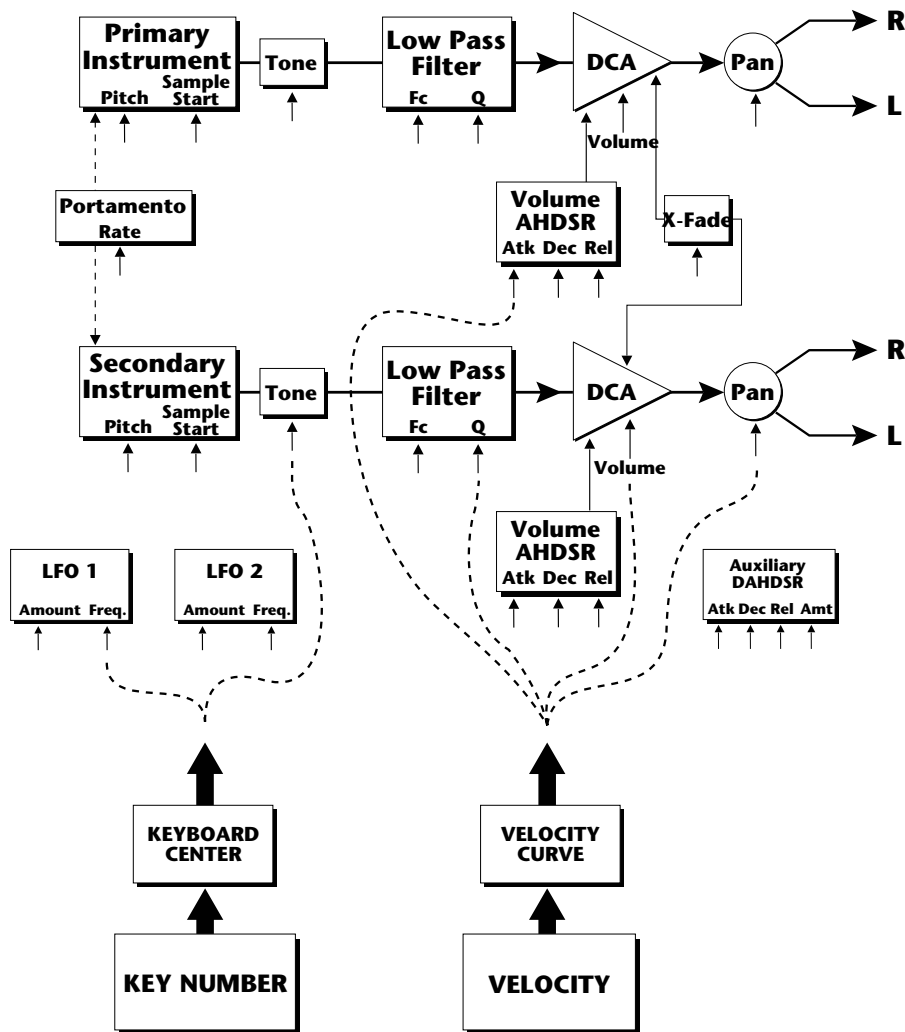
The Low Pass Filter is used to shape the harmonic content of an instrument. The Fc can be modulated by any source. The auxiliary envelope is commonly used to dynamically shape the harmonic content over time. Q or resonance can only be modulated by a velocity or key source. There are two types of low pass filter available: a 2-pole filter and a 4-pole filter. The 4-pole filter has a steeper slope and a stronger filtering action.

DCA

Digitally **C**ontrolled **A**mplifier. Together with the Volume AHDSR, the DCA is used to shape the volume contour of a sound. The DCA can be controlled by any modulation source. Key Velocity is often used as a modulation source for the DCA so that the harder you play, the louder the sound becomes.

Pan

Adjusts the balance of sound to the left and right channels. Pan can only be modulated by a velocity or key source.



