

Hexapad Microtonal User Guide

Version 0.80, released January 3, 2016

Overview

Hexapad Microtonal is an update to the Lemur Hexapad project, providing a hexagonal key array interface with user settable number of notes per octave. Key note and octave numbers are displayed across any user setting from 1 to 51 notes per octave. The octaves are color coded to help distinguish adjacent octaves. An octave alignment setting allows the array to change from a simple row times column shape to one that auto-adjusts to keep fingering the same for every successive octave. Root octave and note variables allow setting the root note relative to MIDI notes.

IMPORTANT NOTE: Hexapad Microtonal does not remap key pitches to microtonal scales! It simply remaps the assignment and designation of keys in useful ways, so that the keys correspond to remapped scales in end devices that support microtuning with more (or less) than 12 notes per octave: IOS/Android software synthesizers, MIDI/CV converters, keyboard synthesizers or Windows/MacOS/Linux software synthesizers. The output of Hexapad Microtonal is standard MIDI notes with no pitch bend applied, so key arrays are limited to 128 notes, and an external microtonal sound generating device is still needed.

A useful web site for identifying microtonal capable synthesizers is <http://www.microtonal-synthesis.com>. A useful program for loading, creating and manipulating microtonal scales is Scala, located at <http://www.huygens-fokker.org/scala/>. The Scala home page also lists many synthesizers with internal tuning tables.

Global Variables used in Scripts

If you are in edit mode or in the Lemur Editor on your computer, you can see the top level variables and arrays under the Hexapads drop down menu. The list begins with global variables and arrays which can be used either in scripts or assigned by the user. Global variable assignment allows the variable to be used in multiple scripts and have to be defined at this top level. The following global variables are used by scripts and should not be changed in value; normally they are set to zero.

- cursors – an array used to track key presses
- init – initialization variable
- rowLength – calculated array used to track row length for aligned octaves

- shift – calculated value used to adjust notes for aligned octaves
- x – an array used to track status of keys in the key pad array
- xn – an array used to translate keys for octave aligned key pad arrays

User Configurable Global Variables

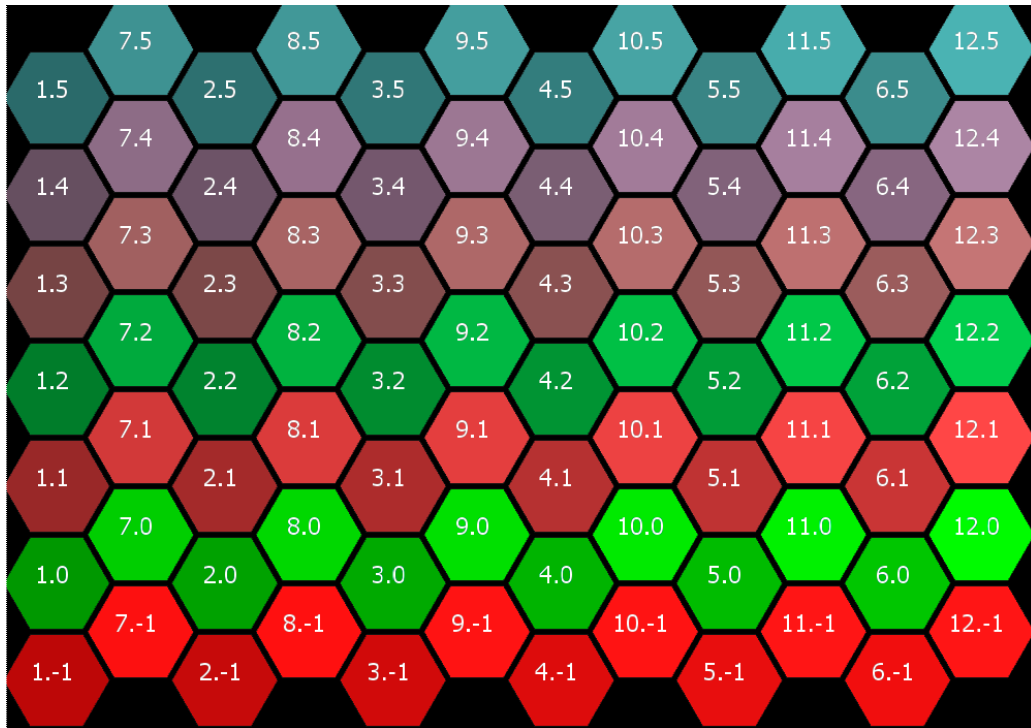
The following variables allow the user to customize the microtonal key array. If you want to have multiple key array versions available, you must change the variable and then save the file with a new name. Instructions for user variable usage are given below.

