



ZAQUENCER

MIDI Sequencer Firmware for BCR2000



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1. Foreword

Thank you for purchasing the Zaqencer firmware for your BCR2000.

When I found a way to run my own software on the BCR I was on fire. I spent countless days and nights to discover the BCR's functions and developing the concept for the Zaqencer. The thought that kept me going was to be able to provide a MIDI analog-style hardware sequencer as an affordable firmware update to an existing device, so that this type of sequencer might finally become available for a large audience. I know I certainly enjoy making electronic music without having to look at a screen all the time, and I hope you do too!

I have now put close to 1.5 years fulltime into developing the Zaqencer firmware, and I am really grateful for you to support my efforts with your purchase. This will hopefully enable me to develop other cool ideas I'm having for the future. So, thanks again!

Now that the firmware is finally finished, I'm eager to see how you will like it. I hope you'll have as much fun using it as I had developing it!

I'd be happy to hear about your experiences with the Zaqencer. Please visit the forum at https://zaqaudio.com/?post_type=forum for feedback and support.

2. List of features

- native, standalone analog-style step sequencer for BCR2000
- no Computer or PC software needed for operation (except for the initial firmware upload)
- 32 steps or less, depending on loop
- 4 tracks, switchable between (mono/polyphone) notetrack or drumtrack
- 2 independent MIDI-Controls (ProgramChange, Aftertouch, PitchBend, CCs) per track
- using the flash storage to save all global params and up to 192 patterns
 - each consisting of 4 tracks
 - organised in 12 banks of 16 patterns each
 - copy patterns
 - copy single tracks between patterns
 - pattern chain to play up to all 192 patterns in a row
- Internal/External Clock source:
 - can send/receive MIDI clock (or both, with MIDI Through setting enabled)
- Per Step Parameters:
 - Note Pitch
 - Note Velocity
 - Note Mute
 - Note Time offset
 - Note Length
 - MIDI-Control Alpha Value
 - MIDI-Control Beta Value
 - WaveGenerator for above parameters with adjustable gain, range, offset
 - simple Chord function: choose from predefined chords
 - StepSkip: remove step from sequence
- Per Track Parameters
 - Loop Start
 - Loop Length
 - Loop Start Offset
 - Clock Divider
 - Shuffle Even+Odd Step
 - Direction Forward/Backward/PingPong/Random
- Global Parameters
 - BPM (for internal clock)
 - Internal/External clock
 - Clock output A/B
 - MIDI Through A/B, filtered A/B
 - visualization options for the Note Pitch parameter
 - Global Musical Scale with Scale Type (Major/Minor etc.) and Scale base parameters
 - one User Scale that can be freely edited and is stored in flash with global parameters
 - Transpose enable (transpose output with incoming note)
 - Trigger pattern load with incoming MIDI CC
 - Adjust quantization of Sequence Reset and pattern switching
 - choice if Mixer Mutes are affected by quantization
 - adjusting track mode: each of the 4 tracks can be either mono/polyphone note- or drumtrack
 - MIDI Out A/B per Track
 - MIDI Channel per Track
 - MIDI Control Alpha Type per Track
 - MIDI Control Beta Type per Track
- Global Play/Stop
- Global Sequence Reset
- In drum mode, control 16 independent instruments (MIDI notes freely assignable and stored in flash with global parameters)
- „Instrument Select“ view for programming drums with TR style interface
 - tap writing drums/single notes
- Mixer view for muting druminstruments and tracks and for triggering „note repeat“ feature

The free Zaquencer Demo has the following limitations:

- limited to 8 steps
- no flash functions (no storing/loading of global parameters or patterns)
 - because of that: no pattern chain, no copying of tracks+patterns
- limited to approximately 20 minutes of runtime (shows „End“ afterwards);
can be restarted but will lose all patterns and global settings due to disabled flash

3. Installation

IMPORTANT NOTES:

Installing the Zaquencer firmware **WILL VOID THE WARRANTY** from the original manufacturer for the device, please make note of that before you proceed.

Installing the Zaquencer firmware on your BCR will **erase everything that's on it**. So if you have made elaborate mappings for your BCR, make sure to export them and save them on a computer before proceeding!!!

Interchanging the Zaquencer firmware with the original BCR one is possible without any problems (except for losing the Flash Presets in both directions).

DO NOT DISCONNECT POWER WHEN WRITING TO FLASH!!!

3.1. Upload

Uploading of the Zaquencer firmware works exactly like uploading an official firmware update.

ZAQ Audio recommends you to get a firm grasp on uploading BCR firmware by using the original BCR Firmware first. Check that everything works fine with your MIDI Interface and the connections, before voiding your warranty in uploading the Zaquencer firmware.

You need a software capable of sending MIDI Sysex Messages (like MIDIOx on PC or SysEx Librarian on Mac OS).

Also, you need a MIDI Interface with DIN connectors. USB will **NOT** work for uploading the firmware.

Connect the output of your MIDI Interface to the MIDI Input of the BCR.



To put the BCR in update (=bootloader) mode, hold the buttons **STORE** and **LOAD** on startup. The display should show „LOAD“, and the held buttons should light up.



Now you can send the sysex file to the BCR via MIDI connection and above mentioned programs.

MIDI/OX:

Make sure that the SysEx output buffer has at least a size of 305 bytes. The timing should be set to 150ms delay between buffers and after F7.

SysEx Librarian:

The timing should be set to 150ms delay between buffers.
Choose a slower transmission speed (starting with 50%).

When the firmware is transferring, you should see a number counting up in the BCR display. If you don't see the number, check the SysEx output buffer size, the MIDI connection, correct MIDI Output of the PC. If all checks correctly, try restarting the BCR (in update mode – see above) and/or the computer's MIDI interface. Also there has been varying success with different MIDI Interfaces, so it's also a good idea to try other interfaces if not successful. As a general rule: the more expensive the MIDI Interface, the better the chance of success.

When transmitting firmware through the BCR Bootloader, watch out that it doesn't show an „F“ on the leftmost LCD digit. When that happens, the block of SysEx messages was transferred incorrectly and you need to retransmit the whole firmware. You can also check this through the answer messages that the BCR outputs after receiving a SysEx Block (you need to connect a MIDI Monitor software to the BCR's MIDI Out while transferring the firmware):

- Block Error	F0 00 20 32 7F 15 35 XX XX 01 F7
- Block OK	F0 00 20 32 7F 15 35 XX XX 00 F7

After the firmware has transferred correctly (the numbers and update bar stop moving), restart the BCR.

DO NOT DISCONNECT POWER WHEN WRITING TO FLASH!!!

