How To Pimp Your Ribbon Controller

Ever wanted more expression from your synthesizer to scare off all those guitar wielding heroes out there? This article provides some pointers and tips for using a ribbon controller in such battles. The text is based on my experiences with adding Doepfer R2M ribbon controller to the Technics WSA-1 synthesizer but of course the same principles can be applied to any comparable combination.

Why a ribbon controller?

Conventional keyboards have a lot of advantages. They are a well developed tool that makes our musical system compatible to our own tactile layout. In that respect it is a great invention. Furthermore electronic technology has added to this by providing velocity sensitivity, aftertouch and generic controllers like pitch bend en modulation wheels.
But still the standard keyboard is a compromise. Since the well tempered keyboard was invented we have a standardized harmonic system that is interchangeable between all keyboard instruments. So under most circumstances fixed pitches are a good thing.
But other instruments, like for instance the violin, are actually much more versatile when it comes to musical expression. The only problem is that such instruments are often monophonic. Also learning to play them takes an extreme amount of time and discipline.
Now what are the disadvantages of standard electronic keyboards?
Pitch bending is typically taken care of by a wheel, while another one might control further expressive elements such as volume or the opening of a filter. Furthermore a good synthesis engine might provide portamento, a preset glide that takes one from the previously played pitch to the second in a continuous delayed flow. In some styles a synth solo can hardly do without the now familiar “weow weow” effect but in the hard light of day portamento is only a crutch. It can never stand up to skillfully played slides on a non fretted string instrument. Furthermore many early digital synthesizers are not even able to emulate portamento because the arithmetic needed for that operation was beyond the power of their processors.
And as far as those wheels are concerned. A preset vibration introduced by a wheel can also never emulate a real vibrato. Yes, a skilfully used pitchbend wheel could theoretically circumvent many of these limitations but in practice it is just another compromise. Pitchbend wheels do give little feedback and even more importantly they always have a dead spot in the middle.

The incentive

To cut a long story short: For real musical expression the standard keyboard could be improved upon.

I have been thinking about adding a good continuous pitch controller for years, at least since I learned to appreciate the excellent functionality the Yamaha CS 80 ribbon provides. So first I oriented myself on analog systems, even contemplating building something akin to a string based Trautonium type controller.
Then I bought myself a Technics WSA-1 acoustic modeling synthesizer. This very interesting and totally underestimated instrument merits it's own story but to place it in the context of this article: It's acoustic modeling engine is dying for the best expressive control technology can provide.
Nowadays the polyphonic Hakan Fingerboard can be ordered straight from the factory. It's a dream come true with it's 3 axis polyphonic tactile surface but it is very expensive and then you still need a synth engine that can process such dense data streams.
Sadly enough the WSA can't process polyphonic aftertouch anyway. So I turned my attention to ribbon controllers. At least for monophonic playing they should be able to add a lot of control.
The last bit fell into place when I saw Spiros Kottis' YouTube video in which he plays an almost perfect emulation of a violin solo on a Doepfer R2M ribbon controller on a track called Kanali Kar. Although I personally like the piece a lot music is always a matter of taste but in this context it is more important to mention that his playing on this video is extremely convincing.
Have a look at Spiros Kotis' video on: http://www.youtube.com/watch?v=KXeTPPRXxMY
Even if I might not be able to reach the same level of expression in the end this video indicated to me the R2M could be an almost perfect monophonic controller for the WSA, at a reasonable price (Its street price is around Eu 250 / US$ 300).