Keyboard and Velocity Modulation Sources

KEYBOARD AND VELOCITY MODULATION

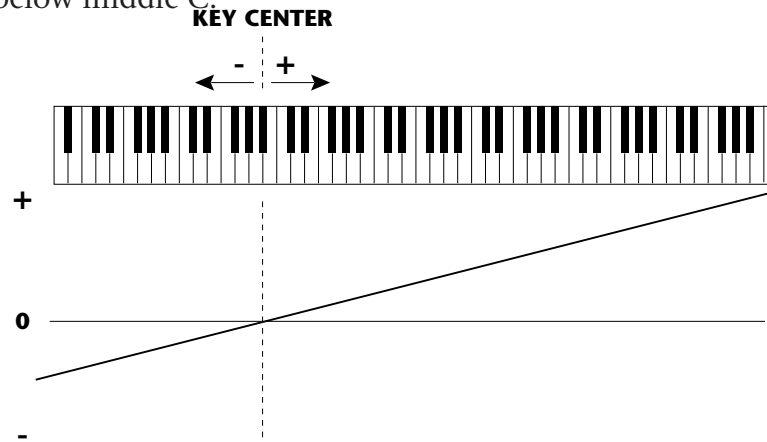
The Keyboard and Velocity Modulation diagram shows the possible routing of Key Number (which key is pressed), and Velocity (how hard the key is pressed). These modulation sources can control any of the destinations indicated by the small arrows. A modulation source can control up to six destinations or one destination can be controlled by up to six modulation sources. The possible modulation routings are completely flexible as shown in the example above.

**Keyboard
Modulation Sources**
Key Number, Key Velocity

Destinations
Off, Pitch, Primary Pitch, Secondary Pitch, Filter Fc, Primary Filter Fc, Secondary Filter Fc, Filter Q, Primary Filter Q, Secondary Filter Q, Volume, Primary Volume, Secondary Volume, Attack, Primary Attack, Secondary Attack, Decay, Primary Decay, Secondary Decay, Release, Primary Release, Secondary Release, Crossfade, LFO 1 Amount, LFO 1 Rate, LFO 2 Amount, LFO 2 Rate, Auxiliary Envelope Amount, Auxiliary Envelope Attack, Auxiliary Envelope Decay, Auxiliary Envelope Release, Sample Start, Primary Sample Start, Secondary Sample Start, Pan, Primary Pan, Secondary Pan, Tone, Primary Tone, Secondary Tone, Portamento Rate, Primary Portamento Rate, Secondary Portamento Rate

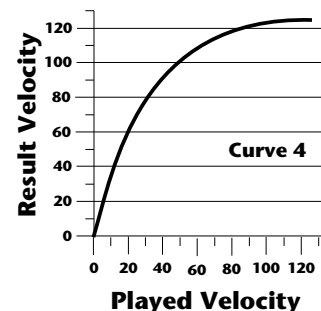
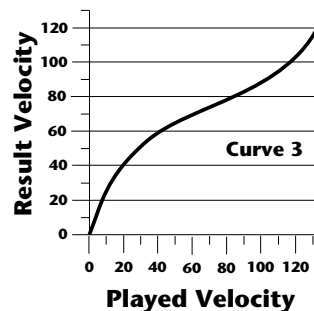
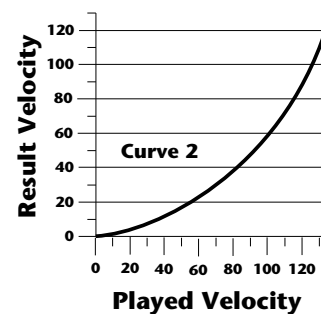
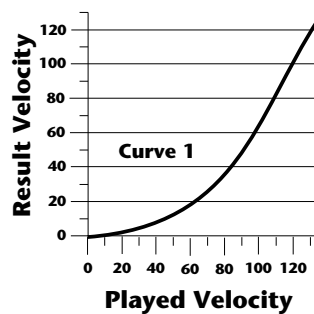
KEY NUMBER

