FUTURERETRO

MANUAL

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INTRODUCTION

Thank you for choosing the **512 Touch Keyboard**. Please take the time to read through this manual for a full understanding of the features, tips, and precautions.

OVERVIEW
The **512** is many things… a keyboard, arpeggiator, sequencer, MIDI to CV converter, MIDI to MIDI converter, and polyphonic MIDI router. It is a tool for learning, producing, and performing music.
I hope you will enjoy it as much as I enjoyed creating it.

PRECAUTIONS
The **512** is powered by a (center positive) +15V DC output power supply. Never use AC output power supplies with this unit. Should your power supply become lost or damaged, replacements can be purchased directly from Future Retro.

Never open the unit. There are no user-serviceable parts inside. Should your unit ever need repairs, please contact Future Retro for all servicing.

Never expose this device to rain or moisture. If liquids are spilled into the unit, unplug the power supply immediately, and let the unit sit in a dry warm environment until all moisture has evaporated.

Avoid exposing the unit to smoke, or extreme hot and cold environments, as these may cause premature component failure. Avoid leaving the unit exposed to direct sunlight as this may discolor the unit's clear finish.

Clean the exterior with a soft dry cloth. Never use abrasive cleaners that may harm the surface and finish of the unit.

DISCLAIMER
All information represented in this manual is believed to be accurate at the time of publication. Any addendums to the manual and further product support may be found on our web site:
www.future-retro.com

Product specifications may be subject to change at any time.

Future Retro assumes no responsibility for inaccuracies, errors, omissions, or liability for any loss or damage resulting directly or indirectly from the use, misuse, or abuse of this product.

Information in this manual may not be copied, reproduced, or distributed in any form without permission from Future Retro.

WARRANTY
All of our products are hand-built in Austin TX using only the finest quality components. We take pride in designing, assembling, inspecting, and testing each unit in-house to meet our high-quality standards and provide trouble-free use.

This product comes with a 1-year warranty covering all parts and labor. Warranty does not cover damage due to tampering, modifications, or any other misuse or abuse.

You must register your product at www.future-retro.com within 30 days of purchasing the unit new for your warranty to be valid.

THE ART OF TOUCH

UNDERSTANDING CAPCITIVE TOUCH
The **512** uses capacitive touch keys instead of traditional mechanical switches. One advantage of doing so is the **512**'s keys will never wear out or require maintenance like traditional keyboards do. The other advantage is the **512** can produce controller information based on how your finger interacts with the surface area of the key, making for a very interactive experience.

Please understand that you do NOT need to hit a key hard to create velocity, or press hard on the keyboards surface to alter touch or aftertouch information. Instead these capacitive touch keys measure how fast your finger approaches a key as well as how much surface area of your finger makes contact with a key when a key is played to determine velocity. Touch or aftertouch is altered by varying the amount of surface area of your finger making contact with a key.

With capacitive touch keys your body acts as a capacitor that is used to detect touches. Therefore you get to become part of the circuit. However, there is one drawback to capacitive touch and that is, as you come in contact with more keys or more surface area of a key, your body becomes less capacitive. In other words if you are playing a single note on the keyboard, and then pitch bend that note you will notice the BEND key has more sensitivity than if you were to instead play a 3-note chord and pitch bend those notes. While we have designed our keyboard to have full response under most circumstances, if you ever find that you need just a little more response from a touch, you can touch the front of the metal chassis with one of your fingers or palm of your hand. The chassis acts as an antenna which helps boost your body's capacitance.

You might also work on developing new playing techniques to use these side effects to your advantage, such as holding a specific modulation amount then interacting with touching the chassis to vary the modulation amount.

One thing you might notice when playing chords, you will have less aftertouch sensitivity than when single notes are played. The aftertouch control the **512** generates is global aftertouch, meaning it only sends one value no matter how many keys are being played. The value it sends will be the largest detected touch on any key. So as you are playing a chord realize that you can get more aftertouch response by applying more touch to one key, while minimizing the surface area touching other keys playing in the chord.

Developing your touch technique will really bring out the expressiveness of the instrument and allow you to play it in various ways.

For instance you can generally get softer touches by touching a key with your finger tip, and larger touches by touching a key with the pad of your finger. Various techniques include rolling your finger from tip to pad, or sliding your finger across a key to make more or less contact.

With the pitch bender pads for instance, you can drag your finger tip up or down to create a bend sensation similar to a pitch bend wheel on a traditional synthesizer. Or instead you can vary the pressure of your finger on the pad to create a proportional pitch control response. You can also rest your finger slightly off the pad, and roll your finger onto the pad to create variations.

It will be well worth your time to develop a technique that works for you. In the MIDI section of the manual we will discuss other parameters you can setup to alter the response of things like velocity, pitch bend, and mod wheel touches to better suit your playing style.

CONNECTIONS

MIDI IN
The MIDI IN jack on the front panel can be connected to the MIDI Out of your DAW, MIDI controller, or sequencer.

MIDI THRU
The MIDI THRU jack on the front panel will transmit all data that is received at the MIDI IN jack without latency. Use this when you need to daisy-chain multiple devices together.

MIDI OUT
The MIDI OUT jack on the front panel can be connected to the MIDI IN of your DAW, sound module, or other sequencers.

CLOCK
The CLOCK output provides a 0 to +10v analog clock signal that can be used to clock external analog modules, sequencers, or trigger envelopes. This clock will vary its timing based on whatever time signature is selected in the **512**. This clock will also shuffle its timing based on settings of the SWING control.

GATE
The GATE output provides a 0 to +10v positive polarity gate signal, and is typically used for triggering envelopes in an analog synthesizer.

KEY CV
The KEY CV output provides an analog voltage in the range of 0 to +9.5v (approximately), and follows the 1v/Oct CV standard. You will typically connect this output to the CV control input of an analog synthesizer's oscillators.

VELOCITY
The VELOCITY output provides an analog voltage in the range of 0 to +10v based on how quickly your finger approaches a key, and how much surface area of your finger makes contact when a key is first struck. This control voltage can be used to alter various aspects of an analog synthesizer.

TOUCH
The TOUCH output provides an analog voltage in the range of 0 to +10v based on how much surface area of your finger is in contact with a key at any time. This control voltage can be used to alter various aspects of an analog synthesizer.

MOD
The MOD output provides an analog voltage in the range of 0 to +10v based on how much surface area of your finger is in contact with the MOD pad. This works similar to a mod wheel found on traditional instruments, and can be used to alter various aspects of an analog synthesizer.

POWER
The **512** comes with a universal (center positive) +15V DC output power supply capable of being used with power mains ranging from 100-240V AC, this allows the unit to be used anywhere in the world simply by using the correct power plug type with the adapter.

The power jack is located on the front panel. Connect the power adapter to the Power jack and the AC outlet.

Set the Power switch to the ON position to turn the unit on, and to OFF to turn the unit off.

QUICK START

CONNECT IT
If you would like to play a MIDI sound module, go ahead and connect the MIDI OUT of the **512** to the MIDI IN of your sound module. Be sure to set the MIDI sound module to receive on MIDI channel 1, as this is what the **512** will default to the first time it is used.

If you would like to play an analog synthesizer, you will need to route the GATE output of the **512** to the GATE input of your envelopes, and the KEY CV output of the **512** to the oscillator CV input on your synthesizer. Connect the VELOCITY, TOUCH, and MOD outputs to various CV inputs on your synthesizer, to add additional control.

POWER UP
When the power is first turned on, the LED's will light while initial parameters are loaded from memory. Once these LED's turn off, the unit is ready to play.

KEYBOARD
The **512** will default to Keyboard mode each time the power is turned on. As you can see the keyboard provides 29 keys you can play. The keyboard will produce Velocity values based on how quickly your finger approaches a key and how much surfaces area of your finger makes contact with a key when a key is first played. Once a sound is playing you can vary the TOUCH amount by altering the amount of contact your finger has with the key. This will also affect the amount of After Touch sent via MIDI.

You can bend a note's pitch up or down using several techniques touching the Up or Down BEND pads. You may wish to slide your finger up and down as though you were using a traditional pitch bend wheel. You can also vary a touch's pressure, similar to proportional pitch control. Alternatively you can make the initial touch with your finger tip, then roll your finger onto the pad so more area of your finger is in contact with the pad.

You can change the octave the keyboard plays in by pressing the -/+ keys.

ARPEGGIATOR
Want to get a taste of the arpeggiator? Press the ARPEGGIATOR key, it's LED will light to indicate the Arpeggiator mode is selected. Press the PLAY key to start the arpeggiator, then press and hold various notes to on the keyboard. Vary the GLIDE, SWING, and TEMPO controls to get a feel for what they do.
To stop the arpeggiator, simply press the PLAY key again.

To return to the Keyboard mode, press the ARPEGGIATOR key turning it's LED off.

DISPLAY LEDS

From here on, the manual will refer to the 9 LED's above the -/+ keys as the "display LED's", as these LED's are used to show various values and selections for parameters being edited.

MAKING SELECTIONS

It is important that you learn to follow the correct order of making parameter selections as sometimes the same key will perform various functions depending on if that key was pressed by itself or while holding another key or combination of keys. Therefore you should not randomly make keys selections until you fully understand the operations of this unit, or you may end up performing an action you did not intend to.

KEYBOARD

The Keyboard mode is automatically selected each time the unit is turned on. The keyboard defaults to the middle octave range selected so you always know where you are starting from. In Keyboard mode you can play notes on the keyboard and generate MIDI and CV/Gate control signals simultaneously for playing MIDI and analog synthesizers.
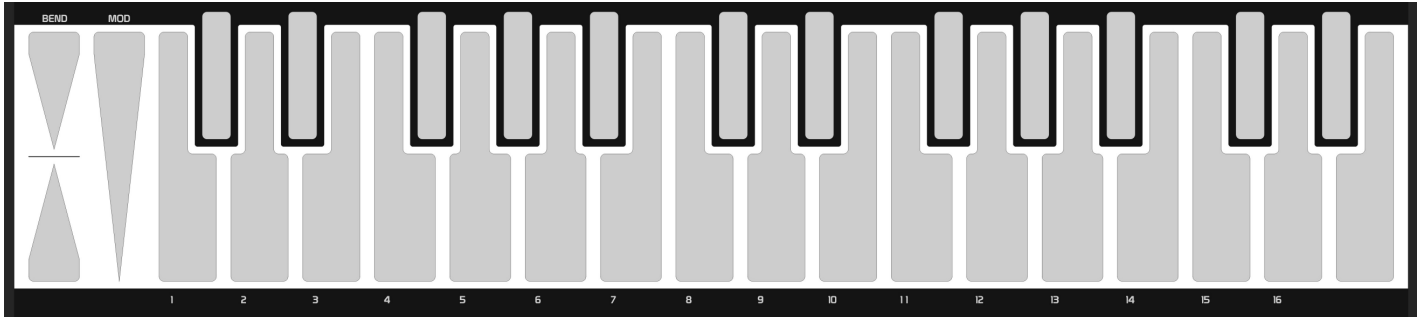
While the keyboard is only 29 notes, there are 9 octave ranges to play these 29 notes, giving you full access to the entire range of MIDI notes 0-127. If you select the lowest octave range, and play low C on the keyboard you will produce MIDI note 0. As you play higher notes or select higher octaves, the MIDI note value will increase.

In addition the **512**'s CV out has a range greater than 9 octaves. The 0-volt reference for the DAC generating the Key CV is user definable over a 5 octave range. This allows you to better align CV pitches to MIDI notes so two instruments are playing within the same range, or any desired octave spread.

As you learn more about scales later in the manual, you'll realize that having only 29 keys is not really a limitation at all, as you can easily have access to note ranges much greater than a typical 29-key keyboard.

The touch response of the keyboard makes it one of the fastest you will find for playing very quick melodies. In addition you have new playing methods at your disposal such as to play and drag chords, strum keys, or use scales to create melodies across the keyboard, allowing you to quickly play through any portion of a melody, forwards, backwards, jumping around, and… oh, there's so much to discover!

NOTE INFORMATION
The keyboard will generate note on/off, pitch, velocity, aftertouch, pitch bend, and mod wheel messages. This information is available simultaneously at the MIDI and analog outputs, allowing you to play both types of devices at the same time.

Play keys on the keyboard just as you would a traditional keyboard.

The keyboard will produce Velocity values based on how quickly your finger approaches a key and how much surfaces area of your finger makes contact with a key when a key is first touched. Once a sound is playing you can vary the TOUCH amount by altering the amount of contact your finger has with the key. This will also affect the amount of aftertouch sent via MIDI.

You can bend a note's pitch up or down applying several techniques of touching the Up or Down BEND pads. You may wish to slide your finger up and down as though you were using a traditional pitch bend wheel. You can also vary a touch's pressure, similar to proportional pitch control. Alternatively you can make the initial touch with your finger tip, then roll your finger onto the pad so more surface area of your finger is in contact with the pad.

OCTAVE

You can change the octave the keyboard is currently playing by pressing the Octave -/+ keys. There are 9 octaves to select, and the 0 octave range is always selected when the unit is first powered on. The display LED's above the Octave keys will light to show what octave is currently selected. If the Octave value is changed while notes are playing, only new notes played will be in the new octave range, while held notes remain in the octave they were played.
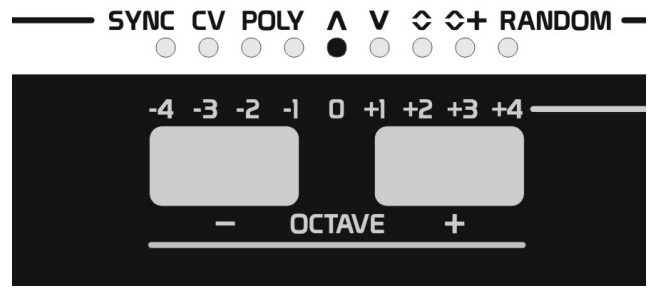
HOLD

If you would like to latch or sustain notes so they continuously drone on, play and hold one or more notes on the keyboard, then activate Hold by pressing and releasing the HOLD key. The HOLD key LED will light indicating Hold is active. Once Hold has latched a note or multiple notes, other notes can be played and they too will continue to sustain or drone. To stop these notes from sustaining, simply press and release the HOLD key. The HOLD key LED will turn off indicating Hold is no longer active.
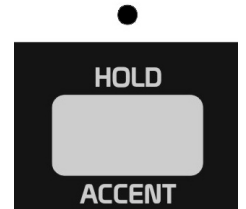
NOTE: Hold does not sustain notes if you simply activate Hold and play notes. You may activate Hold without holding notes, and this is useful when you learn more about the arpeggiator, as this technique allows you to exit Arpeggiator mode, play some notes on the keyboard, and then re-enter Arpeggiator mode, and have Hold still active with less button pressing.

NOTE: Do not hold the HOLD key before playing notes on the keyboard thinking this will sustain the notes. Doing so will select one of 29 different chords that you can play on the keyboard, arpeggiator, or sequencer.

SEMITONE TRANSPOSE

You can transpose the keyboard in semitone steps by pressing and releasing the TRANSPOSE key. It's LED will light when Transpose is active. The keys on the keyboard can now be used to make a selection of the transpose value. Middle C key is the reference and provides no transposition to the keyboard. Selecting keys lower than middle C will transpose the keyboard down by up to -12 semitones. Selecting keys higher than middle C will transpose the keyboard up to +16 semitones. Press and release the TRANSPOSE key again to exit the Transpose mode. If the transpose value was change to any value other than 0, the TRANPOSE key LED will blink to indicate a transpose offset is taking place. If the transpose value is 0, the TRANSPOSE key LED will simply turn off indicating Transpose mode is no longer active, and that no transpose offset is being applied.
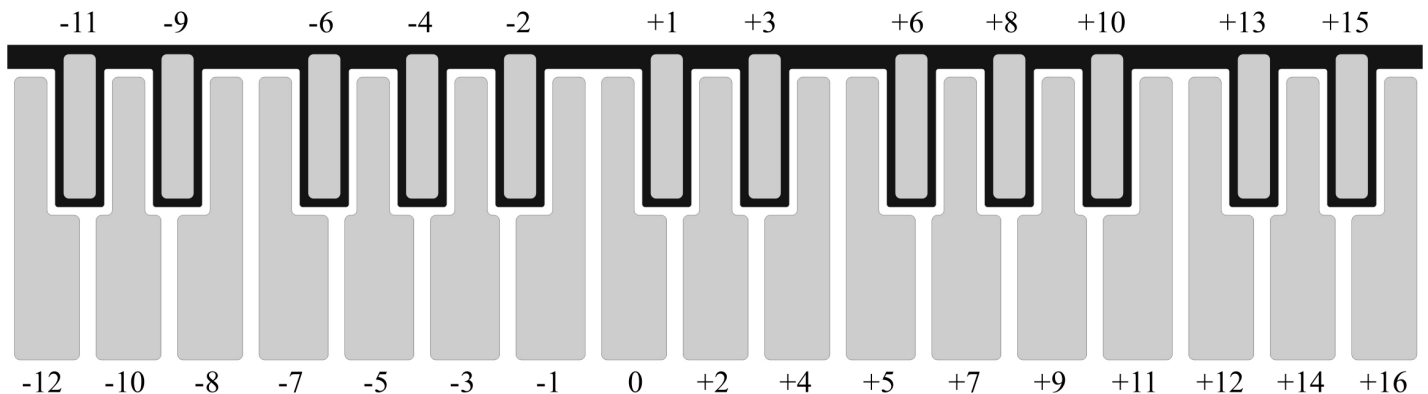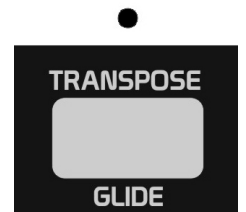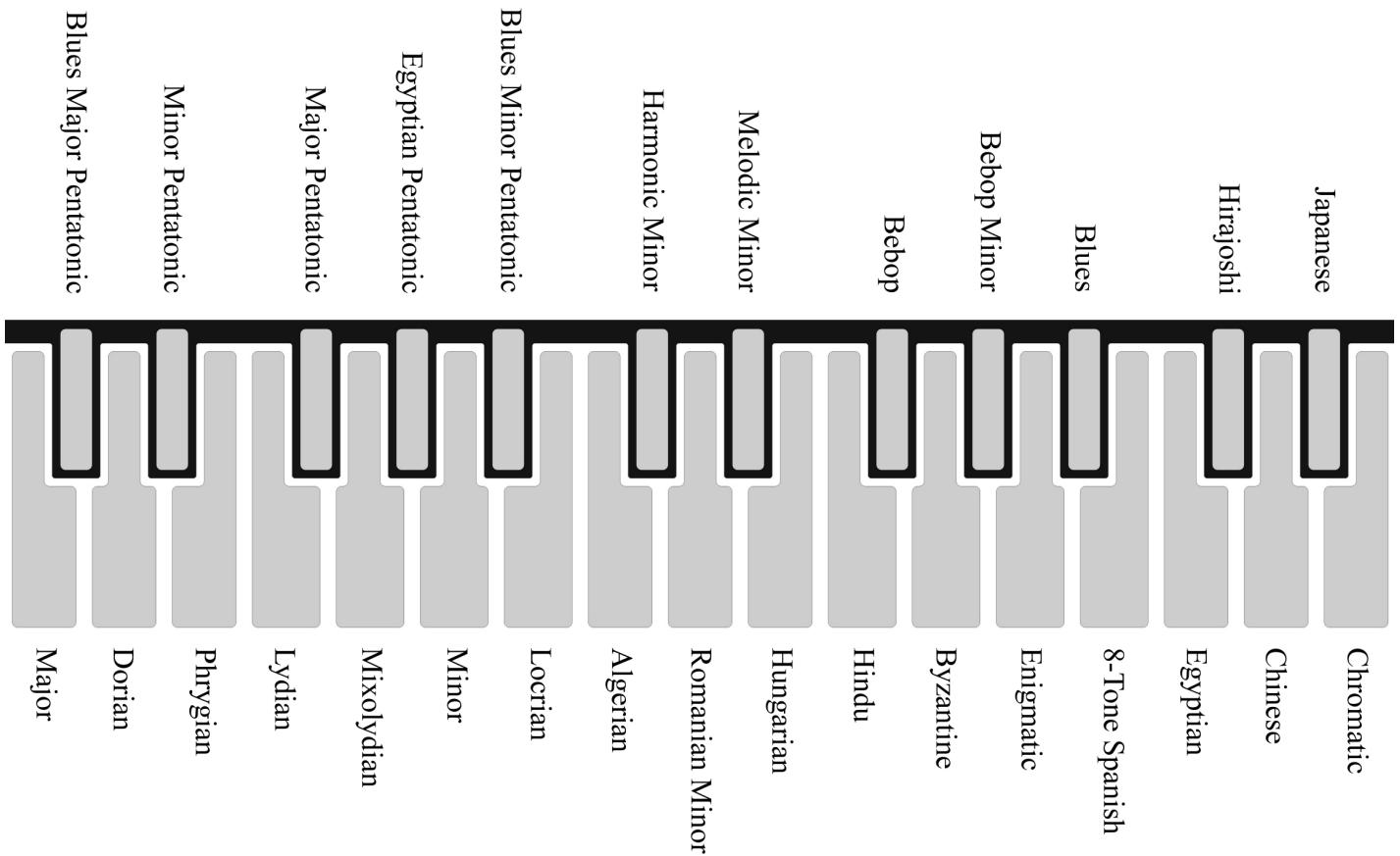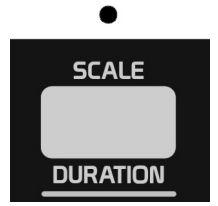
SCALES

SELECTING SCALES

There are 29 scales in all that you can assign to the keyboard or apply to arpeggiations, sequences, or MIDI to CV and MIDI to MIDI conversions. The first 28 scales are all user definable, while the 29th scale is the Chromatic scale. Different scales can be selected on the fly, allowing you to quickly alter what notes are being produced at any time.

