Subsequencely

This is the user manual for my custom Launchpad Pro firmware project to implement a versatile playing surface and sequencer. It's called Subsequencely and it's pretty cool. The goal of the project is to provide a fun and inspiring live performance/song writing tool that is visual, immediate, and straightforward. No special effort is made to replicate the behavior of the default firmware or Ableton Live, but buttons tend to perform tasks similar to their intended functions when it makes sense.

Here are some things you might think are good: sequences that store velocity, aftertouch, and note slides, a session mode where you can link multiple sequences together to create patterns up to 16 bars long, use note skipping to create sequences that play in different time signatures (at the same time!), play sequences in reverse, copy data between sequences, a user mode with up to 8 faders that can be configured for any midi channel and control code, and more!

If you find anything in this manual that is inaccurate or unclear, or you have any suggestions to improve the program, send me a message on github (https://github.com/jrcurtis), or twitter @srankesports. Also check out this video, which walks through most of the important features.

Structure

The software is divided into modes using the buttons on the top right, much like in the default firmware, but some concepts are handled differently. Instead of an 8x8 grid of clips organized into scenes, you simply have 8 monophonic tracks of 32 steps each. Each one is assigned to a row of the launchpad and they are numbered from top to bottom. In this document I will refer to them as tracks or sequences interchangeably.

The different modes of the program are accessed through the session, notes, device, and user buttons on the top right of the Launchpad. Each mode also has its own setup mode, used to configure various settings. You can access the settings mode by pressing the setup button on the top left while in any mode.

Interface Elements

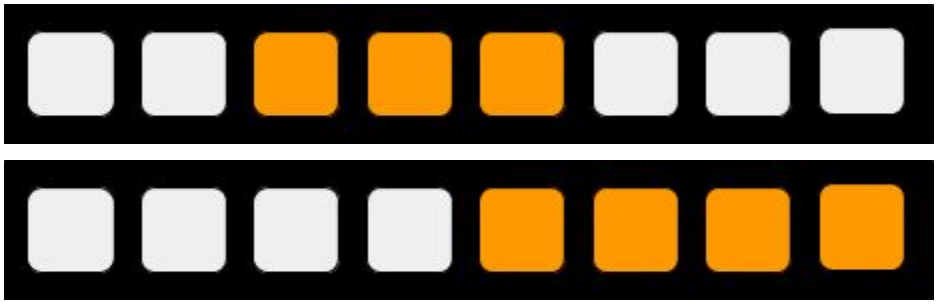
There are some common interface elements that are used throughout the program.

Checkboxes

This one is easy: If it's red, the value is OFF. If it's green, the value is ON. To switch between the two you PRESS ON IT.

Sliders

A slider is a horizontal row of pads that can be used to enter a range of values. The value increases from left to right, and values are entered by pressing on a pad. Some sliders that accept a wide range of values will respond to the velocity of the press to select different values inside the range of a single pad, with the value being represented by the brightness of the pad.

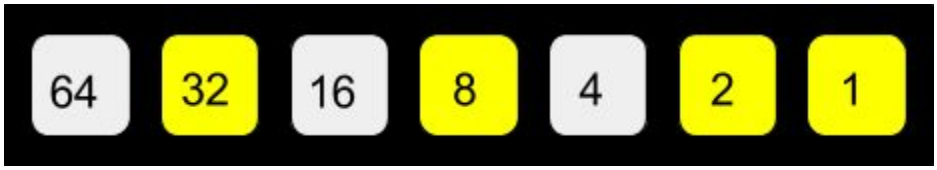


Some sliders are bipolar, meaning they can be either positive or negative. For these sliders the lights pivot around a central point, which represents 0.

Numbers

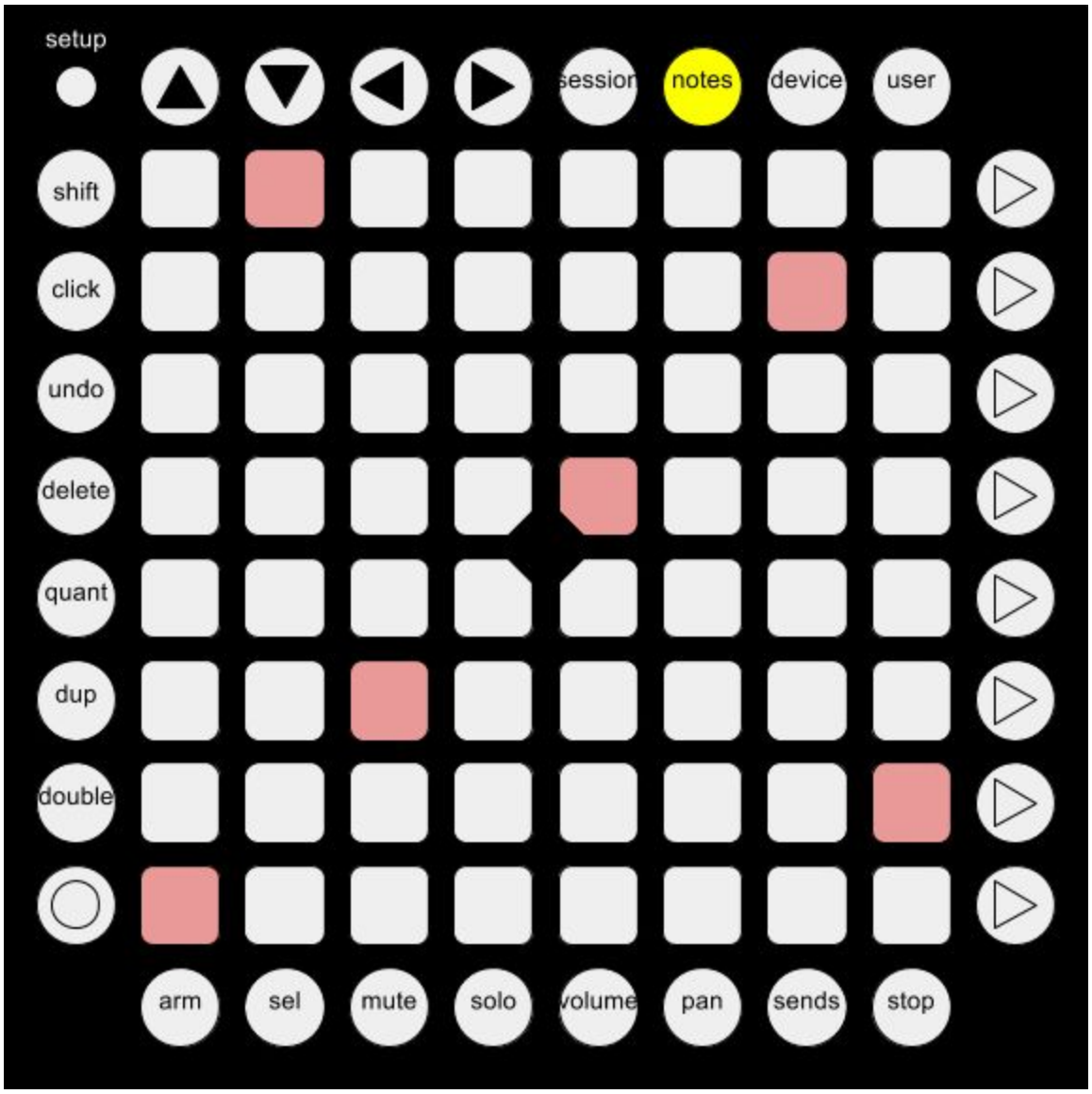
For values where more precise values are needed than sliders, number widgets are used. A number widget is laid out horizontally like a slider, but each pad can be turned on or off like a checkbox and number widgets don't always span all 8 pads in a row. Each pad has a numeric value, and the widget's final value is determined by adding together the numbers on the pads that are turned on.

Here's a simple example where the number 10 has been entered on a 4-pad number widget by adding together 8 and 2. Some people will say "hey, that's just binary numbers" but if you didn't say that then don't worry about binary numbers, you just need to add.



Here's another example where the more advanced number, 43, has been entered into a 7-pad number widget. A good way to enter these numbers is to move left to right, and if adding a pad would make the total go over the number you're trying to enter, then don't add it, but if it won't make you go over, then do add it.

Notes Mode



When you start the program, you begin in notes mode. In notes mode the pads are used to play midi notes. By default the rows are offset by fourths like the strings of a guitar, and the root note (highlighted in pink) is C, but you can change the layout and scale in the notes setup mode.

The arrow buttons at the top left can be used to transpose the notes on the pads. The up and down arrows transpose the pads by a whole octave, and the left and right arrows transpose by just 1 half step. Currently, the half step transpose buttons only cover a 1 octave range (C-B), so you can't repeatedly press them to go multiple octaves up or down, you have to use the octave buttons.

There rest of this section covers some useful shortcuts available in notes mode, but they might not make sense until you've skipped ahead and read about some of the other modes.

Midi

The notes you play in notes mode are immediately sent on the channel of the current active track. Note on and off messages are sent along with the velocity of the press. Polyphonic aftertouch is supported, as well as mapping aftertouch to a control code, but it is not enabled by default.

Tap Tempo

The click button on the left of the pads can be used as a tap tempo, which is always active in every mode, but in notes mode it has additional functionality. By default clicking the tap tempo button 4 or more times in a row will set the tempo by averaging the time between clicks.

