Tubbutec µTune user manual

http://tubbutec.de

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Contents

Part I
This is not a finished manual!! Work in progress !!

1   Introduction

Tubbutec µTune is a microtonal modular multi tool designed to serve all needs that may arise when dealing with microtonal scales in a modular context.

But of course you can also use in a normal, not microtonal way: It is a powerful midi interface, midi router, quantizer and more..

below is a block diagram which shows the most important parts of µTune's signal flow. Only one of the two channels is shown.
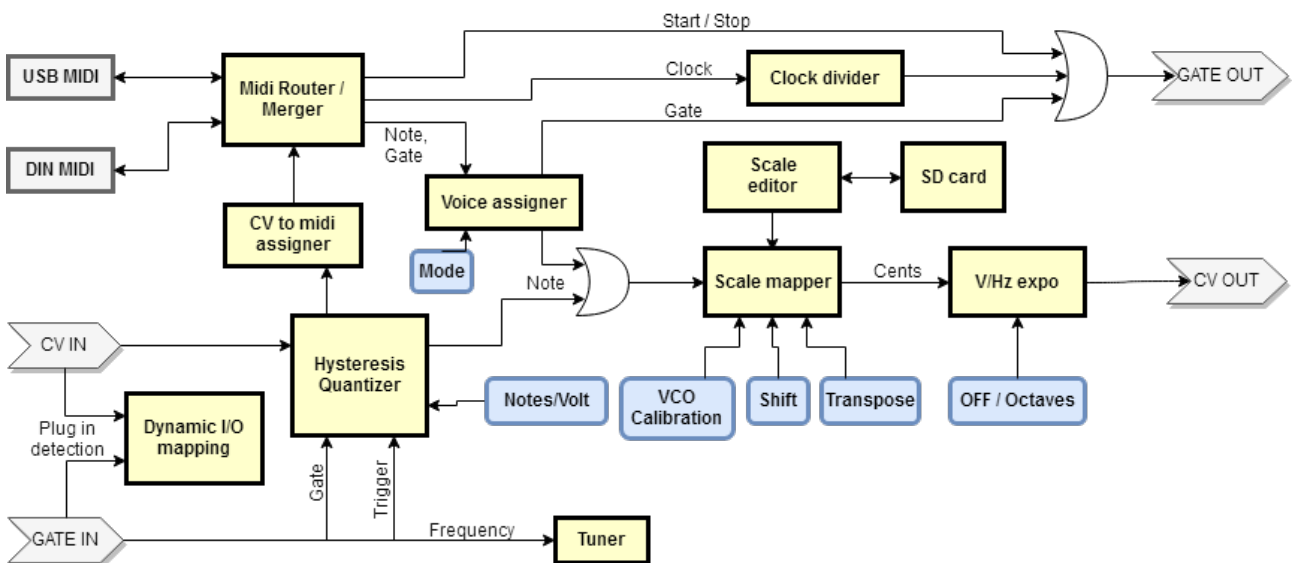
Figure 1: Simplified µTune functional flow chart

The input voltage at CV-in is converted to a note number in the quantizer. It uses a hysteresis at its input in order to filter noisy signals. The quantizer can work in free-running mode, or be triggered or gated by the signal at the GATE input. GATE-in can also provide other functions such as measuring frequency for the tuner, or trigger a random transpose.

A second possible source of note numbers is midi. Midi note events coming from either USB-midi or DIN-midi are routed in the midi router and passed to the voice assigner. Here note and gate signals are created depending on the voice assign mode and output configuration. Dual mono, or several different duo phonic voice assign modes are available.

The note numbers are then passed to the scale mapper. Here they are converted to a pitch value via the currently loaded scale. Parameters such as Transpose or Scale Shift are included as well as the VCO correction factors. Optionally an exponential converter can be activated, turning the logarithmic pitch to a linear one. At the end of this signal chains sits a 16 bit DAC, which turns

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the value into a voltage between 0V and 10V.

The GATE-out can output Midi Start/Stop signals, Midi clock with adjustable divider or midi gate from the voice assigner.

The configuration of input and output functions is dynamic and reacts to whether CV-in and GATE-in are plugged in. For each possible combination functions can be defined freely. This way µTune can change its function based on what you intend to do, without having to change a lot of settings first.