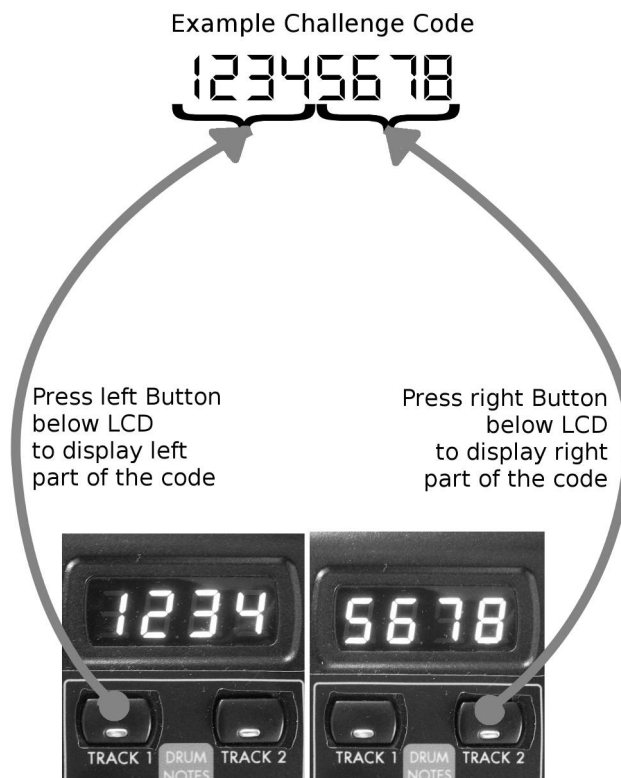
3.2. Authorization

The Zaquencer firmware (not the Demo) is protected by a Challenge-Response System, which means, on first startup on a new device, a challenge code specific to that device is being shown in the display. This challenge code has to be transmitted to ZAQ Audio (see website for instructions) and will result in a response code being sent back to you. Once you've entered the response code your device is authorized and the Zaquencer firmware loads. This BCR will then stay authorized, even when you install Zaquencer updates or put the original BCR firmware back on. You can turn off the BCR between sending and receiving your code, as this will not affect the authorization procedure.

When starting up the Zaquencer firmware for the first time (and every time until authorized) you should see the version number shortly, followed by the letters „Chal“.



This means that the device is now presenting a challenge code to you. **The challenge code is a number consisting of 8 hex digits (letters A-F/numbers 0-9)**. Push the **LEFT LIT BUTTON** under the LCD for the left half of the number and the **RIGHT LIT BUTTON** under the LCD for the right half of the number.



Watch out not to confuse „6“ with „b“ (small „B“).



Press the **EXIT** Button. The LCD displays „Auth“ shortly (Authorization mode) and presents you with 8 glowing top encoders. On each encoder you enter one digit of the response code you've received back from ZAQ Audio from left to right.



Example Response Code

87654321

Enter Response Code with glowing top encoders;
One encoder for each digit from left to right:



Once all 8 digits have been entered correctly, The device is authorized.

You should see „InIt“ in the display and the LED rings of the first 24 encoders counting up. This may take a while. This formats the internal Flash memory of the device and writes the default pattern to every one of the possible 192 slots.

After that procedure has finished, your BCR is ready to go with the Zaquencer firmware!

Tips:

- you can always reinit all flash memory (global settings+patterns) by holding **PAGE <** (the left Page button) and **STOP/PLAY** during turning on the BCR. This will, of course, erase all your musical patterns and global settings
- going back and forth between original BCR and Zaquencer firmware: if preset 1 is written in original BCR firmware, automatic reinit is triggered on next Zaquencer upload; note that if you only write other presets (except nr 1) in the original BCR firmware, and the automatic init is not triggered, you might get garbled pattern info, until you reinit the flash memory like explained here.

DO NOT DISCONNECT POWER WHEN WRITING TO FLASH (during init)!!!

4. Connection

To connect the Zaquencer for regular use, you have to use the standard MIDI jacks on the back of the device. **USB will not work.**

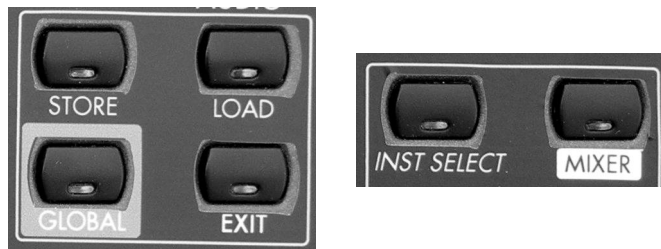


Either connect the Zaquencer to your computer with a MIDI Interface, or connect them via MIDI cables to your MIDI-capable Synthesizers/Drum machines, or both.

5. Overview

The Zaquencer firmware is structured in the following way.

- Main menu
- Global Menu
- Store pattern Menu
- Load pattern Menu
- Instrument Select Menu
- Mixer Menu



The Zaquencer starts up in the Main menu. It is the default menu and as the only menu it doesn't have it's own button, but rather is reached by exiting the other menus.

All the menus are easily accessible, as there is only one layer of depth. Every menu is always just one push of a button away.

Press the respective menu button to enter the menu. Exit a menu either by pressing **EXIT** or it's own menu button with the following behaviour:

- when exiting Store/Load/Global, always return to last mode (except Store/Load/Global)
- when exiting Instrument/Mixer menu with it's own button, return to last mode (if Instrument/Mixer, else return to main)
- when exiting Inst/Mixer menu with **EXIT** button, always return to main

This has been implemented to allow for the smoothest possible menu traversing.

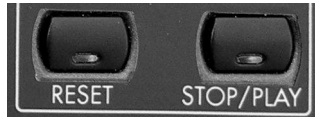
Also note the following special behaviours for Store/Load/Global:

- when using the **EXIT** button to exit these menus, no special function will be triggered
- when using it's own button,
 - on **GLOBAL**: store global parameters (this is the only way to do so).
(If you exit using „Exit Button“, the adjusted parameters will be active until the next power off of the device)
 - on **LOAD**: reload currently selected pattern
 - on **STORE**: store actual values in currently selected pattern

Tip: before switching off the device, if you want to make absolutely sure that all is stored what you are hearing at the moment, doubleclick the **STORE** and also the **GLOBAL** button. The doubleclick on **STORE** will enter and exit the Store Menu, storing the pattern. The doubleclick on **GLOBAL** will enter and exit the Global Menu, storing all Global parameters.

DO NOT DISCONNECT POWER WHEN WRITING TO FLASH!!!

Stop/Play/Reset:



The buttons on the very bottom right are the global **STOP/PLAY** button and the time reset button and these will work the same way in every menu. **STOP/PLAY** only works in „Internal Clock“ mode and starts and stops the clock, so that the sequence will play. **RESET** sets the step counters for every track back to 0, so that the sequence will play from the beginning. This makes sense because by adjusting parameters like „Clock Divider“ , „Direction“, „Sequence Start, Length or Offset“ the relative time position of the tracks to each other might change. Hitting **RESET** makes sure that the tracks in conjunction to each other are heard like they will be stored and recalled in Flash.

Tip: if you´ve liked a certain shifting of the tracks relative to each other that you´ve found by chance (by adjusting the parameters mentioned above), but when hitting **RESET** that cool shift is gone, you can shift the tracks by adjusting the parameter Sequence Offset (explained below) to get back what you heard while jamming.

