By Dan Levin

Rock It with a MIDI KEYTAR

The Rock Band 3 keyboard (keytar) can currently be found online for little more than $20. Although primarily designed as a game controller for the Rock Band video game, it also doubles as a MIDI controller. This makes it one of the least expensive options available for a MIDI keyboard to musicians. At first glance, the MIDI options seem rudimentary at best, and I ignored buying one when they first came out. However, there are quite a few options available that aren't readily apparent, and even a couple hidden controller features that I've chosen to exploit. The end result is a very inexpensive — yet very capable — MIDI controller that can be used both in the music studio and for a little fun on a live stage.

Rock Band Keyboard MIDI Features Summary

The stock Rock Band keyboard is shown in **Figure 1**. Let's take a look at the features available right out of the box:

- Velocity-sensitive two octave keyboard with octave selection up and down.
- Modulation (vibrato) ribbon controller with a button-selectable pitch bend function.
- MIDI program up and down selection.
- MIDI sequencer controls: Stop, Continue, and Start to run your DAW (Digital Audio Workstation), drum machine, or sequencer.
- MIDI panic command (all notes off) for those annoying stuck notes.
- MIDI Drum mode where you can play drum sounds on an external module on MIDI channel 10 (normally, it only outputs notes on MIDI channel 1).

In addition, there is a small 1/8" (3.2 mm) TRS (tip, ring, and sleeve; sometimes called a 'stereo jack') jack next to the MIDI out connector that was intended for future controller expansion. The planned accessory was a dual foot controller that would add a sustain pedal and a volume/foot controller potentiometer pedal. The function of the volume/foot controller is selected from the 'D-pad' gaming control on the front panel. The D-pad is the four-position flat joystick control on the front panel which offers switch closures for up, down, left, and right movements.

In summary, **Table 1** is a list of the front panel MIDI functions (note some buttons are labeled differently between the Xbox, Sony PlayStation, and Wii versions).

You may want to label these MIDI functions like I did as shown in **Figure 2**. Since I painted the body of mine, relabeling was needed anyway. If you do plan to paint the body on yours, remove *everything* from the case. That will make painting much easier, and prevent potential issues with the electronics.

■ **FIGURE 1. Stock Rock Band 3 keyboard.**

■ **FIGURE 2. Repainted keyboard with MIDI functions labeled.**

Let's Add a MIDI Sustain Switch

Now comes the fun part: Tapping those features in the 1/8" pedal jack. I think most will agree that a sustain pedal on a two octave keyboard is not very useful. However, when used on a stage as a keytar, a neck-mounted sustain switch is quite useful for theatrics, and a look at most higher-end keytars reveals this is a fairly common feature. We *could* add another switch to the neck for this purpose, but there is already a nice momentary switch mounted on the neck in an ideal position. The function of the current switch is not very useful, however. When held down, it causes the ribbon controller — usually controlling modulation — to instead control pitch bending. It's quite awkward to do pitch bending this way, so I came up with another method.

I added a small SPST toggle switch to an unused area on the front of the body. I then desoldered the wire from the current neck switch (labeled 'overdrive' on the neck printed circuit board [PCB]) and soldered it to the toggle switch. I then ran ground to the other terminal of the switch. The ground is conveniently located next to where the overdrive wire was on the neck PCB. Details are shown in F**igure 3.** When the switch is closed, pitch bend mode is activated on the ribbon controller. An open switch defaults the ribbon to modulation mode.

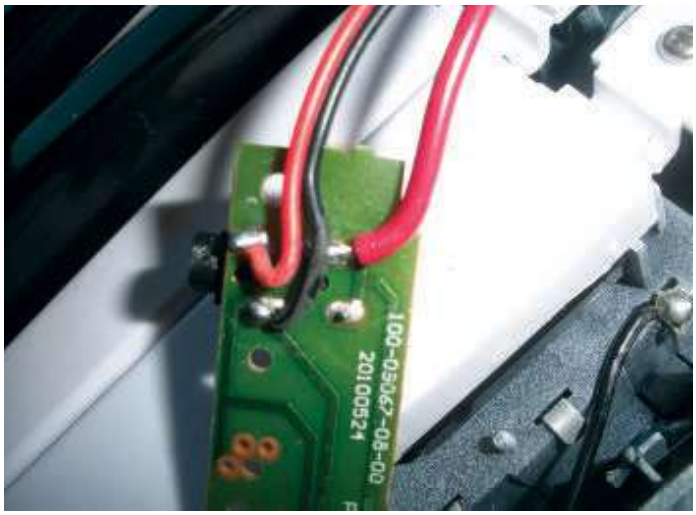
■ **FIGURE 3. Neck PCB. To start the MIDI sustain switch function and move the pitch bend/modulation selection switch, desolder and remove the top wire in the ribbon cable. It's labeled "over_d" on the PCB. Next, solder a wire on the underside of the "gnd" wire solder connection next to the "overdrive" hole.**