If you're in notes mode you can also hold the click button down and tap the pads themselves to simultaneously enter a tempo and record the tapped notes into the active sequence (see active track). Once all 8 beats in the sequence have been entered, the sequence starts playing automatically so that the flow of the notes is unbroken. Note that this is only possible with tracks that are not already playing, and the notes that you play while holding click are immediately recorded over any existing notes in the sequence, rather than waiting until all 8 beats are played.

Live Recording

Live recording is the feature you want if you want to record the notes that you play on the pads. If you'd rather enter the notes one at a time without having to play in time, then scroll down to sequencer mode.

To enter live recording, the sequencer must be armed by pressing the record arm button, and then played by pressing the play button by itself. While the record arm button is lit red, and the active track is playing, any notes you play will be recorded. If you arm the sequencer, but don't play the active track, live recording will not be active. For more information about managing the state of the tracks, see the Playback Submode.

Once you've started live recording, just press the pads to enter notes into the sequence. There is no freeform/off-grid recording, so notes are always quantized to the current sequence step. After notes are recorded, you'll notice the pads lighting up as the sequence plays. Lights only show up for the active sequence, and they might not be visible if you transpose the layout out of range of the recorded notes, but otherwise, this is a handy visual indicator of what's playing in the sequence without having to switch to sequencer mode.

In addition to note and velocity, you can also record aftertouch as you play, and use it to send a midi control code. By holding down a note and varying the pressure on the pad, a varying value can be entered. For more information about aftertouch, see Aftertouch/Control Codes.

Shortcuts

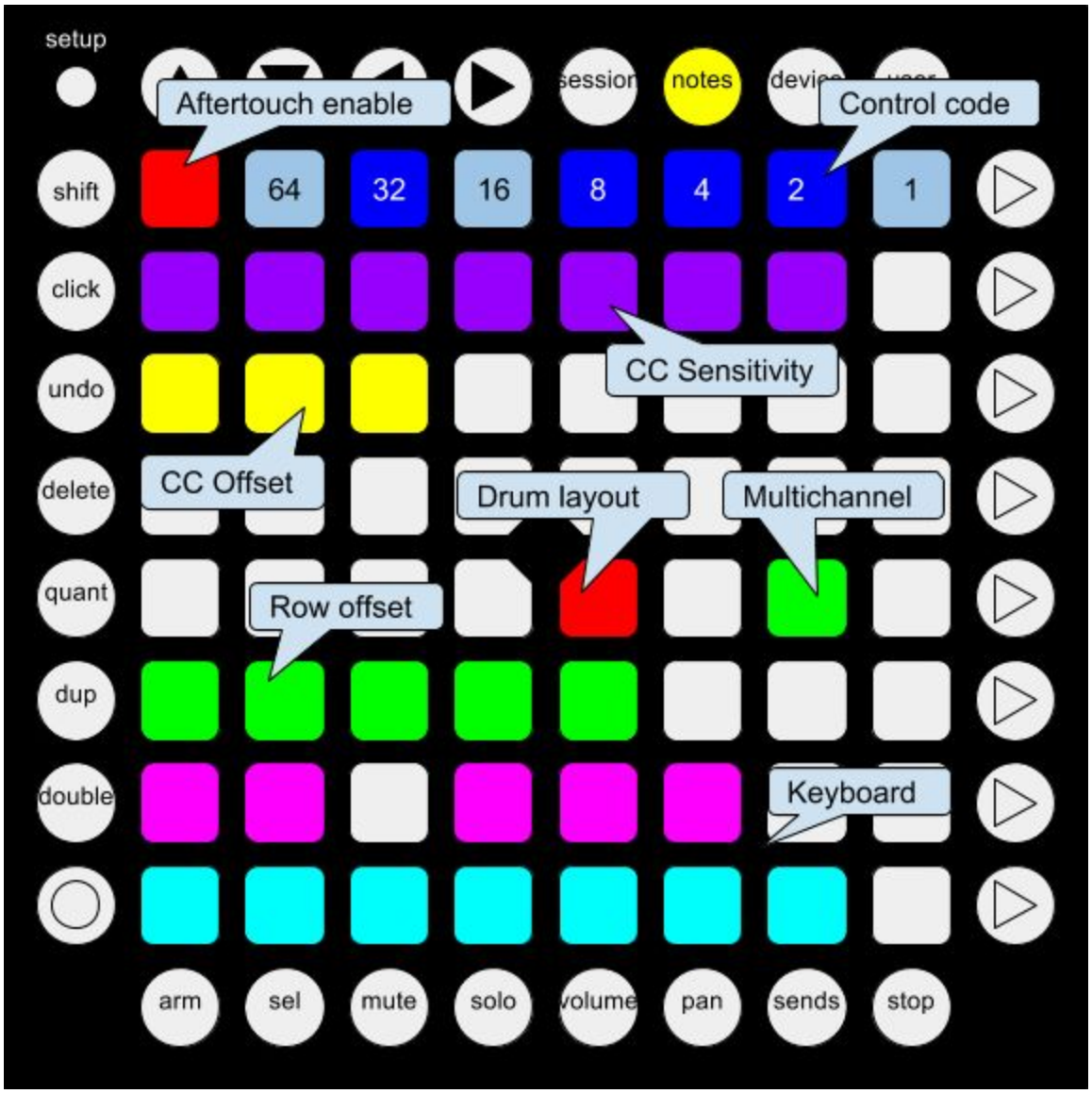
By pressing the undo button while the active track is playing, its playing direction will be reversed.

Pressing and holding the delete button while the active track is playing turns the playhead into an erase head, and clears any notes it passes over. If you press shift+delete, the whole sequence is cleared at once. The track does NOT have to be armed for this to work, so look out!

Bugs/Todo

- Should click+pads store the notes in a separate buffer and only copy them over once all 8 beats are played?
- Click+pads is buggy. It sometimes drops inputs.

Notes Setup



Notes setup can be used to configure the active track's pad layout, the global musical scale, and more.

Scale

The program stores one musical scale that is used wherever notes are entered. Notes played in notes mode, or entered into the sequencer, are constrained to the scale. There is only one global scale, and all tracks use the same one. This is primarily for convenience's sake, since you'll typically only use one scale, and it would be tedious to enter into all 8 tracks individually.

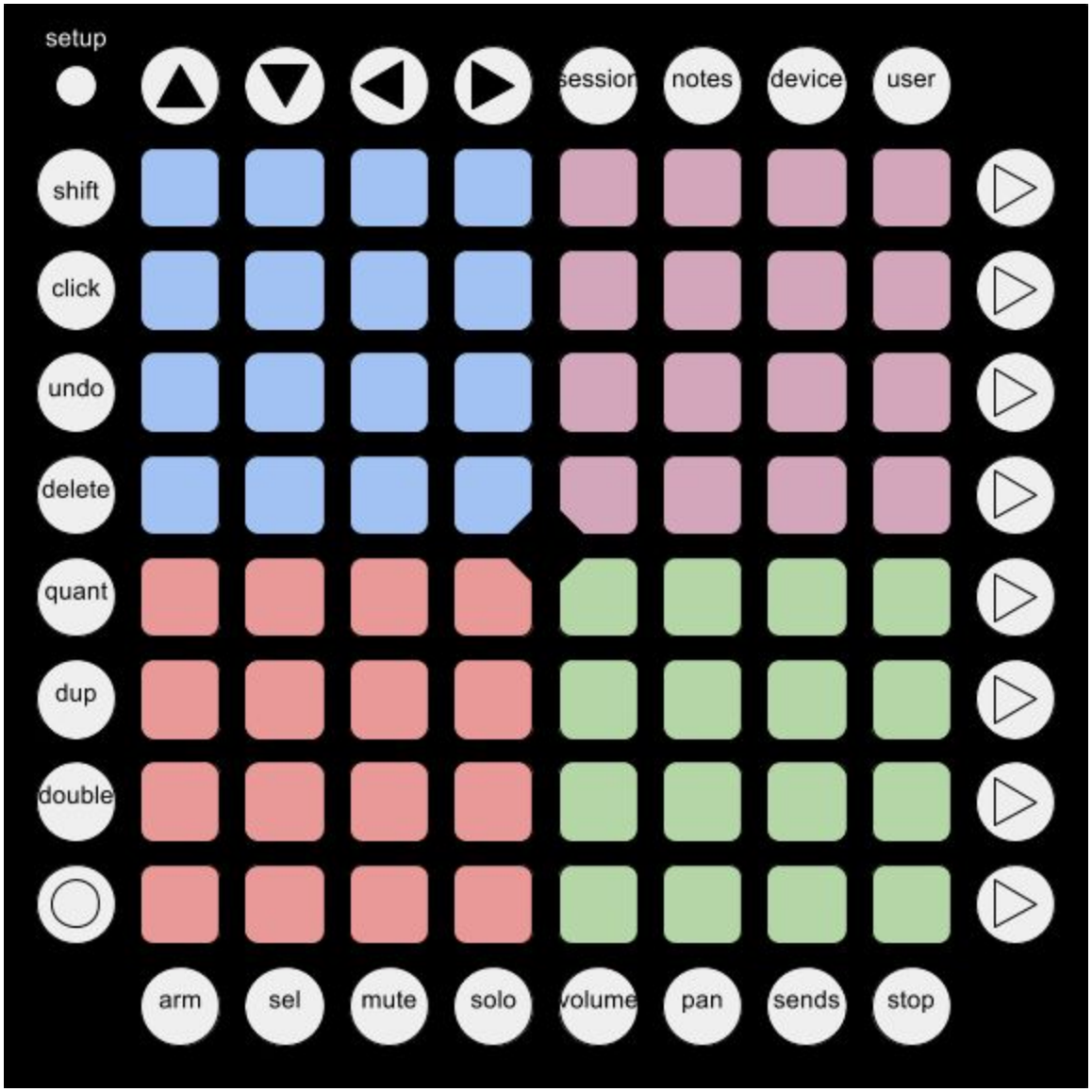
To configure the scale, a 1 octave piano keyboard is drawn at the bottom of the grid, and by pressing the keys, you can enable or disable that note for the scale. The bottom left most key (C by default) is the root note of the scale, so it cannot be turned off.