- **baseNote** – References 12 note per octave MIDI note number to use in the key array in the top left key position. The baseNote shifts the keys in the array, note by note. Normally the reference is “C” which is a multiple of 12 in MIDI : 48, 60, 72, 84, etc. Typical useful values are 60-120.
- **channel** – MIDI channel for note transmission, range 1 to 16.
- **cols** – Number of columns in the hex key pad array. Useable range depends on the screen and keypad sizes, usually 8-12.
- **displayNotes** – Turns on/off the text display of note and octave values. Turn display off with zero, turn display on with one.
- **margin** – Adjusts the gap (black space) between hex key pads. A typical value is -10, larger positive values create larger gaps.
- **notesOct** – Determines the number of notes per Octave displayed in the array. Range is 1 to 51.
- **octAlign** – Turns on/off octave alignment. When off (=0), the full array is presented with notes running sequentially across rows and columns. When on (=1), the keypad is arranged “octave repeating” so you have the same fingering pattern for every octave. As a result keys to the right are sometimes missing (blacked out) to make an odd number notes per octave or array work out.
- **radius** – Size of the individual keys. If your total array size does not fit the screen properly, you can adjust either radius or row and columns to fix it. Normal values 40-70.
- **rootNote** – The root note, when combined with the root octave (rootOct), selects the standard 12 note scale values to use for pivoting of non-12 scales. C=1, C#=2, D=3...B=12, so the allowable range is 12. Normally you’ll pivot off C, rootNote=1.
- **rootOct** – Reference Octave to use in the key array. All keys displayed and transmitted as MIDI will be derived from the baseNote and rootOct variables. Typical values 0-7. See the more detailed description below.
- **rows** – Number of rows in the hex key pad array. Note that a row consists of a zig zag pattern across the screen. Useable range depends on the screen and keypad sizes, usually 3-7.

Note and Octave Display and Key Positions

To simplify the support for microtonal scales with up to 51 notes per octave, notes are displayed as simple numbers from 1 to n, where n = the notesOct variable. Octaves range from -1 to 9 and are based on the MIDI definition, where C4 = MIDI Note 60 (decimal). Note number appears first, then octave number, separated by a period. In the first image below, 1.4 is C4 or MIDI note 60. 3.5 is D5 or MIDI note 74. 12.1 is B1 or MIDI note 35.

For a 12 note per octave scale (notesOct=12), and an array size of 7 by 12 (rows=7, cols=12), the key array displays as below. Since the column width and notes per octave match, there is no difference with octave align (octAlign) is on or off. Base Note = 72, which is C5, while rootOct=4, which makes no difference for 12 notes per octave. Effectively a 12 note per octave scale is always aligned with the 12 note per octave designations for MIDI note numbers.