2   µTune user interface
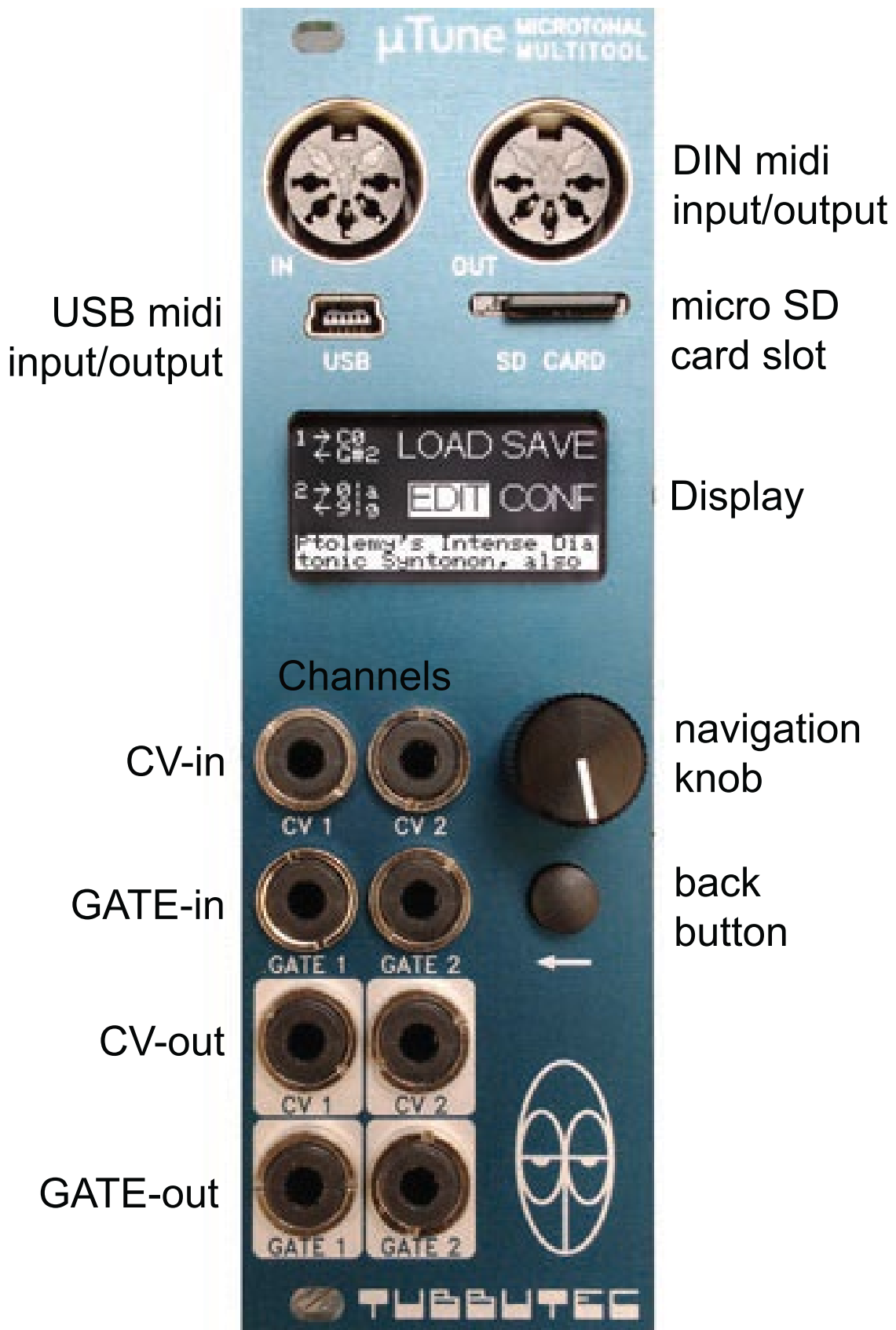

Figure 2: µTune interface overview

Tubbutec µTune comes as a 3HE module with a width of 8HP. It connects to DIN-midi via the two DIN sockets. The input is on the left, the output on the right. A mini-USB socket provides a midi USB device interface. You can connect it to any host (PC, MAC,..). µTune will be automatically recognized as midi interface and a driver installed. Next to the USB connector is a slot for a micro SD card. The card is inserted with its 'tooth' pointing to the left. A 128x64 OLED display shows µTune's menus and configuration pages. You can navigate in the menu by using the navigation knob and the back button. The navigation knob can be turned left or right to select items and change values.You can also press it down, this is the ENTER button. The back button will always bring you back to the previous menu page.