To select a scale, hold the SCALE key, then press and release one of the 29 keyboard keys to make a selection. Release the SCALE key once you are satisfied with the selected scale.

The factory scales programmed into the unit are shown below.

Blues Major Pentatonic | Minor Pentatonic | Major Pentatonic | Egyptian Pentatonic | Blues Minor Pentatonic | Harmonic Minor | Melodic Minor | Bebop | Bebop Minor | Blues | Hirajoshi | Japanese

Major | Dorian | Phrygian | Lydian | Mixolydian | Minor | Locrian | Algerian | Romanian Minor | Hungarian | Hindu | Byzantine | Enigmatic | 8-Tone Spanish | Egyptian | Chinese | Chromatic

SAVING YOUR PREFERRED SCALE

It is possible to select any scale of your choice to be the default scale selected every time the power is turned on. To store a scale as your preferred default, first select the scale. Press and hold the SCALE key, then press and release the PLAY key. Release the SCALE key, and then press the PLAY key once more.
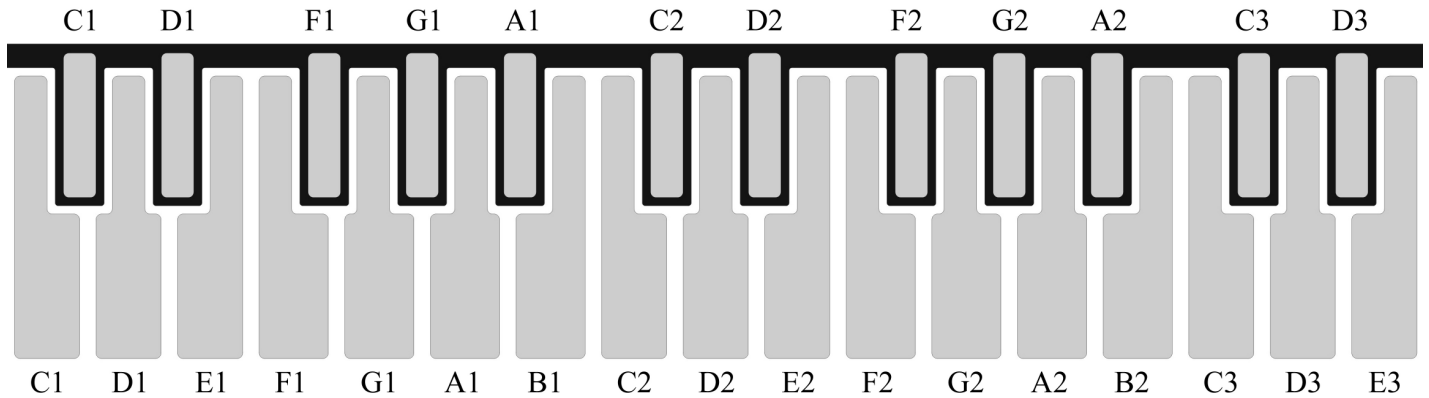
This procedure is very similar to how scales are recorded. The main difference is when storing your preferred scale you will not press any keyboard keys while the unit is in Scale Record mode. Doing so would alter the selected scale, and not store it as your preferred scale.
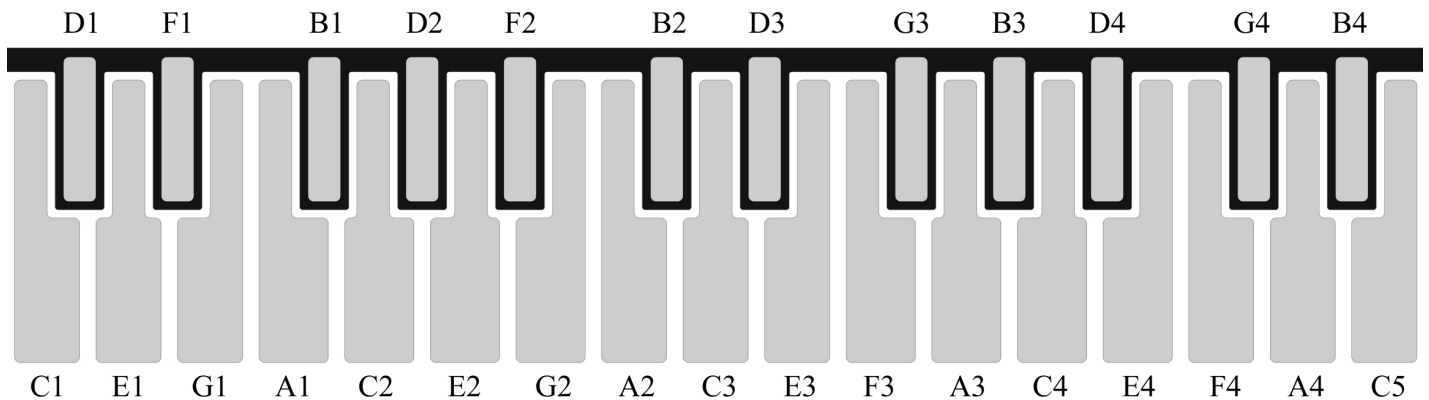
SCALE KEY MAPPING

The notes of a selected scale can be assigned to either the major scale keys (traditionally the white keys of a keyboard) or to all keys on the keyboard. We call these two different mappings of the scale notes Partial Key Scale and Full Key Scale respectively. Scale mapping can be changed on the fly.

Shown below is an example of the Major scale using the Partial Key Scale mapping. Although the notes of the scale are assigned to the major keys, the # keys will still play notes, they simply play the note of the scale that exists prior to their location.

| C1 | D1 | | F1 | G1 | A1 | | C2 | D2 | | F2 | G2 | A2 | | C3 | D3 |

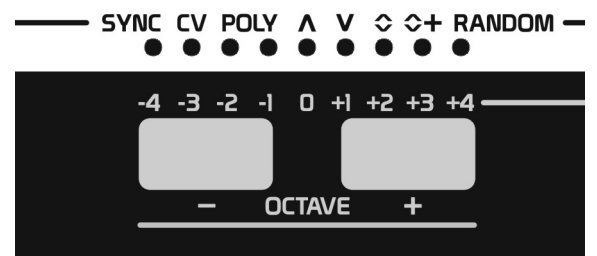| C1 | D1 | E1 | F1 | G1 | A1 | B1 | C2 | D2 | E2 | F2 | G2 | A2 | B2 | C3 | D3 | E3 |

Shown below is an example of the Major scale using the Full Key Scale mapping. Notice how each note of the keyboard uses a different pitch of the scale, and how the pitch range has now increased over the Partial Key Scale mapping.

| D1 | F1 | | B1 | D2 | F2 | | B2 | D3 | | G3 | B3 | D4 | | G4 | B4 |

| C1 | E1 | G1 | A1 | C2 | E2 | G2 | A2 | C3 | E3 | F3 | A3 | C4 | E4 | F4 | A4 | C5 |

To change the Key Scale mapping, press and hold the SCALE key, then press the –key to select Partial Key Scale mapping, or press the +key to select Full Key Scale mapping. The display LED's will show a major key pattern when Partial Key Scale mapping is selected, and will show all display LED's on when Full Key Scale mapping is selected.
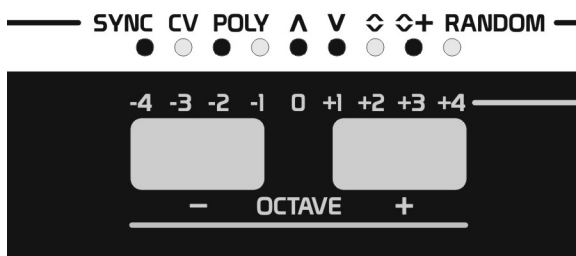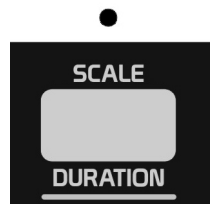
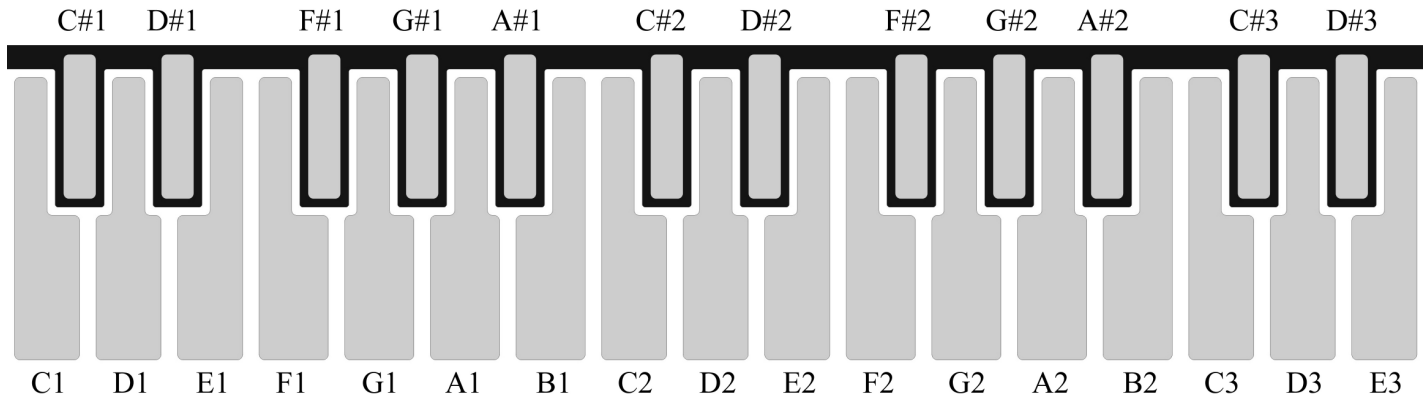LED display pattern for Partial Key Scale mapping   LED display pattern for Full Key Scale mapping
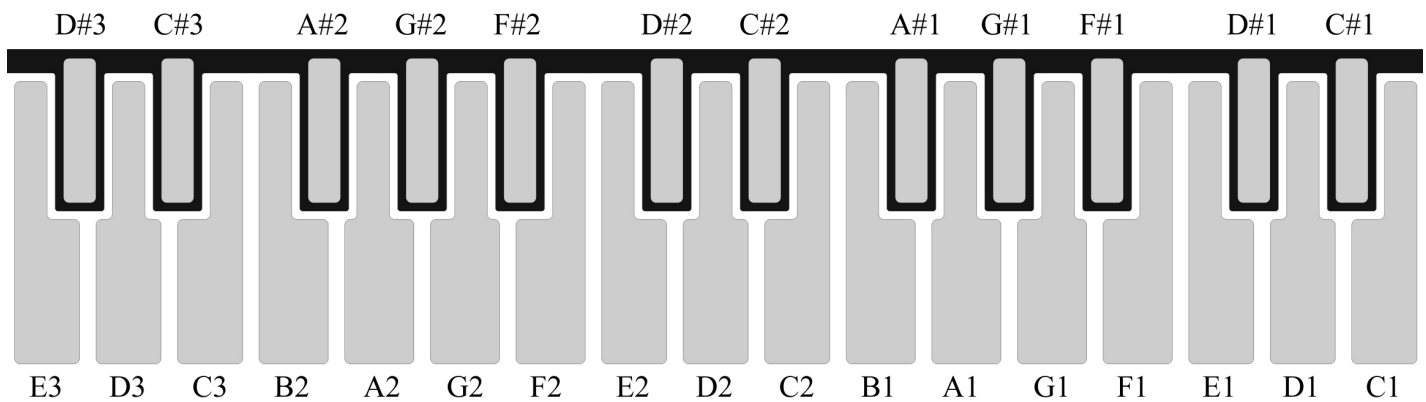
SCALE INVERSION

The **512** can invert the entire keyboard scale. This is like flipping the keys of the keyboard from left to right. Notice the symmetry of the **512**'s keyboard layout allows inverted scales to have a true mirror-like response to a non-inverted scale.

Scale inversion can be made at any time on the fly, making for some interesting changes to notes playing by the arpeggiator or sequencer. You may also want to flip the scale inversion if you are playing the keyboard upside down, or happen to be dyslexic.

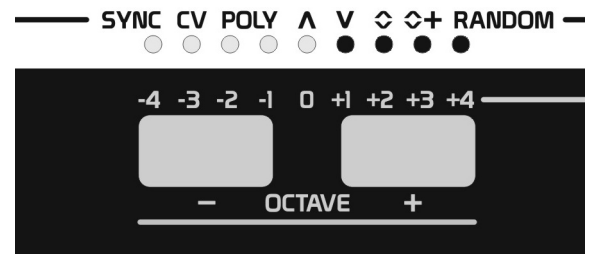The chromatic scale (non-inverted), is shown below.

| C#1 | D#1 | | F#1 | G#1 | A#1 | | C#2 | D#2 | | F#2 | G#2 | A#2 | | C#3 | D#3 |

| C1 | D1 | E1 | F1 | G1 | A1 | B1 | C2 | D2 | E2 | F2 | G2 | A2 | B2 | C3 | D3 | E3 |

The Chromatic scale inverted is shown below.

| D#3 | C#3 | | A#2 | G#2 | F#2 | | D#2 | C#2 | | A#1 | G#1 | F#1 | | D#1 | C#1 |

| E3 | D3 | C3 | B2 | A2 | G2 | F2 | E2 | D2 | C2 | B1 | A1 | G1 | F1 | E1 | D1 | C1 |

To change the scale inversion, hold the SCALE key, press and hold the DIRECTION key, and press the - key to invert the scale, or the +key to have the scale play non-inverted. Release the DIRECTION key, then SCALE key once you have selected the desired Scale Inversion.

SCALE
DURATION

DIRECTION
REST

SYNC CV POLY ∧ ∨ ⇕ ⇕+ RANDOM —

-4 -3 -2 -1 0 +1 +2 +3 +4

— OCTAVE +
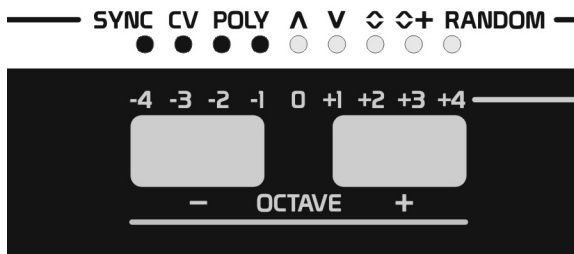
Display LED's will show the above pattern when scales are inverted.

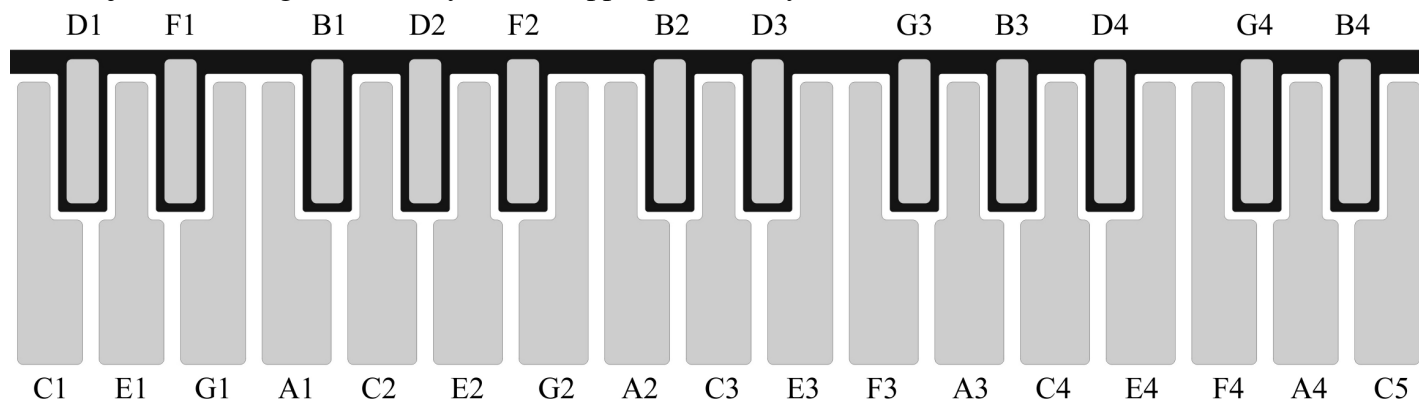SYNC CV POLY ∧ ∨ ⇕ ⇕+ RANDOM —

-4 -3 -2 -1 0 +1 +2 +3 +4

— OCTAVE +

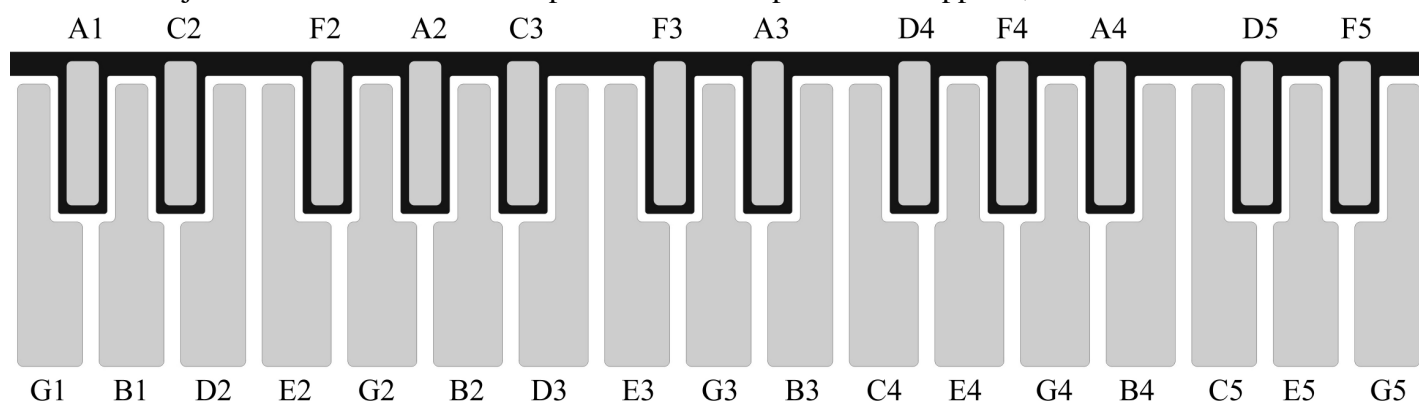Display LED's will show the above pattern when scales are non-inverted.