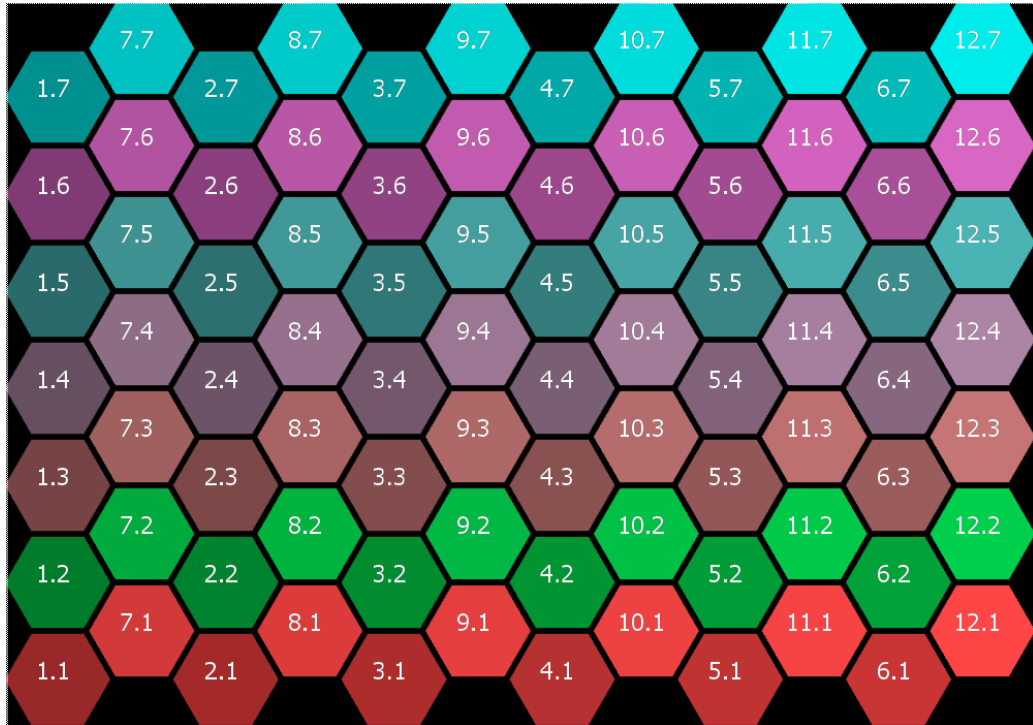


Note ordering is left to right, bottom to top. The rows zig zag to fit the hexagonal array, and for note sequencing the bottom “zig” is numbered sequentially, then the top “zag” continues from there.

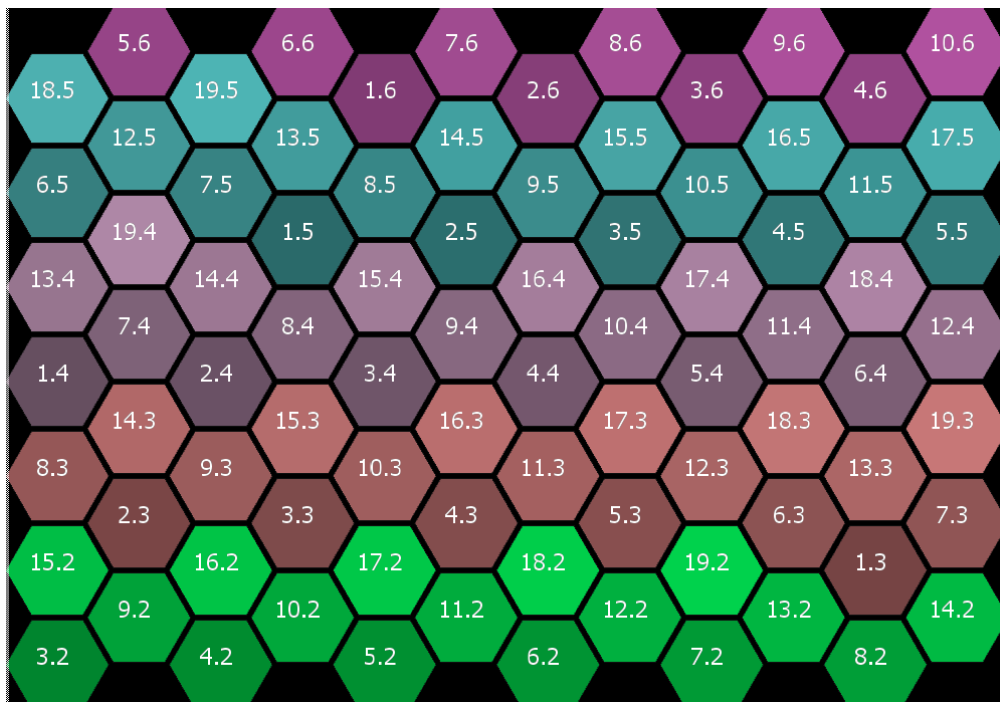
The lowest transmissible note is MIDI note 0 or C-1 or 1.-1 in 12 note display. The highest transmissible MIDI note is 127 or G9 or 8.9 in 12 note display.

