

## De-Generator

8Bit DIY SYNTHESIZER / SAMPLER



### Operating manual V 1.02

The 'De-Generator' is a stereophonic 8Bit synthesizer / sampler diy kit with two digital oscillators for playback of wavetables and samples, a stereophonic 24dB multimode filter and a digital delay / echo circuit. The SD card can be used to load user waveforms and sample files in WAV format into the 1MByte RAM. In addition, the 'DE-GENERATOR' has a 16-step step sequencer. A big color TFT display allows simple operation of the synthesizer and graphic representation of waveforms. Parameters are entered via four rotary encoders and eleven function keys.

The 'De-Generator' is designed as a DIY KIT and is intended for customers who have a basic knowledge of electronics and a little experience with digital or analog synthesizers. Some mechanical experience is required and soldering and assembly of a case are also.

The kit consists of four boards: Motherboard, CPU-Board, Filterboard and Panelboard. The CPU board contains SMD components and is therefore completely assembled and tested and delivered to the customer.

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## Foreword

Thank you for purchasing the 'De-Generator' synthesizer. This synthesizer combines different types of sound synthesis e.g. subtractive synthesis, FM synthesis, wavetable synthesis, sampling and is therefore a great playground for sound tinkerers. A graphical 3.2" TFT display for the visual representation of the waveforms and a simple menu structure simplify the operation. The synthesizer is designed as a kit and is therefore aimed at experienced users with good soldering experience.

## History



As an electronic technician I always wanted to do something with sounds and electronics. Fascinated by the first synthesizers in the 80s and music by Jean Michel Jarre, Kraftwerk, OMD and Depeche Mode, I developed one or the other in the field of music electronics. At the beginning of the 90s I bought my first synthesizer... a Korg Poly-800. My first micro-processor controlled device was a Midi Monitor to analyze midi data sent from the Poly-800.

## DIY Projects

The received Midi data was displayed on an LCD display and Midi commands could be sent to a connected synthesizer or expander module via a keyboard. My Poly-800 synthesizer didn't stay unopened for long. The technology inspired me so much that I had the idea to build my own synthesizer. But as is the case in life, work, family and other things take more time and one's dream fades with time.



## De-Generator

In 2012 I had more time for my hobby again and became aware of the Shruthi synthesizer by Olivier Gillet. That was exactly what I wanted to do. But I just didn't want to rebuild anything either. And so I decided to develop my own synthesizer. Thanks to the generous support of Olivier Gillet, Wolfgang Schmitt, Thomas Margolf and the long-term collaboration with Andre' Laska, I was able to make my dream come true.

## Special thanks

Olivier Gillet, [www.mutable-instruments.net](http://www.mutable-instruments.net)

Wolfgang Schmitt, alias Wiesolator from the cc2-forum

Thomas Margolf, [www.facebook.com/thomasmargolf](https://www.facebook.com/thomasmargolf)

Wolfgang Rudolph and Wolfgang Back, [www.cc2.tv](http://www.cc2.tv)

Andre Laska, [www.tubeohm.com](http://www.tubeohm.com)

## Development team

Hardware: Andre Laska, Rolf Degen

Software: Rolf Degen

Design: Andre Laska

Firmware: 1.0.2 Date 04.03.2019

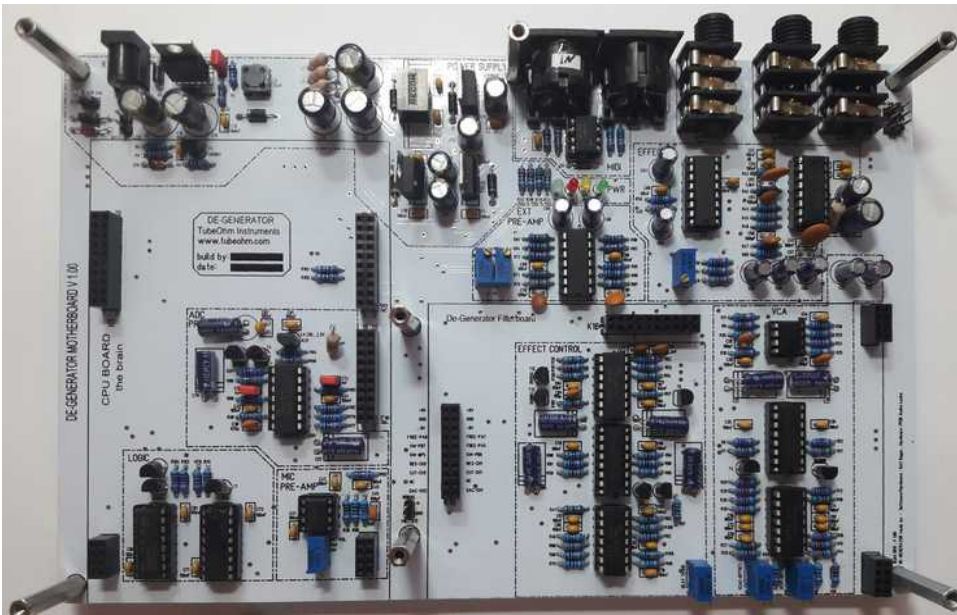
Block in german: <http://cczwei-forum.de/cc2/thread.php?threadid=5878>

Block in english: <https://forum.mutable-instruments.net/t/shruthi-synthesizer-and-my-wave-1/2504/1126>