The Doepfer R2M

The Doepfer R2M is a fully specified 50 cm long ribbon controller combined with a dedicated programmer box including a MIDI interface. So no laptop or other computer is needed to drive a MIDI synthesizer. It can be used in many ways and one's personal preferences can be programmed into presets. Both movement and pressure can be used freely, even up to a point that one generates so much mayhem that the processors start to lag behind and a MIDI jam appears. But even that can be fun.
But as already explained my main goal is a bit more conventional. I see it as an alternative for the conventional keyboard and want to use it to maximize the expression in my playing.
So I typically use the R2M in it´s so called Trautonium mode. The ribbon then generates MIDI note commands according to the position where a note is triggered. Moving the finger up and down adds pitch bend information. By synchronizing the pitch setup of the controlled instrument to the R2M´s on board parameters one can make sure that a note is bend exactly in line with the position of newly triggered notes. In other words: If one bends a note and retriggers at the same position the newly generated note is of the same pitch as the that of the bend note just released. So the R2M then indeed works like the neck of a nonfretted string instrument. One can trigger and repeat notes, bend them, make vibrato's, trills, slurs, etc, etc.
The pressure sensitivity I typically connect to MIDI aftertouch.

The grass is always greener ....

So I bought myself an R2M.
Although it does not always trigger perfectly (One can even hear a small glitch in Spiros eminent video. Can you spot it?) it delivers on most it promises. But in the cold light of day it still has some disadvantages.
These are:

1. For a non-violinist it is extremely difficult to always hit the right pitch. Luckily one can determine how many octaves are generated over the 50 cm length of the ribbon controller but even at lower settings like 1 or 2 octaves it is difficult to play in pitch with a conventionally tuned piece without a lot of practice.
2. The pressure sensor has an extremely short range. It works reasonably well but if feels a bit like a badly implemented aftertouch on a conventional keyboard. One hardly gets any tactile feedback.
3. The R2M does not generate velocity information.
   Every note is generated at a fixed high MIDI velocity number, probably 127. That´s a bummer because the notes are always generated at full volume and who plays a keyboard at maximum velocity all the time? At least a mode to set the typical volume of MIDI messages should have been included but Doepfer says that at the moment of it's development not enough memory space was available to add this feature.
   Well at least it is possible to modify the synthesizers sounds and place them into their own memory locations but who wants to use different presets for the keyboard and the ribbon controller, especially since combining both is such fun? One can for instance play a chord on the keyboard, hold that and

play an additional note on the ribbon controller. If one then slides his finger all notes are bent together. Great stuff. The only trouble is then that the note generated by the ribbon is often extremely loud in comparison to what one averagely plays on the keyboard.
An alternative would be to not generate note commands with the ribbon controller but only the added pitch bending information. But strangely enough this is also not implemented.
Of course it is possible to place a MIDI filter of some sort between the R2M and the synthesizer but that defeats the stand alone concept a bit and drives the price up a lot. Pity.

In all honesty it must be said that these small shortcomings are quite understandable at the price the unit is offered at. But I still saw some room for my some improvements. And here they come.

The solutions

1. Pitch scaling.
   There is quite a good cure for that. Why not make a visual scale and align it to the ribbon controller. One that is more or less comparable to the visual feedback one gets from a conventional keyboard. A visual scaling of the ribbon so to speak.
2. Pressure feedback.
   I could also see a solution for that. Why not mount the whole ribbon controller on some sort of spring. The harder one then presses the lower the controller sinks according to the amount of pressure.
3. The lack of velocity.
   Well actually there is no real solution for this. I'll have to live with it as long as I do not want to include an extra computer or stand alone MIDI filter in the setup. So I did indeed programmed special R2M versions of the more critical sounds. You can't win them all.

Putting it into practice

The photographs show how I implemented my ideas.
In fig. 1 and 2 one can see the basic solution for getting pressure feedback. Here the ribbon controller is placed on pieces of good quality closed cell foam-rubber as a test. It's not hard to imagine that the added force of pressure will make the rubbers compress according to the strength of that pressure.