SCALAR TRANSPOSITION

The **512** can transpose the selected scale by up to 28 scale notes. Unlike a traditional transpose feature where notes are simply offset by a certain amount of semitones, Scalar Transposition is much more musical by shifting notes up and down the scale while confining them to play only notes within the scale.
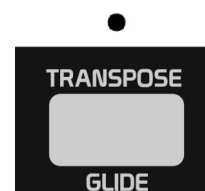
The Major scale using the Full Key Scale mapping on the keyboard is shown below.
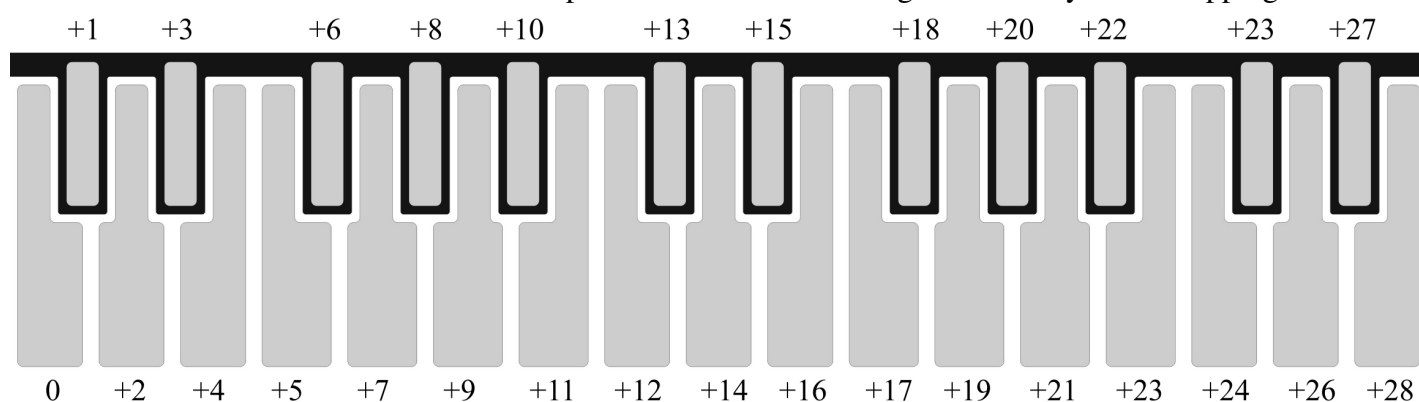
D1   F1   B1   D2   F2   B2   D3   G3   B3   D4   G4   B4

C1   E1   G1   A1   C2   E2   G2   A2   C3   E3   F3   A3   C4   E4   F4   A4   C5

The same Major scale after a Scalar Transposition of +4 steps has been applied, is shown below.

A1   C2   F2   A2   C3   F3   A3   D4   F4   A4   D5   F5

G1   B1   D2   E2   G2   B2   D3   E3   G3   B3   C4   E4   G4   B4   C5   E5   G5

To change the Scalar Transposition, hold the TRANSPOSE key, then press and release one of the 29 keyboard keys to make your selection. Release the TRANSPOSE key when you are done making a selection.

TRANSPOSE
GLIDE

Shown below are the different Scalar Transposition values when using the Full Key Scale mapping.

+1   +3   +6   +8   +10   +13   +15   +18   +20   +22   +23   +27

0   +2   +4   +5   +7   +9   +11   +12   +14   +16   +17   +19   +21   +23   +24   +26   +28

Since Partial Key Scale mapping assigns the notes of the scale to the keyboard differently than Full Key Scale mapping, instead of having 28 Scalar Transposition possibilities, there are now only 16 due to the fact that Partial Key Scale mapping only assigns new scale pitches to the major keys of the keyboard.

The Major scale using the Partial Key Scale mapping on the keyboard is shown below.

The same Major scale after a Scalar Transposition of +4 steps has been applied, is shown below.

To change the Scalar Transposition, hold the TRANSPOSE key, then press and release one of the 17 major keyboard keys to make your selection. Release the TRANSPOSE key when you are done making a selection.
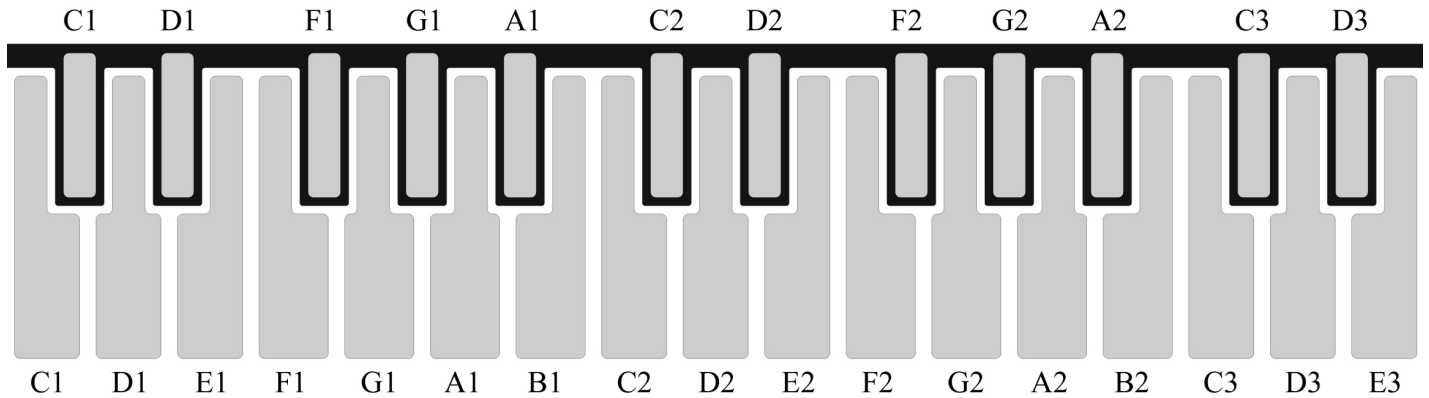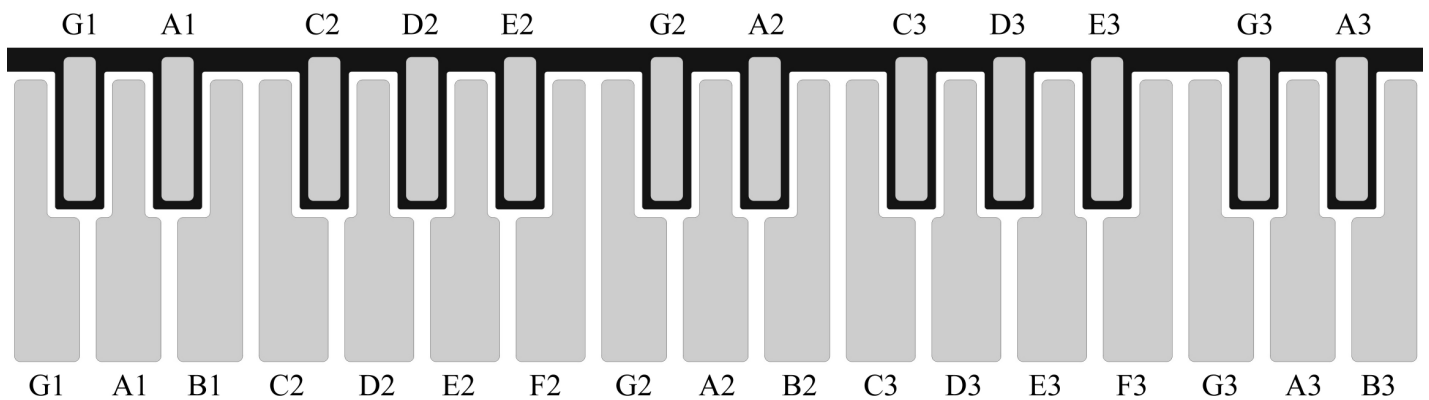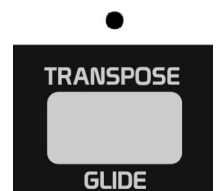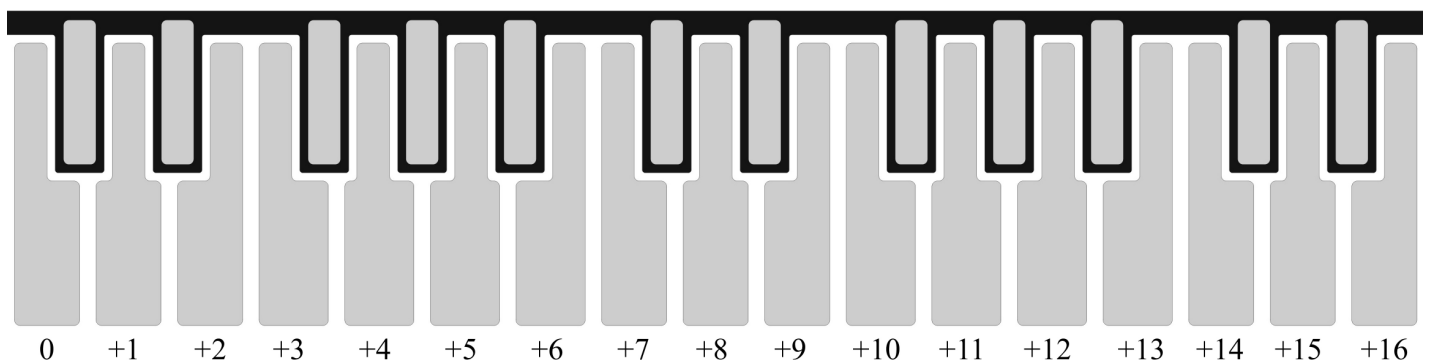

The different Scalar Transposition values when using the Partial Scale mapping is shown below.

| 0 | +1 | +2 | +3 | +4 | +5 | +6 | +7 | +8 | +9 | +10 | +11 | +12 | +13 | +14 | +15 | +16 |

Note, when new scale selections are made, Scalar Transposition will reset to a value of 0.

PROGRAMMING SCALES

It is possible to program your own music scales, to scale memory locations 1-28. However, you can not reprogram the Chromatic scale, scale 29.

Each scale allows you to record up to 29 keys, and each note of the scale can be any of the 29 Chromatic intervals on the keyboard. You may be asking yourself why? The Chromatic scale takes 12 intervals to define its scale, a Major scale takes 7 intervals to define the scale, and a Pentatonic scale takes only 5 intervals to define the scale. While there are a few scales that use more than 12 intervals, the primary reason the **512** offers 29 intervals for a scale is so you can create custom key maps of 29 pitch intervals in any order. You can even repeat the same pitch/interval if you like.

Before programming a scale, first make sure you have selected the scale location you want to write to, as described in the Selecting Scales section of the manual. Note that you can not enter Scale Record mode while the arppegiator or sequencer are playing.

To enter Scale Record mode, hold the SCALE key and press and release the PLAY key. The SCALE, PLAY, and RECORD LED's will all light to show Recording is active, and the unit is ready for you to play notes to define the scale.


Let's say you want to write the Blues Major Pentatonic scale.
Enter the notes shown below in order.
After the last interval of the scale has been entered, press the PLAY key to exit Scale Record mode.
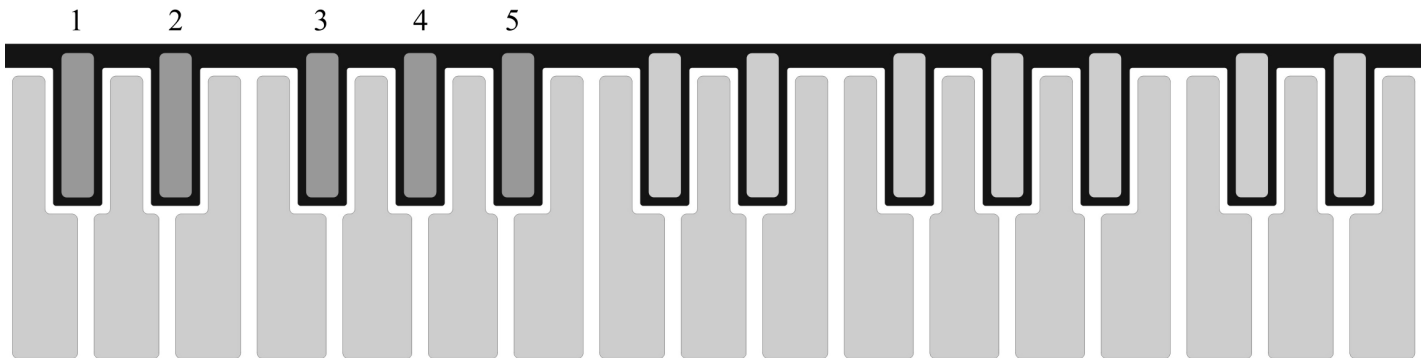
When entering scale intervals, the first key selected will be considered the root of the scale. When you are done entering intervals of the scale, the first note (or root) entered will be transposed to low C on the keyboard, while the interval of all other notes get calculated (in the order they were entered) based on their relationship to the first note entered for the scale. This allows all scales entered to automatically conform to the key of C, which makes life a lot easier when you want to play or transpose them to another key.

The pitches generated for the Blues Major Pentatonic scale (with Full Scale mapping), is shown below.
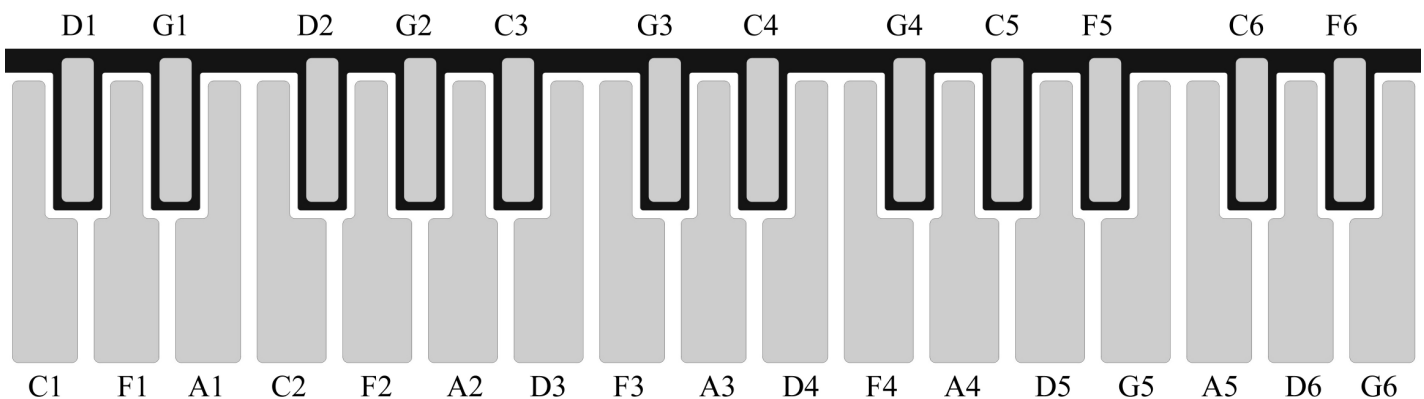
When creating traditional scales it is important that you play or enter all notes within an octave defining the scale from low to high. If you play the notes of the scale from high to low, or out of order, the scale generated reflects the order you entered. You can experiment with the results that various entry methods produce.

Once all intervals for one octave of a scale are entered, the unit will automatically generate all the higher octave intervals to fill the remaining keys of the keyboard.

You can also look at user writable scales as a way to program any order of intervals, whether it is simply the order notes are to be used for a particular melody or other part of the song. For fun, try entering a 16 step melody into a scale. Select Partial Key Scale mapping so the melody now plays as you drag your finger across the major keys labeled 1-16. Interesting! You can now strum your melody, or control the direction, and rate of playback just by moving your finger across these keys. Or try selecting different portions of the melody notes to play in new ways. Remember that you can repeat pitch/intervals too. You don't have to play them just once. You got it! Now keep experimenting with the possibilities.

CAPTURING MIDI SCALE NOTES

If the **512** is in any MIDI mode that uses CV conversion, (IE, where the **512** is looking at MIDI notes it receives to convert to CV and MIDI information), you can enter the Scale Record mode as previously mentioned, and now the **512** will create a scale based on all the MIDI notes it receives.

This can be very useful if you have a melody sequenced in another device and don't remember what scale it was written in, or are too lazy to figure it out. Simply capture the scale and then you can do other fun stuff later like, apply Scalar Transpositions, play along with your sequence on the **512** using the same scale, or perhaps you want to force notes of sequences written in various other scales to the same scale.

Before entering Scale Record mode, make sure you have stopped playback on your external sequencer, or are not currently playing notes on external MIDI keyboard. Activate scale record, then begin playing a music part from your sequencer, or playing keys on your MIDI keyboard. *You will not enter notes on the 512's keyboard.*

Once you feel all notes you would like the scale to contain have been entered, stop playback on the external sequencer or stop playing notes on your MIDI keyboard, and then exit the Scale Record mode. A new scale will be generated based on the notes that were received. However unlike entering scales from the **512**'s keyboard, when entering notes via MIDI only 12 chromatic pitch intervals can be perceived. In other words, if the **512** receives C1 and C2 it does not care that C was played in different octaves, the pitch C will now be included in all octaves of the scale. The same applies for any other pitches received in any octave.

