



Zaquencer

Sequencer hack for Behringer BCR2000 controller

In spite of new controllers, iPad and constantly improving software, the trend to hardware cannot be denied. Many beginners and those switching miss the clear structure and haptics. The success of quality machines in the lower price segment like MicroKorg, MicroBrute, Bass Station 2 and the Volca series, just to name a few current examples, shows the desire to experiment and produce independently of the DAW. In the area of sound generators the right fit for every taste and budget can be found by now. Up to a short time ago, it looked different in the area of Sequencers. With Yamahas RM1X, Akais MPC or Korg Electribes there were workstations with easy to use tact givers, but also with rather different focus. For acquiring a powerful sequencer you had to budget the amount of of a recent home PC.

The desire to “work without a screen” was also present with Christian Stöcklmeier and eventually led to the development of the Zaquencer: effectively a hack, a reprogramming of the firmware of the Behringer BCR2000. This way the USB Controller with MIDI outputs became a standalone desktop-sequencer with remarkable features. The BCR2000 offers 32 LED-illuminated rotary encoders and 16 illuminated buttons, which are turned into an (up to) 32-step-sequencer with four tracks by the Zaquencer firmware. The tracks can be mono- as well as polyphonic or can be used as a drum track. In the internal flash memory, up to 192

patterns (with 4 tracks each) can be stored. Also copying of single tracks or whole patterns in the 12 banks (with up to 16 pattern spaces each) is possible. Thanks to the pattern chain function, all 192 patterns can be played consecutively if needed. For clocking you can either use the internal clock or use the clock from an external source. The Zaquencer does not only send MIDI, it also receives it and as such can be integrated wonderfully in a Live-setup. With the foot switch connections of the BCR you can either receive Start-/Stop signals (Footswitch 1) or switch to the next pattern (Footswitch 2).

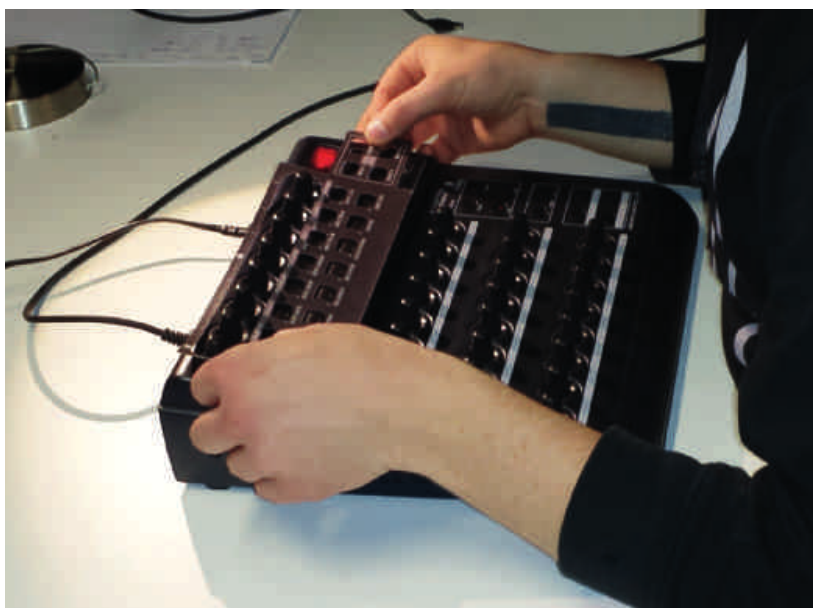
The firmware is offered for 69,- €. Optionally you can order a machine-cut sticker overlay for 19,- €, which makes the transformation of the BCR2000 into the Zaquencer complete. The overlay is also available as a part of the manual for printing yourself, but it's recommended to not save here, because it simplifies working with the Zaquencer very much.

Drumtrack

As mentioned above, you have the possibility to program the tracks of the patterns as drumtracks. For this you adjust the pitches of the signal once through the 16 buttons and then you always have the perfect triggering for the drum computer. In the maximum case it's 16 times 32 steps in a drum track. When the track is selected you choose the desired instrument with the buttons and set the triggers through the encoders.

Step by Step

The parameters for the single steps contain Pitch, Velocity, Mute, Length and Delay (rather more a Time Offset than a "normal delay") and also the possibility to play back simple pre-defined chords, which is meant by the polyphonic use of the tracks. Besides, single steps can be skipped, to deviate from dull 4/4-everything-repeats and to give a little space to chaos.