The four **TRACK** buttons on the top right (below the LCD):



These four buttons allow selecting a track.

Everything that you adjust is adjusted only for the selected track.

A muted track´s **TRACK** button is continuously lit, unmuted tracks are continuously off. The currently selected track is blinking (regardless of Mute status).

The LCD is showing a blinking dot on the position of the selected track if that track is producing notes. Muted tracks don´t show the blinking dot.

In the Mixer menu (more on that below), all 4 blinking dots are shown together, if the tracks are producing notes and are unmuted.

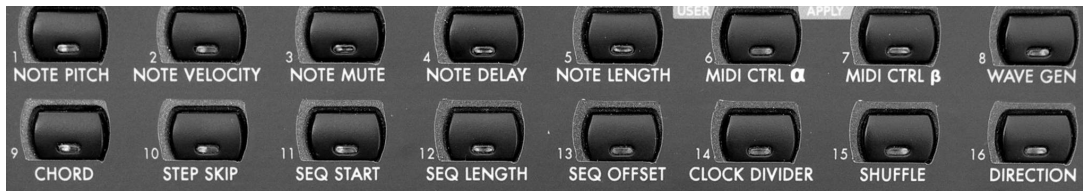
Chord-/Drumtracks:

Each of the 4 Tracks of the Zaquencer can either be configured as a Chord- or a Drumtrack (in the Global Menu). A Chord Track is used to play monophonic melodies or chords. A Drumtrack is used to play up to 16 drum instruments at one time and provides a TR-style interface to program these (Instrument Select Menu). More on the differences below (see parameter **TRACKMODE T1-4** in the Global Menu).

6. Main Menu

The device starts up in the main menu. In this, every encoder of the BCR represents one step of the sequence. The step indicator consists of the three LEDs on the bottom right of every encoder. The three LEDs move with the advancing of the sequence. When they pass an encoder, the note defined for that encoder (by all the parameters) is being played. The other LEDs of every encoder are used to display per-step parameters for the step.

Most parameters of the sequence can be adjusted in the Main Menu. The params are found in the two button rows below the top encoders.



To adjust a parameter press (and release) the respective menu button (e.g. for **NOTE PITCH** the one on the top left), then turn the encoder of the respective step to adjust the parameter for that step.

Tip: By holding down the respective button while turning the encoder, the parameter gets adjusted for every step in the selected sequence length, relative to the actual parameter value. The values are capped at their respective ranges. While steps that are inactive because they lie outside of the active sequence (as determined by **SEQUENCE START** and **SEQUENCE LENGTH**) are not being influenced, steps that are inactive because they are muted or skipped are being influenced by this.

Only active steps will be displayed in the LED rings; a LED ring will be dark if

- step is muted
- step is being skipped
- step is not part of the Sequence being played (as adjusted by **SEQUENCE START** and **SEQUENCE LENGTH** params)

Inactive Steps can still be adjusted with their respective encoders, but will not be displayed or played.

Tip: Note that you can also mute/unmute tracks in the Main Menu by holding one or multiple track buttons and then press the Mixer Menu button. This will not enter Mixer Menu, but toggle those tracks' mutes.

6.1. Note Pitch

This parameter will adjust the Nr of the MIDI Note that is being generated for this step from 0-127. It is only active for a Chord Track and will display „Drum“ in the LCD in a Drum Track to remind you that nothing can be adjusted here in a Drum Track. This is the only parameter that allows for alternative displaying options in the Global Menu (parameter **NOTE DISPLAY**) with the following Options:

Left half (affects LED Ring display):

- Oc (Octave): shows only one octave on the encoder LED Ring, with each LED being one half tone; C is always 1st LED, C# is 2nd LED etc.
- Al (All): shows the whole range of MIDI notes from 0-127 on the LED ring. This means of course that it's quite coarse, and one single LED stands for a range of around 10 notes

Right half (affects 7 Segment LCD display):

- MI (MIDI): shows MIDI Value from 0-127 in LCD

- nA (Name): shows Note Name+Octave in LCD. An „S“ in the second digit means „sharp“; the fourth LCD digit shows the octave of the note. So „CS 4“ means C# in octave 4.

6.2. **Note Velocity**

This parameter will adjust the Velocity of the MIDI note(s) that is being generated for this step from 0-127. The velocity affects all notes being generated in this step. So if there is a chord or different drums playing at the same time, they will all have the same velocity.

6.3. **Note Mute**

This parameter will determine if the MIDI note(s) that is being generated for this step is being played or if it's muted. It has two values, „On“ when turning the encoder to the right or „Mute“ when turning it to the left. On „Mute“ no note is being generated for this step. This does not affect any CCs generated for this step. If you want to produce a silent note for any reason, you can do so by sending an unmuted note with Velocity 0.

When „On“ the LED ring displays Note Pitch for chord tracks, or the rightmost LED for drumtracks. When „Mute“ the LED ring is dark.

The **NOTE MUTE** affects all notes being generated in this step.

NOTE MUTE influence the LED ring display of **NOTE PITCH**, **NOTE VELOCITY**, **NOTE DELAY**, **NOTE LENGTH**, **CHORDS**, but not **MIDI CONTROL**, as these can still play, also not **STEP SKIP** or **SEQUENCE START**, **LENGTH & OFFSET**, as these might still have effect (on **MIDI CONTROL**).

6.4. **Note Delay**

This parameter will adjust the offset in time for this step. With this, you can shift the step a bit ahead or back in time, allowing for funky rhythms. The parameter values are absolute MIDI Clock ticks (which are 24 per quarter note). It's resolution increases with a lower **CLOCK DIVIDER**, because then you have more ticks between notes. The absolute resolution (as measured in milliseconds) is also dependent on the global **BPM** parameter. While you could theoretically create a shuffle with this parameter there is an extra control for shuffle (see below).

NOTE DELAY's range is dependant on the **CLOCK DIVIDER** parameter, as the **NOTE DELAY** does not allow to shift a note behind or before the note after/before it. **SHUFFLE** and **NOTE DELAY** cannot individually displace notes behind the next/previous note. Combined, this is possible. The **NOTE DELAY** affects all notes being generated in this step.

6.5. **Note Length**

This parameter determines the length that a note is being held after playing (or the time after which „NoteOff“ is being transmitted).

It's range is from 96th notes up to 4bars. „t“ in the display means triolic.

The **NOTE LENGTH** affects all notes being generated in this step.

6.6. **MIDI Control Alpha/Beta**

These parameters allow adjusting the value of two independant MIDI Control messages being transmitted on that step. The value ranges from 0-127 and „OFF“. On „OFF“ no **MIDI CONTROL** message is being generated for this step.

The type of the message for each **MIDI CONTROL** is being selected in the Global menu for each track and can be OFF, Program Change, Channel Pressure (Aftertouch), Pitch Bend or Control Change 0-127.

Tip:

If you have a track to spare, you could mute all notes and just send CCs to the sound generators of the other tracks. This allows for polyrhythmic modulation of parameters. For example you could choose to have a very short note sequence, like an arpeggio, consisting only of 3 notes/steps, but send a CC modulation of the filter from another track, that slowly evolves over 32 steps, maybe even with a lower **CLOCK DIVIDER**.