Changing baseNote to 96, or 24 above the prior image, shifts the notes up two octaves as shown below. 1.7 or C7 is now the reference. When doing 12 equal,

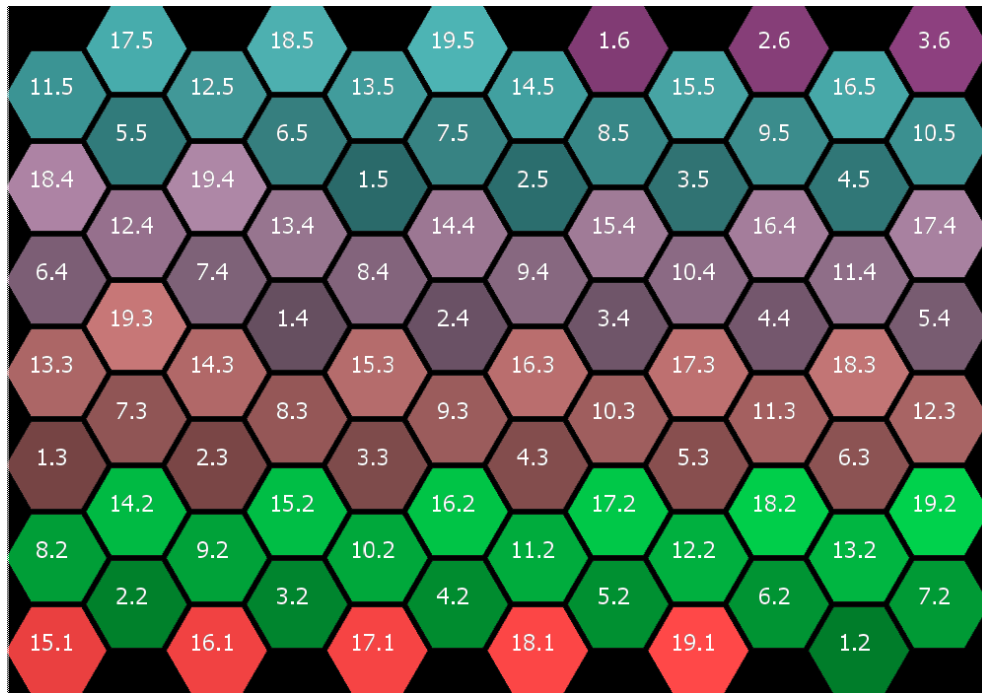
baseNote sets the absolute position of the MIDI note in the upper left most corner of the array.



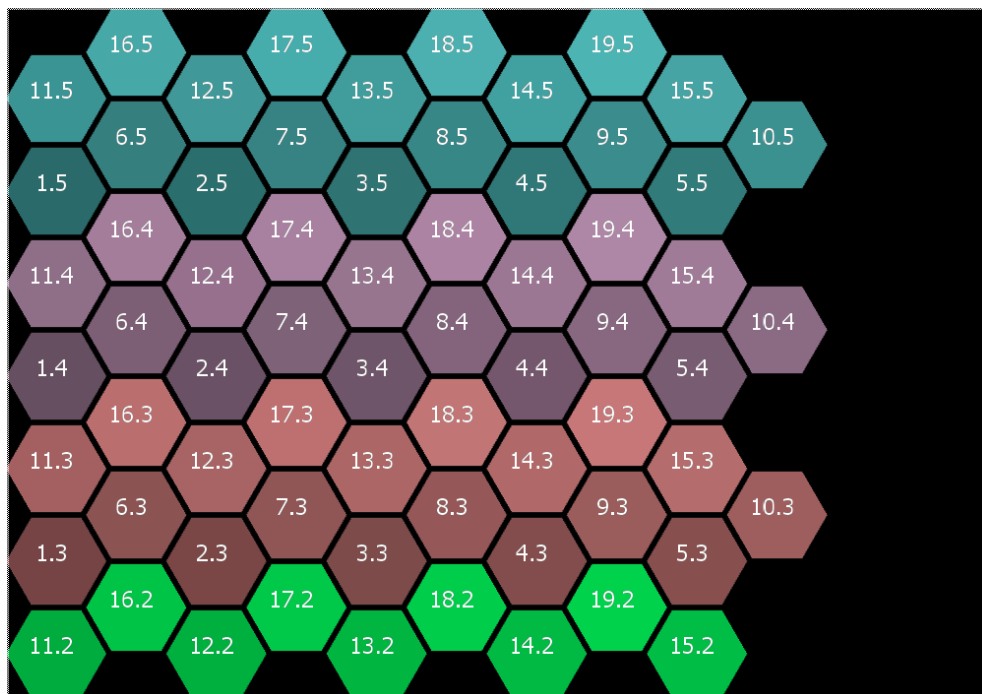
With octave align turned off (octAlign=0), a sample 19 note per octave scale appears as shown below. The 1.4 (C4) positions match across both key arrays, set by rootOct=4.