If for instance the **512** receives the following notes: C1, D4, E2, F1, F3, G5, A3, B2, B7
…the Major Scale shown below would be generated. Notice MIDI Scale key mapping is similar to Partial Key Scale mapping, in that if a pitch is not used for the scale, its note will play the next lowest pitch that is included in the scale. Full Key Scale mapping is never used when doing MIDI to MIDI or MIDI to CV conversion.
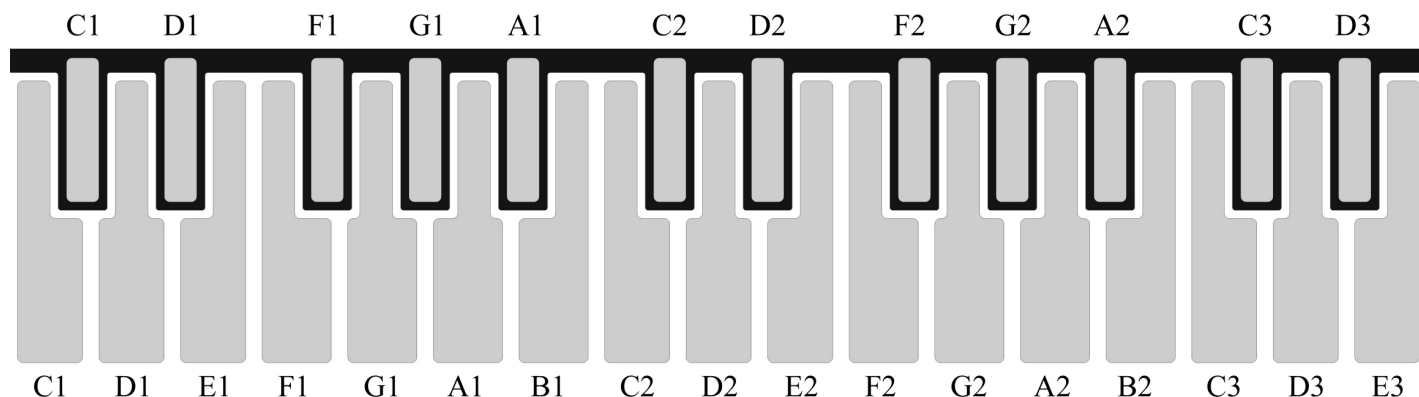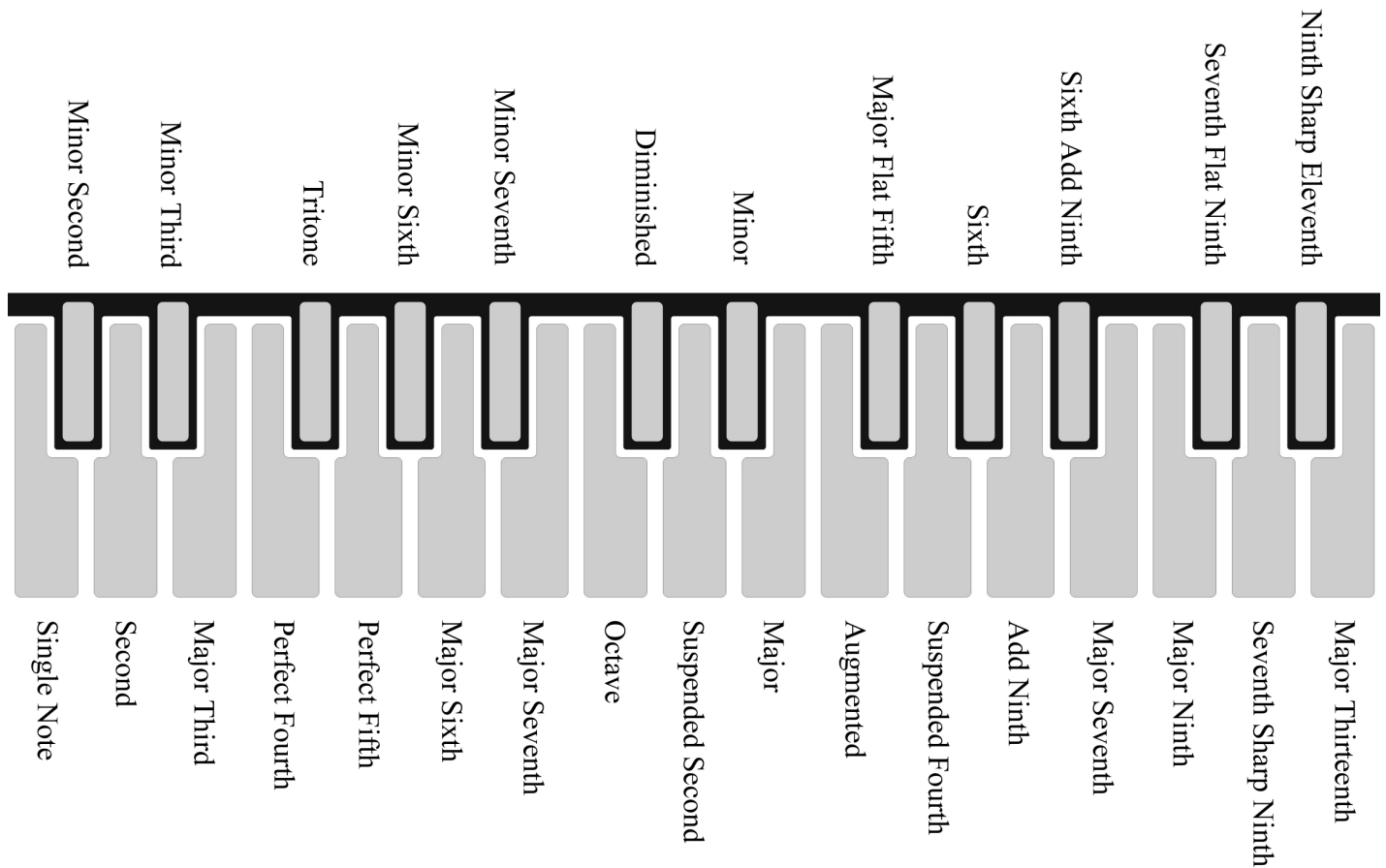
CHORDS

SELECTING CHORDS

There are 29 Chords in all that can be transmitted via MIDI when individual notes are played by the keyboard, arpeggiator, sequencer, or any external MIDI notes received while doing MIDI to MIDI conversions. This is similar to chord hold modes found on synthesizers of the past, where you can latch a chord into memory then play that chord up and down the keyboard range by playing individual keys. The **512** provides several new benefits to this method such as, you can now play up to 16 transpositions of this chord simultaneously, select different chords on the fly, and even apply +/- chord inversions to the chords notes.

The first chord in memory is not a chord at all, but is instead a single note. This memory location can not be overwritten, and should be selected any time you want the keyboard, arpeggiator, or sequencer to simply play what you entered instead of a chord. The other 28 chords can all be user defined, but are preprogrammed from the factory as shown below.

Keyboard diagram with chord labels.

Upper (black key) labels: Minor Second, Minor Third, Tritone, Minor Sixth, Minor Seventh, Diminished, Minor, Major Flat Fifth, Sixth, Sixth Add Ninth, Seventh Flat Ninth, Ninth Sharp Eleventh

Lower (white key) labels: Single Note, Second, Major Third, Perfect Fourth, Perfect Fifth, Major Sixth, Major Seventh, Octave, Suspended Second, Major, Augmented, Suspended Fourth, Add Ninth, Major Seventh, Major Ninth, Seventh Sharp Ninth, Major Thirteenth

HOLD / ACCENT

To select a chord while in the Keyboard or Arpeggiator modes, hold the HOLD key, then press and release one of the 29 keyboard keys to make your selection. Release the HOLD key after your selection has been made. Chord selections can be changed on the fly at any time.

Note, if you are selecting chords while in the Sequencer mode, or any of the MIDI to CV or MIDI to MIDI modes, you can simply press and release the HOLD key to turn Chord Selection off/on, since these modes do not allow you to use the HOLD key for other holding purposes. HOLD key LED will light when this mode is active.
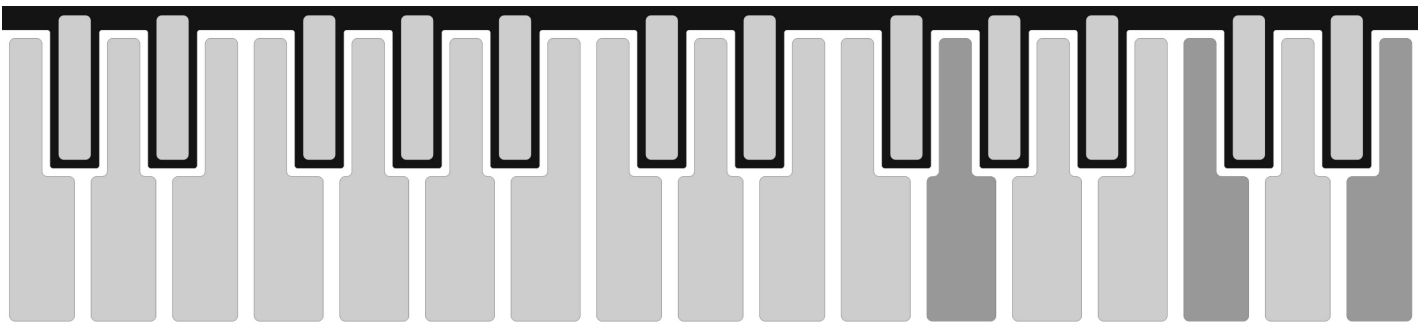
CHORD INVERSION

Chord inversion is the process of taking individual notes of a chord and transposing them up or down an octave. The **512** allows you to invert chords +/- 4 steps. Let's assume you have a Major chord selected to play, and you play middle C on the keyboard. The MIDI notes transmitted would be as though you were playing the individual notes on a keyboard, shown below. At this point the chord inversion is a value of 0.
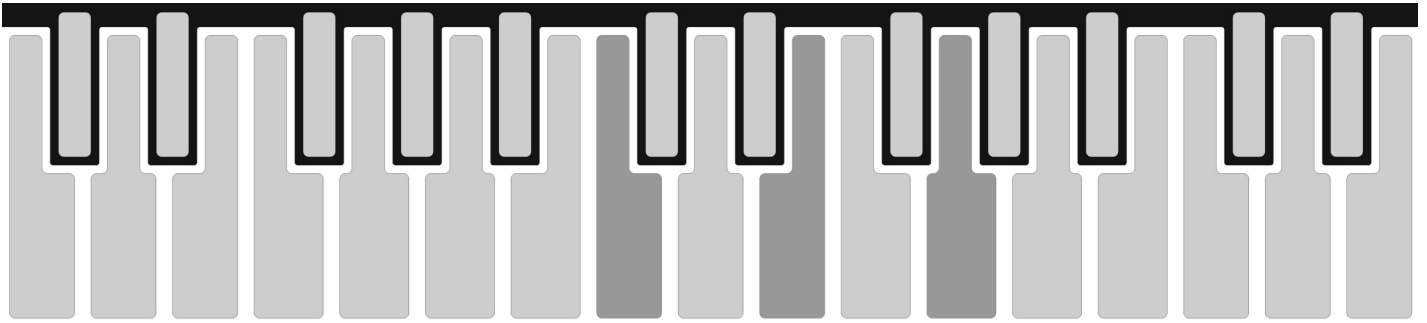
If you were to invert this chord by +1 step and play middle C on the keyboard, it would be as though you were playing the following MIDI notes.
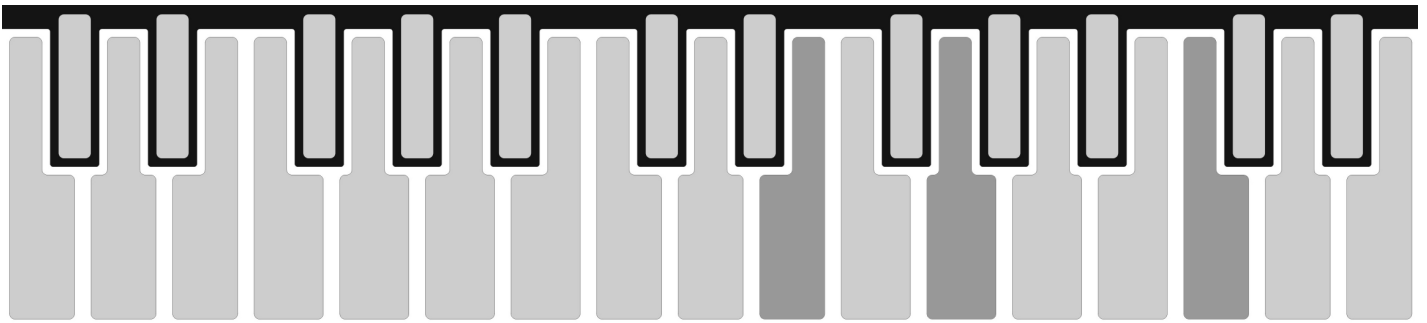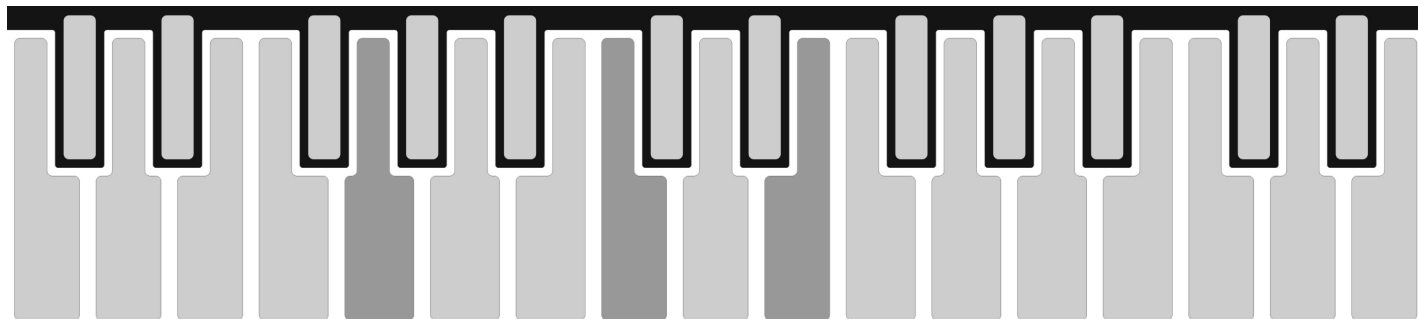

Should you invert the chord +2 steps and play middle C on the keyboard, it would be as though you were playing the following MIDI notes.


Since a 3-note chord is playing, should you select a chord inversion of + 3 steps, it would be as though you had transposed all the notes in our Major chord up to the next higher octave than the key you were actually playing.

Note, when new chords are selected the Chord Inversion value will reset to a 0 value.

If you were to instead invert this chord by -1 step and play middle C on the keyboard, it would be as though you were playing the following MIDI notes.

Should you invert the chord -2 steps and play middle C on the keyboard, it would be as though you were playing the following MIDI notes.
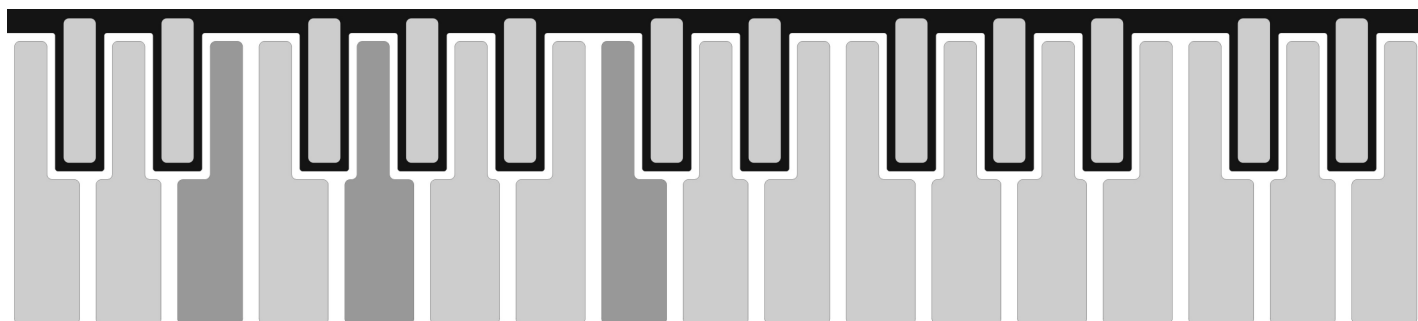
Should you invert the chord -3 steps and play middle C on the keyboard, it would be as though you were playing the following MIDI notes.
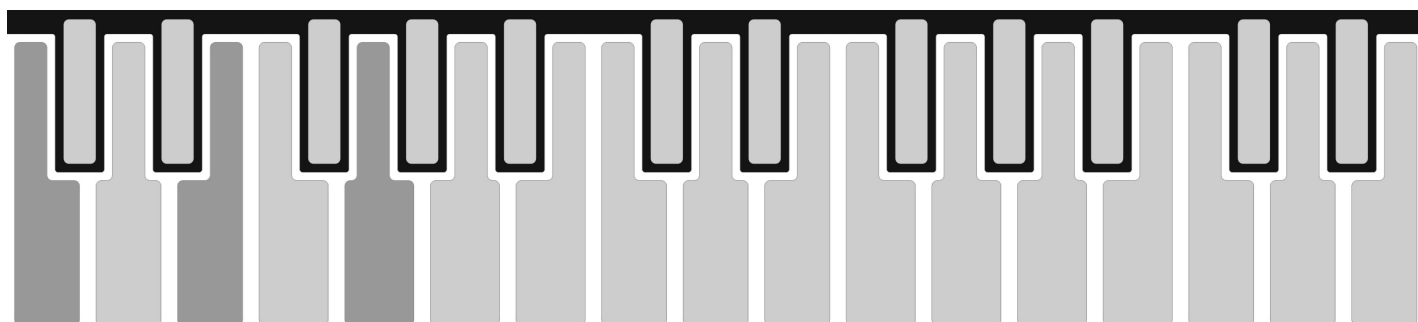
You can see that chord inversion places the chord notes in other octave ranges while maintaining the notes used to build that chord. This can be useful for taking unpleasant chords and spreading their intervals further apart to become more pleasing. It can also be thought of as a way of transposing the chord notes.

In the Major Chord example, C is considered our root note, while E is the 3rd, and G is the 5th . The **512** recognizes their order as the first note entered (or root) being the first note of the chord, while E would be the second note of the chord, and G is the third note of the chord.

Therefore, when you learn to enter your own chord notes you will understand the importance of entering chord notes from low to high, if you want to achieve the same chord inversion results just described. If instead when writing a chord, you entered the notes of the chord in an order other than C, E, and G… for one, your chord could have a different root note, and if you apply Chord Inversion the order notes are transposed reflects the order they were entered for that chord when it was recorded. Experiment as this can lead to other possibilities, and is why the **512** behaves in this way.

PROGRAMMING CHORDS

The first chord in memory is not a chord at all, but instead is a single note. This memory location can not be overwritten, and should be selected any time you want the keyboard, arpeggiator, or sequencer to simply play what you entered instead of a chord. The other 28 chords can all be rewritten, and each can contain up to six chord notes.

Before writing a chord, you must first enter the Keyboard mode, and select the chord location you want to write to, as outlined in the Selecting Chords section.

To enter Chord Record mode, hold the HOLD key and press the PLAY key. You may then release the PLAY key followed by the HOLD key. The HOLD key, PLAY key, and RECORD LED's will light showing Chord Record mode is active and ready for you to play notes of the chord.
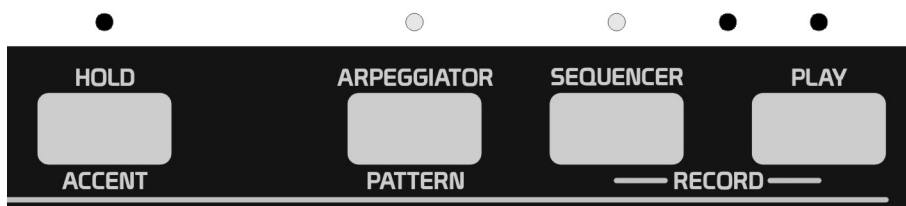
At this point chord notes may be entered one at a time using the 29 keyboard keys. You may continue to hold notes or play them in one at a time if you like, but it is not recommended that you try to play all notes of the chord simultaneously. This is because the order the notes are entered is very important to constructing the chord.

*Note, it is not possible to use external MIDI notes the **512** receives to program chords.*

The first note entered will be the root note of the chord, while all other chord notes entered will have an interval based on their relationship to the note you first played as the root. You can play a chord in any key you like, so choose whatever is easiest.

If you enter six chord notes, Chord Record mode will automatically exit since there are no more chord notes to enter. If the chord you are entering is less than six notes, simply press the PLAY key to exit Chord Record mode. The HOLD key, PLAY key, and RECORD LED's will turn off when Chord Record has been exited.

Go ahead and try out the new chord by playing notes on the keyboard. Realize that you can play up to 16 transpositions of this chord simultaneously, simply by playing up to 16 keys on the keyboard.

Notice how the root note of the chord plays at the pitch you would expect for the current scale selected. If you entered the chord notes from low to high in pitch, all additional chord note pitch intervals will play higher than the root note.

However, if you entered your chord notes from high to low in pitch, the high note becomes the root note, and the additional chord intervals are now playing lower than the root note.

Play with this and try writing the same chord to different chord locations, each using a different order for entering the chord notes.

Keep in mind that the order chord notes are entered will affect the order notes are transposed when you begin to apply Chord Inversion to the chords.

CLOCKS

While playing the keyboard, you may want to send MIDI and Analog clock signals to control the start/stop/timing of other units you want to play along with.

To start the clock, press the PLAY key. The PLAY key LED will blink at quarter-note intervals to indicate clocks are being generated. To stop sending the clocks, simply press the PLAY key again. The PLAY key LED will stop flashing indicating clocks are no longer being generated.

The analog clock pulse will have a 50% on/off duration.

TIME SIGNATURES
When using the Analog CLOCK output, you can choose any of four time signatures for the analog clock to generate. Time signatures can be: 1/4, 2/4, 3/4, and 4/4. Time signatures will also affect the rate at which arpeggiations and sequences play internally or sync to external MIDI clocks. Time signatures have no affect on MIDI clocks that are transmitted to other devices.