# Assemblies

## Motherboard



## CPU-Board



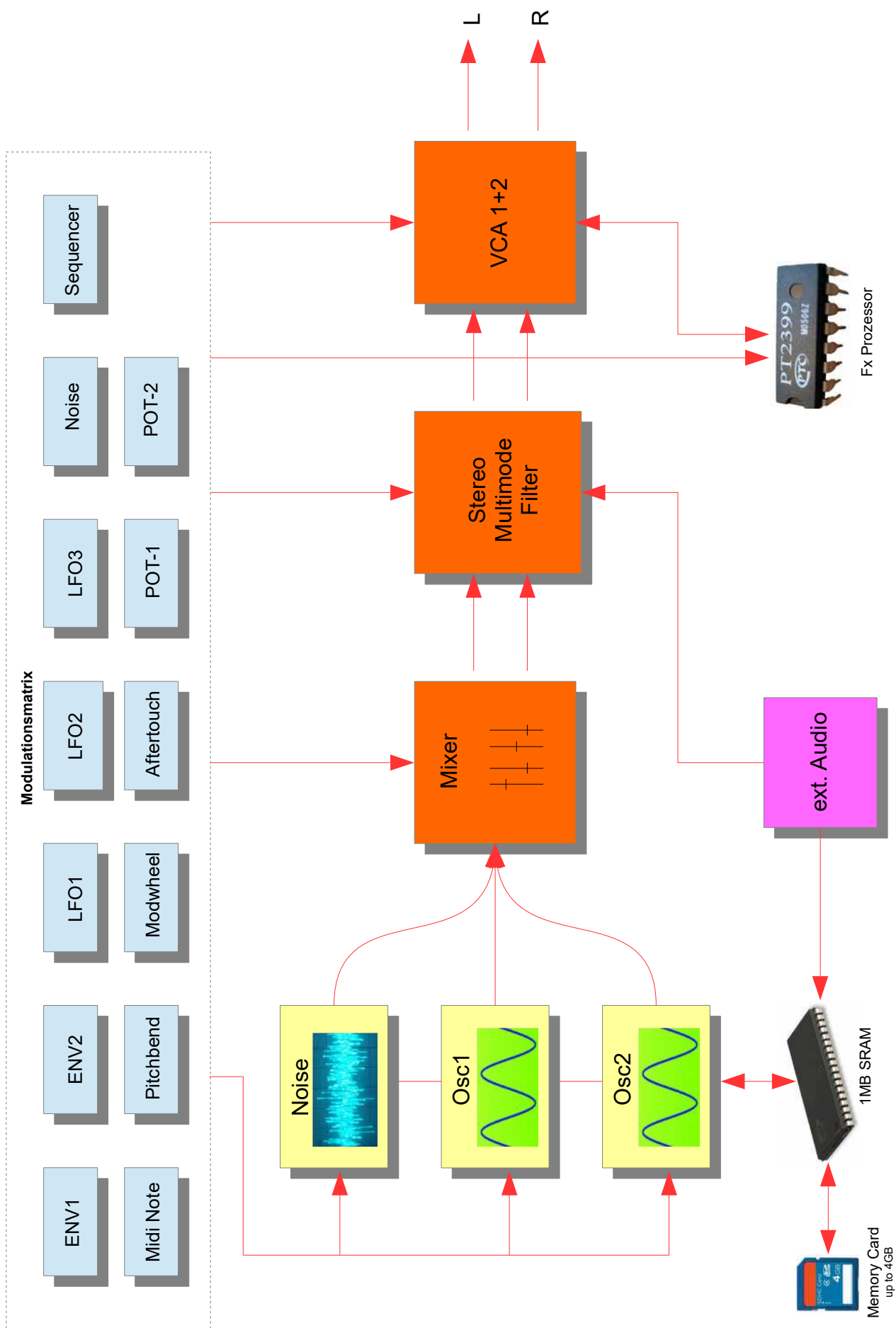
## Filterboard



## Panelboard



# Block diagram



## Sound generation

The 'De-Generator' is a stereophonic 8Bit synthesizer / sampler kit equipped with two digital oscillators for playback of waveforms and samples, a stereophonic analog 24dB multimode filter and a digital delay/echo circuit. An ATxmega128 microcontroller calculates and interpolates the waveforms and samples. In addition, the ATxmega128A1U has a fast memory interface for controlling a 1MB sample memory in the de-generator. A total of 100 preset banks with 128 memory locations each are available for storing sounds on a standard SD card (4-64 GB). A clearly arranged browser helps with preset management.

At the heart of the 'De-Generator' is an ATxmega128 microcontroller from Microchip (formerly ATMEL) which is clocked at 32 Mhz and also calculates the waveforms. In total there are two digital oscillators (DCO) and one sub-oscillator available, which can reproduce a variety of fundamental waveforms, e.g. sine, square and sawtooth as well as sample files. In addition, you can draw your own waveforms in the 'De-Generator' and save them in a waveform bank. Own samples can be recorded either via the integrated microphone or the audio input. It is also possible to load sample files in 16Bit WAV format into the 'De-Generator' via the SD card. There is a built-in editor for sample files, e.g. to delete sample areas and set loop points.

A digital mix function controls the volume and balance of the oscillators. It is also possible to synchronize Oscillator 2 with Oscillator 1 or to activate Ring Modulation. The pitch of both oscillators can be set in a range of +24 / -36 stop steps. A digital noise generator and a portamento function round off the setting options in the oscillator menu.

The 'De-Generator' has a replaceable filter board. The current filterboard with the designation SMR4S7-V1.0 is an analog stereo filter which can be switched as 6 - 24 dB low-pass, 12 dB high-pass and 12dB band-pass. OTA chip's of type LM13700 are used in the filter. They have less internal distortion and therefore a generally smoother sound.

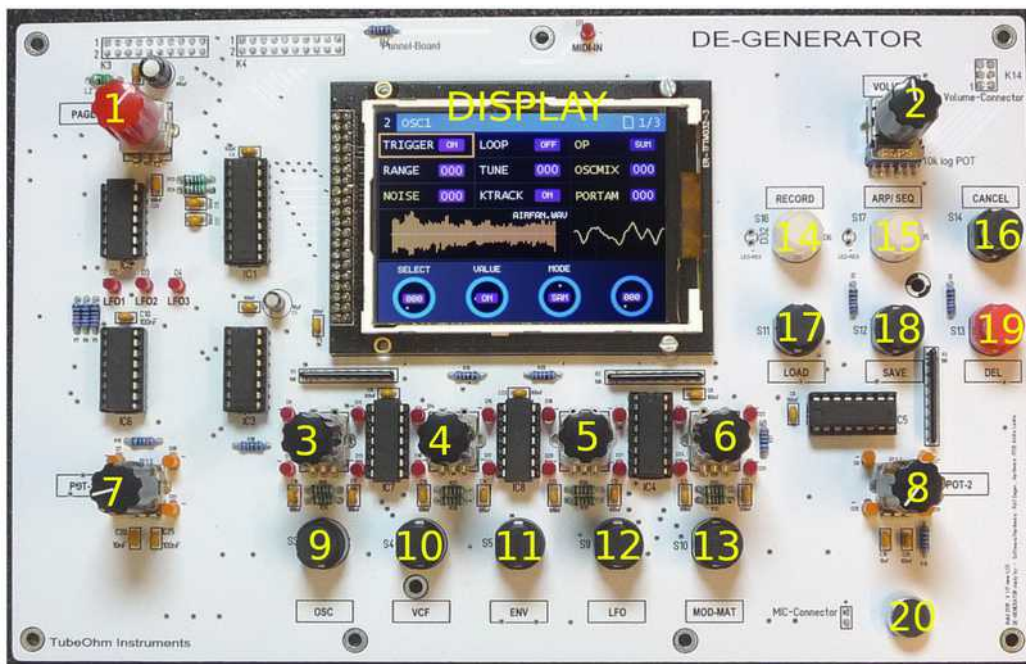
For modulation there are 2 ADSR envelopes, 3 LFOs with 127 waveforms + S&H and a 12-fold modulation matrix. A 16-step sequencer is built in for rhythmic sounds, which can be programmed and transposed from a MIDI keyboard.

## De-Generator Features

- two digital oscillators for sampling / wavetable
- SubOscillator
- Noise generator with adjustable filter frequency
- Stereophonic Multimode Filter 6-24 dB LP/HP/BP/LPHP
- 2 ADSR Generators
- 3 LFOs with up to 127 waves + S&H
- Modulationmatrix with 12 slots
- 2 Live Control Knobs
- Digital Delay 30 - 340ms PT2399
- 12,800 user program memories in 100 banks
- SD card interface 4-16GB
- 1MB Sample SRAM
- 16-step sequencer
- Audio output (L/R)
- Aux In (L/R)
- Midi IN and Midi OUT
- 3.2" color TFT display 320x240 pixels
- 5 rotary encoders and eleven function keys for parameter inputs
- Open Source Firmware
- Firmware update via SD card
- 12 VDC 1000mA Power supply connection
- Designed and engineered in germany



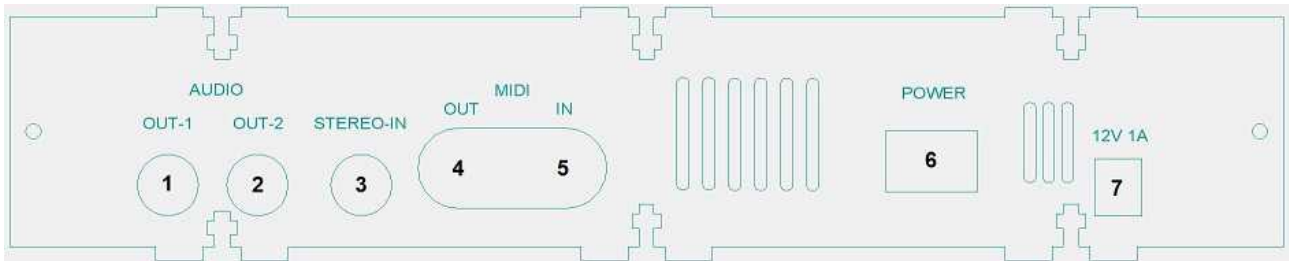
## Control elements



1 PAGES	6 Parameter	11 ENV	16 CANCEL
2 VOLUME	7 Live Control 1	12 LFO	17 LOAD
3 Parameter	8 Live Control 2	13 MOT-MAT	18 SAVE
4 Parameter	9 OSC	14 RECORD	19 DEL
5 Parameter	10 VCF	15 ARP / SEQ	20 Mikrofon