Note that the keyboard reflects the current transpose setting, so if you have hit transpose up 4 times it will be drawn starting from E. Transposing does not, however, change the scale, it only transposes it. Say you start from the default root note of C, and press the C# key to disable it. You are not disabling the note C#, you are disabling the note 1 half step above the root note. If you then transpose one half step up, C# will be the root note (and thus enabled) and D will be one half step above the root note (and thus disabled).

Layout

Above the keyboard is the row offset slider, which can be used to set the distance between rows on the grid. It accepts values from 1 to 8, in units of scale steps. By default it is set to 5 steps of the chromatic scale, which corresponds to fourths tuning like you'd find on a guitar or bass. If you were to enter a major scale, for instance, then a row offset of 8 would mean each pad was a whole octave above the pad below it, and a value of 1 would mean each pad was only one step of the scale higher than the one below.

Continuing up past the row offset slider, there are two checkboxes. On the left is the drum layout checkbox. By checking this, the layout for this track will do away with the scale and row offset entirely, and will instead be split into 4 4x4 drum pad grids, which are laid out chromatically from bottom to top, with each quadrant offset one octave from the one before it. The top row of one quadrant overlaps with the first row of the next one.



To the right of the drum layout checkbox is the multichannel checkbox. With this enabled, each note will be sent on its own MIDI channel, which is calculated by offsetting the track's configured channel by the note index (C is 0, C# is 1, etc). If you've configured track 1 to send on midi channel 3, and enabled multichannel, then C (regardless of what octave) will send on channel 3, D would play on channel 5, and so on. Quick note on this feature: I put it in because I have a Korg Volca Sample, which dedicates a single channel to each voice, and I didn't want to have to dedicate multiple sequences to just one instrument. I don't know how common it is for other hardware to do this, but if you have a piece of hardware that would benefit from a similar feature, or a change to the behavior of this feature, let me know.

Each track keeps track of its own individual row offset, transpose, drum, and multichannel settings. Say you had one track playing a bass line, and another playing a lead, you could have different octave settings on each track and when you switched between them in notes mode,

the pads will be at the correct range. You could set another track to be in drum layout mode, and it will switch back to the drum layout whenever you selected that track.

Aftertouch/Control Codes

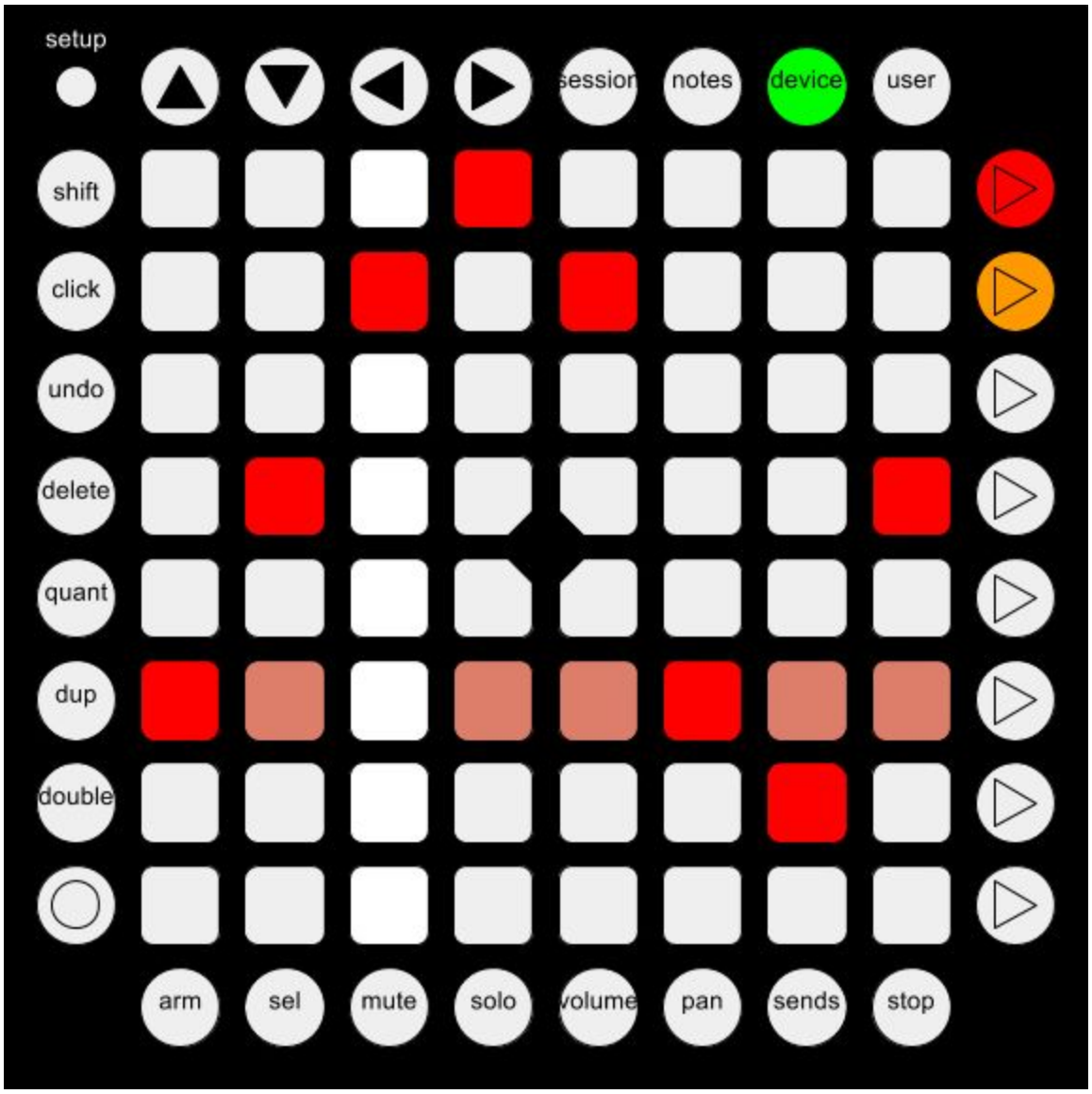
At the top of the grid, there is a group of controls related to the track's handling of aftertouch. In the top left is a checkbox to enable/disable aftertouch. When it is on, any notes played in notes mode will send polyphonic aftertouch, and the highest currently held aftertouch value will also be sent as a midi control change.

The control code number widget is used to select which control code to send. See number widgets for tips on entering this value.

Below that is a slider determining the sensitivity of the aftertouch. At its maximum value, the control codes will span the full 0-127 range, but at lower values, the CC will be scaled down (to about 1/5th at the minimum). By holding shift while you use this slider, you can make the control scale negatively: the harder you press, the smaller the value will be.

Next is the CC offset, which is a value added to the aftertouch value after it is scaled by the sensitivity. This is basically the default value the control will be at, and the harder you press, the further from this point you get (either above or below depending on your selected scaling). This slider sends the selected CC when you change it, which is useful for testing that you entered the correct number, and for use with MIDI learn functions on software instruments.

Sequencer Mode



In sequencer mode, the pads become a grid sequencer where melodies can be drawn visually. The Y axis is pitch, with each pad's note being taken from the global scale (see notes setup). The root note of the scale is highlighted as it is in notes mode. The X axis is time and the current position of the playhead is indicated by a vertical white bar. This section covers editing sequences. For information on playing them, see the playback submode.

To enter notes, simply press the pads. Velocity is recognized in this mode just like notes mode, and by holding shift while you press a pad, that note will have slide enabled, meaning that the

previous note (if any) will transition smoothly into it. This may require configuring the portamento setting on your synthesizer.