To select or change a time signature, hold the MIDI key, then press and hold the SCALE/DURATION key.
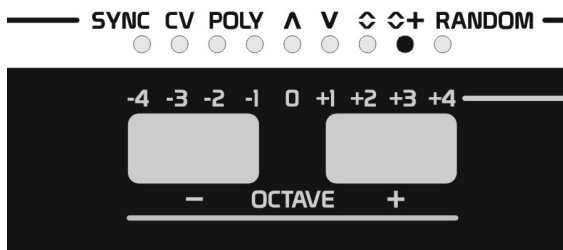
While holding these two keys, the display LED's will light to indicate the time signature currently selected, as shown below.
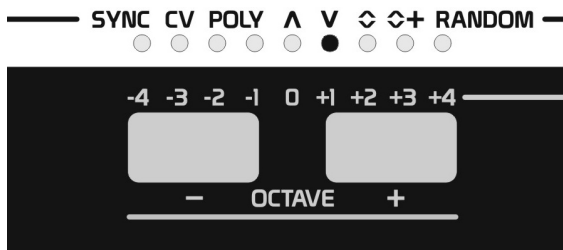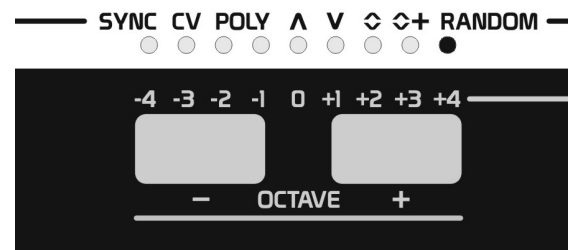
Time signature 1/4 is selected
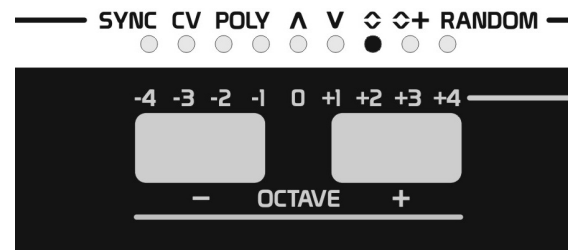
Time signature 2/4 is selected

Time signature 3/4 is selected

Time signature 4/4 is selected

Use the -/+ keys to select the desired time signature. Release the SCALE key, then release the MIDI key once a selection has been made. Changes made to the new time signature will take affect at 1-bar intervals.

The top (first) number in the time signatures indicate the number of notes per beat, while the bottom (second) number in the time signature indicates the number of beats per bar.

With 1/4 time signature, 4 clocks will be generated per bar.
With 2/4 time signature, 8 clocks will be generated per bar.
With 3/4 time signature, 12 clocks will be generated per bar.
With 4/4 time signature, 16 clocks will be generated per bar.

TEMPO

The TEMPO control allows you to adjust the tempo from 20 to 250 BPM.
The tempo will increase as you rotate the TEMPO control clock-wise.
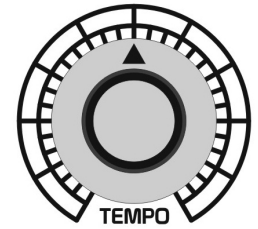
SWING

The SWING control provides a human shuffle or swing feel to the timing of clocks.
The SWING amount will affect timing of the analog CLOCK output, as well as the
timing of notes played by the internal arpeggiator and sequencer. The swing amount
ranges from 50% to 75%. At a 50% setting timing will sound very rigid or quantized.
As you increase the swing amount, odd numbered steps become longer in duration,
while even numbered steps become shorter in duration.
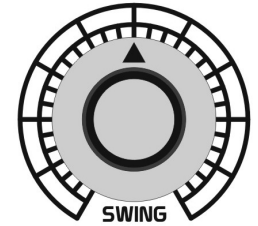
GLIDE

The GLIDE control determines the time it takes for one KEY CV value to transition
to another value. With the GLIDE control turned full counter-clockwise KEY CV
values will jump instantly from one value to another. As you increase the GLIDE
control amount, the KEY CV will take longer to smoothly transition to new KEY CV
values.

The **512** uses Autoglide circuitry. This means that notes only glide when certain
conditions are present.

When playing the keyboard, Autoglide is activated whenever two or more notes are held. Once the second
note is played, the pitch of the first note glides to the pitch of the second, or most recently played note.

The KEY CV produced is last-note priority, meaning if multiple keys are played, only the last key's pitch is
present at the output. The **512** can keep track of the order in which up to 16 notes are played. In this way, if
multiple notes have been played and then you release the last played note, the KEY CV will then output the
CV for the key played just prior to the note you just released.

When using the arpeggiator or sequencer, the patterns stored in memory allow you to define what steps will
glide.

Note, the GLIDE control will not have any affect on note pitches sent to MIDI sound modules.

*Tip: Try sweeping your finger through the keyboard keys using a light touch or the side of your finger only,
and notice notes will usually jump in nice semi-tone intervals without activating the Autoglide circuit.
However if you apply more surface area of your finger or turn it slightly sideways as you drag it across the
keys you are more likely to engage the Autoglide circuit and create a smooth sweeping through the various
pitches played.*

MIDI

MIDI CHANNEL

The **512** can transmit data on multiple or single MIDI channels depending on if Poly MIDI modes have been selected or not. The base MIDI channel (1-16) can be selected at any time on the fly, allowing you to redirect MIDI data when using the keyboard, arpeggiator, sequencer, or performing MIDI to MIDI conversion. This can produce some very interesting results, and is something you should definitely play with!

To change the base MIDI channel, press and hold the MIDI key, then press one of the keyboard keys labeled 1-16 to make your selection.

These keys select MIDI channels 1-16 while the MIDI key is held.

AFTERTOUCH

While holding the MIDI key, the ^ LED will light to indicate if the **512** will transmit aftertouch messages over MIDI or not. If this LED is on, the **512** will transmit aftertouch via MIDI. If the LED is off, no aftertouch messages will be sent via MIDI although touch voltages will still be available at the TOUCH analog output. You may wish to turn this feature off if the MIDI device you are controlling does not respond to aftertouch.

To turn aftertouch on or off, while holding the MIDI key, press high E on the keyboard.

Display LED's show aftertouch is on.

Display LED's show aftertouch is off.

Notice the up/down LED lights to indicate you are editing MIDI parameters, as MIDI is sent and received.

VELOCITY CURVES

The **512** has five selectable Velocity Curves that can be applied to the way the keyboard keys detect velocity. These curves are shown below.
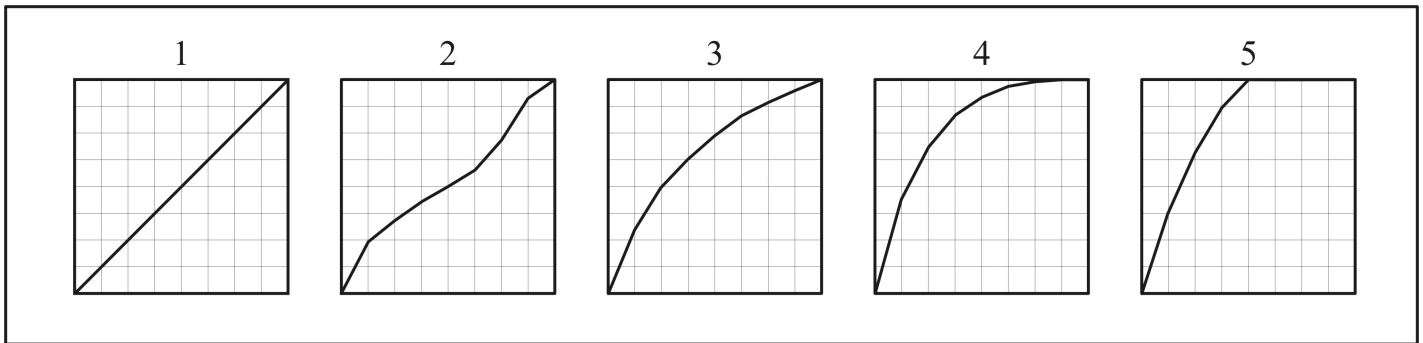

To select a Velocity Curve, hold the MIDI key, then press and release one of the five keyboard keys shown below.
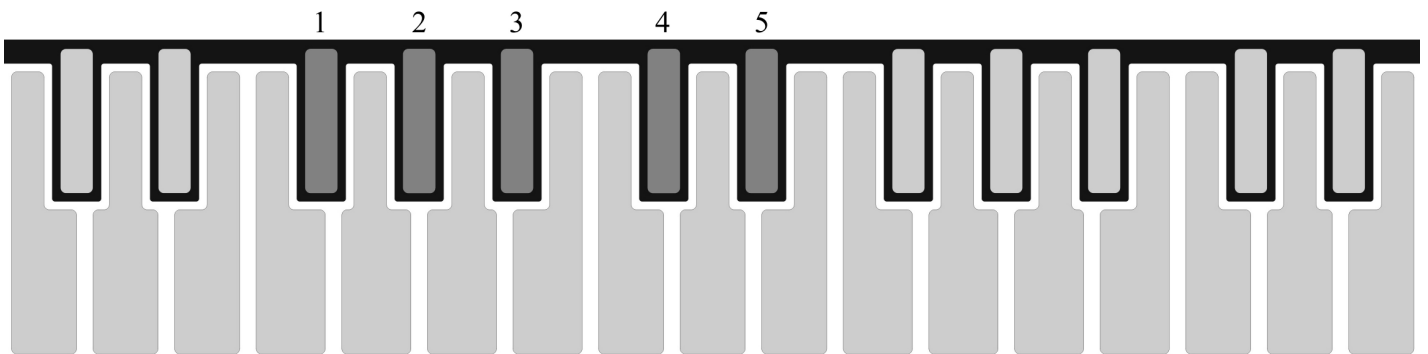
In addition to these curves, you can also select nine limits in which velocity is detected for each curve. If you continue to hold the MIDI key after selecting a Velocity Curve, the display LED's will show the range in which velocity can be detected.

To adjust the Velocity Curve limit, while holding the MIDI key (after a Velocity Curve is selected), use the -/+ keys to adjust the range. Pressing the –key will lower the limit range, and pressing the +key will increase the limit range.
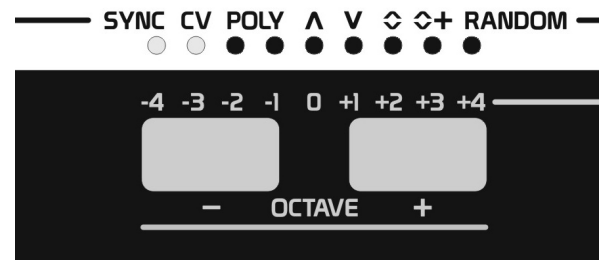

When the limit is adjusted all the way down (all LED's on), you will have the widest range of velocity sensitivity from the keyboard. As you increase this limit, and fewer LED's remain on, you are in essence raising the lowest possible velocity value the keyboard can produce. So with a very high limit, even the softest touch on the keyboard may be sent as a very high velocity value.

These adjustments can really help alter the response of the keyboard to better suite your body's capacitance, and playing technique.

AFTERTOUCH CURVES

The **512** has five selectable Aftertouch Curves that can be applied to the way the keyboard keys detect aftertouch. These curves are shown below.
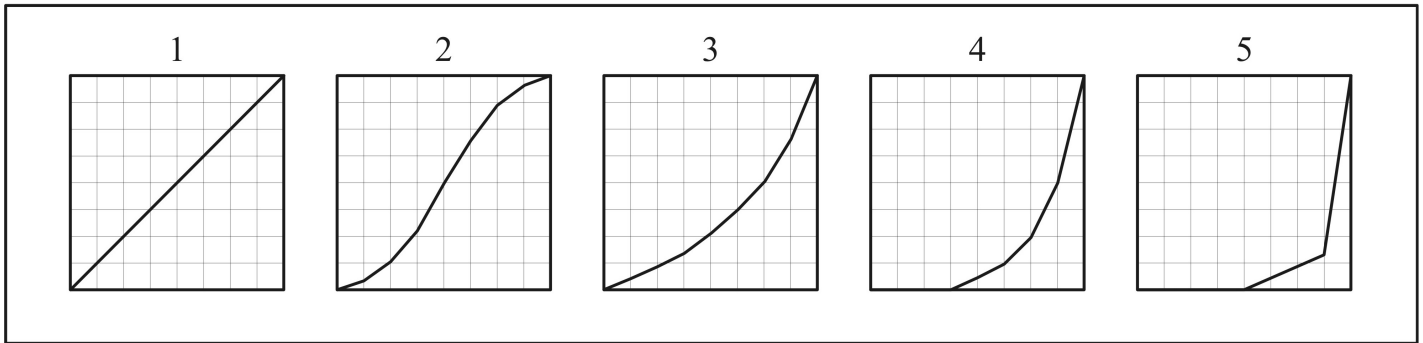

To select an Aftertouch Curve, hold the MIDI key, then press and release one of the five keyboard keys shown below.
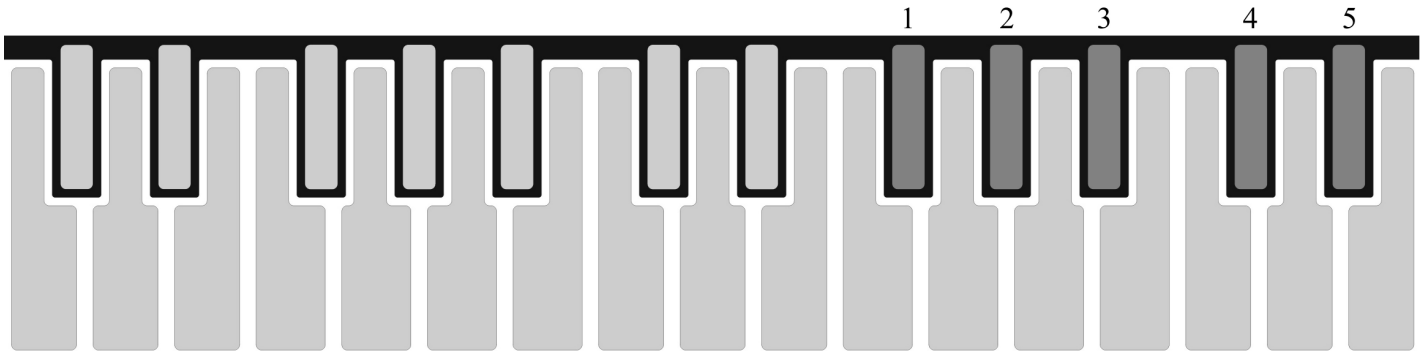
In addition to these curves, you can also select nine limits in which aftertouch is detected for each curve. If you continue to hold the MIDI key after selecting an Aftertouch Curve, the display LED's will show the range in which aftertouch can be detected.

To adjust the Aftertouch Curve limit, while holding the MIDI key (after an Aftertouch Curve is selected), use the -/+ keys to adjust the range. Pressing the –key will lower the limit range, and pressing the +key will increase the limit range.
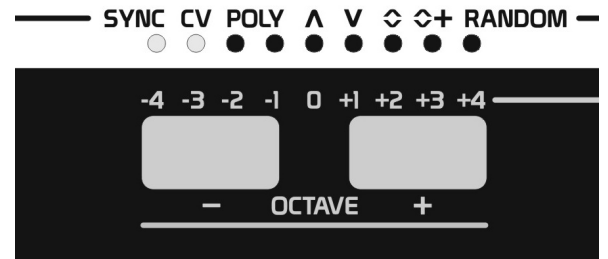
When the limit is adjusted all the way down (all LED's on), you will have the widest range of aftertouch sensitivity from the keyboard, allowing aftertouch messages to be generated with even the softest of touches. As you increase this limit, and fewer LED's remain on, you are in essence raising the level in which aftertouch values will begin to be detected. So with a very high limit, it will become increasingly harder to engage an aftertouch sense.

This allows aftertouch to work over the full range of touch, or you can limit the range to only very large touches which will provide a more traditional aftertouch response, and prevent aftertouch from engaging when notes of high velocity are played.

These adjustments can really help alter the response of the keyboard to better suite your body's capacitance, and playing technique.
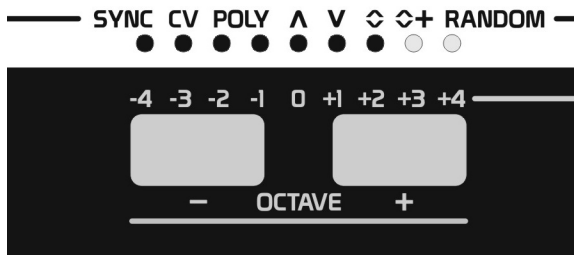
PITCH BEND RESPONSE

You can adjust the Bend Up/Down key's response to touch as well. While this setting will affect MIDI Pitch Bend messages, it will have a greater affect on the KEY CV voltage output. This is because the DAC generating the KEY CV voltages is updated much more quickly than MIDI can be transmitted.

If you are using the KEY CV output and you notice when doing a partial pitch bend that the pitch tends to waiver, you should try increasing the response value setting which will smooth the control voltage and make it much more stable. Alternatively, you may find the pitch bend response is too slow for your liking, and would prefer to decrease the response value.

Since MIDI data is updated less frequently than the DAC's voltage, you should not notice any instabilities. However you can still adjust the response time to get faster or slower pitch bends. With higher settings you get a response similar to using a traditional keyboard's pitch bend wheel. With lower settings you get much faster response times than you may be used to.

To adjust the Pitch Bend Response, hold the MIDI key, then press and hold the BEND UP key. The display LED's will light to show the current response value. Press the –key to decrease the response time, or the +key to increase the response time.

When you are finished making adjustments, release the BEND UP key, then release the MIDI key.

Display LED's show the response value
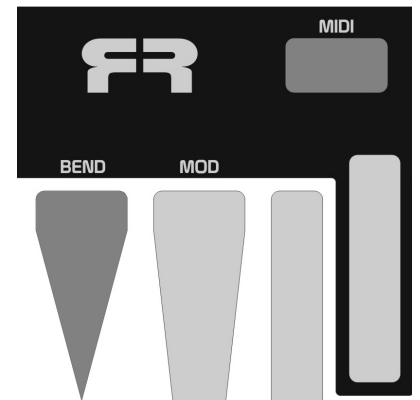
MOD RESPONSE

Similarly to how you can adjust the Pitch Bend Response, you can also adjust the Mod Response. This will affect the response time of the MOD voltage output, as well as Pitch Bend messages transmitted via MIDI.

To adjust the Mod Response, hold the MIDI key, then press and hold the MOD key. The display LED's will light to show the current response value. Press the –key to decrease the response time, or the +key to increase the response time.

When you are finished making adjustments, release the MOD key, then release the MIDI key.

23
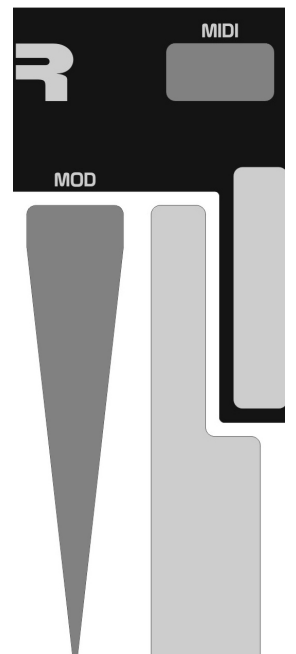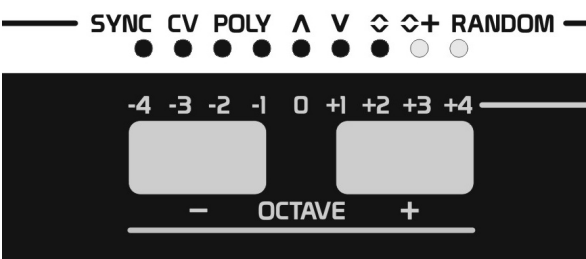
BEND RANGE

The Pitch Bend Range can also be adjusted between Full, or Half range amounts. When Full Range is selected, the BEND keys will respond just as you would normally expect a pitch bend wheel to work on a traditional synthesizer, generating a full range of MIDI and KEY CV bend information.