To convert the existing neck switch into a momentary sustain switch, I ran a wire from the 1/8" TRS pedal jack's

- D-pad up = (Drum mode) lowest keyboard octave outputs on MIDI channel 10 for playing drum voices.
- D-pad down = pedal outputs MIDI channel volume cc 7.
- D-pad right = pedal outputs foot controller MIDI cc 4.
- D-pad left = pedal outputs expression MIDI cc 11.

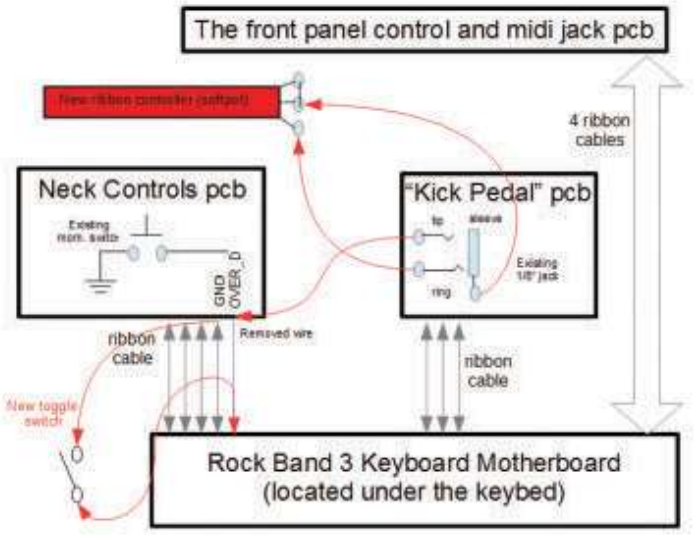
Table 1.

MIDI Command	PlayStation	Wii	Xbox
MIDI Sequencer Stop	Select	- (minus)	Back
MIDI Sequencer Continue	PS Logo	Keyboard	Xbox logo
MIDI Sequencer Start	Start	+ (plus)	Start
MIDI Panic (all notes off/reset)	All 3 buttons above	All 3 buttons above	All 3 buttons above
Keyboard octave decrease by one	(square)	1	X
MIDI Program increase by one	(triangle)	2	Y
Keyboard octave increase by one	(circle)	B	B
MIDI Program decrease by one	X	A	A



■ **FIGURE 4. "Kick Pedal" PCB. Run three wires from the tip, ring, and sleeve terminals to the neck area of the keyboard. The ring is the ground connection and will need to route to the minimum value side of the softpot. The left red wire is the sleeve terminal and connects to the softpot maximum value side of the softpot. The middle black wire is the ring terminal, and the right red wire is the tip terminal which routes to the neck PCB for the new sustain switch.**

tip terminal to the now-vacant overdrive neck PCB hole. The 1/8" TRS jack is mounted on a small board to the right of the highest key and is labeled "kick PCB." I ran three wires from this board up to the neck area: tip, ring, and sleeve (**Figure 4**). The ring and sleeve wires are used for the next part of our modification.



■ **FIGURE 5. Overall block diagram of the Rock Band 3 keyboard with modifications.**

The 1/8" TRS jack is wired a little differently than you might expect. The tip is the sustain signal input. It is held high and looking for a digital 0 (ground) to signal the keyboard's electronics. The sleeve is the AD input for the volume/foot controller potentiometer pedal. The ring is the ground.