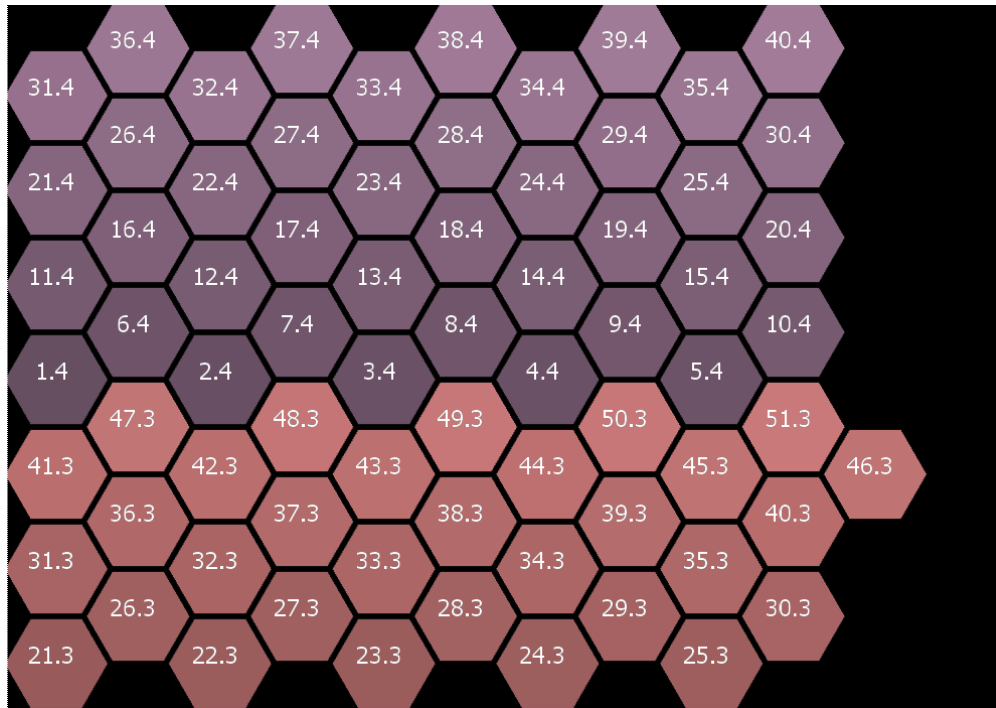
By changing only rootOct to 3, the scale below shifts to reference off 1.3 (MIDI C3) compared to the 12 note per octave array.