6.7. Wave Generator

This is not a parameter but a utility function to fill the other parameters with certain values. You could for example place random notes in the **NOTE PITCH** fields or put a Sine in a **MIDI CONTROL** to smoothly modulate a CC.

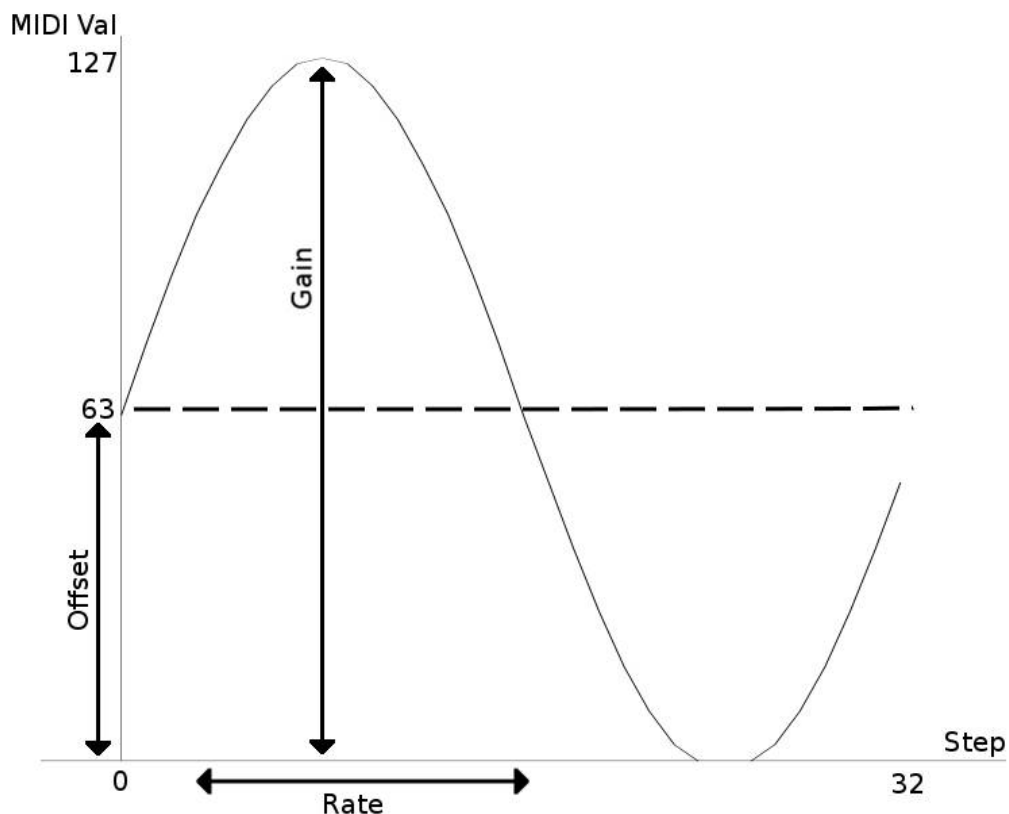
Only steps in the selected sequence (**SEQUENCE START + SEQUENCE LENGTH**) are affected by the Wave Generator.

When holding the **WAVE GENERATOR** button, 4 encoders light up to determine the parameters for the wave created:

- Waveform: Random, Sine, Triangle, Saw, Inverted Saw, Rectangle
- Gain: the amplitude of the waveform in percent;
- Rate: the frequency of the waveform: 1-32; „2” means one cycle of the waveform fits in the 32 steps; 4 means two cycles per 32 steps; etc... This doesn't affect the Random waveform.
- Offset: value offset in MIDI 0-127 and „Add”: this is the baseline that the wave oscillates around. On „Add” it oscillates around the values already present in the parameter fields and so effectively adds the new waveform to the existing one. This doesn't affect the Random waveform. The Random Waveform always oscillates around the parameter in step 1 (top left encoder).

The values are capped at 0 and 127. Not all waveforms can be placed in all parameters. When holding the **WAVE GENERATOR** button, all the other param buttons light up that the selected wave can be applied to. To apply the wave, hit a respective parameter button.

The image below shows Wave: Sine, Gain: 50, Offset: 63, Rate: 2



6.8. Chord

This parameter selects a chord from the chord pool.

It is only active for a Chord Track and will display „Drum“ in the LCD in a Drum Track to remind you that nothing can be adjusted here in a Drum Track.

The chord is being built upon the note present for this step in the **NOTE PITCH** parameter. With Chord=0 you get a monophonic note for this step (the default). The LEDs in the encoder ring display the semitones above the base note. The first LED is always on, as that represents the base note from **NOTE PITCH**. Then for example if the 4th LED and the 8th LED are on it means that a chord is built upon the base note with 3 semitones and 7 semitones distance.

There are the following chords (LCD: 0-14);

```
0:   base note only
1:   3, 7
2:   4, 7
3:   3, 6
4:   4, 8
5:   3, 6, 9
6:   3, 6, 10
7:   3, 7, 10
8:   3, 7, 11
9:   4, 6, 10
10:  4, 7, 9
11:  4, 7, 10
12:  4, 7, 11
13:  4, 8, 10
14:  4, 8, 11
```

Each is found again then with an octave of the base note down (LCD: 100-114) and with an octave of the base note up (LCD: 200-214).

6.9. Step Skip

This parameter will remove a Step from the sequence entirely.

Param values are „Play“ (turn encoder to the right) and „Skip“ (turn encoder to the left).

Opposed to **NOTE MUTE** the sequence will not play a pause here, but skip directly to the next active step, effectively shortening the sequence. It is recommended to either control the active sequence with this parameter or with the **SEQUENCE START** and **SEQUENCE LENGTH** parameters.

While a combination of all is possible, it might be difficult to keep track of what's going on in the sequence.

Tips:

- **STEP SKIP** is fixed to it's encoder and will not move with the pattern **SEQUENCE START**, **SEQUENCE LENGTH** and **SEQUENCE OFFSET**

- you can work with **STEP SKIP** exclusively for shaping patterns, just leave **SEQUENCE START** at 1 and **SEQUENCE LENGTH** at 32

- **STEP SKIP** also influences the LED ring display of **NOTE PITCH**, **NOTE VELOCITY**, **NOTE MUTES**, **NOTE DELAY**, **NOTE LENGTH**, **MIDI CONTROL**, **CHORDS**, **SEQUENCE START**, **LENGTH & OFFSET** (skipped Steps don't show).

6.10. Sequence Start, Sequence Length, Sequence Offset

These parameters together control which of the 32 steps are being played and when. To adjust a parameter, turn the encoder you want to set this param to. Adjusting **SEQUENCE START** will shift the whole sequence to the start point (this is only really apparent if **SEQUENCE LENGTH** is smaller than 32). **SEQUENCE LENGTH** will set the endpoint of the sequence relative to **SEQUENCE START**. If the sequence extends further than the last step (encoder on bottom right), it will wrap around, continuing at the first step (top left). **SEQUENCE OFFSET** determines at which point inside of the sequence it will start to play. This allows for polyrhythmic exploration and shifting of the 4 tracks respective to each other.