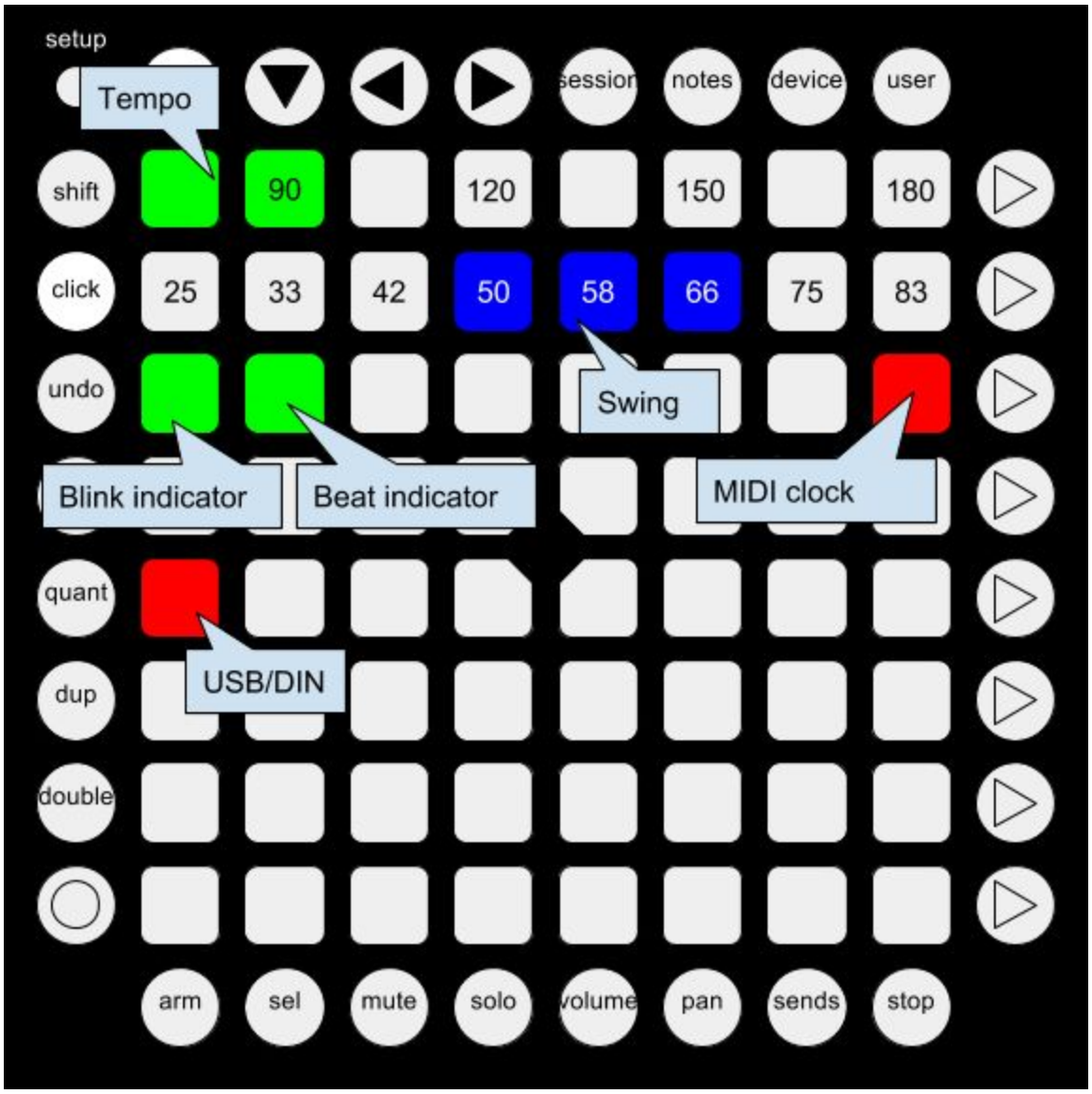
The color of the notes indicates their position within a beat. Red notes are even on the beat. Green are eighth notes midway between quarter notes. And yellow and blue are sixteenth notes before and after the eighths, respectively. In other words counting out the beat one-e-and-a, the one red, e is yellow, and is green, and a is blue. The brightness of the notes indicates their velocity.

The sequence can be navigated by using the transpose buttons. Octave up/down move vertically and transpose up/down move horizontally. When first entering sequencer mode, the zoom-level is all the way out, only showing quarter notes, and no horizontal movement is possible. By using shift+octave up/down you can zoom in or out of the sequence to edit it in finer detail. The first zoom in reveals 8th notes, and the second 16ths. Once zoomed in, use the left and right arrow buttons to move side to side.

Bugs/Todo

- Need to implement the ability to move by pages.
- Need to implement holding the transpose buttons down to continuously scroll.
- Should be able to use click+pad to repeat the note at even 1 beat intervals from selected step (different from using click+pad in notes mode because you aren't constrained to the start of the beat, and it doesn't change the tempo).

Sequencer Setup



In sequencer setup mode, you can access settings global to the sequencer, mostly related to timing!

There are two sliders: a green one on top for tempo and a blue one underneath for swing. Tempo can always be entered by tapping the click button, but the tempo slider is useful for accessing some common values. Each pad is split up into 15 values, with the smallest one (a light press of the leftmost pad) being 60 BPM. This allows you to enter 90 BPM by hitting the second pad with maximum velocity, or 120 by hitting the fourth pad.

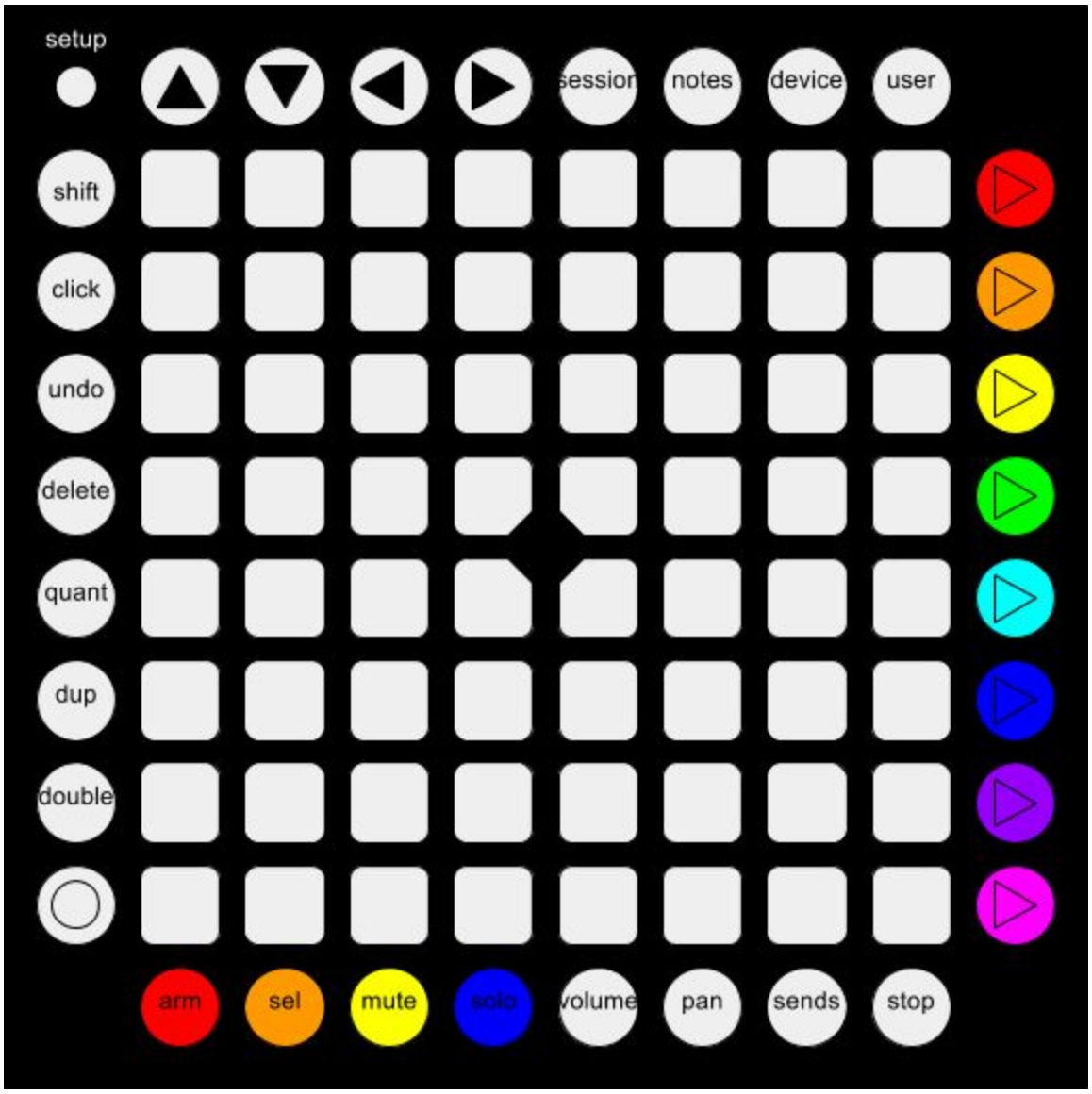
The swing slider is really good, and can't be accessed anywhere else in the program. It's a bipolar slider, with the zero point on the fourth pad, which represents 50%, or straight timing. To the right you have the values 58%, 66%, 75%, and 83%, and to the left, 42%, 33%, and 25%. These values may not be exact, and behavior may become strange at the extreme values. Beware.

There are also some checkboxes. On the left, below the sliders there are two checkboxes right next to each other for enabling visual tempo indicators. The left one makes the click button flash in time to the bpm, and the the right one turns the top row of buttons into a playhead indicator for the current master sequence (the earliest track currently playing). If there is no master sequence, the position indicator will not be active, but the blink indicator always flashes with the global tempo.

All the way on the right is a checkbox to enable MIDI clock. When this is on, a clock signal will be sent in time with the current BPM.