Quite a few synthesizers have a default bend range to +/- 2 semitones. And in some cases this range is not adjustable. But what if a person only wanted to bend notes in a range of +/- 1 semitone? This could allow you to more realistically recreate the affect of bending a guitar string, or allow other more minute pitch modulations to occur. In such a case, this is why the 512 provides the Half Bend Range.

To select a range for the BEND keys, hold the MIDI key, and then press and release one of the two keyboard keys shown below. Once your selection has been made, release the MIDI key.

HALF   FULL
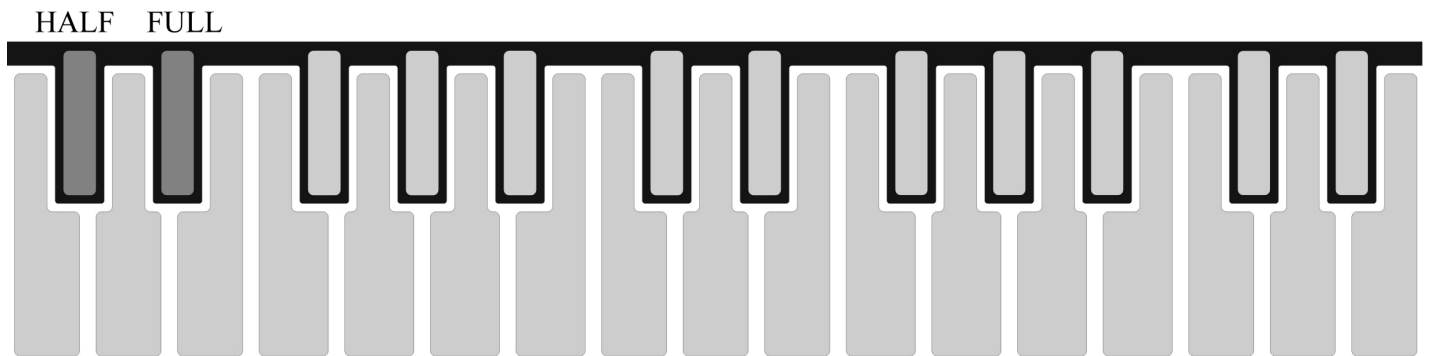
KEY CV OCTAVE OFFSET

It is possible to adjust the 0 voltage reference for the KEY CV output over 5 different octaves. This allows you to better align the octave range of notes being generated in an analog synthesizer verses those being played via MIDI.

To adjust the KEY CV offset, hold the MIDI key, then press and hold the TRANSPOSE key. The display LED's will light to show a selection of 0, +1, +2, +3, or +4. Use the -/+ keys to select the desired offset value. As you increase the offset value, the 0 voltage reference for KEY CV output will be shifted up in octave increments. Once you are satisfied with the selection, release the TRANSPOSE key, then release the MIDI key.
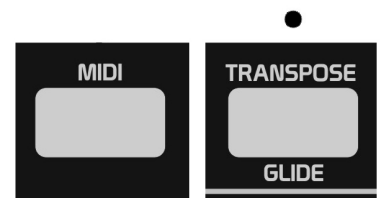
With an offset of 0, the KEY CV output will produce 0 volts when low C is played on the keyboard, and the lowest Octave range is selected.
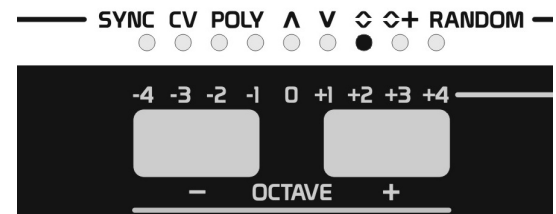
SAVING YOUR MIDI PREFERENCE SETTINGS

Now that you have set the unit up to your liking, it would be a good idea to save off these preferences so they will always be recalled each time the unit is powered on.

To save the MIDI channel, Aftertouch On/Off status, Velocity Curve and Range, Aftertouch Curve and Range, KEY CV offset, Bend Range, and Bend and Mod Response, hold the MIDI key and then press and release the PLAY key. The RECORD LED will flash briefly and saving is complete. You can now release the MIDI key.

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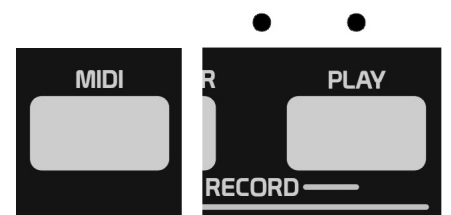
MIDI MODES

There are eight MIDI mode selections. These modes define how the unit will use MIDI in various ways. MIDI mode selection can not be changed if you are currently playing notes on the keyboard, playing the internal arpeggiator or sequencer, or while receiving MIDI note data while in one of the MIDI to MIDI converter modes. You will need to stop playing keys on the keyboard, stop playback of the arpeggiator or sequencer, or stop sending external MIDI notes before a new selection can be made.

To change MIDI mode selections, hold the MIDI key, and use the -/+keys to make a selection. The three left-most display LED's will light to indicate the current MIDI mode selection. Release the MIDI key once a selection has been made.

IMPORTANT: When selecting any MIDI mode that does CV conversion (CV LED is on), the 512 will define the MIDI IN channel as the base MIDI channel currently selected at the time you enter any of the CV MIDI modes. So if you want the **512** to respond to notes coming in on MIDI channel 1, make sure you have selected a base MIDI channel of 1 before selecting this CV MIDI mode. Once the CV MIDI mode has been selected you can change the base MIDI channel to whatever channel you want the 512 to send MIDI data on.

NORMAL
Normal is the default MIDI mode selected when the unit is first turned on. This mode is identified with all MIDI mode LED's being off.

In Normal mode, the unit carries out all operations internally. The **512** will ignore any devices connected to the MIDI IN jack.
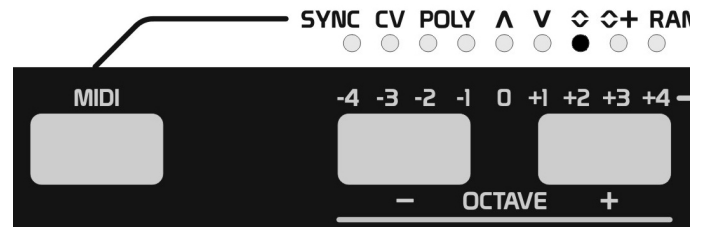
SYNC
The Sync MIDI mode allows the **512** to use external MIDI start/stop/clock commands to control and sync playback of the arpeggiator, sequencer, or when you simply want to generate analog clocks in time with MIDI clocks.
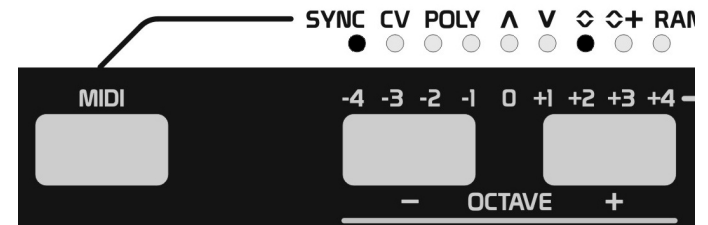
CV
The CV mode allows the **512** to perform MIDI to CV conversion and MIDI to MIDI conversion using a single MIDI channel out.

In this mode the **512** will convert MIDI Note On/Off, Pitch, Pitch Bend, Mod Wheel, Velocity, and Aftertouch messages it receives into the appropriate analog Gate and CV outputs.
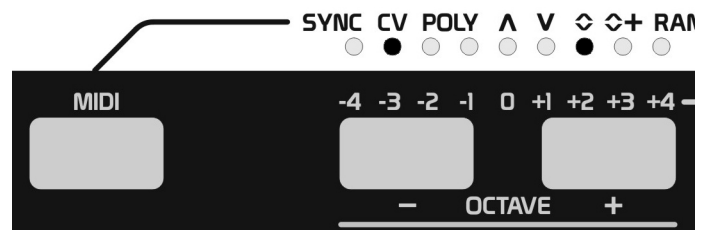
In addition, you can change the base MIDI channel on the fly and redirect MIDI information the **512** receives to then transmit this data on any of 16 possible MIDI channels. Cool!

Let's say you have a rather basic MIDI sequencer hooked up to the **512** while doing MIDI to CV and MIDI to MIDI conversion, and that sequencer only sends Note On/Off, Pitch, and Velocity data. Wouldn't it be great if you could add Pitch Bend, Mod Wheel, and Aftertouch values to the information the sequencer is generating? Well you can!

Simply use the **512**'s BEND and MOD keys for adding Pitch Bend and Mod Wheel messages. Aftertouch messages will be added anytime you touch the keyboard keys. Aftertouch messages will be sent even when you select other parameter values using the keyboard. Say what…? You can add aftertouch while selecting a transpose value, changing the MIDI channel, selecting a scale, selecting chords and so on.

Not only can you add to the MIDI data the **512** receives you can totally manipulate it.
In fact you can force incoming MIDI notes to any of the **512**'s scales simply by selecting the appropriate scale, transpose incoming MIDI notes in semitones using the keyboard, do Scalar Transpositions, add Chords, apply Chord Inversions, or change the MIDI channel… all on the fly, Seriously!

If you select chords to play, all chord notes will be transmitted on the base MIDI channel selected.

While in CV mode, you can still activate the internal clock to produce both analog CLOCK and MIDI clock signals, and vary the Tempo or Swing amounts.

SYNC/CV
The SYNC/CV mode provides all the functionality of the CV mode, with the added feature of converting external MIDI clock messages into analog CLOCK signals.
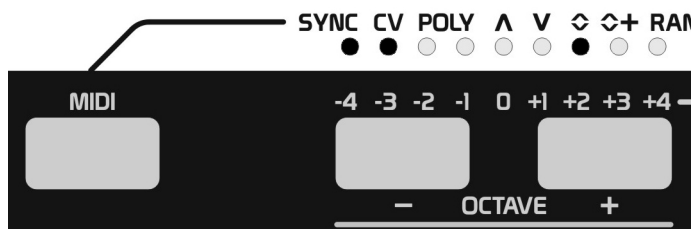
Keep in mind the time signature selected in the **512** will determine the rate of the analog CLOCK signal generated.

Varying the amount of Swing will also affect the timing of the analog CLOCK signal generated.

POLY
The POLY mode allows the **512** to send multiple notes played on the keyboard, or chord notes played by the arpeggiator and sequencer, to be intelligently redirected so each note is transmitted on a different MIDI channel. This allows you to play up to 16 monophonic synthesizer voices polyphonically.
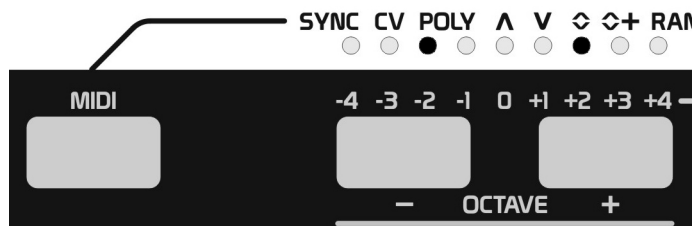
The first note will be transmitted on the base MIDI channel the **512** is set to send MIDI data on. Each additional note you wish to play will be sent on the next available (higher) MIDI channel. If the base MIDI channel is set to 15, and you play a 3-note chord, the first note plays on channel 15, the second note plays on channel 16, and the third note wraps around to play on channel 1.

You will need to route the MIDI OUT of the **512** to the MIDI IN of each synthesizer you want to play. You can either daisy-chain MIDI connections if your synthesizers have THRU ports on them, or use a MIDI THRU box to send the **512**'s MIDI OUT signal to all sound modules in parallel.

Set the MIDI channel of the sound module you want to use for the first voice to the same value as is set for the base MIDI channel of the **512**. Each sound module used for additional voices should be set +1 MIDI channel higher than the previous sound module.

The **512** will send Pitch Bend, Mod Wheel, Velocity, and Aftertouch to all MIDI channels playing voices.

When in Keyboard Mode, and playing chords in memory, the chord notes will all be sent on the same MIDI channel for that voice. Since arpeggiations and sequences only generate one note at a time, if chords in memory are played, each note of the chord is assigned to a unique MIDI channel.

POLY/SYNC

The POLY/SYNC mode provides all the functionality of POLY mode with the addition of using external MIDI start/stop/clock commands to control and sync playback of the arpeggiator, sequencer, or when you simply want to generate analog clocks in time with MIDI clocks.
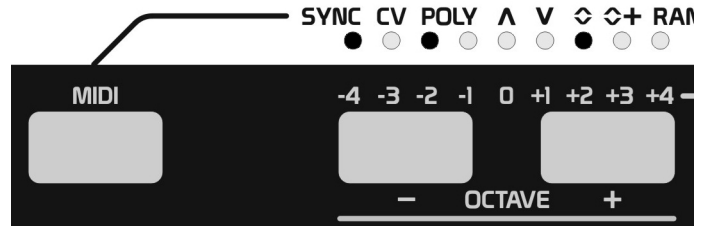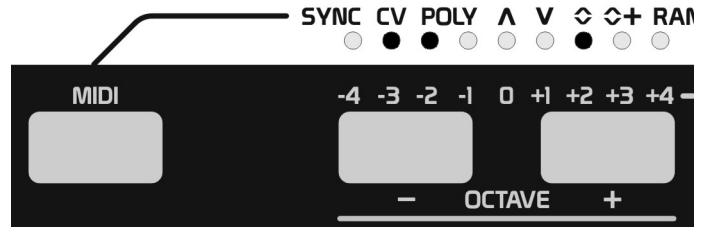
POLY/CV

The POLY/CV mode allows the **512** to act as a MIDI to CV and MIDI to MIDI converter. Whenever the **512** receives multiple notes played simultaneously from any external MIDI equipment it will intelligently redirect each note to be transmitted on a different MIDI channel. This allows you to play up to 16 monophonic synthesizer voices polyphonically using external MIDI sequencers or controllers.

Keep in mind that while this mode does do MIDI to CV conversion, since the **512** is most likely receiving multiple MIDI notes to play, the KEY CV generated will always be what the **512** perceives as the last received MIDI note.

Just as the (non-Poly) CV mode allows, you can use the **512**'s BEND and MOD keys for adding Pitch Bend and Mod Wheel messages. Aftertouch messages will be added anytime you touch the keyboard keys. Aftertouch messages will be sent even when you select other parameter values using the keyboard. You can add aftertouch while selecting a transpose value, changing the MIDI channel, selecting a scale, selecting chords and so on.

Not only can you add to the MIDI data the **512** receives you can totally manipulate it.
In fact you can force incoming MIDI notes to any of the **512**'s scales simply by selecting the appropriate scale, transpose incoming MIDI notes in semitones using the keyboard, do Scalar Transpositions, add Chords, apply Chord Inversions, or change the MIDI channel… all on the fly!

It should be noted that the POLY modes of the **512** are not just for playing multiple monophonic synthesizers, it can also be tremendous fun when used to play a single multi-timbral polyphonic MIDI sound module. Simply assign each voice within that sound module to a different MIDI channel, and for good fun set each voice to a different (although similar) sound, and listen to what happens.

With this setup be sure to try changing the base MIDI channel on the fly.
Oh… the possibilities you are about to discover!

POLY/SYNC/CV

The POLY/SYNC/CV mode provides all the functionality of the POLY/CV mode, with the added feature of converting external MIDI clock messages into an analog CLOCK signal.

Keep in mind the time signature selected in the **512** will determine the rate of the analog CLOCK signal generated.
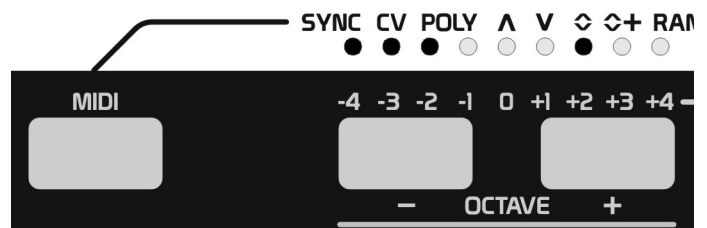
Varying the amount of Swing will also affect the timing of the analog CLOCK signal generated.

RANGE AND DIRECTION

The Range and Direction functions are usually found as features within an arpeggiator. However the **512** allows you to apply these same features to sequences as well.

RANGE

The Range feature allows arpeggiations and sequences to transpose notes to higher or lower octaves for a defined number of times. This will happen every time the arpeggiation or sequence completes a Direction or reaches a Loop point.

There are nine selections for the Range. At power-up, the unit defaults to a Range value of 0, meaning arpeggiations and sequences will only play pitches entered into them with no additional transpositions occurring. You may also select a Range value of +/- 1, 2, 3, or 4 octaves.

With a Range value of +3, an arpeggiation or sequence will first play notes as they were entered, then play that same pattern again transposed 1 octave higher, then play transposed 2 octaves higher, and finally play transposed 3 octaves higher. Once the third octave transposition finishes, the pattern will return to playing with a transposition of 0, and the entire transposition process starts all over again.

If you select a negative value for the Range, the pattern would begin playing as entered, and then play the same pattern an octave lower. This will continue to happen for the number of times defined by the value selection until the whole process loops back around and begins again.

To change the Range value, hold the RANGE key. The display LED's will light to show the current Range selected. Use the -/+ keys to select the desired Range value. Once satisfied with your selection, you can release the RANGE key.


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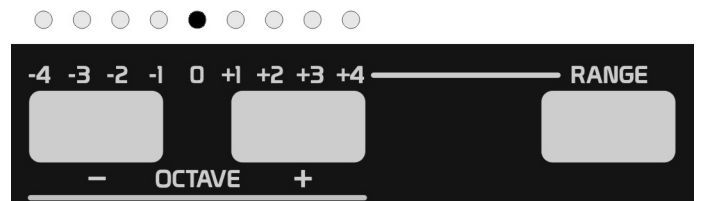
DIRECTION

The Direction feature determines the order that arpeggiator and sequencer patterns will play. There are five directions to choose from, and the symbols above the five right-most display LED's help identify these directions.

To change the Direction value, hold the DIRECTION key, and use the -/+ keys to select the desired Direction. Once satisfied with your selection, you can release the DIRECTION key.
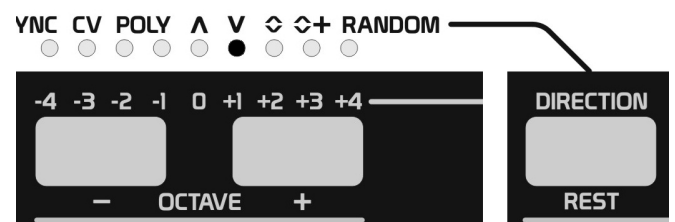
UP
The Up direction plays notes in the order they were originally entered.
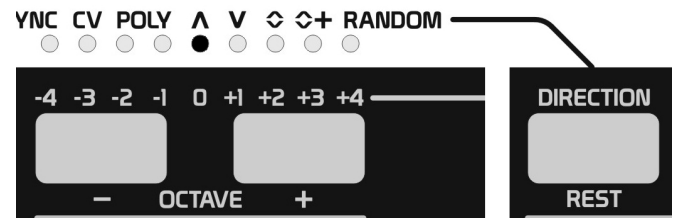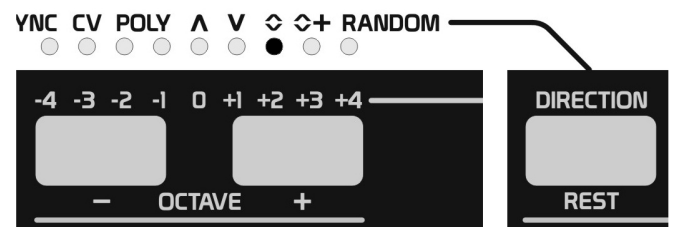
DOWN
The Down direction plays notes in the reverse order of how they were entered.

UP/DOWN EXCLUSIVE
This direction will play notes as entered, and then reverse the order played without repeating the first or last note entered. As an example, if and arpeggiation or sequence is to play four notes, they will play as: 1, 2, 3, 4, 3, 2, and then continue repeating this pattern over and over.