Each step belonging to the sequence has the bottom right LED of the encoder lit up. The starting point is marked by the 2 LEDs on the bottom right of the encoder.

These params also influence the LED ring display of **NOTE PITCH, NOTE VELOCITY, NOTE MUTES, NOTE DELAY, NOTE LENGTH, MIDI CONTROL, CHORDS, STEP SKIP** (inactive Steps don't show).

6.11. Clock Divider

This parameter allows to set the **CLOCK DIVIDER** for the Track. This determines after how many MIDI ticks the next note in the sequence is played:

Div 1:	whole note	96 ticks
Div 2:	half note	48 ticks
Div 4:	quarter note	24 ticks
Div 8:	8 th note	12 ticks
Div 16:	16 th note	6 ticks
Div 32:	32 nd note	3 ticks
Triolic:		
Div 24:	24 th note	4 ticks
Div 12:	12 th note	8 ticks
Div 6:	6 th note	16 ticks
Div 3:	3 rd note	32 ticks

Parameters dependent on time (like **NOTE DELAY** and **SHUFFLE**) have higher resolution the lower the clock divider is. Lower clock divider means more ticks between notes => higher time resolution.

You can turn any encoder to adjust the **CLOCK DIVIDER** as it is not dependant on steps.

6.12. Shuffle

This parameter allows adjusting shuffle for the even and odd steps for the whole track. If a step is even or odd is determined relative to the beginning of the sequence (adjusted by **SEQUENCE START+SEQUENCE OFFSET**; that means you don't change the shuffle by altering these). Steps that have a shuffle applied to them are being delayed towards the next step. The amount can be adjusted in percent. The regular distance between two steps are 100%. No shuffle (0%) means then that no note is being delayed. Shuffle of 50% means that the step would be played in the middle of the regular distance. The resolution of the percentage is dependent on the selected **CLOCK DIVIDER** for that track. Same as for **NOTE DELAY**: the time resolution is MIDI Ticks, and that resolution increases with decreasing **CLOCK DIVIDER**.

SHUFFLE can only be adjusted by the lit up encoders, the one on the left for even steps, the one on the right for odd steps.

SHUFFLE and **NOTE DELAY** cannot individually displace notes behind the next/previous note. Combined, this is possible.

6.13. Direction

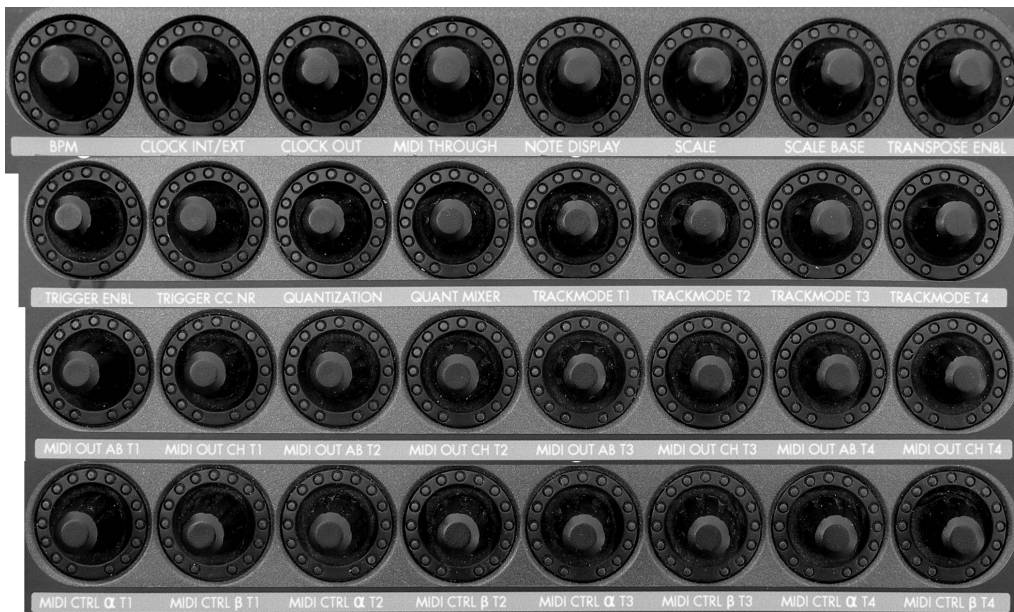
This parameter determines the direction that the sequence is being traversed in for the whole track. Options are Forward, Backward, Ping Pong (alternating Forward and Backward) and Random (next step is being randomly selected).

You can turn any encoder to adjust the **DIRECTION** as it is not dependant on steps.

7. Global Menu

The button to enter the Global Menu is marked with a grey background. Once the Global Menu is entered by pressing this button, all parameters with a grey background become active.

The Global Menu allows adjusting Parameters that globally affect the whole Sequencer. Most of the time, a global parameter is placed on one encoder. Rotating that encoder will change the assigned global parameter.



7.1. Drum Notes



One exception to this is the notes for Drum Tracks.

Each Drum Track has the option of playing out up to 16 independent drum instruments. The notes of these instruments are also being mapped in the global menu. To do this for each track, hold down a **TRACK** button (top right, below LCD). The first 16 encoders will light up, allowing you to assign an individual MIDI note for each drum instrument. If you turn an unlit encoder while holding a **TRACK** button, you will change all 16 instruments relatively at the same time.

The note display is affected by the **NOTEDISPLAY** Global Parameter (either Midi Note Numbers or Name with octave). A Midi Note is generated and sent to the Midi Channel and Output of the selected Track if it's a Drumtrack and if it's not muted. If you modify all DrumNotes by turning an unlit encoder, only the first encoder generates the Note.

Example: your drum machine has the Kick Drum on MIDI Note 36, Snare Drum on Note 37. If you want the Kick Drum as your first and Snare as your second drum instrument, hold the **TRACK** button of your drum track in the global menu, and adjust the first encoder to MIDI note 36, the second encoder to 37. etc etc.

Also, there are the following global Parameters:

7.2. BPM

This parameter allows adjusting the speed of the internal clock generator in Beats Per Minute. Fine adjustment (one digit behind the comma) can be made if the encoder is being pushed while turning. This BPM setting is being overridden if the device is being slaved to an external clock.

If the encoder is only being pushed, the LCD will show the actual value.

7.3. Clock Source Internal/External

This parameter allows selecting the clock source. Either run on the internal clock (being the master), or slave to an external clock (MIDI Clock received on the MIDI In). Setting this to „Ext“ will deactivate the **START/STOP** Button, as the sequence will also be started/stopped from the external master. Changing the clock source will always stop the clock. On „Ext“ the Zaquencer expects from the master a Midi Start Message (0xFA) to start the sequence, followed by Midi Clock messages (0xF8) to drive the clock. To cleanly stop and reset the Sequence a Midi Stop (0xFC) is necessary. Other clock messages are not being evaluated.