The tip is looking for an open circuit to ground connection (switch closure) to send a sustain pedal on command. A ground to open circuit (switch release) signals a sustain pedal off command. The sleeve AD input is looking for a resistance in the 100 to 10K ohm range. The keyboard's software also complicates things.

If you go to a resistance below about 100 ohms, the software tells the keyboard there is no potentiometer pedal and the volume defaults to full. In this scenario, you could be decreasing the volume and then when you are just about at zero volume, the thing will call for full volume. I suppose this could be used for dynamic effect, but I just found it annoying.

Also, if the resistance is too high, the software tells the keyboard nothing's plugged in and the functions are disabled. **Figure 5** shows the overall electronics block diagram with the modifications.

Let's Add Another MIDI Controller

The ideal potentiometer to replace the volume pedal for me is a 50 mm long (2") 10K ohm softpot. Softpots are made by Spectra Symbol and are available at various electronic distributors such as SparkFun, Digi-Key, Adafruit, and Mouser Electronics. Mine cost about $5. You can get longer lengths, but 50 mm seemed the right length for the

Resources

Rock Band 3 MIDI Guide:
www.fakebitpolytechnic.com/wp-content/uploads/2013/07/rb3keyboardmidimanualv2.pdf

Softpot Datasheet:
www.sparkfun.com/datasheets/Sensors/Flex/SoftPot-Datasheet.pdf

Sources for Softpot:
www.sparkfun.com
www.adafruit.com
www.mouser.com
www.digikey.com

Sources for further information on the Rock Band 3 keyboard, other modifications, adding sound capabilities, using with softsynths, etc.:
http://createdigitalmusic.com/2010/10/hands-on-rock-band-3s-keytar-a-surprisingly-serious-80-midi-keyboard
http://samislam.hubpages.com/hub/Rockband-3-Keyboard-as-a-MIDI-Controller
http://hackaday.com/2011/02/18/8-bit-midi-synthesizer
http://robertsonics.com/2014/10/19/turn-the-rockband-3-keyboard-into-a-sampling-instrument-with-the-wav-trigger
www.youtube.com/watch?v=HGoSdSSI4ul

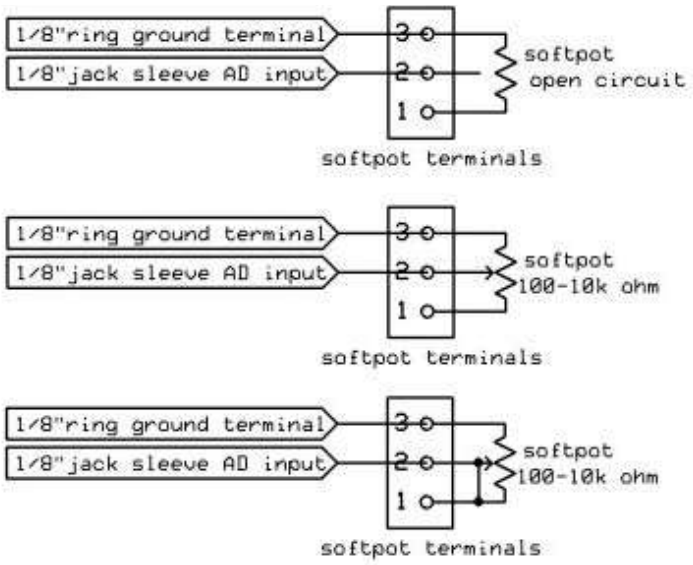
Sites for other DIY Electronic Music Ideas:
www.muffwiggler.com/forum
http://electro-music.com/forum/index.php?f=112

RB3 Keyboard Controls:

Velocity note data
MIDI program up
MIDI program down
Octave up
Octave down
MIDI panic (three finger salute)
Mod wheel (pitch bend wheel selectable)
MIDI sustain (jack input)
MIDI foot controller, volume control, expression control (jack input/selectable)
MIDI start, stop, continue sequencer control