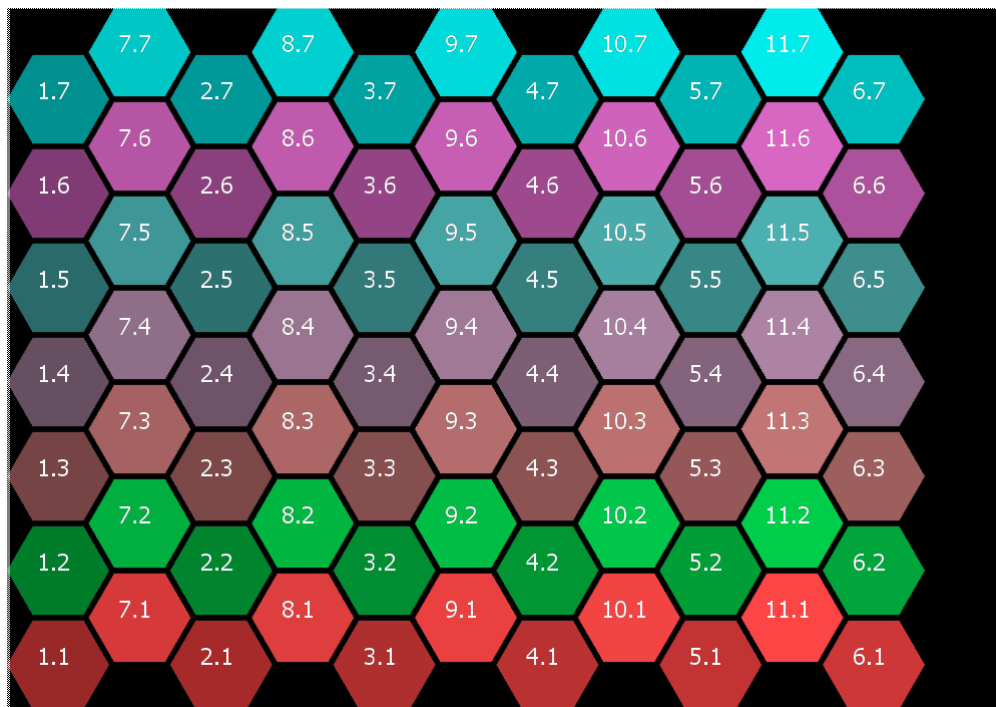
With octave align turned on (octAlign=1) and rootOct back to 4, a sample 19 note per octave scale appears as below. Each key now appears in the same relative position for every octave, reducing each row width as needed for alignment.



The key array alignment works for scales up to 51 notes per octave as shown below.



Octave align also works for octave less than 12 notes per octave, or less than the array column width. NotesOct=11 below.



To summarize:

- `baseNote` sets the position of the notes in the array.
- `rootOct` sets the root octave for pivoting of non-12 scale notes
- `rootNote` sets the root note of the 12 note scale and is used with `rootOct` to set the pivot point. In just intonation, think of `rootOct` and `rootNote` combined as defining 1/1. It is really defining the MIDI note number for the non-12 scale to base itself from. Normal settings will pivot from `rootNote=1` or C and `rootOct=4` or `octave4`, for a MIDI C4 root.
- The root note is normally used for non-12 notes per octave. If `rootOct=4`, `rootNote=1` and `notesOct=19`, then example MIDI notes are:
 - `note 18.3 = MIDI note 58`
 - `note 19.3 = MIDI note 59`
 - `note 1.4 = MIDI note 60 = root note`
 - `note 2.4 = MIDI note 61`
 - ...
 - `note 18.3 = MIDI note 77`
 - `note 19.4 = MIDI note 78`
 - `note 1.5 = MIDI note 79`
- If `rootOct=4`, `rootNote=3` and `notesOct=19`, then example MIDI notes are:
 - `note 18.3 = MIDI note 60`
 - `note 19.3 = MIDI note 61`
 - `note 1.4 = MIDI note 62 = root note`
 - `note 2.4 = MIDI note 63`
 - ...
 - `note 18.3 = MIDI note 79`
 - `note 19.4 = MIDI note 80`
 - `note 1.5 = MIDI note 81`
- The displayed keys do not change based on `rootNote`, only the MIDI notes transmitted will change.
- If you see notes repeated at the bottom or top of the key array, that means you have reached the MIDI note limits of 0-127. Adjust `rootOct` and `baseNote` to get a more useable range.
- If note names other than 1, 2, 3... are preferred, they are defined in the array "notes" in the draw script and can be rewritten by the user.