UP/DOWN INCLUSIVE
This direction will play notes as entered, and then reverses the order played. As an example, if and arpeggiation or sequence is to play four notes, they will play as: 1, 2, 3, 4, 4, 3, 2, 1 and then continue repeating this pattern over and over.
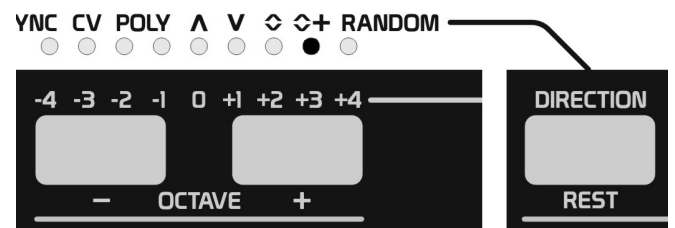
RANDOM
The Random direction will randomly select and play any of the notes that have been entered into the arpeggiation or sequence.
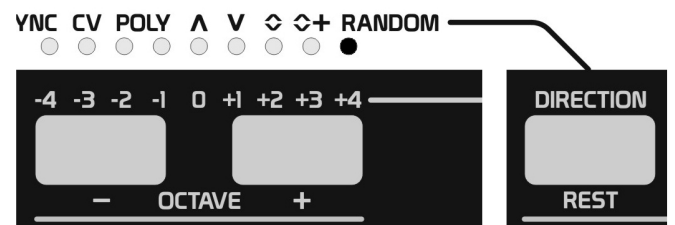
Note, when playing a direction other than UP, Sustained notes may sound slightly different, allowing notes programmed after the sustained step to be audible while other steps no longer play because they are now following another step's sustain. Keep this in mind while entering notes values into steps that follow any other step set to sustain. Treat them as though at some point they can be audible.

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ARPEGGIATOR

The Arpeggiator can be used to quickly generate simple melodies by holding notes on the keyboard or by entering and holding notes into memory.

PLAYING THE ARPEGGIATOR

To select the Arpeggiator, while in the Keyboard mode, press and release the ARPEGGIATOR key. The ARPEGGIATOR key LED will light to show the Arpeggiator mode is now active.

To exit the Arpeggiator mode, and return to Keyboard mode, simply press the ARPEGGIATOR key so that its LED is off.

Once in the Arpeggiator mode, you must press the PLAY key for the arpeggiation to begin. The PLAY key LED will then blink at 1/4 note intervals to indicate the arpeggiator is playing.
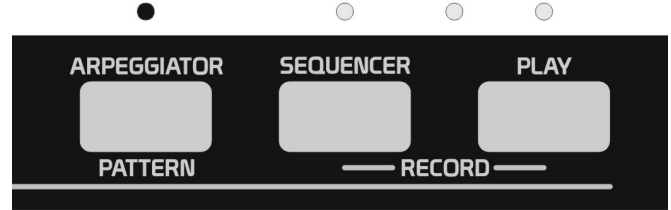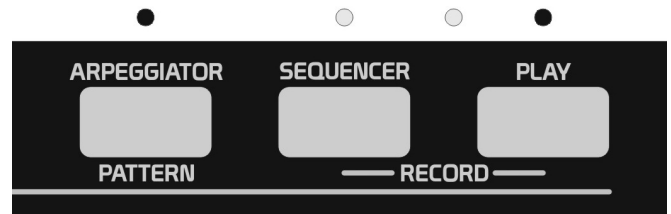
To stop playback of the arpeggiator, simply press the PLAY key again, turning the PLAY key LED off.

Assuming you have entered the Arpeggiator mode and have started playback, go ahead and hold notes on the keyboard, and they will begin arpeggiating from low to high (as long as the UP Direction is currently selected). Try playing different note combinations and using different Direction or Range settings as you learn what the arpeggiator is capable of.

Feel free to play with the BEND and MOD keys, or alter the touch of the keys you are holding to arpeggiate to generate aftertouch control as well.

Once you have a combination of keys playing that you like, press and release the HOLD key. The HOLD key LED will light indicating Hold is now activated, and you can remove your hands from the keys, or continue adding more notes to those already being held. When all keys are released the notes will continue arpeggiating.

Now that your hands are free, the real fun begins. Go ahead and play with selecting different Scales, choosing different Octave values, Transposing the arpeggiation, applying Scalar Transposition, selecting Chords, add Chord Inversions, change the MIDI channel on the fly, or check out all the combinations of Range and Directions and the affect they have on the pattern currently playing.

While Hold is active, if you make a new selection of notes on the keyboard to arpeggiate, this will overwrite the previous notes being held and only the new notes will arpeggiate. Another benefit of entering notes with Hold activated is that you can enter notes to play in any order you like (instead of low to high when Hold is off). In fact you can even enter the same note to play multiple times in the arpeggiation simply by playing that note multiple times while at least one key on the keyboard remains held.

The arpeggiator can hold up to 16 pitches to arpeggiate. If you try entering more than 16, the 16th step to arpeggiate will be overwritten with the most recently played note.

Notice when the Hold mode is active, you can stop playback by pressing the PLAY key, and should you restart playback by pressing the PLAY key again, the arpeggiator remembers the notes held in memory and will simply begin playing notes in the order they were entered, starting with the first note.

SELECTING ARPEGGIATOR RHYTHM PATTERNS

The **512** provides 29 user writable rhythm patterns to use with the arpeggiator. These rhythm patterns determine if a step should play as a Rest, have a specific note Duration, or Sustain to the next step. Each step can also produce a different Velocity value, or determine if the pitch on that step shall glide from the previous pitch played or not.

You can select different patterns at any time while the arpeggiator is playing or stopped. New selections of patterns will take affect as soon as the next step of the arpeggiator plays.

To select a rhythm pattern, hold the ARPEGGIATOR/PATTERN key, then press and release one of the 29 keys of the keyboard.

Notice if you begin to select a pattern then change your mind and don't enter anything while holding the ARPEGGIATOR key, when the ARPEGGIATOR key is released the **512** will assume you intended to exit the Arpeggiator mode and return to the Keyboard mode. If this happens by mistake, you can simply reselect the Arpeggiator mode and enter new notes to begin arpeggiating again.

Pattern location numbers are shown below.
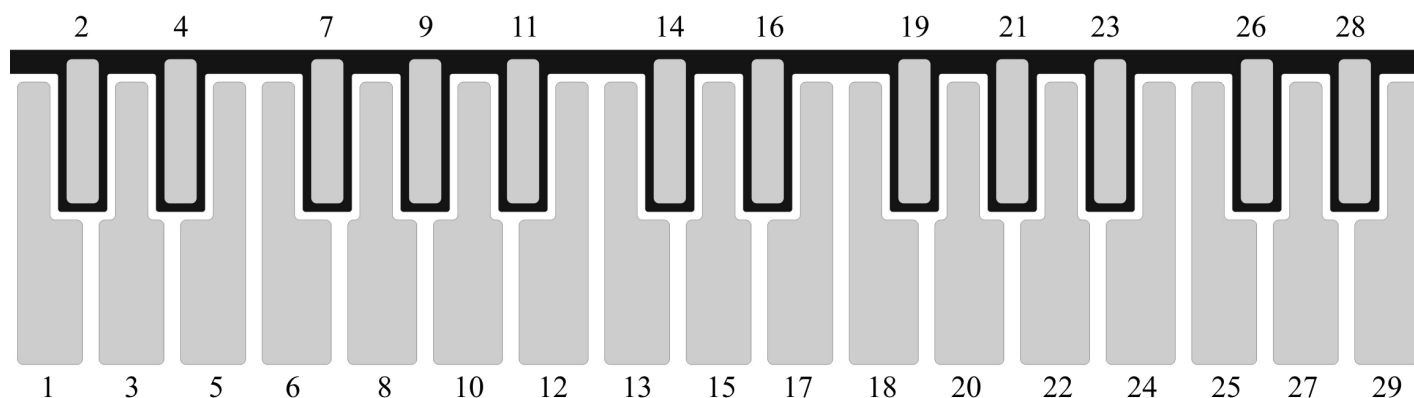
Each key holds a different rhythm pattern. However, if your unit is fresh from the factory or has recently been initialized, all rhythm patterns default to the same thing. The default patterns play every step as a 50% note duration, with a MIDI velocity value of 127, and all steps are written to glide from the previous step's pitch. This is what you might expect from a traditional arpeggiator with only basic features. And of course the **512** goes much deeper than these simple default patterns.

This seems like the ideal time to learn how to create your own rhythm patterns.

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PROGRAMMING ARPEGGIATOR RHYTHM PATTERNS

The **512** provides 29 user writable rhythm patterns to use with the arpeggiator. These rhythm patterns determine if a step should play as a Rest, have a specific Duration, or Sustain to the next step. Each step can also produce a different Velocity value, or determine if the pitch on that step shall glide from the previous pitch played or not.

Before you begin, make sure the Arpeggiator mode is selected, playback is stopped, and you have selected the rhythm pattern location you want to write to.

ENTER RECORD MODE

To enter the Record mode, hold the ARPEGGIATOR key, then press and release the PLAY key. The ARPEGGIATOR key, PLAY key, and RECORD LED will all light indicating Record mode is active, and is ready for you to play in rhythm information. You can now release the ARPEGGIATOR key.
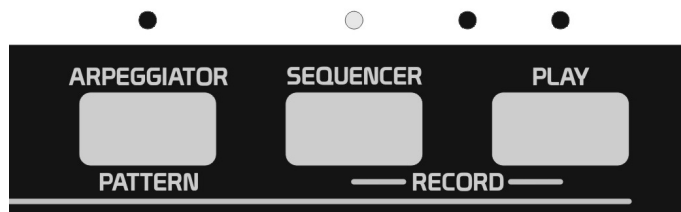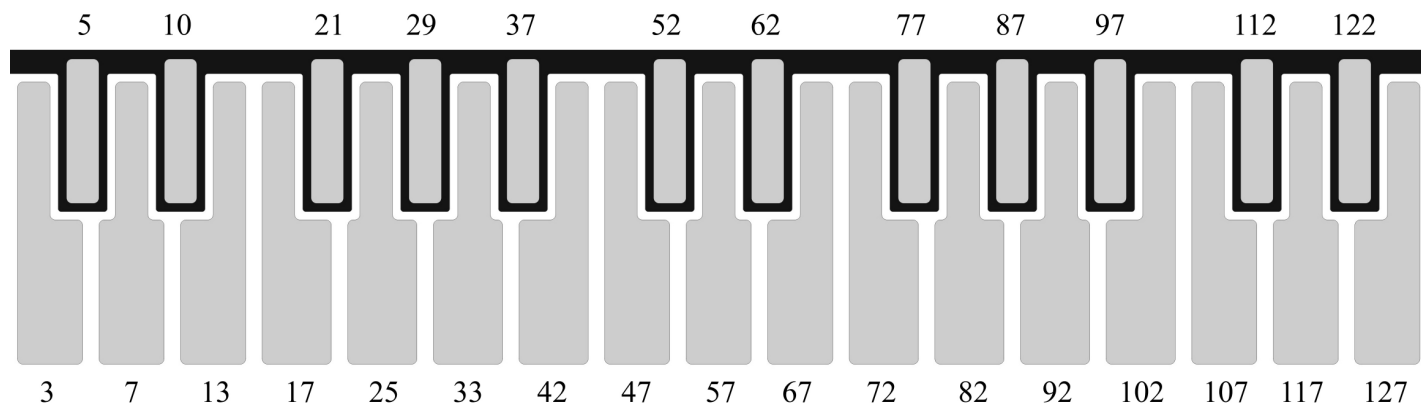
The display LED's will help keep track of where you are while entering step information. When you first enter Record mode, the 0 and +1 LED's turn on. This indicates you are at the first step of beat 1. As soon as you enter rhythm data (or press the +key) the 0 LED will turn off, indicating you are no longer on the first step of the pattern. When four steps have been entered the +1 LED will turn off and +2 LED will turn on indicating you are now at beat 2. Up to 16 steps can be entered. If you make a mistake while entering a value, simply press the –key to step back one step and re-enter a new value. Likewise you can use the -/+keys to advance to any step to write, should you need to correct specific steps.
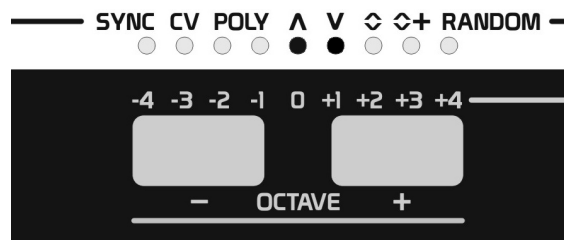
Once data has been entered for all 16 steps, Record mode will turn off automatically since there are no more steps to write to. If you are making corrections to only a couple steps, and wish to exit Record mode when finished making your changes, simply press the PLAY key. The PLAY key and RECORD LED will turn off indicating that Record mode is no longer active.

DEFINE THE VELOCITY VALUE

At this point you are ready to enter rhythm information, but first you should decide what velocity you want the step to be. When you first enter Record mode, if a Velocity value is not defined, a default value of 127 will be selected. To set the Velocity value, hold the HOLD/ACCENT key, then press and release one of the 29 keyboard keys representing the velocity value as shown below. Notice the values are arrange from low to high, left to right respectively.

5	10		21	29		37		52	62		77	87		97		112	122
3	7	13	17	25	33	42	47	57	67	72	82	92	102	107	117	127

Now that a Velocity value has been selected, you can write multiple steps at this same value. If a step needs to be a different value, simply select a new Velocity value before entering that step's rhythm duration.

ENTER THE NOTE DURATION
Pressing any of the 29 keyboard keys will enter a specific note duration to the current step of the rhythm pattern. The note durations are shown below. Notice the values are arrange from shortest to longest, left to right respectively, with 50% duration at middle C, high D is 100%, and high E is Sustain.

| 8% | 15% | | 25% | 33% | 42% | | 53% | 60% | | 70% | 79% | 86% | | 96% | 100% |

| 5% | 12% | 18% | 22% | 30% | 38% | 46% | 50% | 57% | 63% | 66% | 75% | 82% | 90% | 93% | 100% | SUST |
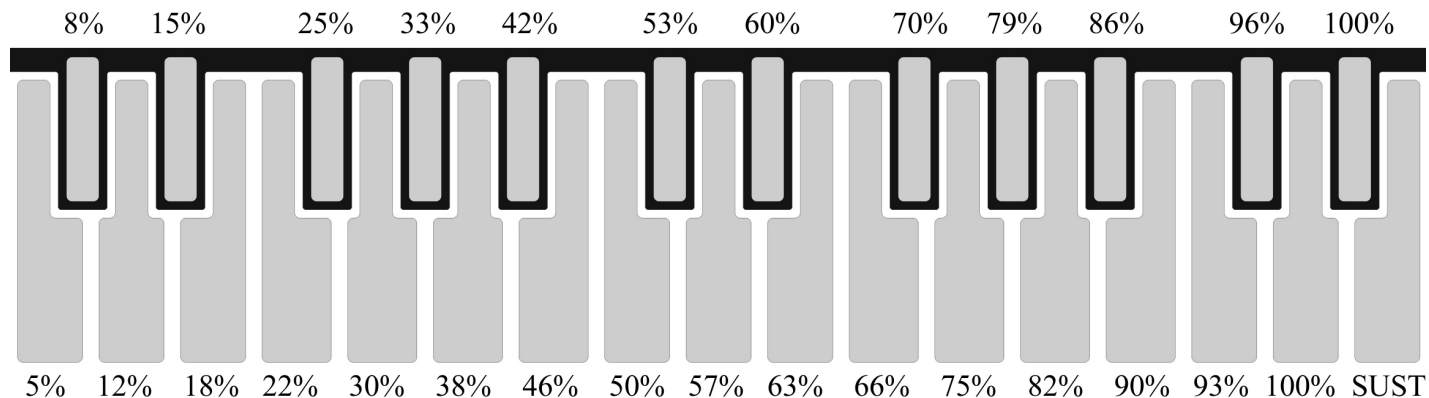
The step to write to will advance one step each time a new Duration value is entered.

When a Sustain is entered, this step will sustain to the following step. If the step following a Sustain is written with a duration of 50%, this sustained note will last a total of 150% of a single step's duration. In this way you can use Sustain to create notes as long as you wish.

ENTERING RESTS
If you want to enter a Rest (where no note occurs) into the rhythm, simply press the DIRECTION/REST key.
The step to write will advance one step each time a new Rest is entered.

Note, if a Rest is entered into a step following a Sustained note, the step set to Sustain will play for 100% duration of its step, followed by the Rest. This allows the Rest note to choke the Sustained note.

ENTERING GLIDES
If you press and hold the TRANPOSE/GLIDE key and enter a Duration value, the previously played pitch will glide to the pitch played on this step.

Note, entering glides will only affect the KEY CV output, and will have no affect on MIDI notes.
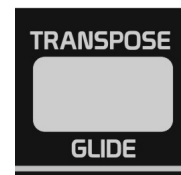
Remember, if you make a mistake and enter an incorrect value for a step, simply press the –key, and enter the correct value for the step.

SEQUENCER

The Sequencer provides 145 user writable patterns. These patterns are arranged as 5 banks of 29 sequences. Each sequence can be up to 64 steps (4 bars long using 4/4 time signature), and each step records a single note pitch, the step's note duration, the velocity value for the step, and whether or not this step will glide its pitch from the last pitch played.

PLAYING THE SEQUENCER
To select the Sequencer, while in the Keyboard mode, press and release the SEQUENCER key. The SEQUENCER key LED will light to show the Sequencer mode is now active.

To exit the Sequencer mode and return to Keyboard mode, (with playback stopped) simply press the SEQUENCER key so that its LED is off.

Once in the SEQUENCER Mode, you must press the PLAY key for the sequencer to begin. The PLAY key LED will then blink at 1/4 note intervals to indicate the sequencer is playing.

To stop playback of the sequencer, simply press the PLAY key again, turning the PLAY key LED off.

While a sequence plays, feel free to play with the BEND and MOD keys, or alter the touch of the keys on the keyboard (while making any selections) to generate aftertouch control as well.

For instance, while a sequence is playing, activate Transpose. Even if you do not wish to transpose the sequence, altering a finger's touch on middle C (transpose value of 0) keyboard key will not transpose the sequence but will alter the TOUCH and aftertouch values the **512** produces. This also allows you to create aftertouch expressions while you are making various selections to other parameter values.

Go ahead and play with selecting different Scales, choosing different Octaves, Transposing the sequence, applying Scalar Transposition, selecting Chords, add Chord Inversions, change the MIDI channel on the fly, or check out all the combinations of Range and Directions and their affect on the sequence currently playing.

Note, since the sequencer does not have any features that require you to activate Hold mode to latch notes like the Keyboard and Arpeggiator modes do… Whenever you turn Hold on/off while in the sequencer, this will latch the Chord Select mode on/off allowing you to select chords quickly by pressing keys on the keyboard. This makes life a little easier than having to hold the HOLD key to choose different Chords, as the Keyboard and Arpeggiator modes require you to do.

Also notice, if Hold is active and you press the TRANSPOSE key, Hold (Chord Select) will turn off, and Transpose will now be active. The same behavior happens if Transpose is active and you press the HOLD key. This simply allows you to select the parameter you want to edit quickly without having to deactivate a mode first.
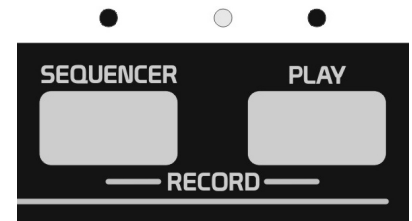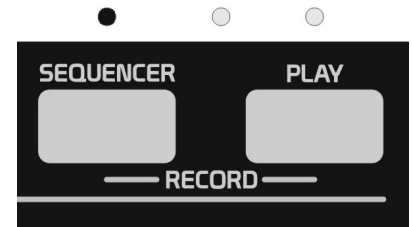
SELECTING SEQUENCES

The Sequencer provides 145 user writable patterns. These patterns are arranged as 5 banks of 29 sequences.