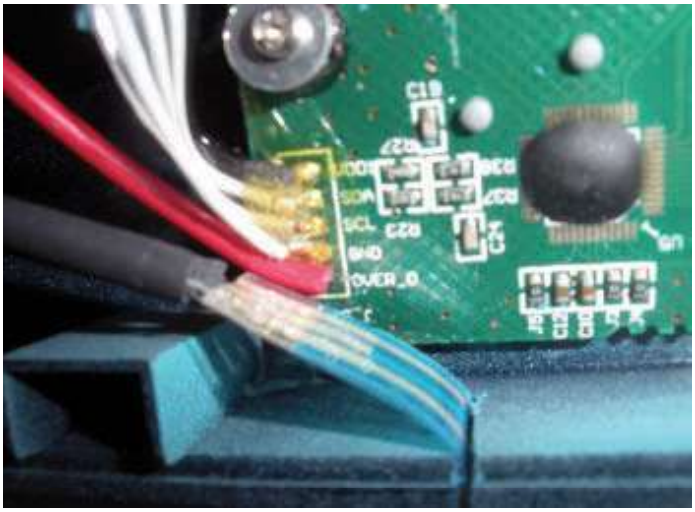
Mods:

1. Add a toggle switch to select ribbon mod or pitch bend.
2. Convert flat neck switch into a sustain switch.
3. Add a pot on the neck for foot controller/ expression/ volume.



■ **FIGURE 8. Softpot operation. The top picture shows how the circuit appears without a finger pressing on it: The wiper is open circuit. The middle picture shows that the softpot behaves like a normal potentiometer with a finger applying pressure to it. The bottom picture shows how we short the wiper to the maximum value softpot terminal to ensure the keyboard's AD input always sees at least 10K ohm of resistance — even when the finger is removed.**

■ **FIGURE 6. Softpot mounted on the keyboard neck. Note the hacksaw cut made to accommodate the softpot's flat ribbon cable terminals.**



■ **FIGURE 7. Softpot wiring detail. Note shrink tubing applied to the terminals to prevent short circuits. Also note the new red sustain wire connection to the neck PCB at the 'over_d' location.**

keytar neck. I had to trim about 1/8" (3.2 mm) off each side of the softpot to fit on the top half of the body.

Be careful not to cut into the traces of the pot if you do elect to trim it. The back of the softpot comes with an adhesive to mount it. I routed the connector ribbon into the body by cutting a thin slot perpendicular to the upper case half with a hack saw (**Figure 6**).

The width of the hacksaw blade was more than adequate for the connector to slip into.

To wire up the softpot (**Figure 7**), I connected it to the two remaining wires from the TRS pedal jack. If you're careful, you can snake the wires underneath the keyboard where they are protected and out of the way. One wire connects to the ring (ground) and the other wire hooks up to the sleeve (AD input). Be sure to run the ground to the minimum side of the softpot. Don't forget to protect any exposed terminals with shrink tubing. Also take care to short the minimum softpot terminal to the middle/wiper terminal so it operates correctly.

Don't just hook the AD input to the middle wiper and the maximum value. The wiper goes open circuit when a finger is not applied to it. Remember the goofy behavior I mentioned with the software? By shorting the minimum terminal and wiper terminals together, you ensure the AD input always has at least 10K ohms of resistance and doesn't see an open circuit.

I should mention the softpot has a minimum resistance of 100 ohms, which takes care of the AD input not liking to see less than 100 ohms on its input.

Figure 8 shows the normal softpot operation and how

it should be wired in the Rock Band keyboard. If you elect to use a traditional potentiometer that goes close to zero ohms at the minimum setting, you'll want to wire a 100-150 ohm resistor between the minimum softpot terminal and the TRS jack's ring/ground connection.

The function of the new softpot is selected from the 'D-Pad.' It will output MIDI expression, foot controller, or MIDI volume data (MIDI controllers 11, 4, and 7, respectively).

I use my software DAW/sequencer/tracker's 'learn' features to match the softpot to the feature I want to control, so the setting in the keyboard is not critical.

Watch Your Grounds!

During the building and testing of this project, I noticed not all grounds in the Rock Band 3 keyboard are created equal. There is a digital ground, an analog ground, and each board has its own ground. The ground wiring I'm specifying for these modifications seems to be the most robust I've been able to come up with. Dying batteries even created a situation where I had to switch grounds to keep things operating intelligently longer.

Test It Out

After re-assembling the keyboard's body, put the batteries in, plug in a MIDI cord, and attach it to your favorite synthesizer module or MIDI-to-USB converter for computer use. Then, turn it on and you're ready to make music.