If the encoder is only being pushed, the LCD will show the actual value.

7.4. Clock Out A/B

This parameter determines if the clock (no matter if internal or external) is being put out at MIDI Out A/B or both or none. This can then serve as clock through as well (receive and slave to clock coming in on MIDI In, putting it out to output selected here). Note that if you've adjusted the global **MIDI THROUGH** to unfiltered mode, this will already also output any incoming clock, so be aware not to output the clock twice.

If the encoder is only being pushed, the LCD will show the actual value.

7.5. MIDI Through A/B

This parameter determines if any MIDI Input is being sent through to the outputs A/B, both or none. There is a filtered mode („F“ in LCD) that will not put out all incoming MIDI messages already used in the Zaquencer (like clock, notes for transpose and CCs for pattern change) and an unfiltered mode that will mirror any incoming MIDI message at the output, regardless of content.

If the encoder is only being pushed, the LCD will show the actual value.

7.6. Note Display

This parameter will adjust the way that the **NOTE PITCH** Parameter is being displayed, both in LED rings and 7 segment LCD:

Left half (affects LED Ring display)

- Oc (Octave): shows only one octave on the encoder LED Ring, with each LED being on for half tone; C is always 1st LED, C# is 2nd LED etc.

- Al (All): shows the whole range of MIDI notes from 0-127 on the LED ring. This means of course that it's quite coarse, and one LED stands for a range of around 10 notes

Right half (affects 7 Segment LCD display)

- MI (MIDI): shows MIDI Value from 0-127 in LCD

- nA (Name): shows Note Name+Octave in LCD. An „S” in the second digit means „sharp”; the fourth LCD digit shows the octave of the note. So „CS 4” means C# in octave 4

You can skip through the 4 possible combinations of above settings by turning the encoder: Oc.MI, Oc.nA, AL.MI, AL.nA.

If the encoder is only being pushed, the LCD will show the actual value.

7.7. Scale & Scale Base

These parameters allow enabling a global scale, on which all notes being played are scaled to. This does not affect Drum Tracks. The **SCALE** parameter allows selecting a mapping from incoming musical step to outgoing musical step (e.g. Major, Minor). The **SCALE BASE** parameter allows shifting that mapping to a base note (e.g. select 1(Major) with the **SCALE** parameter and „d” with the **SCALE BASE** parameter to scale all outgoing notes to the d Major scale).

If the **SCALE** encoder is being pushed, the LCD will show the number of the mapping along with a matrix representation of the mapping on the bottom 2 encoder rows. The number of encoder equals the incoming musical step, the number of the LED on this encoder equals the outgoing musical step. For example, if you select **SCALE** Nr. 1 (Major) you will see that the second encoder does not display the second LED anymore, but the first one, like the first step. For example in C this means that C# (second step) is not a part of the scale and any incoming C# will be scaled to C (first step) before being played.

Available scales are:

```
1 {{0,0,2,2,4,5,5,7,7,9,9,11}}, //scale MAJOR
2 {{0,0,2,3,3,5,5,7,8,8,10,10}}, //scale MINOR
3 {{0,0,2,3,3,5,5,7,7,9,10,10}}, //scale DORIAN
4 {{0,1,1,3,3,5,5,7,8,8,10,10}}, //scale PHRYGIAN
5 {{0,0,2,2,4,4,6,7,7,9,9,11}}, //scale LYDIAN
6 {{0,0,2,2,4,5,5,7,7,9,10,10}}, //scale MIXOLYDIAN
7 {{0,1,1,3,3,5,6,6,8,8,10,10}}, //scale LOKRIAN
8 {{0,0,2,2,4,4,6,6,8,8,10,10}}, //scale WHOLETONE
9 {{0,0,0,3,3,3,7,7,7,10,10,10}}, //scale MIN7
10 {{0,0,0,3,3,3,6,6,6,9,9,9}}, //scale DIM7
11 {{0,0,2,3,3,5,6,6,8,9,9,11}}, //scale OCTATONIC2_1
12 {{0,1,1,3,4,4,6,7,7,9,10,10}}, //scale OCTATONIC1_2
13 {{0,0,2,2,4,4,7,7,7,9,9,9}}, //scale MAJOR_PENTATONIC
14 {{0,0,0,3,3,5,5,5,7,7,10,10}}, //scale MINOR_PENTATONIC
15 {{11,10,9,8,7,6,5,4,3,2,1,0}}, //scale INVERT
```



When holding the Button below the **SCALE** Encoder in Global Menu, you can adjust a **USER SCALE**. This can be freely adjusted with the 12 lit encoders and will be stored with the global parameters. You can then select the **USER SCALE** by turning the **SCALE** encoder way to the left. Application of scales is usually non-destructive. That means, that your musical sequence will be scaled live according to those parameters, but not altered in memory. You can apply a **SCALE** setting permanently to all tracks, by pushing the buttons below the **SCALE** and **SCALE BASE** encoders at the same time. The notes in the current sequence are then changed to their scaled counterparts. Note that if you want to keep this setting permanently, you still have to store the pattern in flash, after applying the scale. This function allows for different scales between patterns. But please also note to switch off the global **SCALE** setting after applying a different scale, or else the sequence would be scaled twice in a row (first destructive, and then non-destructive).

7.8. *Transpose Enable*

This parameter allows for transposition of the sequence according to an incoming MIDI note. It can be either set to „Off“ (disabling the feature), a MIDI Channel (the notes received on this channel trigger transpose for all 4 tracks), to „trAc“ (Track: each track can be transposed individually, receiving notes on the same input channel as they have as output channel) or to a channel group „1-4“, „2-5“, „3-6“ etc... (each track can be transposed individually, receiving notes on it´s respective channel of the group – for example group „3-6“ would transpose

track 1 with input channel 3,
track 2 with input channel 4,
track 3 with input channel 5 and
track 4 with input channel 6).

The note C3 (MIDI Note 48) means no transpose, the other transpose values are relative to that (Example: MIDI Note in 50 would transpose by 2 semitones up). Transposition is in effect as long as any other MIDI Note is being received (48 for „Off“), or this parameter is changed in Global Menu.

The transposition value is kept between changing the global setting, so you could enable transpose, play a note for transposition, disable transpose, and when you re-enable it, the transposition comes into effect again.

There are two independent transposition values for „ch X“ and „trAc“ modes.

If the encoder is only being pushed, the LCD will show the actual value.

7.9. *Trigger Enable & Trigger CC Nr*

This parameter allows triggering patterns through incoming MIDI CCs. It can be either set to „Off“ (disabling the feature), or a MIDI Channel (the CCs received on this channel trigger the pattern change).

Only CCs received on the **TRIGGER CC NR** will be effective. Then, the CC Value received will trigger the respective pattern. Note that CCs have a range of 0-127, so it´s not possible to trigger patterns >128 through this method.