You can select different sequences at any time while the sequencer is playing or stopped. When new selections are made, the new sequence selected will begin playing as soon as the current sequence reaches its loop point.

To select a sequence, hold the ARPEGGIATOR/PATTERN key, the display LED's will light to show the Bank you are selecting sequences from. Press the -/+ keys if you would like to choose a different bank of sequences, then press and release one of the 29 keys of the keyboard to select a sequence.

Bank selection ranges from 0 to +4.
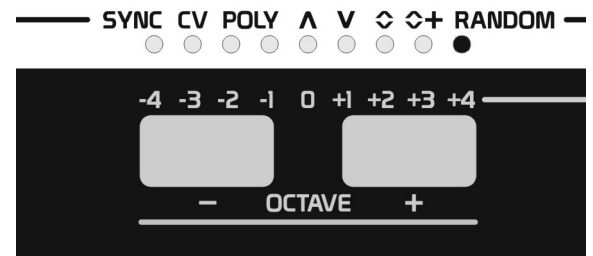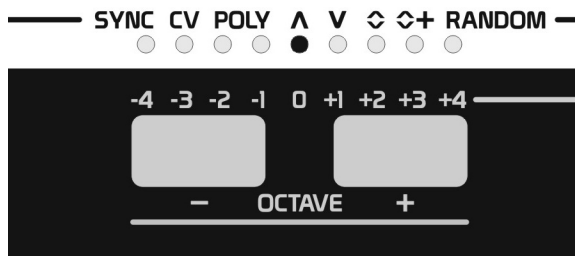
Sequence location numbers are shown below.
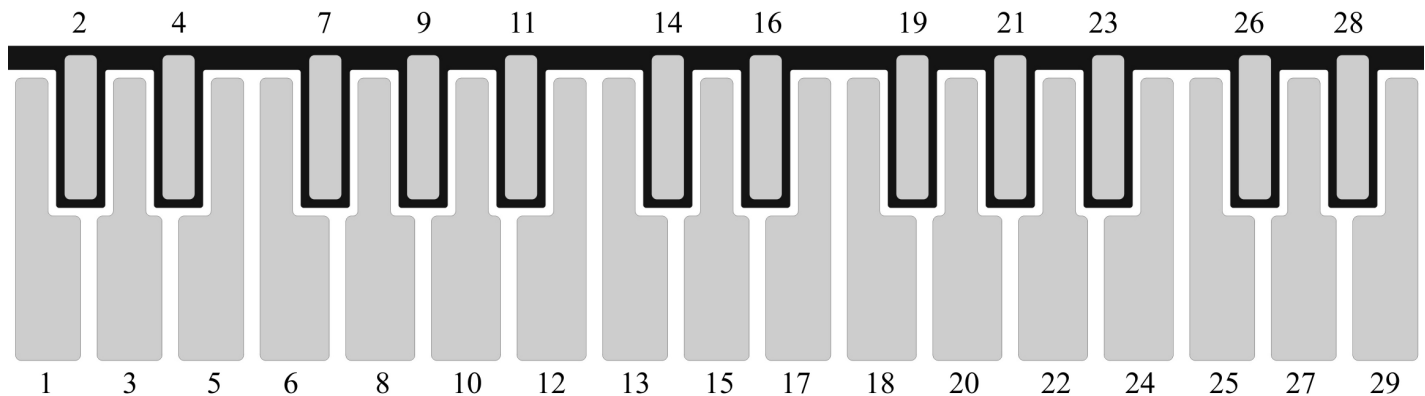
Each key holds a different sequence. However, if your unit is fresh from the factory or has recently been initialized, all sequences have been reset to a default state. The default sequences are all set to loop at 1 step, and not play anything.

This seems like the ideal time to learn how to create your own sequences.

Note, when both Tranpose or Hold are not activated, you can press any key of the keyboard to quickly make sequence selections, without holding the ARPEGGIATOR/PATTERN key. However if you want to change the current Bank, you do need to hold the ARPEGGIATOR/PATTERN key, select the desire Bank, and then select a Sequence.

If Transpose or Hold modes are active and you hold the ARPEGGIATOR/PATTERN key while selecting sequences, it will prevent changes being made to the Transpose or Chord Selection while selecting sequences, without having to deactivate these modes.

PROGRAMMING SEQUENCES

Each sequence can be up to 64 steps (4 bars long using 4/4 time signature), and each step records a single note pitch, the step's duration, the step's velocity value, and whether or not this step will glide its pitch from the last pitch played.

Before you begin, make sure the Sequencer mode is selected, playback is stopped, and you have selected the Bank and Sequence location you want to write to.

ENTER RECORD MODE

To enter the Record mode, hold the SEQENCER key, then press and release the PLAY key. The SEQUENCER key, PLAY key, and RECORD LED will all light indicating Record mode is active, and is ready for you to play in sequence information. You can now release the SEQUENCER key.
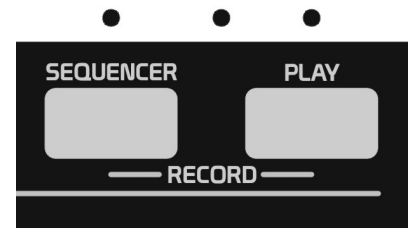
The display LED's will help keep track of where you are while entering step information. When you first enter Record mode, the -1, 0 and +1 LED's turn on. The four left-most display LED's indicate the current bar (even though these are negative numbers), the 0 LED lights when the first step of the pattern is selected, and the four right-most display LED's indicates the current beat. As soon as you enter sequence data (or press the +key) the 0 LED will turn off, indicating you are no longer on the first step of the sequence. When four steps have been entered the +1 LED will turn off and +2 LED will turn on indicating you are now at beat 2. Once all four steps have been entered for the 4th beat, the bar LED will update to the next bar, and the beat LED will return to indicate beat 1.
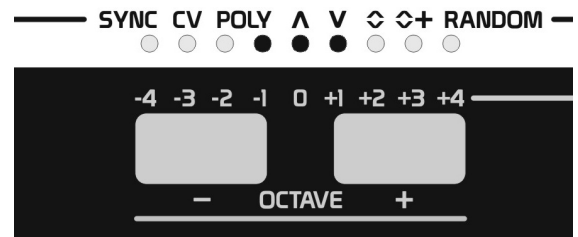
Up to 64 steps can be entered. If you make a mistake while entering a value, simply press the –key to step back one step and re-enter a new value. Likewise you can use the -/+ keys to advance to any step to write, should you need to correct specific steps.

Once data has been entered for all 64 steps, Record mode will turn off automatically since there are no more steps to write to. If you are making corrections to only a couple steps, and wish to exit Record mode when finished making your changes, simply press the PLAY key. The PLAY key and RECORD LED will turn off indicating that Record mode is no longer active.

LOOP POINT

The loop point will be defined as whatever step is selected when you exit Record mode. Therefore, if you enter 16 values and then exit Record mode, the sequence will play for 16 steps and then loop.

You can later adjust the Loop Point simply by entering Record mode, advancing X amount of steps using the +key, and then exit Record mode. As long as no other information was entered while Record mode was active, only the Loop Point will change.
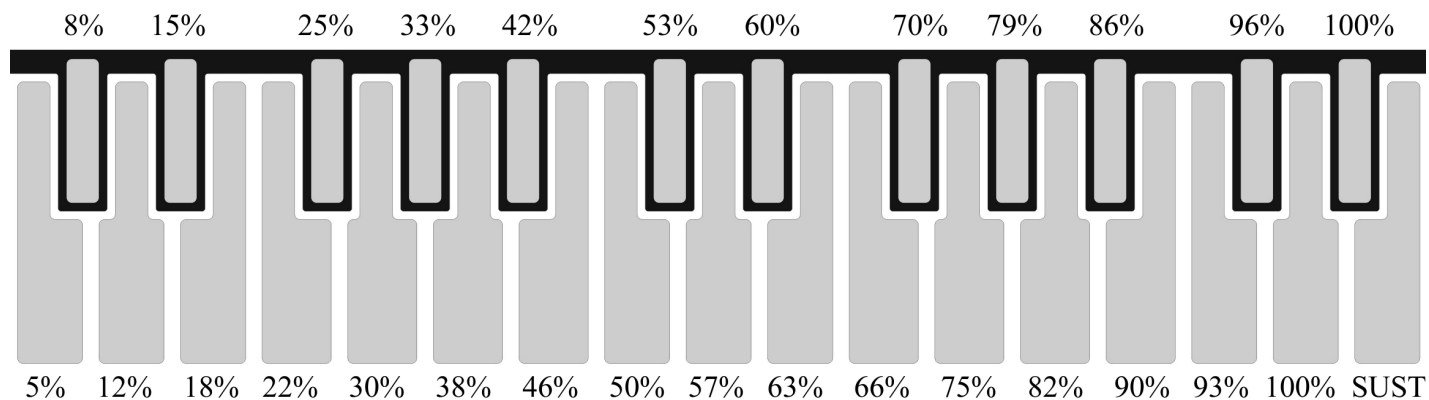
DEFINE THE VELOCITY VALUE

Before entering Pitch values, first you should decide what velocity you want the step to be. When you first enter Record mode, if a Velocity value is not defined, a default value of 127 will be selected. To set the Velocity value, hold the HOLD/ACCENT key, then press and release one of the 29 keyboard keys representing the velocity value as shown below. Notice the values are arrange from low to high, left to right respectively.

| 5 | 10 | | 21 | 29 | 37 | | 52 | 62 | | 77 | 87 | 97 | | 112 | 122 |

| 3 | 7 | 13 | 17 | 25 | 33 | 42 | 47 | 57 | 67 | 72 | 82 | 92 | 102 | 107 | 117 | 127 |

Now that a Velocity value has been selected, you can write multiple steps at this same value. If a step needs to be a different value, simply select a new Velocity value before entering that step's Pitch.

ENTER THE NOTE DURATION

Before entering Pitch values, you should also decide what Duration you want the step to be. When you first enter Record mode, if a Duration value is not defined, a default value of 50% will be selected. To set the Duration value, hold the SCALE/DURATION key, then press and release one of the 29 keyboard keys representing the note duration as shown below. Notice the values are arrange from shortest to longest, left to right respectively, with 50% duration at middle C, high D is 100%, and high E is Sustain.

| 8% | 15% | | 25% | 33% | 42% | | 53% | 60% | | 70% | 79% | 86% | | 96% | 100% |

| 5% | 12% | 18% | 22% | 30% | 38% | 46% | 50% | 57% | 63% | 66% | 75% | 82% | 90% | 93% | 100% | SUST |

The current note duration setting will apply to all notes you enter into the sequence until Record mode is exited or you change the Duration value. So if you would like a note duration of 75% for one step followed by a note duration of 25%, select 75% duration and enter the first step's pitch, then select the 25% duration and enter the second step's pitch.

When a Sustain is entered, this step will sustain to the following step. If the step following a Sustain is written with a duration of 50%, this sustained note will last a total of 150% of a single step's duration. In this way you can use Sustain to create notes as long as you wish.

ENTERING A SUSTAIN
There is an alternative method for entering a Sustained note. Rather than defining the note Duration as Sustain as previously mentioned, you can simply hold the RANGE key while entering a note's Pitch. This too will write the current step as Sustained.

ENTERING A REST
If you want to enter a Rest (where no note occurs) into the sequence, simply press the DIRECTION/REST key. The step to write will advance one step each time a Rest is entered.

Note, if a Rest is entered into a step following a Sustained note, the step set to Sustain will play for 100% duration of its step, followed by the Rest. This allows the Rest note to choke the Sustained note.

ENTERING A GLIDE
If you press and hold the TRANPOSE/GLIDE key and enter a Pitch value, the previously played pitch will glide to the pitch played on this step.
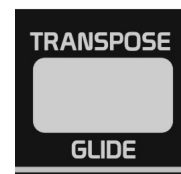
Note, entering glides will only affect the KEY CV output, and will have no affect on MIDI notes.

Remember, if you make a mistake and enter an incorrect value for a step, simply press the –key, and enter the correct value for the step.

ENTERING THE PITCH
Once you are satisfied with the Velocity and note Duration settings, you are ready to enter a Pitch for the current step of the sequence.

Entering the Pitch is as simple as playing any of the 29 keys on the keyboard. When a key is played, this pitch is entered into the current sequencer step, along with the velocity, note duration, and glide status.

The step to write will advance one step each time a new Pitch is entered.

WRITING TRADITIONAL SEQUENCES
While it may seem like a lot of steps to enter a sequence, if your goal is to recreate sequences similar to traditional sequencers, the procedure is really quite simple. As previously stated, when you enter Record mode, the note Duration defaults to a 50% duration which is what traditional sequencers will write as a single note-on. Velocity value will also default to 127.

Therefore, you can simply start entering the pitches in the order you wish them to play. If you want the current step to sustain to the next, hold the RANGE key while entering a Pitch. Or if you want the step to be a Rest, press the DIRECTION/REST key. If you want to glide the previous pitch to the pitch of the current step, simply hold the TRANPOSE/GLIDE key while entering a pitch. It's actually much faster than traditional sequence editing where you must first select a step, and then enter a value.

TROUBLESHOOTING

POWER
99.9% of the time, if a unit is not powering up or working properly, this is due to customers using the incorrect power supply, or a power supply has failed over time. Make sure the power supply you're using is the correct one, and is generating (center positive) +15V DC output and providing 400mA current. Replacement power supplies can be ordered directly through Future Retro.

LOCK UP
If for some reason your unit starts misbehaving, or becomes non-responsive, simply turn the unit off and back on to reset it. If you continue to experience repeated lock ups, note the conditions and what you were trying to do when this occurs and send us a detailed email so we can help troubleshoot the issue further.

NOTES ARE NOT PLAYING
If you find that certain notes are not playing as expected, it could be that the note you are trying to produce is beyond the MIDI range of 0-127 or the Note range of the KEY CV's DAC, due to certain parameter setting you have made. Check the Octave, Transpose, Scalar Transpose settings and adjust their values to be within the range of the device you are controlling.

Also make sure that MIDI channels of the devices needing to communicate with one another are both set to the same value. Don't forget that when you are using any of the CV MIDI Modes that the **512**'s MIDI IN channel must be selected before you enter the CV MIDI Mode you want to use.

TOUCH RESPONSE
If the **512** is not responding to key touches the way you like, please revisit the MIDI section of the manual and adjust the Bend, Mod, Velocity, and Aftertouch curves, and sensitivity settings.

CONTROL VOLTAGES
You may find that the oscillators you are controlling with the KEY CV output can not track the entire range the **512** is capable of producing. If you experience tracking errors in oscillators, make sure you are not pushing the oscillators beyond their limit. If the oscillators were designed well, receiving higher voltages than the oscillator can track should not harm them.

Although **512** control voltage outputs range from 0 to +10v, if the module you are controlling prefers a smaller range, simply attenuate the control signal with the Modulation Amount control on that module. This can be applied to all but the KEY CV output, unless you wish to alter the pitch tracking as well.

Although the output jacks on the **512** are 1/8", you can still connect them to and control devices with 1/4" inputs such as our XS synthesizer. You simply need to buy the correct cables, which are readily available.

The **512** produces the 1v/Oct CV standard most commonly found throughout the analog synthesizer market. EML and Buchla synthesizers require a 1.2v/Oct CV for their oscillators to track properly. This option may be possible in the future with a modification to your unit, please contact us directly to inquire.

MEMORY

When you record a Scale, Chord, Arpeggiator Rhythm Pattern, Sequence, or save MIDI and Power-up preferences, this data is written to an EEPROM. This memory does not require any battery back-up power to retain stored information. This memory is rated to retain stored values for more than 200 years!

INITIALIZING MEMORY

All **512** units ship with their memory initialized. Should you wish to return your unit to the original factory condition, you may initialize the memory. Keep in mind that while this procedure will restore basic settings like MIDI and controller preference settings, and load the factory Chords and Scales, it will also erase all Arpeggiator Rhythm Patterns, and Sequences! Therefore you should think twice about doing so, as there is no going back once you commit to this procedure.

Also it is not recommended that you reinitialize the unit many times. There really is no need to do so, as you can always overwrite any existing parameters in memory individually as needed without wiping out all the memory. In addition, initializing the memory should not be considered a way of resolving any problems you may experience during operation.

To initialize the memory, while in the Keyboard Mode, hold both the RANGE and DIRECTION keys, then press and release the PLAY key. The RECORD LED will light indicating initialization is taking place. You can release the RANGE and DIRECTION keys, and the RECORD LED will turn off in approximately 15 seconds when the initialization process is complete.

KEY TEST

There is a simple key test built into the **512**'s software that can be used to check if touch keys are working properly. To enter this test mode, hold the –key, then press and release the PLAY key. You can then release the –key.

Pressing any touch key on the **512** should cause all LED's on the unit to light if a touch is detected on that key. This is also a way of checking to see that all LED's are functioning properly as well.

When you are done testing, you will need to turn the **512** off, and back on to exit this testing mode.

CALIBRATION

There is a simple calibration procedure built into the **512** that can be useful when you need to calibrate the KEY CV output voltage, and would like to test that all other analog outputs are working correctly.

To enter the calibration mode, hold the +key, then press and release the PLAY key. You can then release the +key. Connect an oscilloscope to any of the analog outputs and verify that signals are being generated. If you need to recalibrate the KEY CV output to conform to the 1v/Oct CV standard, using a 1/8" cable, connect the KEY CV out jack to the leads of a precision volt meter. Note the mention of "precision" here. You should really be using a voltmeter that can read voltages five or more places past the decimal point, as the equivalent of a musical cent is 0.00083 volts.

The calibration will automatically generate a voltage for each octave the KEY CV can produce. Therefore you should adjust the CV trim pot (located just to the right of the MOD jack on the front panel) so that each octave's voltage produced is exactly 1 volt higher than the previous.

To exit the calibration mode, simply turn the **512**'s power off, and then back on.

SPECIFICATIONS

Dimensions: (W) 17.5" x (D) 7" x (H) 1.5"
Unit Weight: 2.6 lbs
Universal Power Supply: 100-240V AC input, 15V DC output
Power In: 15V DC
Current Draw: 290mA (typical)

MIDI Connections: In, Thru, Out (5-Pin Din)
MIDI Channels: 1-16
MIDI Note Range: 0-127
MIDI To CV Conversion: Yes
Polyphonic MIDI Conversion: Yes, 16 Channel/16 Note Polyphony
Velocity Curves: 5
Touch Curves: 5
Bend Sensitivity: 0 – 9
Mod Sensitivity: 0 – 9

Analog Outputs: Clock, Gate, Key CV, Velocity, Touch, Mod
Analog Output Ranges: 0 to +10v
KEY CV Note Range: 0 to > +9V, 1v/Oct Standard
KEY CV Octave Offset: 0 to +4 Octaves

Glide Time: 0 to Approximately 3 Seconds
Swing Amount: 50% - 75%
Tempo Range: 20 – 250 BPM
Time Signatures: 1/4, 2/4, 3/4, 4/4

Keyboard: 29 keys
Octave Ranges: 9
Transpose Range: -12 to +16 semitones
Controls Produced: Note-On/Off, Pitch, Pitch Bend, Velocity, Mod Wheel, Aftertouch, Clock/Start/Stop
Chords: 28 x 6-note chords
Chord Inversion: +/- 4 steps
Scales: 29 x 29-note scales
Scalar Transpose Range: 28 steps
Scale Inversion: Yes

Arpeggiator: Yes
Rhythm Patterns: 29 x 16-step patterns
Play Directions: Up, Down, Up-Down Exclusion, Up-Down Inclusion, Random
Range: -4 to +4 Octave Reiterations
Note Order: Ascending, As-played
Hold: Yes

Sequencer: Yes
Sequences: 145 (9 banks x 29 sequences) x 64-step patterns
Recorded Sequence Content: Note Pitch, Duration, Sustain, Rest, Glide, Velocity
Play Directions: Up, Down, Up-Down Exclusion, Up-Down Inclusion, Random
Range: -4 to +4 Octave Reiterations
Loop Point: 0-64 steps