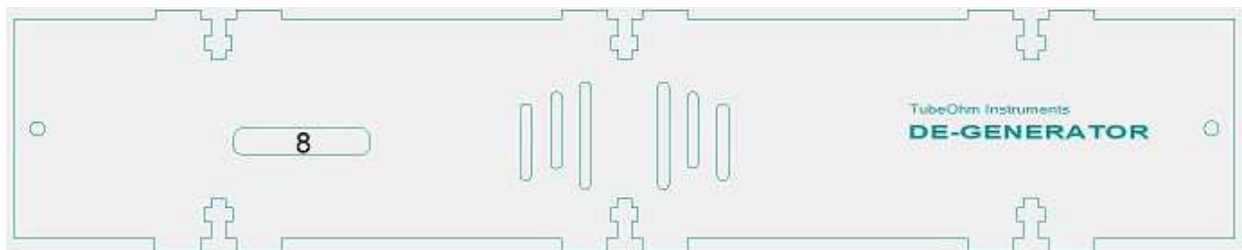
Overview of control elements. The PAGE knob (1) is used to scroll through the DE-GENERATOR menu page. This controller is also equipped with a key function. Pressing this button takes you to the submenus. Press the controller again to return to the selected main page. The control VOLUME (2) determines the total volume of the 'De-Generator'. The controls (3,4,5,6) are used to enter parameter values. The Live Control Potentiometer (7,8) can be used to modulate a programmed target in the modulation matrix, e.g. an oscillator or filter. The keys (9,10,11,12,13) are used to directly select a menu page. The RECORD key (14) starts a sample recording on menu page 12. The ARP/SEQ key (15) starts the built-in step sequencer. The CANCEL key (16) is used to cancel the function if the Delete or Save function has been called accidentally. Use the LOAD key (17) to load a sound program, sample or sequence. The SAVE key (18) is used to store presets, samples or sequences. Press DEL (19) to delete a sound program or sample from a selected bank. An integrated microphone (20) can be used to record your own samples.

## Connections on the rear side



- (1) Audio output left
- (2) Audio output right
- (3) Audio input (left/right)
- (4) Midi-OUT
- (5) Midi-IN
- (6) Power switch
- (7) Power connection 12VDC / 1000mA

## Front side



- (8) SD card slot (card type: SDHC 4-16GB Class 10)

## Operation

### Power supply connection

The de-generator is supplied with power by an external 12 VDC power supply unit at the power supply connector (7). The power supply should be designed for a current load of 1000 mA. The De-Generator is switched on or off with the Power switch (6). Make sure that all peripheral devices such as active speakers are switched off and turn down the volume on the VOLUME control.

### Power switch

After power-on, system parameters for initializing the de-generator are loaded from the SD card and the sample memory is checked. During this time the start screen is displayed with the TubeOhm logo. The SD card must contain the required system folders and files, otherwise an error message will be displayed. A detailed description of the necessary system folders and files can be found in the appendix on page xx. All necessary system folders and files can be downloaded from the tubeohm.com website in the download area.

### Operation

With the de-generator, great importance was attached to a simple and clear operating concept. There are a total of fourteen menu pages and submenus. The PAGES controller can be used to scroll through the menu pages of the De-Generator. The page number of a menu is shown in the upper left corner of the display. The PAGES controller is additionally equipped with a key function. If you press this key, you will be taken to a submenu and back, if available. The number of submenu items is displayed at the top right. The parameters are selected via the four data controllers (3 - 6) below the display. The data controllers (encoders) are equipped with a dynamic acceleration function. The faster the knob is turned, the faster the value changes. The setting for this can be found on the system page under the parameter ENC-DYN.







## Program selection

The PRESETS menu is responsible for loading and saving a sound program. Use the **PRESET** and **BANK** controls to select a sound program. A colored rectangle marks the selection. Press the **LOAD** button to load the sound program. The **SAVE** button is used to save a sound program.

The **DEL** key is used for deleting. A preset can be copied to another memory location using the **LOAD** and **SAVE**



buttons. On the right side of the menu there is a small mini scope and a display for the last loaded sound program. Each preset contains the parameter settings and sequence data, if available. The graphical symbols next to the preset names indicate whether the preset contains samples  or consists only of waveforms . The data size of a preset is displayed to the right of the graphical symbols. If a preset contains sequencer data and automatically starts the sequencer after loading, an symbol  is displayed. If Sequencer data is present and the sequencer does not start automatically, an symbol  is displayed. If you want the sequencer to start automatically after loading a preset, the sequencer must be switched on before saving a preset. The sequencer stops briefly while the data is being written to the SD card.

## Oscillator

The DE-GENERATOR has two digital oscillators which have almost the same parameter settings. In addition, Oscillator 1 has a SubOscillator with adjustable waveform and range.

The SELECT control is used to select the parameters. A colored rectangle marks the selected parameter. The VALUE control is used to change the parameters.



## Oscillator - Mode

The two oscillators have different operating modes, which are determined by the controller mode (see table).

**Oszillator – MODE**

<b>OFF</b>	The oscillator is switched off.
<b>WAV</b>	The oscillator is in waveform mode.
<b>SAM</b>	The oscillator is in sample mode.
<b>Osc1</b>	(Osc2 only) When Osc1 is in sample mode, Osc2 can access the sample from Osc1.

## Wave mode

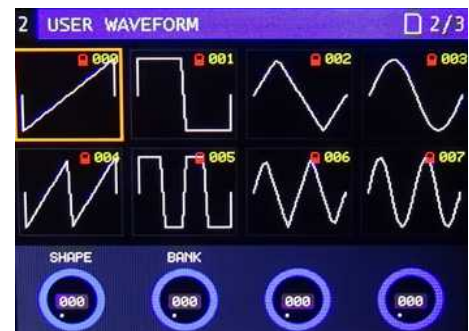
If the oscillator is in **WAV-MODE** (waveform mode), you can use **SHAPE** to access a variety of waveforms in the De-Generator. The selected waveform is displayed in the lower left menu window.

**SHAPE values**

<b>USER</b>	Selection of user waveforms from the SD card
<b>SAW</b>	Sawtooth (bandlimited)
<b>SQU</b>	Square wave (bandlimited)
<b>DPWM</b>	Square wave with pulse-width
<b>TRI</b>	Triangle
<b>ZSAW</b>	Phase-distortion saw with filter sweep
<b>LPZ</b>	CzReso saw LP
<b>PKZ</b>	CzReso saw
<b>HPZ</b>	CzReso saw HP
<b>LPZP</b>	CzPulsReso saw LP
<b>PKZP</b>	CzPulsReso saw
<b>HPZP</b>	CzPulsReso saw HP
<b>ZSYN</b>	Phase-distortion self-sync
<b>ZTRI</b>	Phase-distortion resonant triangle
<b>PAD</b>	Quad sawtooth
<b>QPW</b>	Quad square wave
<b>FM</b>	2-operators FM
<b>FMFB</b>	2-operators FM with feedback
<b>8Bit</b>	8-bits sounding waveforms
<b>CRUS</b>	bit-crushed sine and triangle wave
<b>NOIS</b>	Filtered noise generator
<b>VOW</b>	Formant synthesis

## User waveforms

To select user waveforms, set the SHAPE parameter to USER and then press the LOAD button. A new window for selecting a user waveform will appear. A total of 128 waveforms are available per bank. Bank 000 offers a standard selection of waveforms and is locked for write access (red lock symbol). With SHAPE you can directly select a waveform and play it on a midi keyboard. Press the PAGES knob to return to the Oscillator menu.





## Waveform - Editor

The WAVEFORM Editor allows you to draw your own user waveforms or load and modify waveforms from a waveform bank. In **SHAPE USER** mode, press the **LOAD** button twice to open the editor. The editor appears and the current user waveform is displayed. Use the **CURSOR** slider to move to the desired position in the waveform to be changed. With **X.MOVE** you change the waveform in horizontal direction and with **Y.MOVE** in vertical direction. You can also change the waveform during playback via the sequencer and listen to it.