Fig. 1: Mounting the ribbon controller on rubbers

Fig. 2: Detail

The next step was to build a frame that incorporates this solution. This frame also provides a resting place for the palm of the hand or one or more of the fingers that do not actually control the ribbon. This gives the player a stronger “footing”.
Furthermore I made the depth of the frame such that visual scales could be attached to them, thus providing feedback for where the standard pitches lie.
I also decided to include the control box into the setup. It's depth was actually used as the depth measurement for the base plate. This left room for 25 mm strips “above and below” the actual ribbon controller.
The width of the base was determined by adding together the width of the controller box, the ribbon controller and the USB connector sticking out from its right. Lengthening the base with this extra bit of the connector lessens the chance of both the cable or connector becoming damaged during use.
The extra space around the foam rubber “springs” below the actual ribbon controller made it possible to mount almost the complete USB cable in the frame. Only the bit leading to the connector on the back of the controller box is still sticking out.
I want to use the ribbon controller in front of the existing WSA keyboard. Therefore I also checked how high the whole assembly would have to be to get an optimum height compared to the keyboard. (see fig.4)

Fig. 3. Checking the optimal height

Fig. 4: General layout

The basic measurements of the base plate thus became 770 x 90 mm x 15 mm.
Fig. 4 shows the rough version of this setup. Simple scrap wood was used, the rounded wood profiles above and below the ribbon where actually scavenged from an old organ seat. Always good for that postmodern Minimoogish, wood finish.
The total height of this layout was 61 mm.
I did however encounter a problem. The 3 connectors protruding from the backside of the controller-box interfered with the housing of the WSA. This mean I was not able to move my contraption completely up to the WSA. For this reason I decided to reduce the height of the base-plate with 3 mm's, bringing the total height back to 58 mm. Now the connectors just fit below the WSA housing and thus the controller can be moved closer to the keyboard.

So now I had my basic frame assembly incorporating all the main parts and connectors. But I still had to add the visual key-scale.
This first needed some additional thinking though.

1. On a conventional keyboard the middle of the keys does not actually emulate their pitches. The black keys are less wide then the white ones. This has been done to make an octave as narrow as possible while still taking the width of the average human finger into account.
   But on the R2M all notes have the same width. Therefore it was important to design a layout in which all the 13 notes in an octave are equal in width.
2. On the other hand it would be good to still be able to see where the “black keys” are.
3. Lastly: On a normal keyboard the total width of the key provides the standard pitch but on a ribbon controller every intermediate position also produces pitch information. For extra convenience I decided to work with triangular shapes to point out the exact position of the tempered pitches.

I found to the following subdivisions of the 50 cm of the ribbon controller to be the most practical:

- 3 octaves, being equal in length to 3 octaves on a normal keyboard and thus feeling quite natural for atypical keyboard player
- 2 octaves, providing an alternative where smaller inaccuracies in finger placement and movement would be less critical in the tuning department.

In a computer drawing program I then designed the layout shown in Fig. 5.

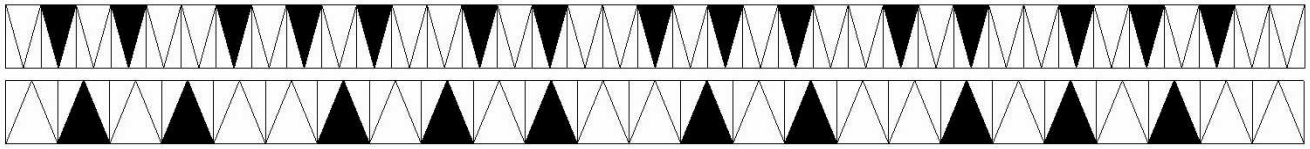

Fig. 5: key-scale design up to scale for a 2 and 3 octave layout.

I printed out this drawing at he right scale on a laser printer and put transparent foil over it. I decided to fit the 3 octave scale to the frame constantly and use a loose 2 octave scale as a fold away overlay. The results can be seen in Fig. 6 and Fig. 7.

Fig. 6: The fixed 3 octave layout in place.

Fig. 7: The 2 octave overlay added.

I then added a casing around the controller box to keep that in place, thus not having to screw or glue it to the base. Lastly I added a clip over the right part of the ribbon controller housing to fix it semi-permanently to the frame. For both I used simple plastic (poly ethylene) strips but of course other materials can also be used. See Fig.8 for the finished setup.

Fig. 8: The finished setup

And the rest is ……?

And so my special ergonomic adaptation of the Doepfer R2M is finished. Now the only thing left is to play the best music I can come up with on this wonderful combination. For the results stay tuned to my website at:

www.brassee.com

Marc Brassé
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