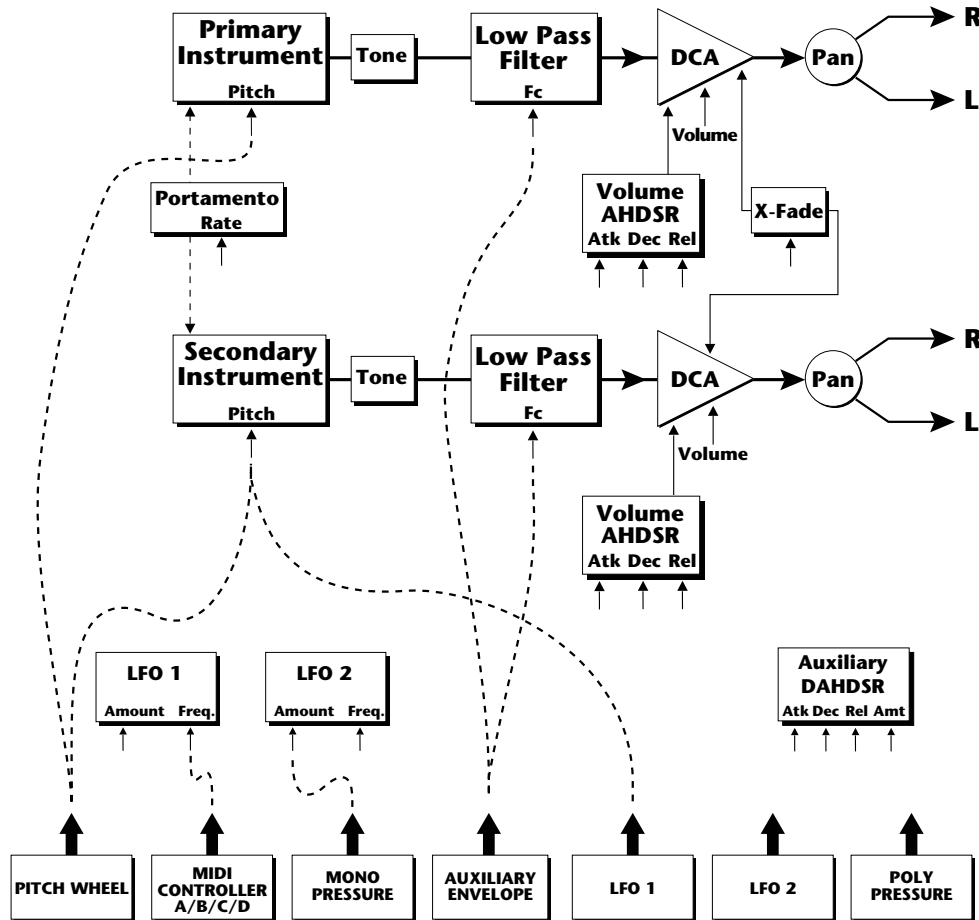
The Key Number is affected by the Keyboard Center parameter which can be set to any key from A-1 to C7. The keyboard center establishes a reference point for keyboard modulation; keys above this point will have a positive value, while keys below it will be negative. For example, if we wished to change the volume of an instrument using key number and the key center were set to middle C, the instrument would get progressively louder above middle C and progressively softer below middle C.



VELOCITY CURVES

Incoming velocity values can be scaled by one of the four velocity curves in order to match your playing style or better adapt to the MIDI controller. Experiment with the four curves to find the one that works best for your style and MIDI controller.





Realtime Modulation Sources

REALTIME MODULATION

In addition to keyboard and velocity modulation, Vintage Keys has multiple realtime modulation sources. Realtime modulation sources are parameters which can be continuously varied over time. The velocity and keyboard modulations, in comparison, are set at the key depression. The realtime modulation sources can control any of the destinations except sample start, Q, tone and pan, as indicated by the small arrows. A modulation source can control up to eight destinations or one destination can be controlled by up to eight modulation sources. The possible modulation routings are completely flexible as shown in the example above.