## TOOLS - Filter function

The WAVEFORM editor in the De-Generator has a digital filter, amplitude, clip and random function. **TOOLS** selects the function and **DEL** performs the calculation. This allows to additionally modify an existing waveform from the waveform bank or a self-drawn waveform. The desired filter type is set with the **TOOLS** knob and then the **DEL** key is pressed. Adjustable are Lowpass, Highpass, Bandpass and Notch.



The digital filter works on the principle of the Infinite Impulse Response Filter (IIR) and works with feedback that corresponds to the behavior of an analog filter. A further press on the **DEL** button repeats the filter calculation and a stronger filter effect is achieved. **CANCEL** restores the old waveform.

## TOOLS – function

Another possibility to change the waveform is the **VOL** function. With the **DEL** key the amplitude of the waveform can be increased in +1dB steps. At maximum gain the amplitude is inverted. The **CLIP** function works in a similar way. The amplitudes are simply clipped at maximum gain. The **RND** function creates a new waveform from two randomly selected waveform halves from the current waveform bank. Set the **TOOLS** slider to **RND**. Press **DEL** to calculate and display new waveforms. This can be used to create a large number of new waveforms. Press the **DEL** key again to repeat the process. Press **PAGES** to return to the oscillator menu.





With **SAVE** the new waveform can be stored in a selected waveform bank. If the selected waveform bank does not yet exist (message: No files !), a new waveform bank is automatically created by pressing the **SAVE** button and the new waveform is saved in place 000. The **SAVE** function can be aborted with the **CANCEL** key. Press **PAGES** to return to the oscillator menu.

### WAV-Mode Parameter

The **PRM** parameter affects the timbre of a waveform. The two parameters **OP** (Modulation operator) and **MIX** (Osc balance) influence the mixing function of both oscillators (see table). The parameters marked in yellow are responsible for both oscillators. The **RANGE** parameter transposes the oscillator in -36/+24 semitones. **TUNE** sets the fine tuning of an oscillator. **PORTAM** (Portamento) controls the continuous pitch shift from one note to the next. Low values produce a short flex time and higher values produce a long flex time. If the value is 0, the portamento function is disabled. **NOISE** controls the volume of the noise generator.



### OP settings (WAV-Mode)

OP	Description	MIX
SUM	Sum mixer (monophonic)	Balance Osc1 and Osc2
2CH	Sum mixer (stereophonic)	Balance Osc1 and Osc2
SYNC	Synchronization of Osc2 by Osc1	Balance Osc1 and Osc2
RING	Ring modulation	Balance of Osc and Ring Modulation
XOR	Exclusive-Or combination of Osc1 + Osc2	Strength of overflow
BITS	Bit reduction of Osc1 and Osc2	Bit resolution
FUZZ	Waveshaping of Osc1 and Osc2	Strength of the Waveshapers

**SUB** adjusts the volume of the SubOscillator. Use the **SUB-WAVE** data slider to set the waveform and octave position.

### SUB-WAVE settings

SIN1	Sine Oct -1
SAW1	Sawtooth Oct -1
SQU1	Square Oc1 -1
SIN2	Sine Oct -2
SAW2	Sawtooth Oct -2
SQU2	Square Oct -2

## Sample - Mode

When the oscillator is in sample mode (**SAM**), you can access a large number of stored sample files on the SD card. To load a sample, press the **LOAD** key. Use the **SAMPLE** and **BANK** data controls to select a sample. A colored rectangle marks the selection. The **LOAD** key loads the sample. If the sample is larger than the available memory, the loading process is aborted with a message. The free memory space is displayed in KByte on the right in the menu heading (in the current firmware max 924 KB). The **SAVE** key is used to save a recorded sample. A new sample is always saved to a free memory location in the selected bank. It is not possible to overwrite another sample. To delete a sample, press the **DEL** key. A sample can be copied to another sample bank using the **LOAD** and **SAVE** keys. The maximum number of samples in a bank is 128.



## Sample-Mode parameter

The **TRIGGER** parameter determines whether the sample is restarted with the midi note or runs freely. **LOOP** activates the loop points in the sample. The setting for the loop points can be found in the **Sample Editor**. If **LOOP** is switched off, the entire sample is played back only once until the end and stops automatically. The two parameters **OP** (Operator) and **MIX** (Mixer) control how Oscillator 1 and Oscillator 2 are mixed together (see table). The parameters marked in yellow are responsible for both oscillators.



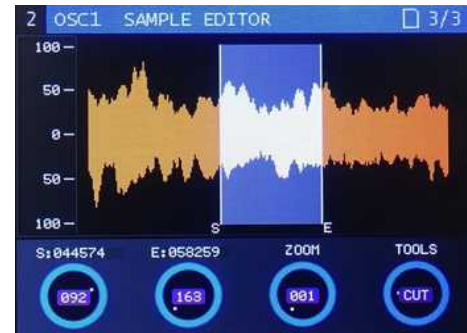
With the parameter **RANGE** you transpose the oscillator in -36/+24 semitones. **TUNE** sets the fine tuning of an oscillator. **PORTAM** (Portamento) controls the continuous pitch shift from one note to the next. Low values produce a short flex time and higher values produce a long flex time. **NOISE** controls the volume of the noise generator. With **KTRACK** you can switch off the pitch control of the oscillator. The played pitch then corresponds to the Midi note A4 (440Hz).

**OP settings (Sample-Mode)**

OP	Description	MIX
SUM	Sum mixer (monophonic)	Balance OSC1 and OSC2
2CH	Sum mixer (stereophonic)	Balance Osc1 and Osc2
RING	Ringmodulation	Balance OSC1 and Ringmodulation
XOR	Exclusive-Or combination of OSC1 + OSC2	Strength of overflow
BITS	Bit reduction of OSC1 and OSC2	Bit resolution
FUZZ	Waveshaping of OSC1 and OSC2	Strength of the Waveshapers

## Sample – Editor

The De-Generator has a simple **SAMPLE-EDITOR** with which you can set loop points for sample playback or **cut**, **mute** or **reverse** areas. To access the Sample Editor, load a sample and then press the **PAGES** knob twice. The start position of a loop is set with the **S** slider. The number next to it indicates the start position in the sample. The same applies to the end position of a loop. This can be set with the data knob **E**. In order to set the loop to an exact position, you can enlarge the marked area with **ZOOM**. The cursor automatically jumps to the last changed position and shows it in the middle of the display. If the marked positions are outside the visible range, you can use the data controllers **S** and **E** to jump immediately to the marked position and change it.



The table below explains the TOOLS function in detail. To execute the TOOLS function, press the DEL button. Press the CANCEL button to cancel the function.

### TOOLS function

Settings	Function
MUTE	With Mute you can mute a marked area.
CUT	The CUT function is used to delete marked areas.
LOOP	The LOOP function plays the sample from the beginning to the selected end position. Then the playback jumps to the start position and plays the marked sample area in an endless loop.
SEC	With SEL, playback jumps directly to the starting point and plays the area only once.
SECL	SECL plays the area in an endless loop.
REV	Reverses a area.

## Save Sample

A modified sample can be stored in a selected sample bank by pressing the SAVE key. The marked LOOP points are also saved. A special feature is that when saving a PRESET, both oscillators save their samples as copies in the PRESET folder. If the original samples or the sample bank are deleted or re-sorted, the oscillator samples are still in the PRESET folder. Only when a PRESET is deleted will the samples in the PRESET folder also be deleted.

## Filter

The De-Generator has a replaceable filter board which is connected to the motherboard via the K15 and K16 plug contacts. The current filterboard called **SMR4 Multi 7** is a **stereophonic multimode filter** which can be switched as **high pass, bandpass** and **low pass** with a slope of 6 dB to 24 dB per octave. Use **MODE** to select the filter type (see table). The **CUTOFF** slider determines the cutoff frequency of the selected filter type. **RESONANCE** determines the boost of the frequencies in the range of the set filter frequency. **KEYTRACK** determines how strongly the filter frequency depends on the midi note played. If the values are positive, the filter frequency increases when notes above the reference note A4 are played. If the values are negative, the filter frequency decreases accordingly.