µTune has two CV/gate channels with four 3.5mm sockets each. Each channel consists of CV-in, GATE-in, CV-out and GATE-out. The outputs are marked with a white background. All inputs and outputs can be configured to serve various functions.

3   Main menu

Figure 3: Main menu

The main menu shows an overview of µTune's status. Furthermore you can load a scale from SD card (LOAD), Save a scale (SAVE), edit a scale (EDIT) and enter the configuration menu (CONF). Simply enter these menus by navigating to them with the navigation knob and press enter.

On the left side you can see the status of channels 1 and 2. The right pointing arrow shows the GATE-in status. It becomes thicker if the gate is active. Next to it, the 'input note' is displayed. This is the note recognized by the quantizer. The left pointing arrow shows the status of the output gate. Next to it the 'output note' is shown. This is the note that is mapped via the scale mapper and put out to CV-out as a voltage. There are different ways input and output notes can be displayed. (See notations).

On the bottom of the main menu, you can see the name of the currently loaded scale.
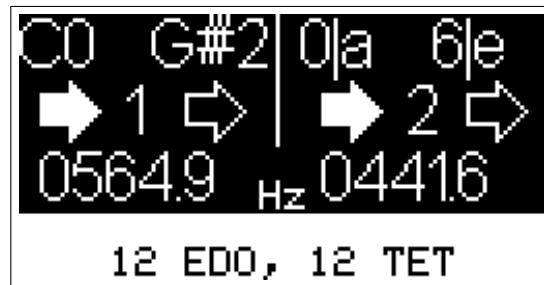
3.1   Status Page / Tuner

Figure 4: Status and Tuner

If you press BACK in the main menu, you get to the status and tuner page. On the left side, you see input and output status of channel 1, on the right side those of channel 2. Below you can see the frequency detected at the GATE-in inputs. On the bottom you can see the name of the currently loaded scale.

To exit the status and tuner page, press any button or turn the navigation knob.

4   Load, Edit and Save scales

4.1   Load a scale

Figure 5: File browser

To load a scale press LOAD in the main menu. This will open the file browser showing the contents of the SD card. Directories are marked with a 'folder' symbol, scale files with a 'scale file' symbol. In the upper right corner you can see the number of entries in the current directory.

By using the navigation knob you can scroll through the directory contents. When a scale file is selected, the bottom of the screen will show the name of the scale. You can load a scale by pressing ENTER. μTune reads and writes the Scala .scl format.

When selecting a directory, you can enter it by pressing ENTER. The ... entry brings you up one directory.

Due to limitations of the μTune hardware and the FAT file system, the items are not sorted alphabetically, but roughly in the order of their creation. Additionally directory access becomes slower, the further down you scroll in a directory. We therefore recommend to organize scales in a tree structure with not more than about 50 scale files per directory.

After loading a scale, press the BACK button to get back to the main menu.

Figure 6: Scale editor

4.2 Save a scale

Press SAVE to save your current scale. You can now chose if you want to save the scale using a new file name (Save as), save the scale using the current file name (Save) or if would like to first chose the directory to save the scale (Choose directory). If you decide to enter a new file name, you will be presented with the file name dialog. Use the navigation knob to select the next character of the file name. Press enter to use this character. If you want to delete the last character press DEL, for upper case letters press SHIFT. When you are finished entering the file name, press OK. To cancel press the BACK button.

4.3 Scale editor

The built in editor lets you create and edit scales without the need of an additional computer.

4.3.1 Navigation in scale editor

If you cursor is above a note number on the left and blinking, you can use the navigation knob to scroll up or down. Press enter and the cursor will stop blinking, indicating that you have selected a line to edit. You can now use the navigation knob to select parameters. Press enter on a parameter to edit it and press it again to resume selecting other parameters.