And below all of these on the left, by itself, is a checkbox to switch between the USB MIDI port (red) and the DIN port (green).

Playback Submode



The playback submode is used to play, mute, solo, etc. the sequences you read about in sequencer mode. The reason it is called a submode is that the buttons it uses are always active in every mode, so these features are always immediately accessible.

The playback functions are accessed through the 8 play buttons along the right side of the pad grid, and four modifier buttons along the bottom left (record arm, track select, mute, and solo). By themselves the play buttons will start or stop a track, and they light up to indicate that they are currently playing. With the use of the modifiers more tasks can be performed.

Sequences have independent playheads. They are only synchronized to the nearest step (16th note), so each sequence can be at a different position. To help with lining up the sequences, you can hold shift while pressing a play button, and it will not start playing until the start of the master track's next beat. The master track is NOT the same thing as the active track. The master track is the topmost track that is currently playing, and it is used as a reference by other tracks for when the start of a beat is.

Record arm is used to arm the sequencer for live recording. While this button is lit red, and the active track is playing, anything you play will be recorded.

Track select is used to set which track is currently "active". The active track has special functionality in several modes, and is described in its own section below. This button always reflects the color of the active track. While holding this button, the play button of the active track will light green.

Mute is used to prevent a track from sounding, but allow it to keep playing to maintain its place in the sequence. If any tracks are currently muted, the mute button will be yellow, and muted tracks are indicated in yellow while this button is held down.

Solo is like the opposite of mute. If there is at least one soloed track, all the non soloed tracks are muted. When one or more tracks are soloed, the solo button turns blue. As usual, hold this down to see which tracks are soloed.

Active Track

There is always one track out of the 8 available that is designated as the active track, and its purpose is different in different modes. The active track can be changed at any time by holding down the track select button and pressing one of the 8 play buttons. You can always tell which track is active because the track select button changes its color to match that of the track.

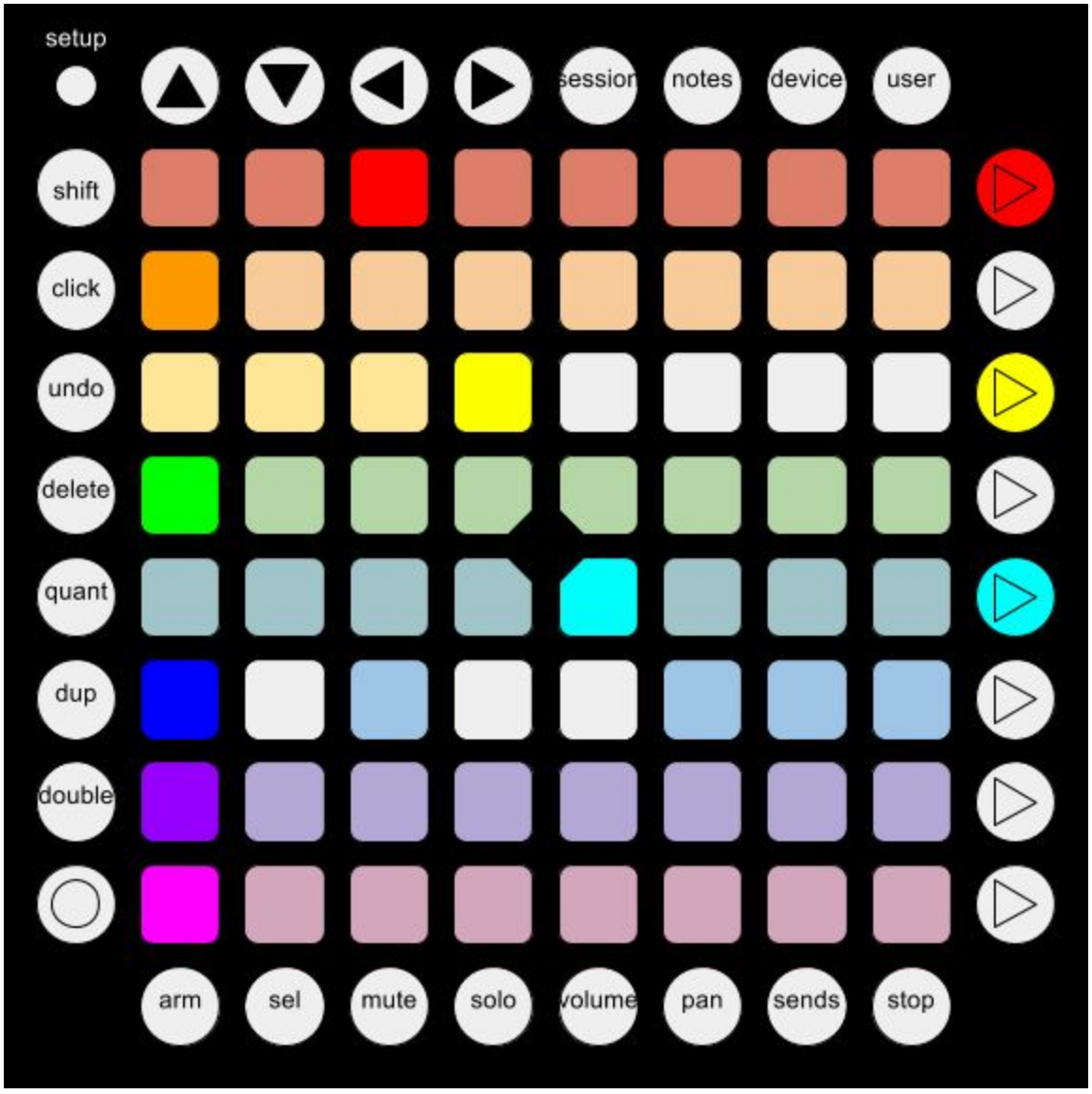
In notes mode, the active track is the one whose layout shows up on the pads. The note that gets played when you press a pad, or recorded when live recording is on, is determined by the active track's layout, and when you play the pads, the midi channel that they send on is the active track's midi channel (configurable in session setup mode). However, a track being active is independent from it being armed. You can have one track be active and another one be armed and only the armed one will be recorded into.

Another feature of the active track in notes mode is that when the active track is playing, the corresponding pads will light up when notes are played (assuming the layout hasn't been transposed too far up or down, and the note hasn't been removed from the current scale).

Notes setup uses the active track to determine which settings you are editing, since most of the settings there, like the control code and row offset, have a unique value for each track.

In sequencer mode, the active track is the one that is displayed and edited.

Session Mode



Session mode provides access to broad control over the playback and configuration of the 8 tracks, and it's also the prettiest mode. Each track is displayed across its own row with the position of the playhead indicated by the brighter light, and any skipped beats indicated by not being lit at all.

The simplest interaction in session mode is to press any pad, which will queue the sequence to start playing from the beginning of that beat, or jump the playhead there immediately if the sequence is already playing. By holding shift, you can queue a sequence to play on beat, as described in playback submode. An important fact is that on-beat queueing only works for sequences that aren't already playing. If a sequence is playing it jump immediately regardless of the shift button.

Clock Division

When you hold the click button in session mode, you'll see the first column of pads light up white. This indicates the clock division. Clock division can be set independently for each sequence to any value from 1 to 8. The clock that is being divided is the global tempo clock, NOT the master track's clock, so slowing down the master track will not slow the others down even more.

Playback Reverse

Holding undo while pressing a pad will switch that sequence's play direction between forward and reverse.

Note Clear

By holding delete and pressing a pad the notes in a selected beat can be deleted. This deletes any notes within the 4 step range from the sequence and they can't be brought back.

Beat Skipping

Using the quantise button rather than the delete button will set a section of steps to be skipped. The notes are still in the sequence, but the playhead will jump over them and immediately begin playing the next enabled step when it encounters skipped notes. This can be used to create sequences in different time signatures. Be wary of setting tons of notes to be skipped because every step, the track has to search for the next enabled note and it gets slower the further it has to search. This warning especially applies when you have many linked sequences (see below).

Copy/Paste

The duplicate button is used for copy+paste. Hold duplicate and press a row. You'll see half of the row start to blink white to indicate that it is in the clipboard. Each track has 2 clipboard slots, divided into the left half of the row and the right half. The left half is the "live" sequence, the notes that are currently playing. The right half is the storage bank, which is not played, but can be used to store not data that you want to save for later.

Once you have a flashing row, press another row (left or right side) to copy the note data into that slot. Only the notes will be copied, not other properties of the sequence, like layout/transpose settings, midi channel, etc. When a track is selected it stays in the clipboard until the duplicate button is released, so one track can quickly be copied into multiple destinations.