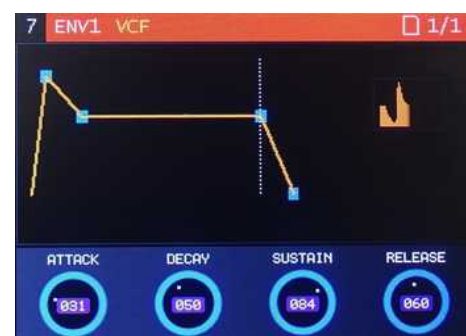


**Filter-Mode (SMR4-Multi 7)**

Settings	Function
LP6	6dB low-pass filter
LP12	12dB low pass filter
LP18	18 dB low pass filter
LP24	24 dB low pass filter
BP12	12 dB bandpass filter
HP12	12 dB High pass filter
LPHP	12 dB Low and high pass filters

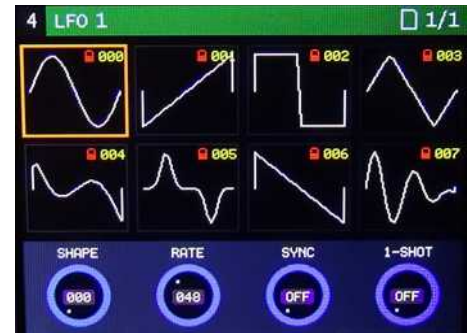
## Envelope

The De-Generator has two **ADSR** envelope generators. In the modulation matrix, the two envelopes (**ENV1 + ENV2**) can be programmed for different modulation targets. The modulation targets are displayed in yellow in the header of the envelope menu. By default **ENV1** controls the **VCF** (filter) and **ENV2** controls the **VCA** (see yellow text on the headline). **ATTACK** sets the rise time from receiving a midi note to the maximum value. The rise time can be set in the range of 0-35 seconds. With **DECAY** you determine the duration until the falling attack value reaches the set sustain level. The duration depends on the sustain level and ranges from 0-35 seconds. With **SUSTAIN** you set the sustain level after the decay phase while the midi note is held. With **RELEASE** you determine how long it should take after releasing the midi note until the value reaches the minimum. A mini-scope in the right window area informs you about the envelope curve.



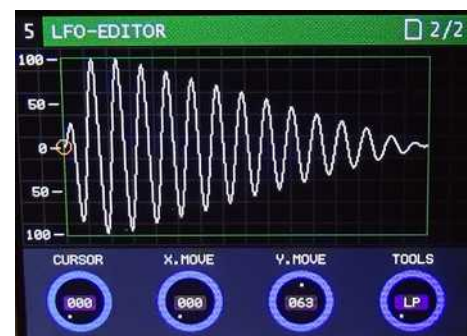
## LFO

The De-Generator has **three LFOs** (Low Frequency Oscillator). In the modulation matrix the LFOs can be programmed to different modulation targets. By default, the Modulation Wheel (ModMat Slot 12) controls the strength of the LFO 1 Amount, which in turn controls the fine pitch of OSC1 and OSC2. The LFOs have a total of 16 non-changeable standard waveforms and 111 freely changeable user waveforms. LFO waveform 127 is a Sample & Hold function (S&H) for random effects.



## LFO Editor

To access the **LFO Editor**, press the **LOAD** button in the **LFO menu**. The editor appears and the current waveform is displayed. Use the **CURSOR** slider to move to the desired position in the waveform to be changed. With **X.MOVE** you change the waveform in horizontal direction and with **Y.MOVE** in vertical direction. You can also change the waveform during playback via the sequencer and listen to it.



With **SAVE** the new waveform can be stored in the waveform bank. Saving a new waveform is only possible above the standard waveforms starting with no. 015, since the standard waveforms are write-protected (red lock symbol). The **SAVE function** can be aborted with the **CANCEL** key.

## LFO-TOOLS

Another possibility to change the waveform is the **TOOLS** function similar to the Oscillator menu. Here you can call **filter** and **amplitude** functions and execute them with the **DEL** key.

## LFO Parameter

With **SHAPE** you select a mode of oscillation. **RATE** selects the **LFO frequency** in the range from 0.015 Hz to 500 Hz. The LFO can be restarted (synchronized) with the received Midi note. To do this, you must set the **SYNC** control to **ON**. If the **SYNC** knob is set to **OFF**, the LFO oscillates freely. For modulations with a low frequency, you can use the synchronization of the LFO so that it always starts at zero. With the **1-SHOT** function the LFO is started only once and stops at the end. To use the **1-SHOT** function, the SYNC knob must be set to ON, otherwise the LFO cannot be restarted.



## Fx DELAY

The De-Generator is equipped with a Digital Delay/Echo chip. You can set a delay time of 30 to 324 milliseconds with the data controller **TIME**. With the data controller **FEEDBACK** you can set the number of repetitions. Use **VOLUME** to mix fx volume with VCA output and **PANORAMA** to adjust the balance of fx sound. **FxTIME**, **FxVALUE** (volume) and **Fx BAL** can be controlled with modulation sources in the modulationsmatrix.



## SEQUENCER

A **16 step sequencer** is integrated in the De-Generator. To enter sequencer data please press the **RECORD** button. As confirmation the button lights up red. Now you have the possibility to enter notes and velocity values via a midi keyboard. The notation is displayed as a note value and the **velocity** as a **horizontal bar graph**. The **note length H** is automatically preset to an average value of 64. However, this value can be changed later. To change the data of a **STEP** or enter it manually, you can use the **STEP** data slider to select and change the desired **STEP**. A blue rectangle marks the selection. Use **SELECT** to select the parameter to be changed. A coloured rectangle marks the selection. With **VALUE** you can now change the parameter value.



### Sequencer submenu

The sequencer has two menu pages. Press the **PAGE** knob to switch between the two menu pages. **RANGE** transposes the notes one octave up or down after the last step. The **internal clock** for the tempo is set with BPM from **40 - 240 BPM**. To use the external midi clock, set the BPM parameter to EXT (turn to the left). As soon as a midi clock signal is received from the De-Generator, the display next to the BPM parameter changes and the current tempo is displayed. The clock divider can be adjusted in 12 steps from **1/1 to 1/96** with the **DIV** parameter. **DIR** sets the playback direction of the sequencer (see table).





### DIR - Function

DIR	Description
>	Sequence is played from left to right in continuous loop
<	Sequence is played from right to left in continuous loop
<>	Sequence is played in both directions in continuous loop
><	Sequence is played in both directions in a continuous loop. The first and last step is played twice.
RND	Sequence is played in random order in a continuous loop.

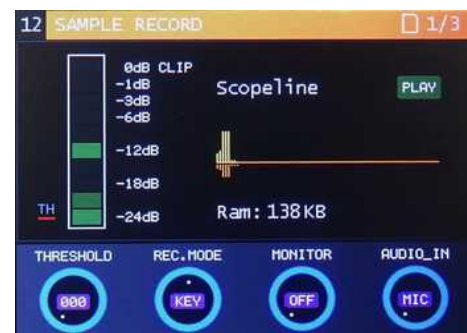
With **PLAY** you determine whether the sequencer is started with a midi note from the keyboard (NOT) or via the **ARP/SEQ** key on the De-Generator. Before the sequencer can be started with a midi note, **PLAY** must be set to **NOT** and the **ARP/SEQ** key must be pressed. To confirm, the **ARP/SEQ** button will light up in dimmed red. As soon as a midi note is received, the sequencer starts and the **ARP/SEQ** key lights up briefly. With **NOTE** you can change the note values. Press **VELO** to adjust the volume of the note. Hold adjusts the note length from very short to legato. Use **Mute** to mute the STEP.