4.3.2 Edit scales

In the first line you can set the number of notes in the scale, change its name (NAME) and create a new equal tempered scale (NEW). In order to create an equal tempered scale, set the number of notes to the desired value, set the repeating interval (see below) and press NEW. A new equal tempered scale will be created and the scale name adjusted accordingly. For example setting the note number to 12 and the repeating interval to 2/1 will create a 12TET scale, setting the note number to 13 and the repeating interval to 3/1 will create the equal tempered Bohlen-Pierce scale.

The other lines starting with 01, 02, etc show the notes of the scale. Each note is displayed in two lines. From left to right the first line shows the note number (03), an active indicator (little arrow), the note pitch in cents and note pitch as fraction. The second line contains the name of the interval if it is a known one.

You can edit each of these parameters:

- The active indicator can be toggled to deactivate a note in scale, basically creating a subset of notes.
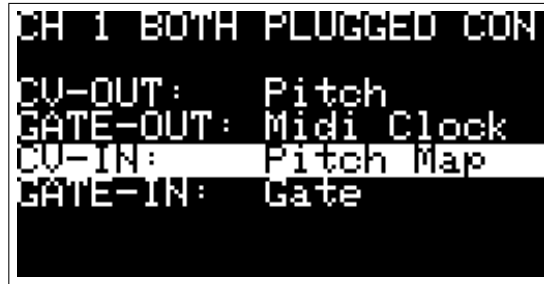
Figure 7: Channel config

- The pitch in cents can be edited by selecting a digit and using the navigation knob to adjust the value. Usually this is a positive number, but some exotic scales contain negative pitches, so negative cents are possible.

- You can also set the pitch as a fraction. In this representation 1/1 is unison, or 0 Cents, 2/1 is an octave, 3/2 is a perfect fifth. Changing the fractional value will adjust the cents accordingly. If it is a known interval, its name will be displayed in the second line. Fractions with a numerator larger than the denominator will create positive cent values, fractions with a numerator smaller then the denominator will create negative cents

- You can also move the cursor to the second line and chose your pitch from a list of intervals. The fractional and cent values will be adjusted accordingly. If no known interval is selected the second line shows nothing, but scrolling starts from the interval closest to the current pitch. So for example if you have a pitch value of 300 cents, you can move the cursor to the second line and starts scrolling. Scrolling will show you "Persian wosta" (302.8 cent), "Wide augmented 2nd" (296.1 cent) , and so on.

5 Config Menu

In the config menu you can set configuration for inputs and outputs, midi and keyboard mapping. It also contains the VCO calibration, and miscellaneous tools, such as a midi monitor.

5.1 Channel configuration

Channel 1 and 2 can be configured individually by selecting 'Channel 1' or 'Channel 2' in the config menu.

μTune can detect weather an input is used and change the configuration accordingly. For each of the four possible modes (cv and gate not plugged in, cv only plugged in, gate only plugged in and both plugged in) you can configure the function of each input and output. This can be done in a simple way which is sufficient in most cases, or you can specify the behavior in full detail.

Simple channel config Here you can set configuration for all inputs and outputs. μTune will copy these settings to the parameters in the Advanced Config, overriding them if applicable. The following input and output configurations are possible.

- CV-OUT: Pitch (Pitch voltage), VEL CH1/2 (Midi velocity from channel 1 / 2), Aft CH 1/2 (Midi aftertouch from channel 1/2), OffVel CH 1/2 (Note off velocity channel 1/2)

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- GATE-OUT: None (output disabled), Midi Gate (Midi gate from voice assigner), Midi clock, Midi Start/Stop, Gate Pass (Pass through the incoming gate)

- CV-IN: None (input disabled), Pitch Map (map quantized value to pitch via scale), Transp CH1/2/both (Transpose channel 1/2/both), Shift CH 1/2/both (Change scale root of channel 1/2/both)

- GATE-IN: None (input disabled), Gate (Quantizer runs in gated mode), Trigger (Quantizer runs in triggered mode), Random CH1/2/both (Randomly transpose channel 1/2/both on trigger), Frequency (use input for frequency detection)

Advanced channel config   Advanced channel config contains all the parameters of simple channel config, but they are adjustable for each of the four possible configurations individually:

- Both unplugged: GATE-in and CV-in are both unplugged

- CV-IN plugged in: Only CV-in is plugged in, GATE-in is unplugged

- GATE-IN plugged in: Only GATE-in is plugged in, CV-in is unplugged

- Both plugged in:; Both GATE-in and CV-in are plugged in

Other channel parameters   Further channel parameters are adjustable

- Clock divider: Set the divider for the midi clock. Is used when Midi Clock is selected as GATE-out function.