Supersequences

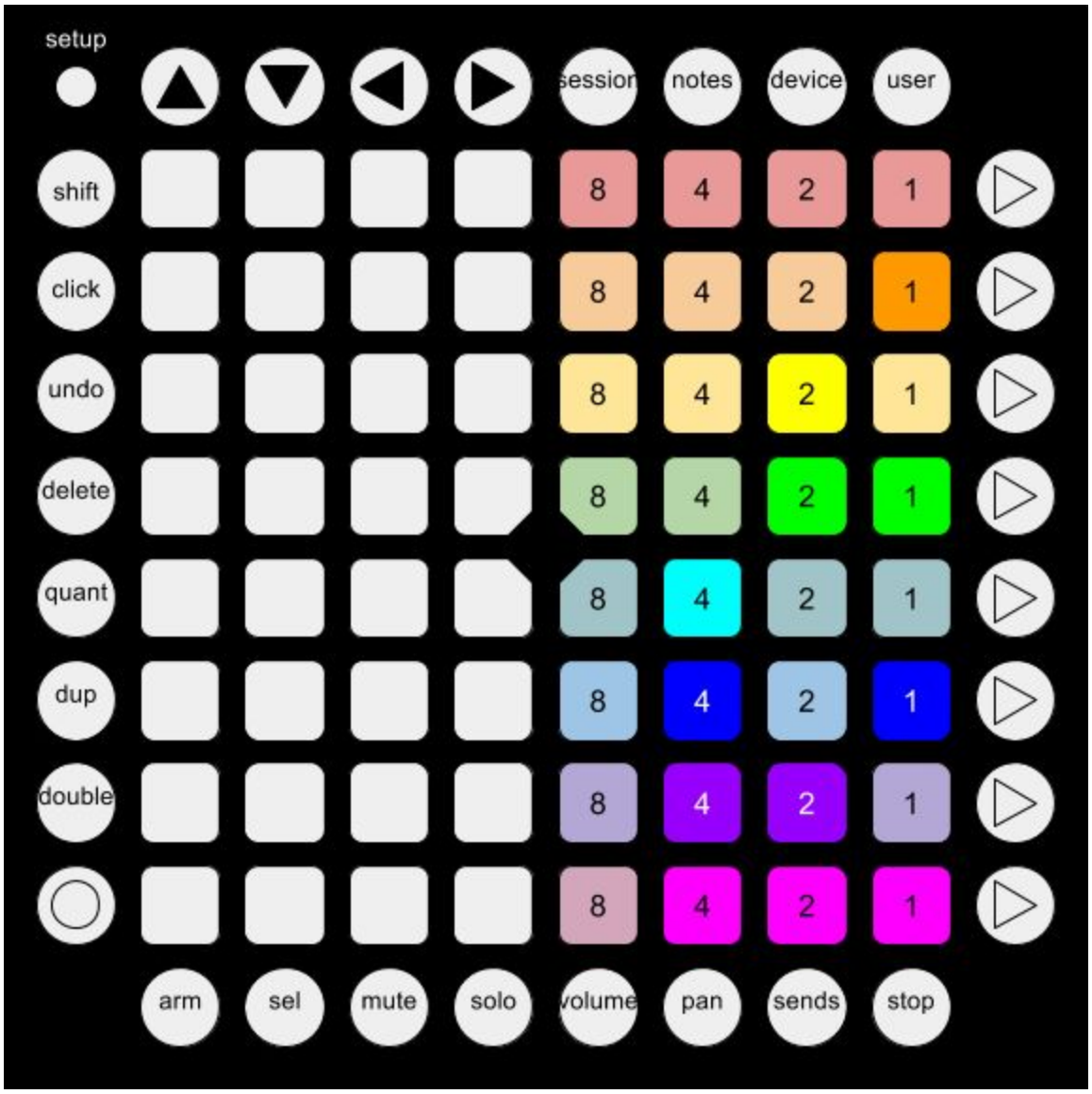
Double is a very important button: it allows you to make sequences longer than the normal length. While double is held, pressing a row sets it to be linked to the sequence below (“doubling” its length (or tripling etc.)). The pads of the second sequence will turn the color of the first sequence to indicate that it has become a “sub” sequence. Subsequences are no longer in control of their playhead, so they can’t be used independently. Think of it as losing the linked sequence entirely, and creating one extra long supersequence that behaves mostly like a normal sequence.

Jump to pad, note skipping, note deleting, and clock dividing should work like normal, and will use the supersequence’s settings. Pressing the play button of a subsequence will not make that sequence start playing anymore, it will make the supersequence’s playhead jump to the beginning of the selected row. Sequence copying, however, still works on a row-by-row basis rather than copying an entire group of linked sequences at once.

Sequence Transposing

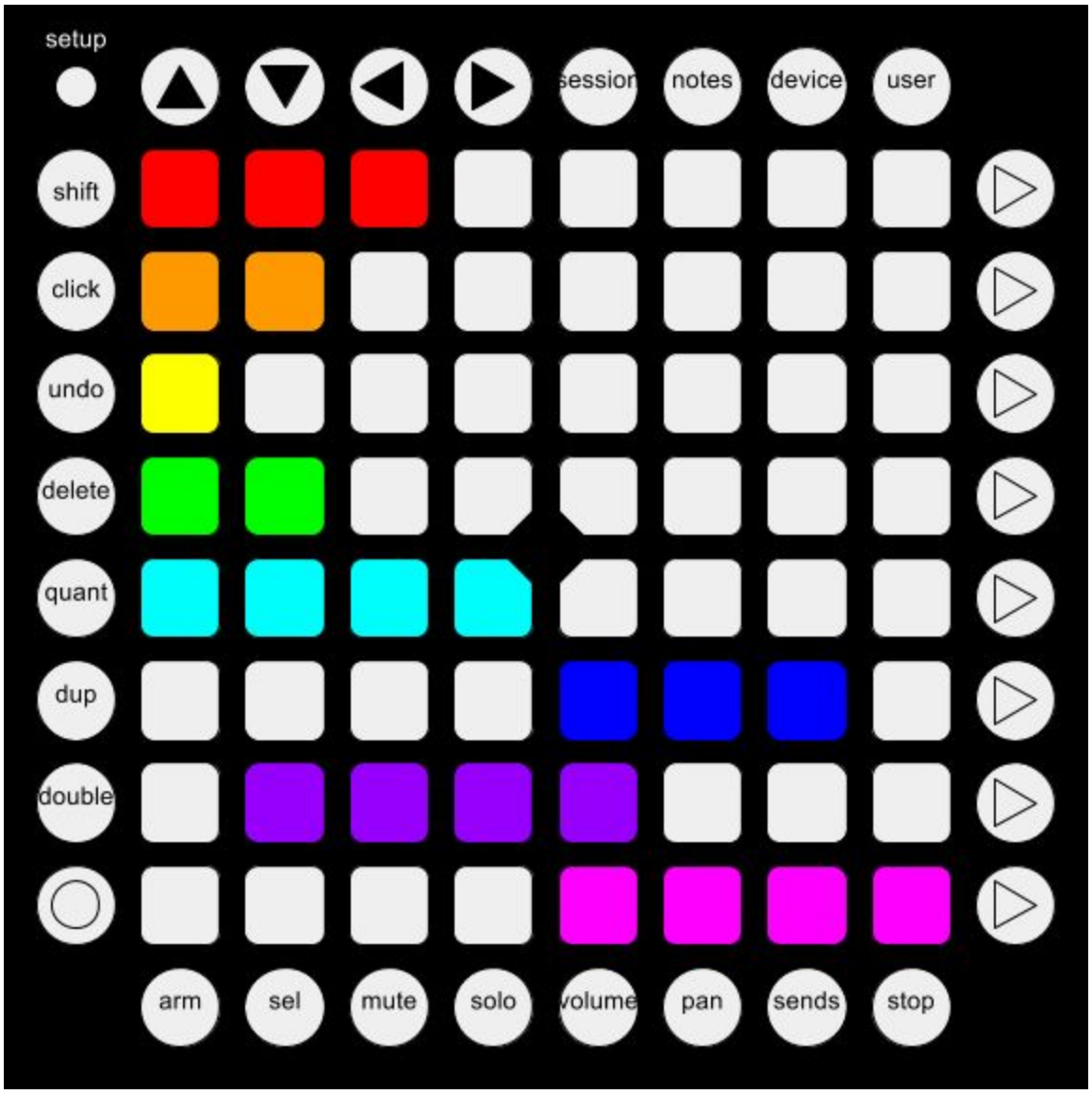
In session mode, the transpose buttons also work as modifiers. By holding a transpose button (either octave, or half-step), and pressing a row, that whole sequence will be transposed by the selected amount. Try using this in conjunction with sequence copying to create chords!