### Sequencer - Pattern

To save a sequence pattern, press the **SAVE** button. Here you can assign a pattern number from 0 - 99 and save the pattern. To load a specific pattern, press the **LOAD** key and select a number with the data knob. Press **LOAD** a second time to load the pattern and start the sequencer. When saving a preset, the current pattern is saved in the preset folder. When the preset is loaded, the same pattern is loaded into the sequencer. A **blue S** indicates the presence of a sequencer pattern in the Preset View.

### SAMPLE RECORD

On the SAMPLE RECORD menu page, you can **record**, **edit** and **save** your own samples in a sample bank. An LED bar graph and a monitor function help you to set the correct recording level. A **Scopeline** informs about the amplitude curve and **sample memory**. The recording source can be either the **integrated microphone** in the De-Generator or an **external audio source** at the **audio input**. Switching is done with the data controller **AUDIO\_IN**. To check the quality of the audio signal, you can listen to the signal via the **monitor function**. The **monitor function** can be switched on or off with the **MONITOR** control. The De-Generator has a **special clipping circuit** to limit the maximum audio level at the **analog-to-digital converter** input. This means that the distortion caused by exceeding the maximum level is very low.



There are three ways to start a sample recording (see table). The recording can be stopped by pressing the RECORD key. The recording stops automatically when the end of the memory is reached. To play the sample, the MONITOR knob must be set to OFF. The sample rate is 40KHz. The reference note for playing a sample at the original pitch is Midi 69 (A4).

### REC-MODE

REC-MODE	Description
KEY	Recording starts when the RECORD button on the De-Generator is pressed.
NOTE	To prepare the recording, press the RECORD button on the De-Generator. Recording starts as soon as a midi note is received.
THRE	To prepare the recording, press the RECORD button on the DE-GENERATOR. Recording starts as soon as the preset threshold level is exceeded.

When a new sample is recorded, the old samples in both oscillators are deleted. The new sample is located in oscillator 1. Oscillator 2 is deactivated. All other parameter settings are retained.

### Sample Editor

To edit the recorded sample, use the PAGES knob. The Editor functions have already been explained in detail on page 17 and are the same here.



### Save Sample

A new sample can be stored in a selected sample bank by pressing the SAVE key. The functions are explained in detail on page 17.



## Modulationsmatrix

The modulation matrix of the de-generator is a real playground for the sound tinkerer. Here a variety of modulation sources can be routed to different modulation targets (see table). There are 12 modulation slots available for the links, with slot 12 for the modulation wheel as modulation source. A special feature are the two Live Control knobs **POT-1** and **POT-2**. These knobs allow different parameters in the

SLOT	SOURCE	DESTINATION	AMOUNT
1	ENV1	Cutoff	+63
2	ENV2	VCA	+64
3	LFO1	Cutoff	+ 8
4	LFO1	LFO1	0
5	LFO1	LFO1	0
6	Pot-1	Cutoff	+64

modulation matrix to be modulated in real time. The modulation strength (Amount) can be adjusted to positive and negative values. This makes it possible, for example, to invert the attack phase of the envelope generator for the VCA so that the volume decreases as the attack level increases.

**Modulationsmatrix** (Firmware V 1.05)

Quelle	Ziel
ENV1	VCA
ENV2	VCA BAL
LFO1	CUTOFF
LFO2	CUTOFF BAL
LFO3	RESO
VELO	LFO1
NOTE	LFO2
NOISE	LFO3
SEQ	OSC1 FINE
MODW	OSC2 FINE
PBND	OSC1 PITCH
AFTR	OSC2 PITCH
POT-1	OSC1+2 FINE
POT-2	OSC1+2 PITCH
OFFSET	OSC1 PRM
	OSC2 PRM
	OSC-MIX
	Fx TIME
	Fx BAL
	Fx VALUE
	NOISE VALUE

## System settings

On the last menu page (14) there are important system settings, e.g. settings for the Midi reception channel or Master Tune for the tuning of the de-generator.

### MIDICh

This is the setting for the Midi reception channel of the De-Generator. When Omni is selected, the De-Generator receives on all Midi channels.



### ENC DYN

The data controllers (encoders) in the De-Generator operate dynamically. This means that the values change in larger jumps during fast rotary movements. With slow rotary movements, the values change in small jumps. The ENC DYN parameter can be used to adjust the dynamics to the personal rotation feeling.

### FILTER

Future option. The filter board in the De-Generator is replaceable. For future options a different filterboard can be set here.

### PRESET

The De-Generator has the possibility to automatically load the last used preset when starting the system. **PRESET** must be set to **ON**. If **PRESET** is set to **OFF**, only the default values are loaded at system start (see table).

### SCOPE

This allows the Mini Scope function to be switched on or off. If the processor load becomes too high with certain system settings and the menu pages are no longer displayed fast enough, the processor load can be reduced by switching off the Mini Scope function.

### TxMIDI

The Midi output can be switched off here. The DE-GENERATOR will then no longer send Midi data via this connector.

### AUDIOIn

This function controls the filter input. If AUDIOIn is set to ON, the audio input of the de-generator is switched to the filter input and played back when playing a note.

## M.TUNE

De-Generator Master Tune for fine tuning.

## OCTAVE

Transpose the de-generator -2/+2 octaves.

## MIDI CC

Midi Control Change Message can be switched on or off.

Midi Controll Change Message

Funktion	Wert	Nummer
<b>Oscillator 1</b>		
SHAPE 1	0 - 21	CC # 20
PRM 1	0 - 127	CC # 21
RANGE 1	-36 +24	CC # 22
TUNE 1	-64 +64	CC # 27
<b>Oszillator 2</b>		
SHAPE 2	0 - 21	CC # 24
PRM 2	0 - 127	CC # 25
TUNE 2	-64 +64	CC # 26
OP	0 - 6	CC # 28
MIX	0 - 127	CC # 29
NOISE	0 - 127	CC # 31
<b>LFO 1</b>		
SHAPE 1	0 - 17	CC # 112
RATE 1	0 - 127	CC # 113
<b>LFO 2</b>		
SHAPE 2	0 - 17	CC # 114
RATE 2	0 - 127	CC # 115
<b>LFO 3</b>		
SHAPE 3	0 - 17	CC # 116
RATE 3	0 - 127	CC # 117
<b>ENV 1</b>		
ATTACK 1	0 - 127	CC # 104
DECAY 1	0 - 127	CC # 105
SUSTAIN 1	0 - 127	CC # 106
RELEASE 1	0 - 127	CC # 107

### Midi Controll Change Message

Funktion	Wert	Nummer
<b>ENV 2</b>		
ATTACK 2	0 - 127	CC # 108
DECAY 2	0 - 127	CC # 109
SUSTAIN 2	0 - 127	CC # 110
RELEASE 2	0 - 127	CC # 111
<b>FILTER (SMR4)</b>		
CUTOFF	0 - 127	CC # 14
RESONANZ	0 - 127	CC # 15
KEYTRACK	-63 +63	CC # 13
MODE	0 - 6	CC # 12
<b>Fx DELAY</b>		
TIME	0 - 127	CC # 40
FEEDBACK	0 - 127	CC # 41
VOLUME	0 - 127	CC # 42
PANORAMA	-63 +63	CC # 43
<b>SEQUENCER</b>		
START / STOP	127 / 0	CC # 45
<b>MODULATIONSMATRIX</b>		
AMOUNT 1	-63 +63	CC # 64
AMOUNT 2	-63 +63	CC # 65
AMOUNT 3	-63 +63	CC # 66
AMOUNT 4	-63 +63	CC # 67
AMOUNT 5	-63 +63	CC # 68
AMOUNT 6	-63 +63	CC # 69
AMOUNT 7	-63 +63	CC # 70
AMOUNT 8	-63 +63	CC # 71
AMOUNT 9	-63 +63	CC # 72
AMOUNT 10	-63 +63	CC # 73
AMOUNT 11	-63 +63	CC # 74
AMOUNT 12	-63 +63	CC # 75