- CV-in NOTES/V: The number of notes per Volt the quantizer detects at the input. Usually this number is 12 because of the 1V/octave standard, but for scales with a length different than 12 it may make sense to change this. If you have a quartertone scale for example you can set this to 24 and still maintain 1V/Octave. A higher number of notes will however result in a reduced noise rejection, depending on the voltage source this might lead to incorrectly detected notes.

- V/Hz: Set the number of octaves for V/Hz mode, or turn it off (default). More info in the chapter about V/Hz mode

- V/Hz Offset: Offset parameter for V/Hz mode, see chapter V/Hz

- Trigger Delay: If Trigger is selected as GATE-in function, this parameter introduces an additional delay between trigger detection and actual quantizing. This is to compensate for sequencers with a slowly rising CV output.

- Notation: Set the displayed notation of the current note for this channel. See chapter notations.

5.2 Midi configuration

The Midi configuration settings contain parameters for midi input (Midi-to-CV), midi output (CV-to-MIDI), as well as configuration pages for the midi router.
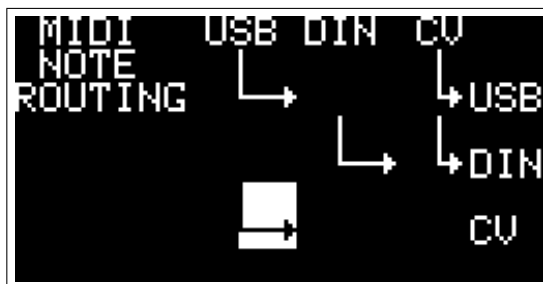
Figure 8: Midi Routing

5.2.1 Input Config

- In channel 1: Set the midi input channel for µTune channel 1, or turn it off.

- In channel 2: Set the midi input channel for µTune channel 2, or turn it off.

- Assign: Voice assigner mode.

    – Dual mono gives you two independent monophonic voices.

    – Cycle A and B are duophonic assign schemes, here only midi channel 1 is used as input.

    – Cycle A switches voices on each note on event

    – Cycle B does so only if the new note has not yet been assigned to a voice.

    – Random assigns the new notes to the voices randomly

- In bender range: Range of the pitch bend input in seminotes. 1 means the full range of the midi pitch bend message is assigned to ±1seminote, 12 means ±12 seminotes. 0 means pitch bend input is turned off.

5.2.2 Output Config

- Out channel 1: Set the midi output channel for µTune channel 1, or turn it off.

- Out channel 2: Set the midi output channel for µTune channel 2, or turn it off.

- Out note offset. This number is added to the midi note created by the CV-to-MIDI converter. It can be used to adjust its pitch offset.

- Out bender range: Range of the pitch bend output in seminotes. 1 means the full range of the midi pitch bend message is assigned to ±1seminote, 12 means ±12 seminotes. 0 means pitch bend output is turned off.

5.2.3 Midi Routing

A flexible midi router and merger lets you route midi note and real-time messages independently.
    Note routing sets the routing paths for all non-midi real time messages such as: Note messages, controller messages, pitch bend, aftertouch, etc. These messages can be duplicated and merged. Clock routing sets the routing paths for midi clock, midi start, midi stop and continue. These messages can be duplicated, but to merged due to their nature.
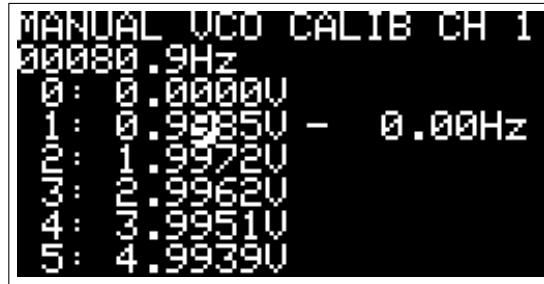
Figure 9: VCO calibration

In the routing menu you can see three midi sources on the top: USB (USB midi input), DIN (DIN midi input) and CV (midi from the CV to midi converter). On the right are three midi targets: USB (USB midi out), DIN (DIN midi out) and CV (µTune's voice assigner).