Realtime Modulation Sources

Pitch Wheel,
MIDI Control A,
MIDI Control B,
MIDI Control C,
MIDI Control D,
Mono Pressure,
Polyphonic Pressure,
LFO 1, LFO 2,
Auxiliary Envelope

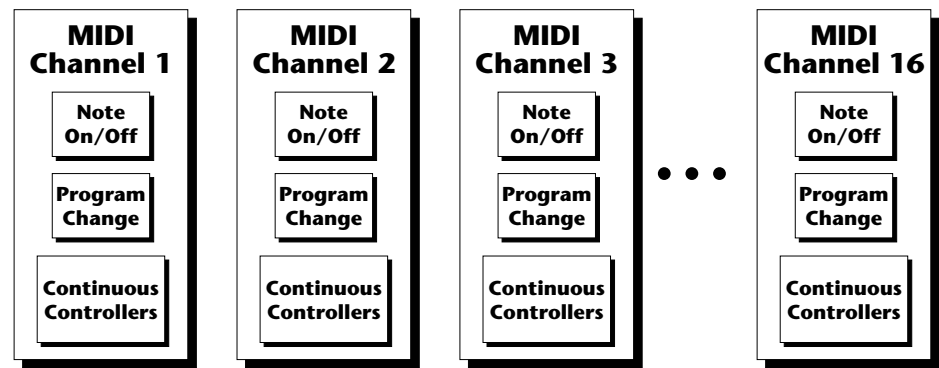
Destinations

Off,
Pitch, Primary Pitch,
Secondary Pitch,
Filter Fc, Primary Filter Fc,
Secondary Filter Fc,
Volume, Primary Volume,
Secondary Volume,
Attack, Primary Attack,
Secondary Attack,
Decay, Primary Decay,
Secondary Decay,
Release, Primary Release,
Secondary Release,
Crossfade,
LFO 1 Amount, LFO 1 Rate,
LFO 2 Amount, LFO 2 Rate,
Auxiliary Envelope Amount,
Auxiliary Envelope Attack,
Auxiliary Envelope Decay,
Auxiliary Envelope Release,
Portamento Rate, Primary
Portamento Rate,
Secondary Portamento Rate

••• MIDI wind controllers may work better if you assign one of the MIDI A, B, C, D controllers to control volume. This will allow the MIDI volume to be **added** to the current volume.

MIDI REALTIME CONTROLS

The MIDI realtime controllers may seem confusing at first, but they are really very simple to understand. You probably already know that there are 16 MIDI channels that can be used. Each of the 16 MIDI channels uses basically 3 types of messages; *note on/off*, *program changes*, and *continuous controller* messages. Your MIDI keyboard, in addition to telling Vintage Keys which note was played, may also send *realtime control* information, which simply means occurring in real time or live. (You may be using a MIDI device other than a keyboard, but for simplicity's sake we'll presume that you're using a keyboard.) Realtime control sources include such things as pitch wheels or levers, modulation wheels or levers, control pedals, aftertouch, etc. and are used to add more expression or control. Your MIDI keyboard sends out realtime controller information on separate channels called *continuous controller channels*. There is a set of 32 continuous controller channels for each of the 16 MIDI channels. Some of the controller channels, such as pitch wheel, volume, and pan have been standardized. For example, volume is usually sent on continuous controller channel #7.



Common realtime controllers such as the pitch wheel, volume, pan and pressure are pre-programmed to their proper destinations. Your keyboard may have other realtime controls such as a control pedal or data slider which can also be programmed to control most of the parameters on Vintage Keys.

Vintage Keys is equipped with a sophisticated *MidiPatch™ system*, which allows you to route any continuous controller to any realtime modulation destination. The MidiPatch system is also very easy to use. First, you must know which controller numbers your keyboard can transmit.

Let's say for example, that you are using a Yamaha DX7 as your master keyboard. The DX has pitch and mod. wheels, a breath controller, a data slider and a foot pedal, all of which transmit their values over MIDI. The standard MIDI controller numbers for the controls are listed below (the pitch wheel has a dedicated controller, PWH). First, we would go to the Master menu, MIDI Controller Assign and define the 4 MIDI controllers that we wish to use. Assign each controller number to one of the letters A-B-C-D.