Sequencing

While running, the loop can be changed arbitrarily. This way, e.g. start- and endpoints can be changed around. For every track you can set an offset, play it back in reverse or ping-pong and even a random playback of steps is possible. The clock-divider with settings 1, 2, 4, 8, 16, 32, 24, 12, 6, 3 influences the tempo and makes triplets possible.

Operation

For support there is a small forum on the manufacturer's homepage. The users manual is contained in the download. Everything is in English, which is rather technical and not too easy to understand, but even with rudimentary English skills you should manage. On top of that, Christian, the developer, is easily reachable through social media or email and strives to be helpful.

Once you've worked through the few pages of the manual, the basic operation of the Zaquencer is clear. There is a helpful quick start guide in the manual. In the test, even musical beginners were able to find their way around it after a short explanation. The menu structure is very simple and easy to understand, especially in combination with the overlay sticker.

It's a bit of a shame that the BCR2000 controller is a not-so-pretty plastic box. When you lift it up, the plastic creaks and also the pots do not really feel great. Considering that, you can get the device used starting at 80 Euro - the original price being around 149 Euro. Together with the approximately 90 Euro for the firmware and the sticker, you can get an incredibly versatile sequencer with a mass of usable features for only 170 Euro with a little luck.

Christian Stöcklmeier has answered us a few questions about his development:

Hello Christian, many thanks that you take the time. Before we get to talk about your BCR hack, please tell us a little bit about yourself. How did your life shape itself before you came to the Zaquencer?

Hi David, thanks for the invitation for the interview! The way it was with me was that I always did many things that, at the time, did not necessarily had a lot to do with each other, but in retrospect all helped that I was able to realize the Zaquencer. I'm now in my mid 30s and began playing the drums 20 years ago - the begin of my musical interest. I have then



Christian
Stöcklmeier

played in bands for many years and always made the recordings of those bands. It became clear to me that I wanted to go in the direction of sound engineer or audio technology professionally. So after high school I first did an apprenticeship as a radio- and TV technician and then went to uni in Ilmenau to study Media Technology with a focus on audio technology. At uni I already had a project with MIDI (we built a universal hardware controller for rack synthesizers based on the ucapps platform). My thesis was about usability of music-hardwarecontrollers, and the interest for MIDI persisted since then. For my first job after uni, I was hired as a scientific assistant at Fraunhofer IIS (in the department where they had developed MP3 back in the day). There I have learned a lot about software development for musical applications. Since 2013 I'm self-employed and have founded ZAQ Audio.

Do you make music yourself? How did you get the idea to program the Zaquencer?

Yes, I have two music projects at this point. My long-time band is called Regionalliga (regionalliga500.de). This band was founded in the year 2000. We had started out to play rock music with German lyrics, but switched to unplugged about three years ago, to take it easy. During my time at uni I had discovered electronic music for myself. After ten years as musician in alternative rock, for a short time music-making left me rather cold. At parties and in clubs I then got in touch with music from Daft Punk, Justice, Fred Falke and the likes, and turned into a music fan again like I was feeling with 16 the last time. This created the wish to also have an electronic music project of my own, and so I've brought ZAQ into life (www.zaqlmusic.com). For the first EP "Follow Your Way" Volker Mehringer, our singer from Regionalliga, contributed the vocals for a few tracks, which I had then processed quite a bit electronically. I had tried different tools for electronic music production - new and old, Ableton as well as analog tape machines and analog synthesizers, but also guitar and bass - and always had wanted a step sequencer to be able to work completely without a screen. These devices were still very expensive at the time and so I've looked for ways to find a cheaper solution. This way I had the idea for the Zaquencer.

Did you try out sequencers (if yes, which ones)?

Not many hardware sequencers. I was able to play around with a Doepfer Dark Time at a store. I also have an Acidlab Miami here, so I know the sequencer of that. A friend has shown me the Elektron Octatrack at some point. I know some Softwaresequencers/DAWs (Logic, Live, Cubase) and have

worked with MIDI there, so that was also a source of inspiration. I've designed the Zaquencer in a way so that it's good to use and with the features that I wanted for my music.

How was your approach, what did you want to realize and did it all work out? Where were the problems?