You can use the navigation knob and the enter button to turn routing paths on and off. For example in the picture USB-in and CV-in are merged and routed to USB-out. DIN-in and CV-in are merged and routed to DIN-out. And USB-in is routed to the µTune voice assigner.

Since merging is not possible with clock signals, in Clock routing only one source per target is possible.

5.3   Keyboard mapping

In the keyboard mapping menu you can specify how an incoming note number (be it from a midi keyboard or quantized CV-in input) is mapped to the scale. Currently there are the following parameters, but complete keyboard mapping and .kbm file support will be added soon.

- Mdl note: The middle note specifies the center if the scale. When playing this note the pitch will be constant no matter which scale you load or how many notes the scale has. µTune displays this note in two different notations (number and seminotes)

- Mdl volt: The voltage corresponding to the Middle note. This voltage will be at the output if you play the middle note, no matter which scale is loaded. µTune displays the voltage in 1/12V steps.

- Ref note: The reference note for which the Reference Frequency is given (currently not used, will be used by the tuner)

- Ref pitch: Reference pitch, frequency of the Reference Note (currently not used, will be used by the tuner)

5.4   VCO calibration

µTune contains an 11-point output calibration for VCOs. VCO calibration can be used to improve tracking of a VCO, or to adjust the V/Octave scaling.

VCO calibration menu lets you select the channel, open and save a calibration file, reset the calibration to default and perform the actual calibration.

To perform a calibration make sure your VCO is plugged into CV-out. (Let's say on channel 2). Select channel 2 and enter 'Manual VCO calibration'.

Now plug the output from your VCO into GATE-in on channel 2. In the upper left corner you will see the detected VCO frequency. Navigate to the 0V entry and press enter. µTune will now output

0V and save its frequency. When the frequency reading is stable, press enter again and navigate to the 1V entry. Press enter and μTune will now output 1V. The pitch of the VCO should now be an octave higher. μTune shows you the difference between the detected and the expected pitch. If the detected pitch is negative you have to increase the voltage, if it is positive you have to decrease it. Try adjusting the voltage until the frequency difference reads 0Hz. depending on how stable your VCO is this might not quite be possible due to pitch drift, but try to zero in as good as possible.

When finished repeat this for all voltages.

You can now save the calibration. It is completely independent from the channel, so if you later connect the same VCO to channel 1, you can just load the file into it.

VCO calibration can also be used to change the output V/Oct scaling. The EMS Synthi A for example uses 0.32V/Oct or 0.26V/Oct. Just set 1: to 0.32V, 2 to 0.64V, and so on and you are ready to go!

VCO calibration also works in V/Hz mode, currently the voltages displayed are meaningless, but it works nevertheless.

5.5 Misc

The Misc menu contains various tools and settings

5.5.1 About

The about page shows infos about μTune and the people who helped building it. Use the navigation knob to scroll.

5.5.2 Midi monitor

The midi monitor shows the recent midi messages which passed through the midi router. Each line shows one message. On the left message source and targets are shown. U stands for USB-Midi, D for DIN-Midi and μ for μTune. The reset of the line shows the message, press enter to switch between several representations.

5.5.3 Expert settings

Settings used during production and deveopement. such as calibration, testmodes, etc.. you better don't touch these unless you know excactly what you are doing

5.6 Firmware reset

This resets all parameters to their default values.

6 Input output configuration

7 Scales

-Introduction - notes, repetition interval, ...