Also note that it is mandatory to send the CC message a bit ahead of time to be in sync (It has to be received before the MIDI clock pulse, if the Zaquencer is being clocked externally, or else the first step will be missed). This can be done for example by giving the CC track a negative delay (like it´s possible in Ableton Live), or to adjust the driver setting of the MIDI Interface. A negative delay of 1ms should be sufficient.

7.10. Quantization & QuantizeMixerMutes

This parameter allows adjusting the global quantization. The range is 96th notes to 4bars. Following events are effected by this global quantization: pattern changes, **RESET** of time, mixer mutes (if enabled with **QUANTIZE MIXER MUTES**). The effect is always the same: if you trigger one of the mentioned functions by pressing a button, it only comes into effect at the next quantization time point/increment.

7.11. TrackMode T1-4

This parameter is for switching the Track Mode for tracks 1-4. Options are Chord and Drum. The differences are already explained throughout the manual, but are listed here in detail again:

- On Drum Mode, no input/display in **NOTE PITCH/CHORD** Main Menu
- **NOTE MUTES** are displayed differently: Note Val in Chords, 127 in Drum
- InstrumentSelect Menu: only allows input in Drum Mode, LED ring shows notes in Chord Mode, drums in Drum Mode
- Algo: Chords: send note of pitch field + chord built on top of that, affected by global scale
Drums: send drum instrument notes based on global drumnotes, unaffected by scale
- TapWrite: Chords sets note/mute; Drum: sets drum instrument on/off
- Randomize: Chords randomizes chord number, Drum randomizes selected drumInst on/off
- Mixer: drum track selectable for 16 buttons on left; chord track shows all as mute

When switching the Track Mode, Drum Notes and Chords are initialized to 0.

Defaults are: Chord for track 1-4.

7.12. MIDI Out A/B T1-4

This parameter selects the physical MIDI Output on the back of the device, where the respective Track will be played out.

Defaults are: A for track 1-4

7.13. MIDI Out Ch T1-4

This parameter selects the MIDI Output Channel, on which the respective Track will be played out. Defaults are:

Channel 1 for track 1, Channel 2 for track 2, Channel 3 for track 3, Channel 4 for track 4

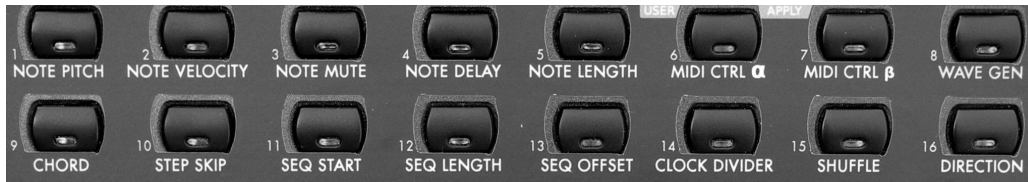
7.14. MIDI Control Alpha/Beta T1-4

These parameters allow selecting the type of MIDI Control message that is being sent for each step. It can be OFF, Program Change, Channel Pressure (Aftertouch), Pitch Bend or Control Change 0-127.

8. Store Menu

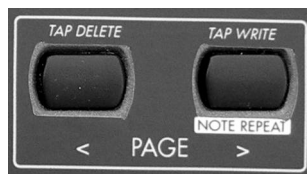


The Store Menu allows storing the current sequence in flash memory. The two button rows on the top are lit, representing 16 pattern slots (they also have numbers from 1-16 on the overlay).



Pressing one of these **PATTERN** buttons will store the current sequence in this pattern slot, and select the pattern. The currently selected pattern is blinking.

With the **PAGE <** and **PAGE >** buttons you can select pattern page 1-12.

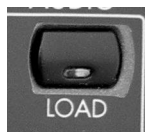


The pattern page is shown as „PA 1“ - „PA12“ in the LCD. Each pattern page holds 16 patterns, so altogether there is room for 192 patterns on the device.

The LED rings show the Step Counter indicator (three moving dots on the lower right in the LED ring) and the start- and endpoint (one static dot on the lower right in the LED ring) for the last selected track.

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9. Load Menu



The load menu allows recalling patterns from flash memory. The layout is identical to the store menu. Pressing one of the 16 **PATTERN** buttons recalls and selects this pattern slot.

In addition you have the four **TRACK** buttons lit, which allow copying/recalling single tracks. To do this, first press and hold the **TRACK** button of your **destination** and then press a button for the **source**. This can either be a **TRACK** button as well, copying the contents from the source to the destination track, or it can be one of the 16 **PATTERN** buttons, effectively recalling the destination track from this pattern only.

Example: hold down **TRACK** button 4 as destination. Then press **PATTERN** button 2. This will result in recalling track nr. 4 from pattern 2 and putting it in the current track nr. 4.

Note that if you choose the currently selected source pattern, the track will be reloaded from flash, undoing any non-committed changes.

Tip: copying/moving whole patterns can be done by loading them first in the load menu and then storing them to a new pattern slot in the store menu.

Pattern Chain:

Holding a **PATTERN** button (two button rows, 1-16) while pressing another **PATTERN** button will result in putting those two patterns and all patterns inbetween in a pattern chain that will be looped.

Exiting the pattern chain is possible by pressing/releasing a single **PATTERN** button (which will also load that pattern).

A pattern chain is being stored with the Global Menu Parameters. That means that if you store the global menu with a pattern chain enabled, the Zaquencer will recall that pattern chain on next startup.

Restarting with **STOP/PLAY** always starts at the first pattern of the chain.

The duration for how long one pattern in the chain will be played, depends on it's slowest track. The slowest track (the track needing the most time) will be played through once before switching to the next pattern. The time that a track lasts is being determined by it's **CLOCK DIVIDER** and **SEQUENCE LENGTH** settings.

In pattern chain mode, the Step Counter indicator (three moving dots on the lower right in the LED ring) and the start- and endpoint (one static dot on the lower right in the LED ring) will reflect the track taking the longest time.

Please note that the mutes from the mixer also get recalled with the patterns. If you need additional mutes for live use that don't get changed by recalling a pattern, please regard using the mutes in the audio domain (e.g. on the drummachine, or the mixing board).

Tips:

- If you have a track to spare, you could use it to arrange the length of the patterns for the pattern chain function. That is, mute the spare track, so it produces no output, but set it's length, so that the other tracks get played as many times as the mute track needs to complete once.
- Of course, you can also just copy the same (or similar) patterns to consecutive pattern slots, to ensure multiple play throughs in pattern chain mode.
- Pattern chaining also works between Pages. So you can hold the first pattern button, then select a Pattern Page (with the **PAGE <** and **PAGE >** buttons) and then press the second pattern button. You can chain up to all 192 patterns this way.
- Pattern chaining works by loading the patterns from flash one after the other. So any unsaved changes made to a sequence while in a pattern chain will be discarded when the next pattern in the chain is being loaded.

10. Instrument Select Menu



This menu allows for TR style editing of Drum Tracks.