The Zaquencer came into being very organically. I wrote one feature after the other, without having planned everything from the beginning. When one feature was finished and working great I went on to the next one. I let myself guide from the fun at using it. Development neared its completion when I noticed that the knobs on the BCR and also the space in flash memory for new features were running out. An intuitive operation was very important to me, that's why I wanted to refrain from double assignment of the knobs if at all possible. At the end I had to consider carefully which feature will make it into the firmware, which buttons I can use for it etc. When I was almost done I showed the Zaquencer to two friends from uni, Volker Dümke and Jacob Korn (Uncanny Valley), and also incorporated many of their suggestions before the release. There were partially big changes, like the mixer mode for the mutes, and also the drum tracks. Volker has a Vermona DRM1 and has been looking for a long time for an affordable sequencer to trigger the sounds similarly to a Roland TR. This was a challenge that excited me. The difficulties lied in the nature of the hack, so that it sometimes took quite some time until I really mastered a basic function of the BCR (e.g. receive MIDI data). The Zaquencer is based on Willem van Engens BC2000 SDK, and even though this already covered some of the functions, a big part

of the 2-year development time was spent getting all the BCR functions to run. Willem has supported me now and again during development with tips and has eventually also allowed for a commercial use of his SDK by providing a closed-source license. I am very grateful to him for this, because without the prospect of commercialization I don't think I could have invested the time in the Zaquencer.

How did you choose the Behringer BCR2000 Controller?

When I searched for ways to realize an affordable step-sequencer, my eye fell on the BCR2000 that I had still lying around. Even then I found it quite perfect as a hardware platform for a step-sequencer - the number of buttons and rotary encoders, as well as the many LED rings for the optical feedback of parameters. Then I found Willem's SDK for the BCR2000 through Google. Once I had created a moving light with a testprogram for the first time, I was so excited by the possibilities of the BCR that I continued this path.

Installation of the hack is a little bit tricky. Do you want to describe it shortly?

The installation of the Zaquencer works the same way as the installation of an original Behringer firmware-update. I think it might deter a little bit, maybe because I have described it as detailed as possible in the manual and on our forum, to eliminate error sources. Basically you only have to connect the BCR via MIDI Jacks to a Mac/PC, hold Store+Learn when powering on the BCR and then transmit the firmware with a SysEx management-software (e.g. the free MidiOX or SysEx Librarian) to the BCR. Then you have to complete the authorization, this is the copy protection. After the first startup, an individual number for this BCR is being shown in the display, the Challenge Code.

The user has to enter this code into a form on our website. He then automatically receives the Response Code from the server, which he can use to unlock the BCR. The authorization stays valid, even when you install a Zaquencer upgrade or the original Behringer firmware.

Is there a reaction from Behringer towards your reprogramming?

I had decided to approach Behringer prior to release. I got an appointment with Thomas Zint, the original developer of the BCR2000. I have presented the project to him and two of his colleagues, and already



had a demo-unit with me. Anyway, Behringer had nothing against me distributing the firmware – albeit understandably only with pointing out the loss of the original warranty. They have even spread the news on their blog and Facebook after release. I could not have wished for a more positive reaction! I am very grateful to Behringer for allowing and even supporting the project.

At what point have you decided to commercialize the Zaquencer and not to release it to the public, for example covered by an open-source license?

Already at the start of development it became clear to me that this is going to be a big time expense, which I have to justify financially. I have worked on it for about 18 months full time self-employed. I don't know if I could have realized the project at all as a hobby for free release.

Do you plan further projects or upgrades for the Zaquencer at this moment?

My work at this time is mainly focussed on updates for the Zaquencer. Version 1.03 with SysEx Import/Export is just in Beta and I hope to release it soon. After this I want to realize more features that the community has wished for in the ZAQ Audio forum. On top of that I have a few other ideas, but it's too early to talk about them right now.

What's the resonance to the Zaquencer? Do you get a lot of feedback from people using the Zaquencer in the studio or even live?

The resonance is very positive. The predominant reaction is enthusiasm, especially concerning the amount of features compared to the price.

Many people write comments on our Facebook (also a few reviews), YouTube, in our forum and also in other audio forums. Most people like the intuitive operation of the Zaquencer and that the menu structure is nice and flat (almost „one knob per function“). Of course the users express some feature wishes that they like to see realized, and I try to accommodate for that in future updates. What I'm really happy about are the many YouTube videos, that have been created by the users with the Zaquencer. It is nice to see that people use the Zaquencer firmware to create something new in return, and with the videos you can immediately see the fun they have using it.

There is an (unused) USB connection on the Zaquencer. Have you thought about incorporating something like the Launchpad as a moving-light expansion?

I have not had this idea before, interesting! I don't know if the existing USB connection on the BCR would work as a host, because it's a USB-B connection. I did not delve that deeply into USB yet. Until now I had only thought about using the USB jack for a connection with a computer, to save the separate MIDI-USB interface. I have discarded this though, because it would mean quite some development effort, that I'd rather invest into new sequencing features. On top of that, MIDI USB interfaces are available very cheaply from many manufacturers, or are already included in a soundcard.

Original article: David Thiehoff
English translation: ZAQ Audio

Further infos
www.zaquadio.com