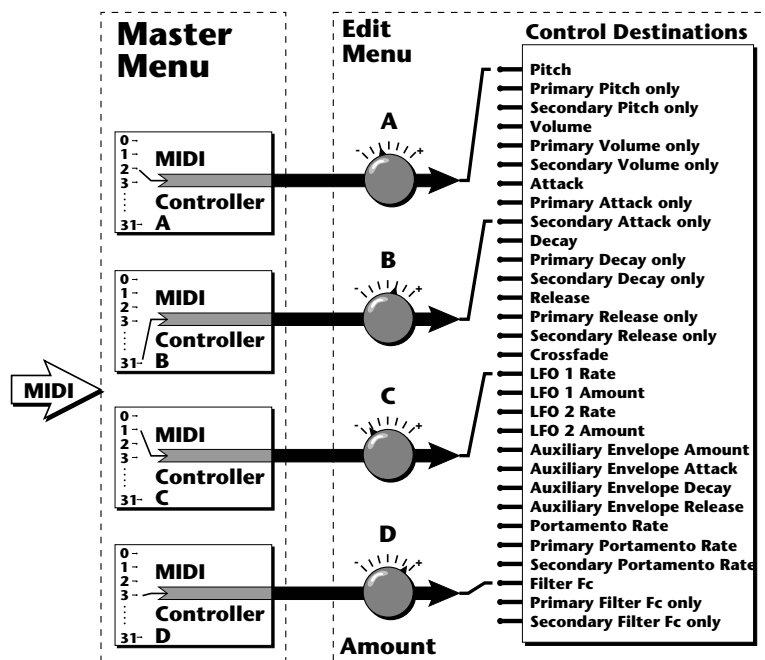
01 - Modulation Wheel A

02 - Breath Controller B

04 - Foot Pedal C

06 - Data Entry D

To complete the connections for a particular preset, go to the Edit menu, Realtime Control, and route the MIDI A, B, C, D to the desired destinations. These could be patched to any 4 destinations or even to the same destination. The MIDI Controller Amount menu, (in the Edit menu) allows you to scale the amounts of each of the controllers by a positive or negative value. The signal flow is shown in the diagram below.



The MIDI controllers A-B-C-D must have both a source (0-31), and a destination assigned.

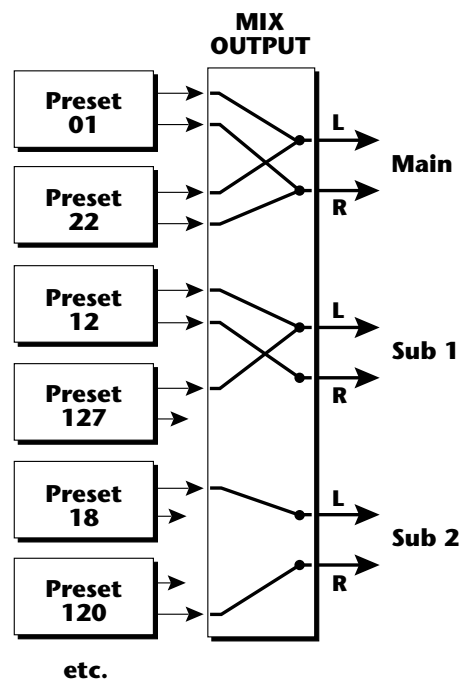
Standard MIDI Controller Numbers

- 1 Modulation Wheel
- 2 Breath Controller
- 3 Pressure Rev 1 DX7
- 4 Foot Pedal
- 5 Portamento Time
- 6 Data Entry
- 7 Volume
- 8 Balance
- 9 Undefined
- 10 Pan

STEREO MIX OUTPUTS

Vintage Keys has three sets of polyphonic stereo outputs (Main, Sub 1, Sub 2). The channels used by a particular preset may be directed to appear at any one of these three stereo outputs. This feature is useful for signal processing (EQ, reverb, etc.) of individual sounds prior to final mixdown. By panning a preset completely left or right, it can be routed to a single output jack.

Note: All presets will be automatically routed to the Main outputs unless plugs are inserted into the Sub 1 or Sub 2 outputs.



Each preset can be routed to one (and only one) set of stereo outputs.