The two button rows at the top here represent a drum instrument each. These drum instruments will generate a MIDI Note with the **DRUM NOTE** values assigned in the Global Menu. Pressing a button will select this instrument, and with a turn of the encoder you can enable or disable it for the step of the turned encoder.

A selected drum instrument button will be continuously lit. The other buttons will flicker when that drum instrument is being played on the current time.

Each of the instruments is represented on the encoder led rings by their individual LED (instrument 16 turns on LEDs 1+2, because there are only 15 LEDs). Only the LED of the selected instrument is shown normally.

Special Functions:

- Holding the track button (top right, beneath LCD) of the drum track will light up the LEDs of all instruments (except nr. 16, because there are only 15 LEDs).
- Holding a drum instrument select button (1-16) while turning an encoder will result in enabling/disabling that instrument for all steps of the selected sequence.
- Holding the Instrument Select Menu Button and pressing the **WAVE GENERATOR** button at the same time will result in placing a random pattern in the selected drum instrument

Tap Write/Erase

The Instrument Select Menu also contains a tap write mode for Drum Tracks and Chord Tracks (monophonic tap write only).

The button to enter the Instrument Select Menu is marked as italic. Once the Instrument Select Menu is entered by pressing it's button, all parameters written in italic become active.

To enable this mode, press **PAGE >** while in the Instrument Select Menu. The LCD will show „rEC“ with tap write enabled.



Another press of **PAGE >** (or selecting another track, or exiting the menu) will disable tap write mode.

In tap write mode you can tap the two button rows (1-16) while the clock is playing to put the respective note to the step when you've played it. Alternatively you can play the notes with a connected MIDI keyboard or pad controller (for a Drum Track this will only react to the drum notes set for this track in the global menu).

Either way, the length of the played note is **not** recorded. The tapped notes are set with the length of the **NOTELENGTH** parameter.

When the clock is not playing you can preview the sounds by tapping the two button rows (with Tap Write enabled). In Chord Mode, the buttons on the top left and right are used to

switch the octave displayed on the two button rows (not relevant with the use of a MIDI keyboard).

The note is written as is, but may be scaled by the global scale when being played out. A previewed note is affected by the global scale.

The **CHORD** parameter is not being influenced by the tap writes. That means if there is a chord enabled for a step you will write the base note for that chord in tap writing, and then then chord will be played with that new base note. For monophonic tap write make sure that there are no chords enabled for all the steps.

Internally, a tapwritten note is handled like this:

in Chord Track: unmute the step and set the note to the played one.

in Drum Track: enable played drum instrument at current time.

Pressing **PAGE <** while the clock is running is tap erase. This works a little different for Chord and Drum Tracks. In a Chord Track, pressing (or holding) **PAGE <** will simply mute the step at the current time. In a Drum Track, you have to hold **PAGE <** while pressing a drum instrument button to remove the note from this drum instrument at the current time.

Tips:

- Note that you can also mute/unmute tracks in the Instrument Select Menu by holding one or multiple track buttons and then press the Mixer Menu button. This will not enter Mixer Menu, but toggle those tracks' mutes.

- To clean a pattern for tap writing, you can either use **TAPDELETE** like explained above or you can (for a chord track) navigate to the main menu and mute all steps. Or (for a drum track) you can clear all drum notes by holding the drum instrument's button before turning the encoder in Instrument Select mode, like explained above under Special Functions.

11. Mixer Menu



The mixer menu provides mute buttons for each of the 4 tracks and for every drum instrument separately. These mutes are part of the pattern and will be stored and recalled for every pattern. If you need additional mutes for live use that don't get changed by recalling a pattern, please regard using the mutes in the audio domain (e.g. on the drummachine, or the mixing board).

The normal function of the 4 **TRACK** buttons (below LCD) here is not to select a track, but to toggle the mute status for this track. On the left, the 16 buttons of the two rows toggle the mutes for the selected Drum Track. The first Drum Track of the four tracks will get automatically selected. The display shows „dt x“, where x is the number of the displayed Drum Track. You can switch the displayed Drum Track by holding the Mixer Menu button + pressing one of the 4 **TRACK** buttons. If you select a chord track this way, all drum instruments appear as mute and button presses of the two rows are ignored.

The button Leds will stay on if the track is muted. Else they will flicker with the activity of the track (with played notes), each drum instrument individually and also for each track.

Note that the toggling of mutes (both track and drum instrument) might be quantized to the next quantization timepoint, if the **QUANTIZE MIXER** setting in the Global Menu is „on“. If it's „off“, toggling mutes will be effective immediately.

The LCD display will show up to 4 blinking dots, one for the activity of each track.

Whenever a track plays out a MIDI message, it's dot will blink.

If a track is muted it's dot won't blink.

Note Repeat:

The button to enter the Mixer Menu is marked with a white background. Once the Mixer Menu is entered by pressing it's button, all parameters with a white background become active. Holding **PAGE >** in Mixer Menu will enable the note repeat mode.



Turning any encoder will set the speed of the note repeat. Then you can either press a drum instrument button (1-16) or one of the track buttons to initiate the repeat. Pressing a drum instrument button for note repeat will repeat that drum instrument, regardless of when the button was pressed or what's happening in the current step. Pressing a **TRACK** button (1-4) will repeat everything that is just being played in that track at the time of the button press. This can be a single note, a chord, a combination of drum hits, or also a mute (then, of course there is nothing to be heard through the repeat). While some notes are repeating you can add other drum instruments or tracks to the repeating. Also you can turn any encoder to adjust the speed of the repeat while it's repeating.

Releasing **PAGE >** will exit the note repeat mode and return to normal playing operation.

Tip:

Note that you can also mute/unmute tracks in the Main Menu and Instrument Select Menu by holding a **TRACK** button and then press the Mixer Menu button. This will not enter Mixer Menu, but toggle the track's mute.

12. Technical Infos

- Processor load

The number of simultaneous MIDI Notes that the Zaqencer can send is limited by processing speed boundaries. Also, a single, 3 byte MIDI Message takes about 1ms to transmit (Note message takes 2 ms altogether, 1ms for Note On and later 1ms for Note Off).

The Zaqencer can process a high number of notes (At 300 BPM a little more than 1 Note (On+Off) per clocktick, or 8 Messages per 32nd note), but you can hit the ceiling if you try ;) When this happens, output will slow down, and after a short time the display will show "PrOC" for "Processor Overload".

Please reduce the MIDI output to resolve this (by turning off a track, CC messages, choosing lower clock divider etc...).

Full monophonic output (that is, all 4 tracks blasting at 32 clock divider with a note and 2 CCs per every step - chord function not included in the measurement) you can go up to about 150 BPM and stay stable.

Please note that it's a MIDI limitation that when you have a lot going on on the MIDI bus, it is not ensured that simultaneous notes (e.g. drum hits) are being played at the same time. If you experience that, try distributing MIDI events on the two outputs of the BCR. For example, you could dedicate one output to the drum machine exclusively, or try to separate outgoing clock events from note events.

- DO NOT DISCONNECT POWER WHEN WRITING TO FLASH!!!