Session Setup



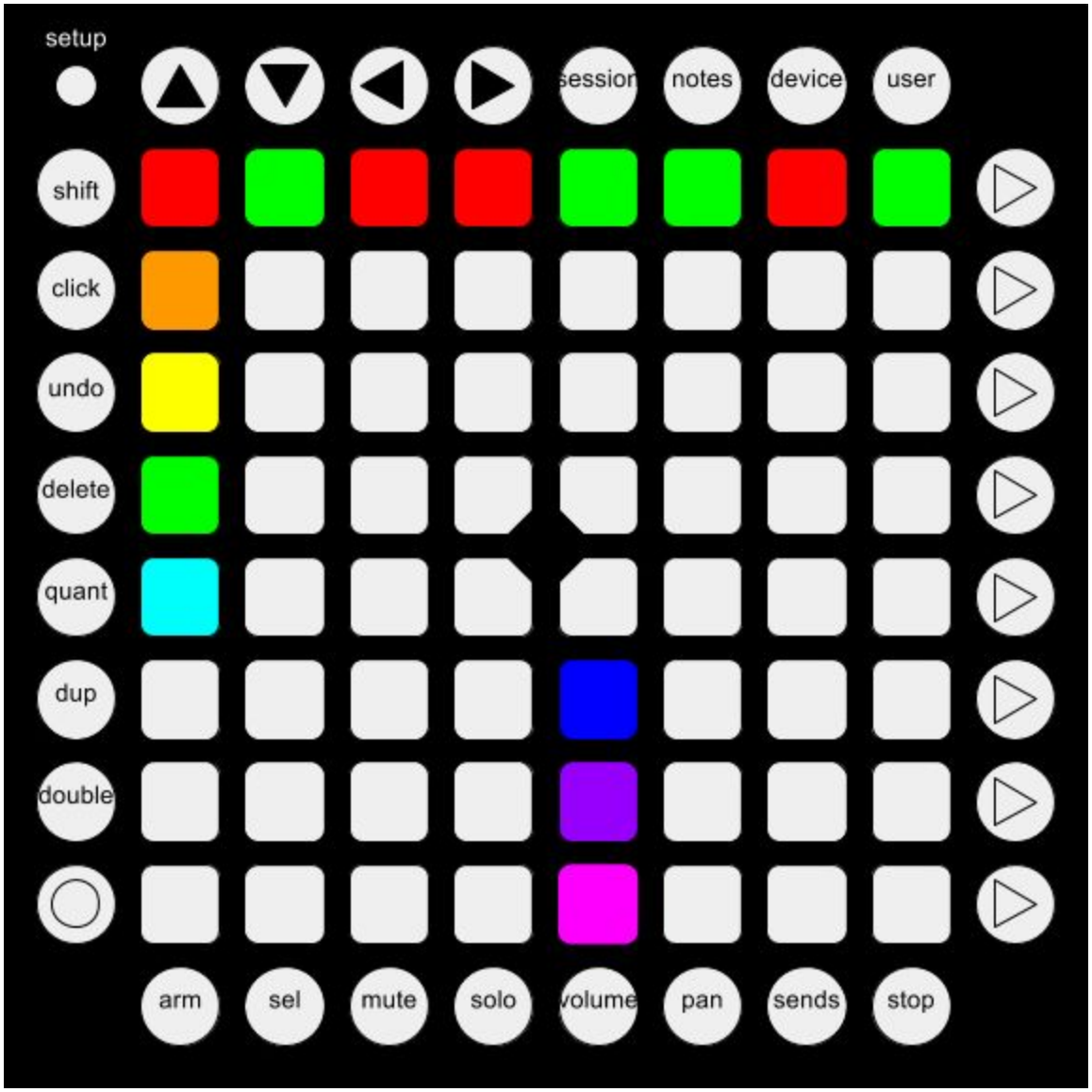
In Session setup you can select which MIDI channel each sequence will send on using the 4-pad number widgets on the right. This number represents the underlying midi channel code, which is 1 less than the human-readable number that your computer/synth will refer to. In other words, if you're trying to send on midi channel 1, enter 0 into this field.

User Mode



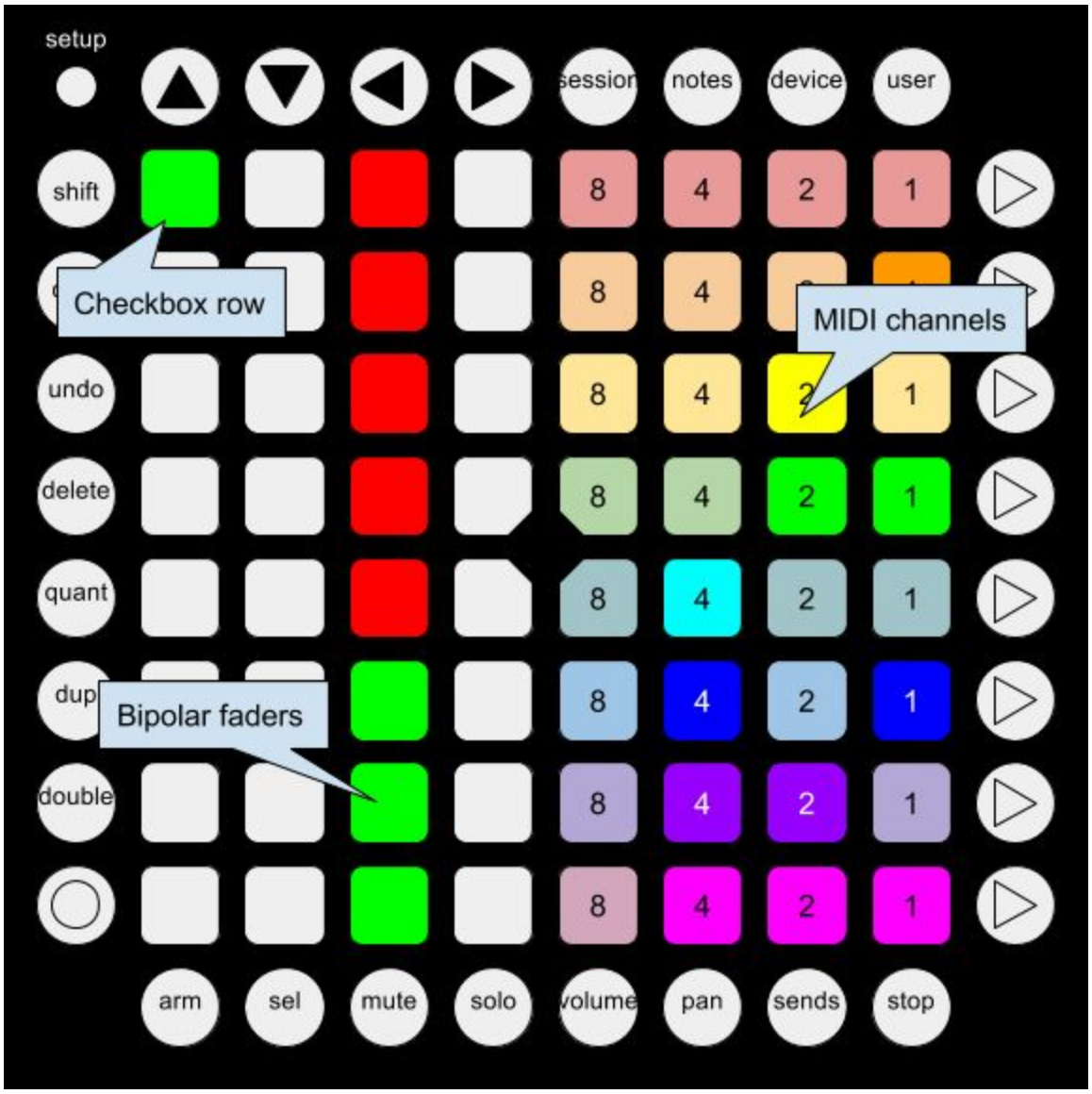
User mode provides a configurable collection of midi controls to be used for any purpose. By default, you get 8 faders that are colored like the sequences in session mode, but that doesn't necessarily mean that they send on the same MIDI channel as the sequence of the same color.

You can see in the picture that some of the sliders can be configured to be bipolar. This is a visual option that can be selected when it makes sense, but the values sent are still 0-127.



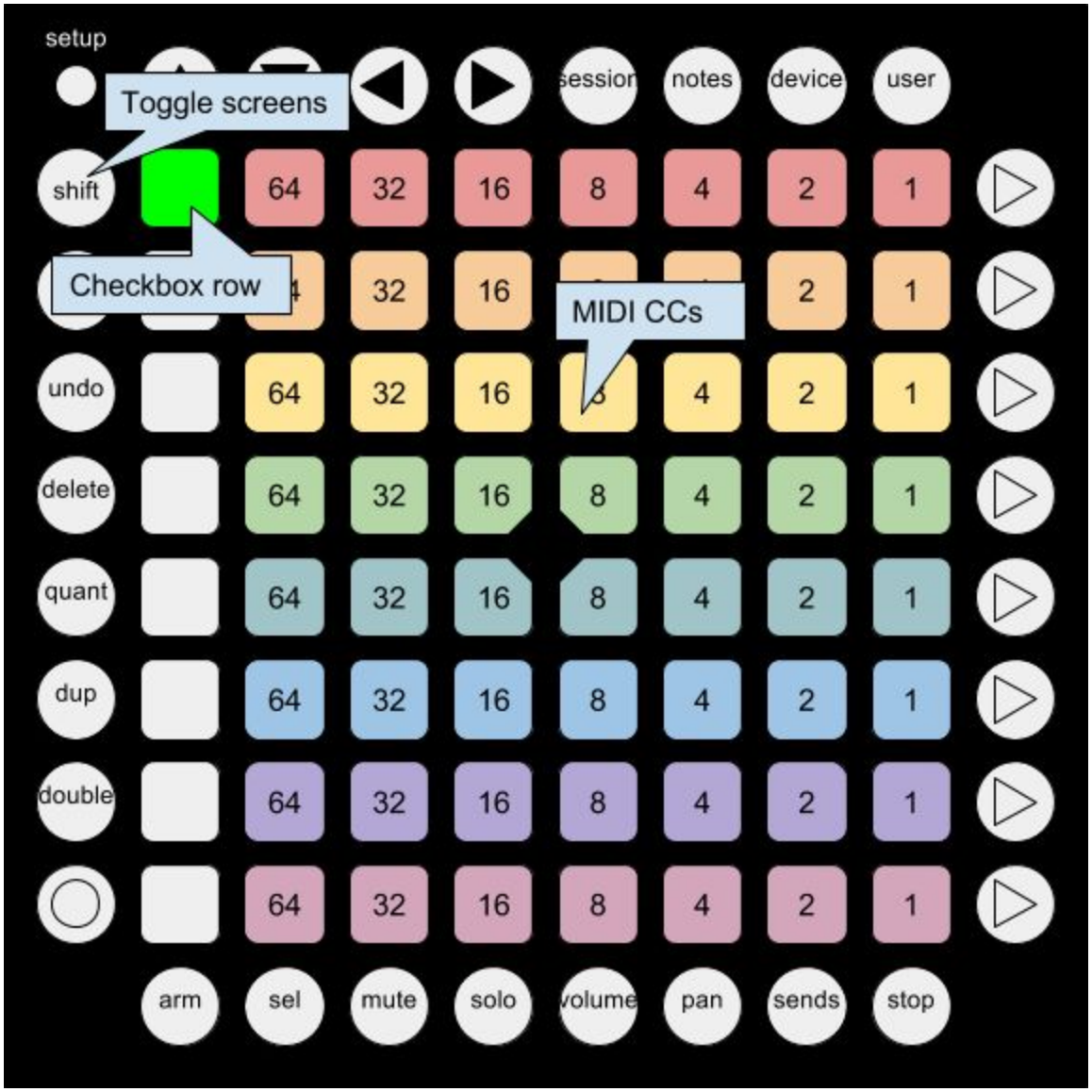
In addition to the faders, you can configure the top row to be a row of toggle boxes that send control codes of 0 or 127 only.