8   Quantizer / mapper

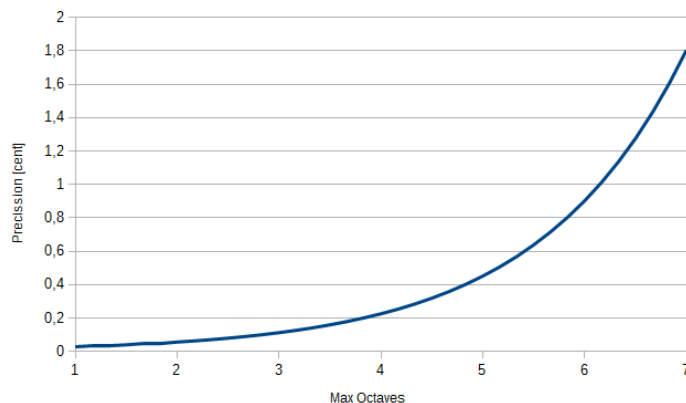- basic stuff - triggered, gated,... - input Notes/Volt - transpose - shift

Figure 10: Precision in Hz/V mode

8.1 Hz/V

µTune provides an optional Hz/V output mode for VCOs / synthesizers with a linear (as opposed to exponential V/Oct) input. Examples are the Korg MS20, or a linear modulation input of a VCO module. Providing the correct voltages to such a VCO can be tricky and sometimes require calibration. We tried to make interfacing as easy as possible though.

In Hz/V mode pitch precision is not constant on an exponential scale. This means that within a finite voltage range (0V-10V) precision measured in cents varies with the maximum number of octaves - the more octaves you want, the less precision you get on the low end. The picture below shows the worst case precision in relation to the maximum number of octaves:

In order to get the most precision, µTune maps the highest note to 10V and then goes down from there. So for example if you have a maximum of 3octaves, C3 will be mapped to 10V, C2 to half of it: 5V, C1 to 2.5V and C0 to 1.25V. Since µTune's output resolution is fixed to about 0.15mV, but each added octave means half the voltage range, the precision halves with each added octave.

Some VCOs or synthesizers add or subtract a fixed voltage at the linear input. To compensate for this, µTune has a voltage offset parameter. If your VCO's frequency is not 0 at 0V input, there is an internal offset added. It usually is positive, so to compensate you'd have to set a negative voltage offset.

As an example let us take the Doepfer A-110-2 VCO. With 0V at the linear input it is running, but stops if -2V are applied. So if we set the offset to -2V, we can use the linear input and obtain correct tune. However this means that of the numbers above (10V, 5V, 2.5V, 1.25V) 2V are subtracted, effectively limiting the maximum range. You could instead subtract 2V with an adder module and not have this side effect. Usually however this is not necessary, normally the offset is much smaller - if it exists at all.

9   Midi

9.1   - midi to CV

9.2   various modes, etc, gate, etc

9.3   voice assign modes

9.4   midi to clock

9.5   CV to midi

9.6   midi router

9.7   midi controller

10   Notations

For each channel different note notations for the display can be chosen. Some notations are better suited for 12 note scales, other more universal supporting any number of notes. The following notations are availible:

Decimal

Note numbers are displayed directly in decimal form starting at number 0.

Hex

Note numbers are displayed directly in hexadecimal form starting at number 0. Each digit can have the values 0-9 and A-F
   Examples: 3E, 07, 2A

Semitone

A common semitone notation. Notes are displayed as C, C#, D, D#, etc.. followed by a number signifying the octave/repeating interval.
   Examples: C0, C#0, D0, D#0

Quartertone

Similar to Semitone notation, but also features quartertone symbols | and ||| in additon to #.
   Examples: C0, C|0, C#0, C|||0, D0

Relative 1

Notation in the form (octave/repeating interval number|note symbol) where 'note symbol' is indicating the note in the scale. 'Note symbols' use letters a-z for the first 26 notes in a scale, followed by letters A-Z for notes 27-52. Followed by Greek letters: alpha, beta, gamma, delta, epsilon, ro, nu and theta (in this order). This notation can cover scales with up to 60 notes.
   A 7-note scale would thus look like this:

1|a, 1|b, 1|c, 1|d, 1|e, 1|f, 1|g, 2|a, 2|b, 2|c, 2|d, 2|e, 2|f, 2|g ,...

Relative 2

Similar to Relative 1, but not using letters a-h, and A-H to not confuse this notation with a Semitone notation.

11   VCO calibration

- manual VCO calibration - (automatic VCO calibration)- - load and save configuration data

12   Tuner

13   Tools

14   12 Technical specifications