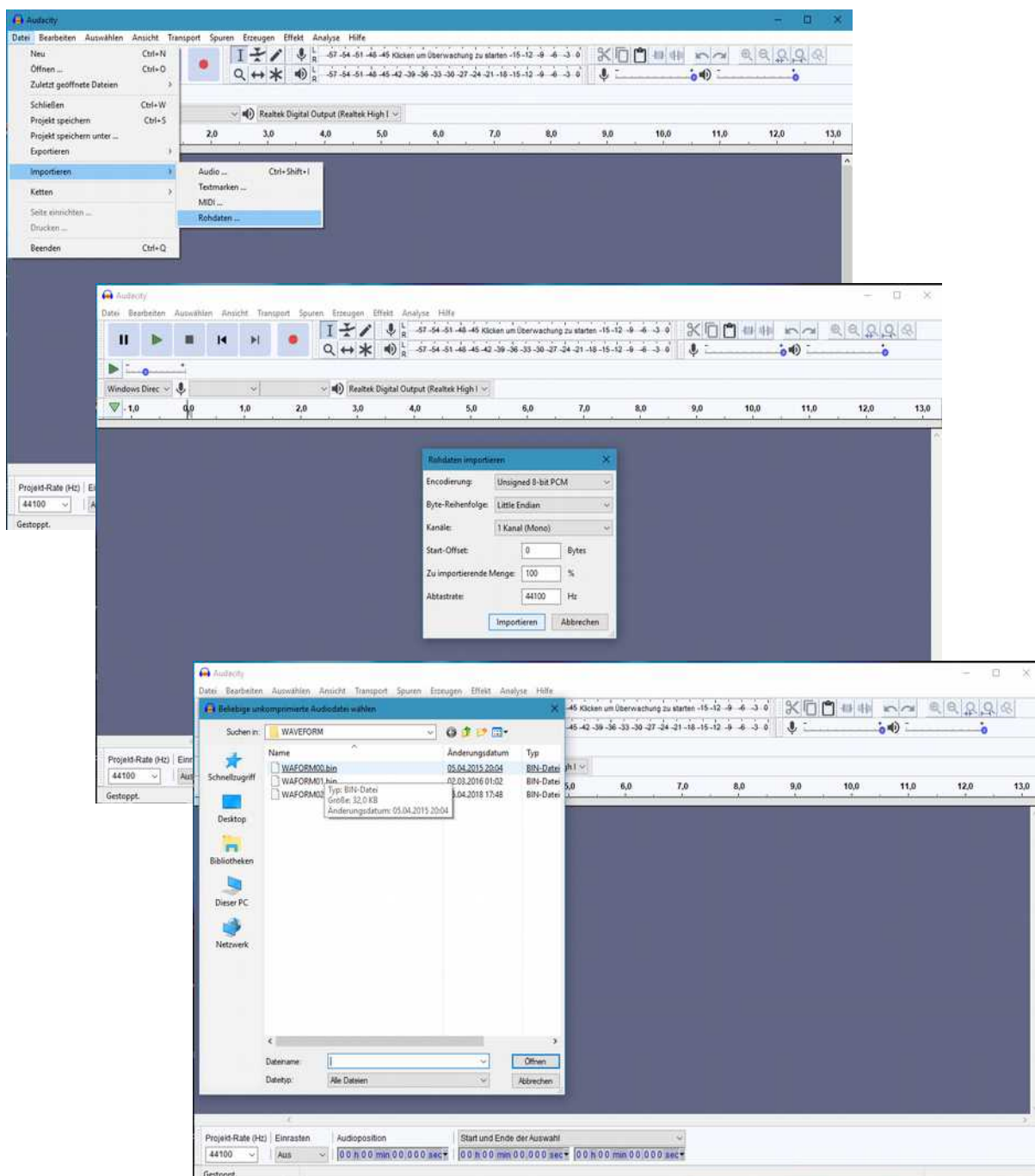
**Initial values after systemstart**

OSC1 Mode	WAV		ENV1 ATTACK	0
OSC1 SHAPE	SAW		ENV1 DECAY	0
OSC1 PRM	0		ENV1 SUSTAIN	127
OSC OP	SUM		ENV1 RELEASE	60
OSC1 RANGE	0		ENV2 ATTACK	0
OSC1 TUNE	0		ENV2 DECAY	0
MIX	0		ENV2 SUSTAIN	127
NOISE	0		ENV2 RELEASE	51
PORTAM	0		CUTOFF	127
LFO1 SHAPE	SIN		RESONANCE	0
LFO1 RATE	48		KEYTRACK	0
LFO1 SYNC	OFF		MODE	LP6
LFO1 1-SHOT	OFF		Fx TIME	0
LFO2 SHAPE	SIN		Fx FEEDBACK	0
LFO2 RATE	0		Fx VOLUME	0
LFO2 SYNC	OFF		Fx BALANCE	0
LFO1 1-SHOT	OFF		SEQ RANGE	0
LFO3 SHAPE	SIN		SEQ BPM	120
LFO3 RATE	0		SEQ DIV	01.08.18
LFO3 SYNC	OFF		SEQ DIR	>
LFO3 1-SHOT	OFF		SEQ PLAY	KEY
SAM REC.MODE	KEY		MIDICh	Omni
SAM THRESHOLD	0		ENC DYN	45
SAM MONITOR	OFF		FILTER	SMR4
SAM AUDIO_IN	MIC		PRESET	OFF
MODULATIONSMA DTRIX			SCOPE	ON
1. ENV1 - CUTOFF	33		TxMIDI	ON
2. ENV2 - VCA	63		AUDIOIn	OFF
3. LFO1 - LFO1	0		M.TUNE	0
4. LFO1 - LFO1	0		OCTAVE	0
5. LFO1 - LFO1	0		MIDI CC	ON
6. LFO1 - LFO1	0		PRGCH	ON
7. LFO1 - LFO1	0			
8. LFO1 - LFO1	0			
9. LFO1 - LFO1	0			
10. LFO1 - LFO1	0			
11. PBND – OSC1+2 PITCH	8			
12. MODW – LFO1 – OSC1+2 FINE	32			

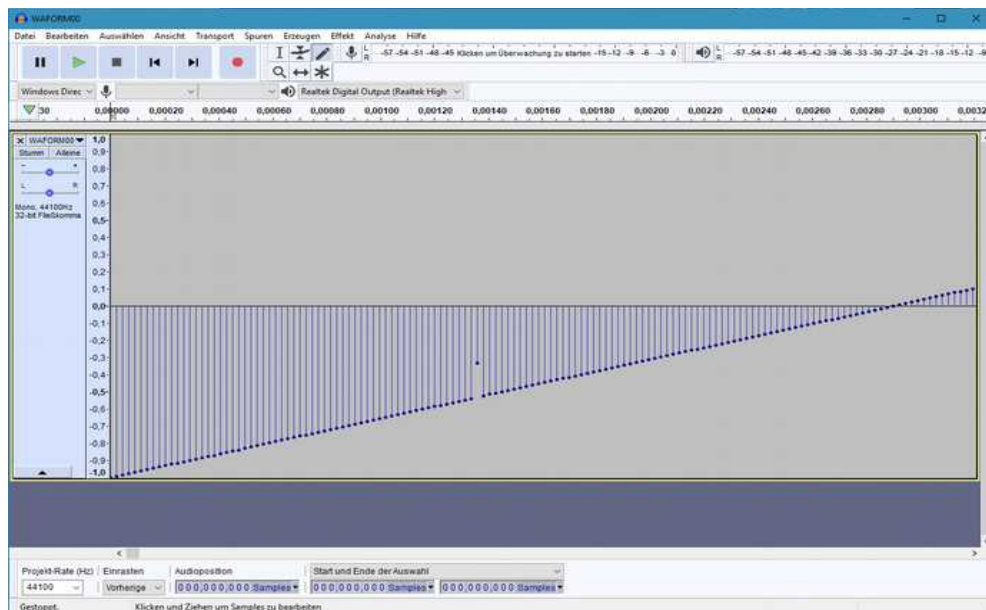
## Creating and changing user waveforms

With an audio editor e.g. Audacity (Freeware) you can easily generate user waveforms for the DE-GENERATOR and save them to SD card. The import and export format is Unsigned 8-Bit PCM Little Endian 1 Channel (Mono). User waveforms are 256 bytes in size and have a resolution of 8 bits. There are 128 waveforms in a bank.