User Setup



User setup consists of 2 screens. The first one contains a bunch of checkboxes, and a bunch of number widgets. The first checkbox on the top left enables the checkbox row in user mode. The column of checkboxes to the right can enable the bipolar mode for the fader on each row. This is useful for values like panning, where it makes more sense to think of it as a negative/positive value.

On the right half of the screen are the number widgets for configuring the MIDI channel for each row. These work just like the ones in session setup mode.



By pressing shift, you can access the second screen of settings for user mode, which is primarily for configuring the CC of each row. The checkbox-row checkbox from the first screen is also there, to remind you of how you have that row configured while you're entering the CC. The checkbox row works a little differently from the others. Each pad on the checkbox row sends on a CC one greater than the one before, so you get a consecutive chunk of 8 CCs, since configuring them individually would be just too much.

Button Quick Reference

Notes Mode

- Pads: All the pads are used to play notes.
- Octave up/down: Used to transpose all the pads up or down 1 octave.
- Transpose down/up: Used to transpose all the pads up or down 1 half step by changing the root note of the scale.
- Click: Used by itself to set the sequencer's tempo by repeatedly tapping, or held down and used with the pads to enter 8 beats into the active sequence.
- Undo: Reverses the active sequence.
- Delete: Erases notes in the active sequence as the playhead passes over them, or clears the sequence when used with shift.
- Shift: Hold shift while using the sensitivity slider in setup mode to select negative CC scaling.

Sequencer Mode

- Pads: Enable/disable the note for the step.
- Shift+pad: Enter a slide note.
- Octave up/down (up/down arrow): Move vertically through the sequence.
- Transpose up/down (left/right arrow): Move horizontally.
- Shift+octave up/down: Zoom in/out of the sequence.
- Shift+delete: Clear the whole sequence.
- Undo: Reverse the sequence's play direction.

Playback Submode

- Play buttons: Used to manipulate one of the 8 tracks.
- Shift+play: Constrains the playing to the start of the beat.
- Record arm: Toggles arming, which enables live recording into the active track.
- Track select, mute, solo: Modify the function of the play buttons.

Session Mode

- Pads: Pressing pads starts a sequence playing, or jumps the playhead to that beat.
- Shift+pads: Queue a stopped sequence to start playing on beat.
- Click+pad: Select a clock division.
- Undo+pad: Reverse a sequence's play direction.
- Delete+pad: Erase that beat from the sequence.

- Quantise+pad: Set that beat to be skipped.
- Duplicate+row+second row: Copy the first sequence's notes to the second sequence.
- Double+row: Sets the sequence to be linked to the sequence below, becoming an extra long sequence.
- Transpose+row: Transpose all the notes in the sequence at once.

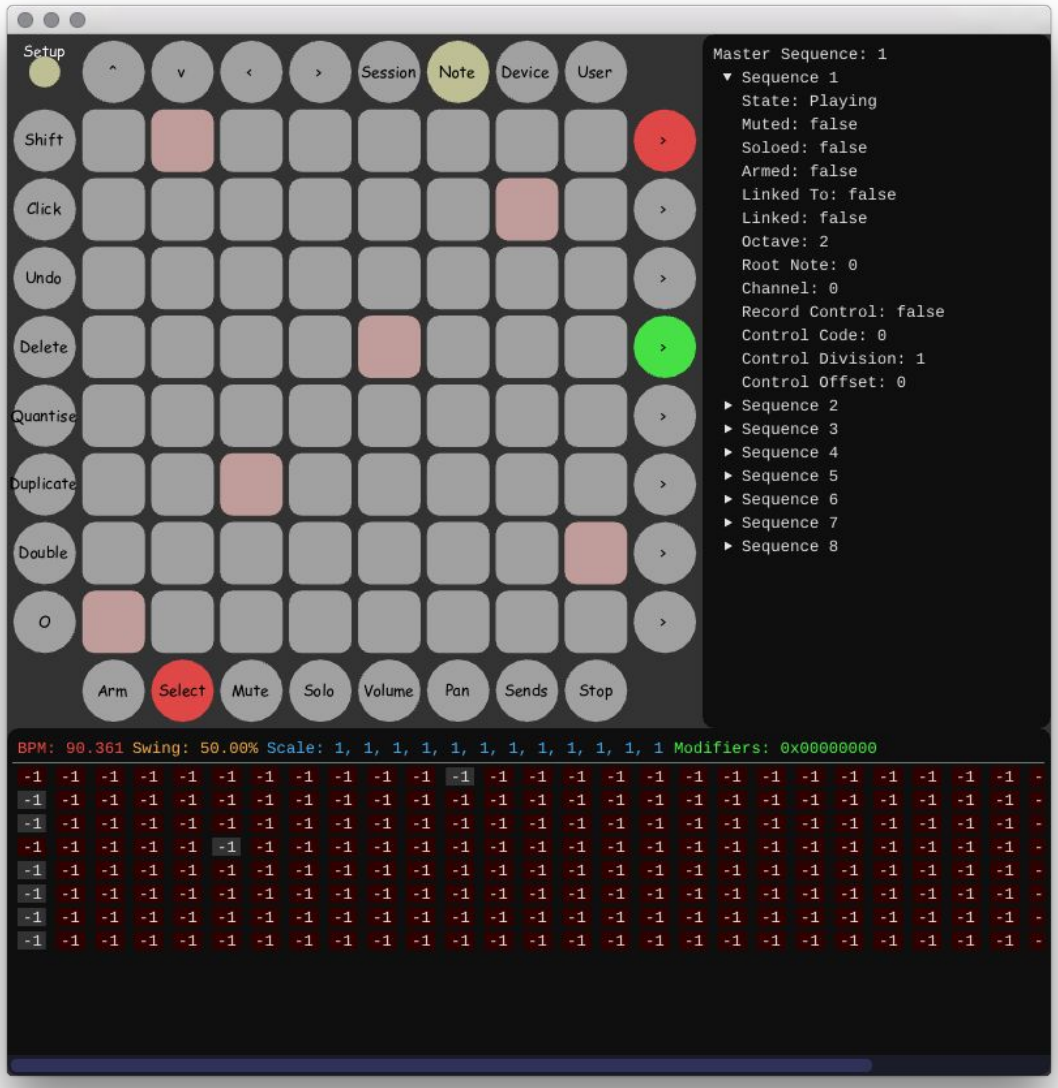
User Mode

- Shift: Switch between the 2 pages of settings in setup mode.

Notes for Programmers

If you'd like to make a contribution to the development of Subsequencely, here's some information that might be useful.

VirtualLpp



VirtualLpp is a wrapper around the Launchpad Pro open firmware API that allows you to test your Launchpad code on a desktop computer. This is a simple wrapper to help with testing and debugging, and is NOT a simulator. This means that this program will not accurately reflect things like the running speed of the code, the memory usage, etc. when compared to the actual launchpad hardware.

VirtualLpp is built on the Cinder framework and uses ImGui for a gui and RtMidi for sending the midi messages from your launchpad code. This means it should be very portable, but I haven't been at a computer other than my mac recently, so currently there is only an XCode project in

the git, but if you'd like to run it on another platform, using the Cinder project generator to make a project and then putting it in the VirtualLpp directory and adding the source files to it should be pretty straightforward.

If you'd like to use VirtualLpp to test your code, a helpful thing to know is that there is a file called launchpad_pro_debug.syx in the VirtualLpp/resources directory that you can load onto your Launchpad in order to use it as a controller for VirtualLpp. When you first boot it up the lights around the edge of the Launchpad will turn red, and when you start VirtualLpp it will look for the Launchpad Standalone device and pad events and LED information will be sent between the software and hardware. You do need to connect the launchpad before you start the program, though, since it currently doesn't support hot plugging.

Launchpad Template