The original ribbon controller can be utilized by your left index finger; the new sustain button with your middle finger; and the new added softpot with your thumb. Now, you have the expression control of the more professional keytars for about $30.

At that price point, *every* keyboardist should have one in their arsenal! **NV**

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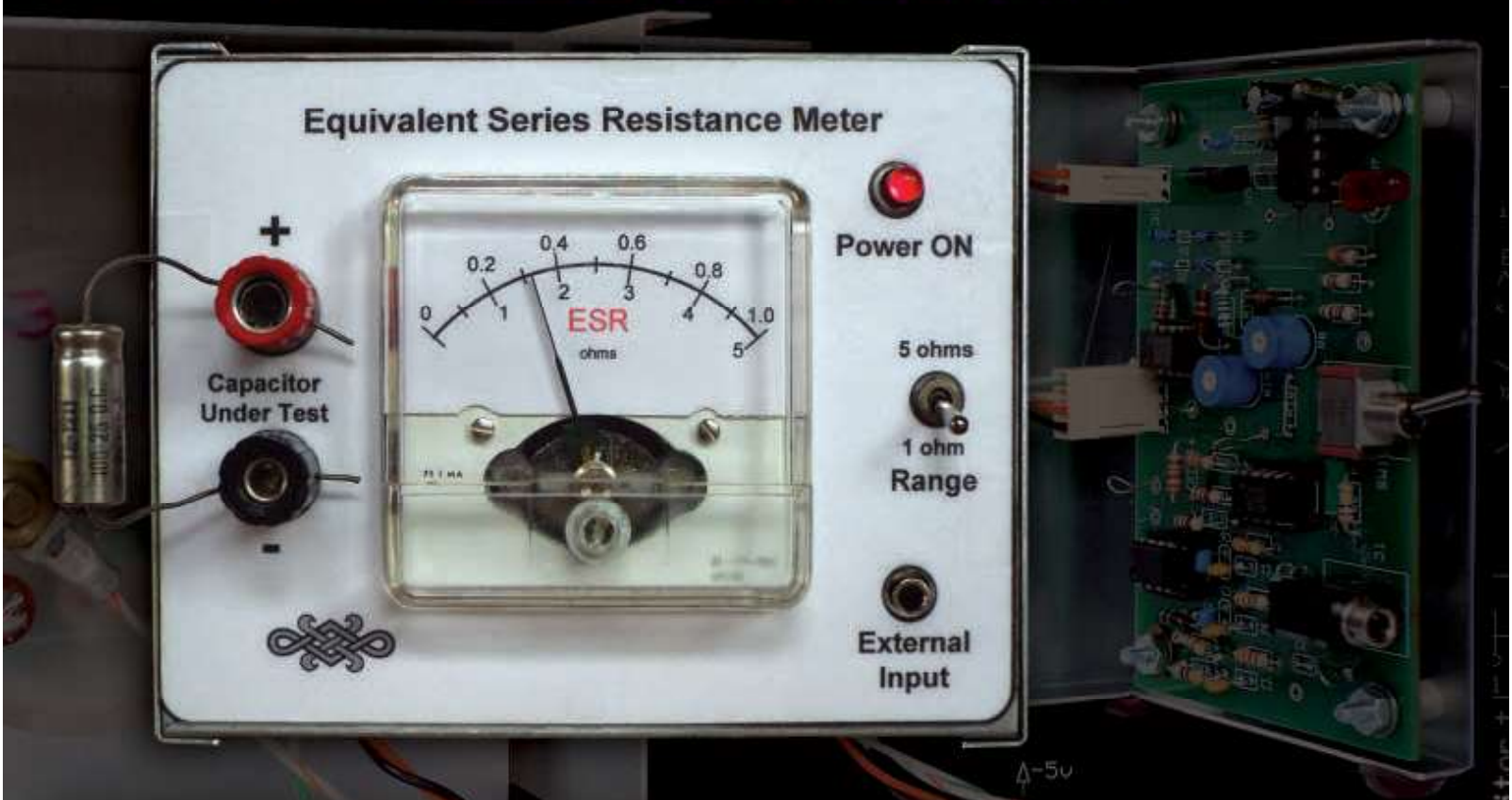

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