To edit a user waveform bank with Audacity, proceed as shown in the figure... Start the program - go to File - Import - Raw data and select the same settings for encoding as in the second figure. Then open a User Waveform Bank in the WAVEFORM folder on the SD card. These are called WAFORMXX.bin. The XX stands for the bank number from 00 to 99.



If the file is loaded, you can use the magnifying glass tool to enlarge the view of a waveform so that individual byte positions can be edited with the pencil symbol.

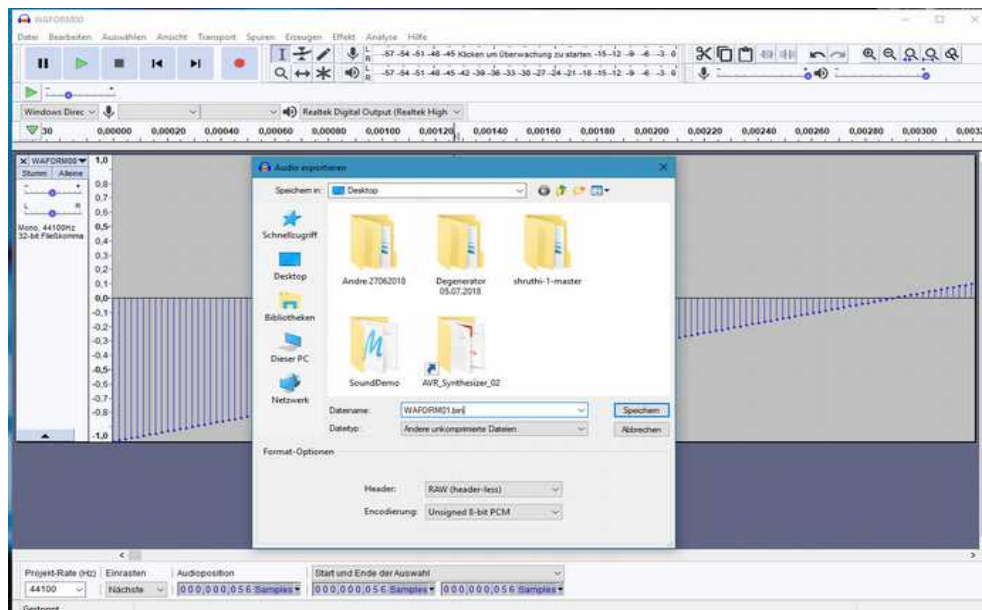


Tip: If you set the Snap function in Audacity to Next (below) and the audio position to Samples, you can navigate to the individual byte positions using the arrow keys on the keyboard.

## Saving user waveforms

Note: The user waveform file must always contain 128 waveforms and not larger than 32,768 bytes.

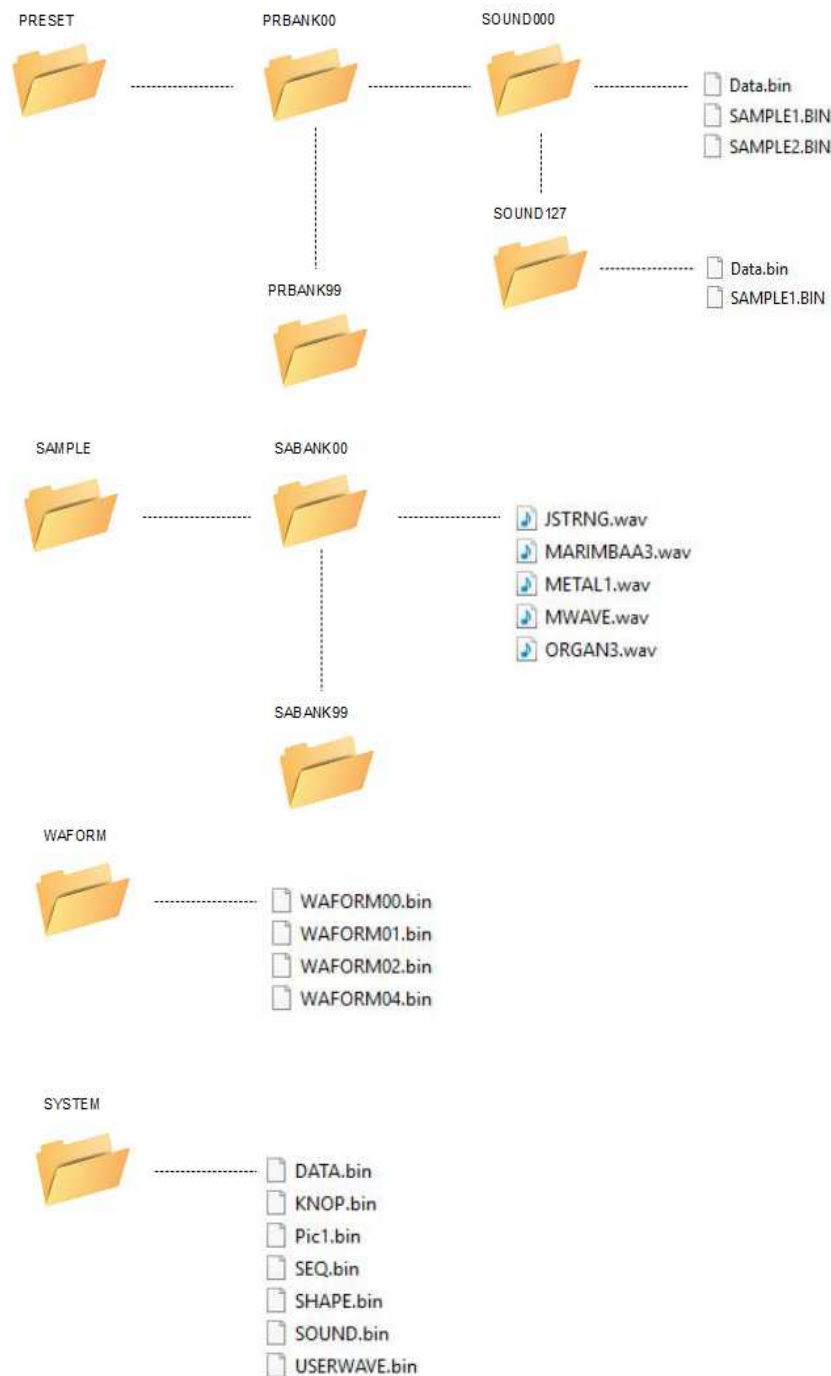
To save the new file on the SD card, select File - Export - Export Audio from the menu and change the file name from WAFORM00.raw to WAFORM01.bin. You have now created a new User Waveform Bank for the DE-GENERATOR and can save it on the SD card.



Please note that the settings for encoding on **RAW (header-less)** and **Unsigned 8-Bit PCM** are selected.

## File and directory structure on the SD card

The De-Generator has an SD card slot for storing and loading data. Commercially available SD cards from 4GB to 16GB can be used. The SD card should be formatted with the FAT32 format. For the system start the De-Generator needs some system files, which are located in the folder SYSTEM on the SD card. Preset data is stored in the PRESET folder. The SAMPLE folder contains the sample library. The WAFORM folder contains the User Waveform Library. All necessary system folders and files can be downloaded from the [tubeohm.com](http://tubeohm.com) website in the download area.



## Der System Test



The firmware in the De-Generator has a built-in system check. This tests the basic hardware such as sample memory, display, Led's, keys, data controller, SD card and audio output.

To start the system test, press and hold the **PAGES** knob while the unit is turned on. As soon as the **System check** appears on the display, the control can be released.