Fig. 5 Top view

A Technical Look at the Ruppert Musical Instruments Basswitch IQ DI Bass Preamp and DI

***By*: Tom Lees**

The Basswitch IQ DI from Ruppert Musical Instruments is self-proclaimed as the bass player's Swiss army knife. Well, after trying for a short time, and even after consulting the manual, I could not locate a bottle opener to pop open my… um… beverage. I also could not locate a fork, serrated knife or a toothpick. As such, I will not be packing the Basswitch IQ DI with my camping gear.

Now, I have to admit that not every model of Swiss army knife has the above utensils. However, every Swiss army knife does have a few distinguishing traits. It is functional and convenient… to the point of being a "must-have" accessory. So, let's see if the Basswitch IQ DI can pack enough wallop in the functionality and convenience categories to truly be a must-have accessory in the bass player's gig bag.

Construction

For a pedal, we have a lot to talk about, so let's get started with the gratuitous gut shot of *Fig. 1*. Taking a look at the internal construction, it is easy to conclude that the Basswitch IQ DI is a well thought out and neatly assembled device. The jacks and switches along the back and side panels are directly soldered to the circuit board, which sits neatly in a rugged enclosure. The potentiometers are coupled to the housing via a custom bracket. The electrical components include a mix of surface mount devices (e.g., resistors, operational amplifiers, etc.) and through-hole devices (e.g., the red boxed capacitors). All together, the Basswitch IQ DI will likely serve as a dependable tool as long as you want to keep the device in service.

There are few notable features, however, that are worth particular attention. The Basswitch IQ DI accommodates power supplies that range from 9-20 volt DC (regardless of polarity) or AC. For any supplied voltage within its range, the internal circuitry internally rectifies, filters and stabilizes the power to

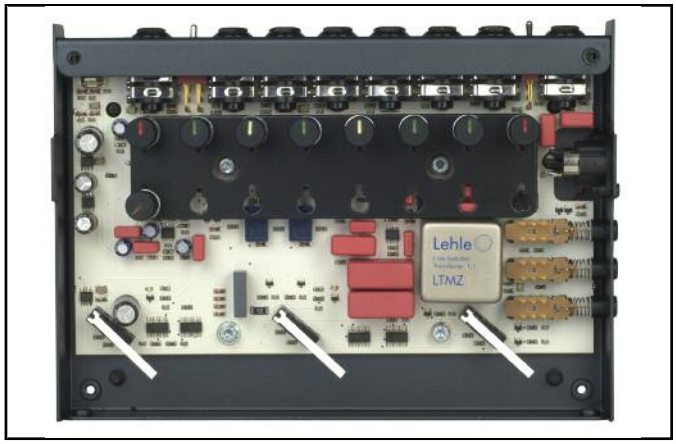

Fig. 1 Gutshot

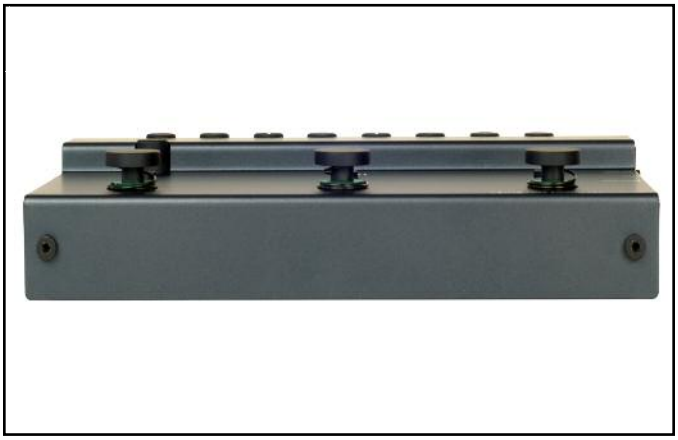

Fig. 2 Actuator button profile

18V DC internal working voltage. To test this out, I applied power to the Basswitch IQ DI from variable bench power supplies and from random adapters I pulled out of my spare adapters bin. Regardless of adapter, the Basswitch IQ DI powered up and performed consistently. I cannot understate how much I appreciate this attention to detail.

The Basswitch IQ DI includes a true transformer isolated DI. This is the silver "box" seen towards the lower right corner of the circuit board in *Fig. 1*. Transformer isolation is critical for eliminating ground hum and other noise when connecting your gear to a mixing console.

Referring to *Fig. 2* along with *Fig. 1*, instead of traditional mechanical footswitches, the Basswitch IQ DI uses a switching system that combines an external "actuator button" (this is the thing that you stomp on – see *Fig. 2*) that operates an internal switch that triggers a relay (these are the three black boxes, each having a silver angled lever arm across the bottom of the circuit board in *Fig. 1*). Although this system sounds more complicated that a simple footswitch, the result is arguably superior to a mechanical switch in three key areas. First, the actuator button absorbs the load of the foot of the musician and transfers the exerted force into the housing. This greatly reduces stress on the actual switch components and circuit board. As the actuator button depresses downward, a small force is used to pivot the corresponding lever arm, which triggers a relay. The result is a switching system that should not break down, even under the most heavy footed of bass players. Second, because the switching system uses relays for the actual internal switching,

Fig. 3 Housing side profile

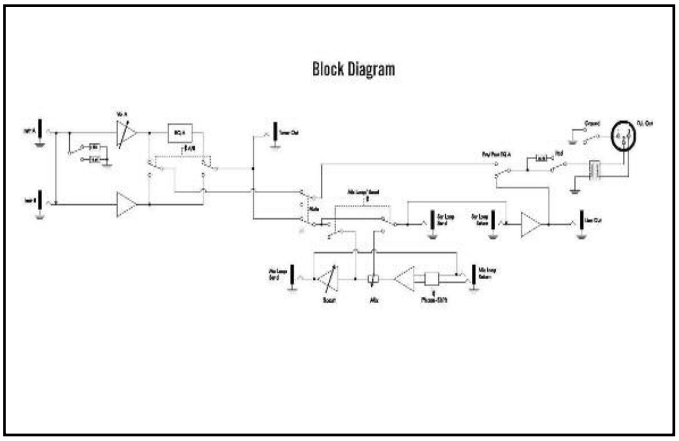

Fig. 4 Block diagram

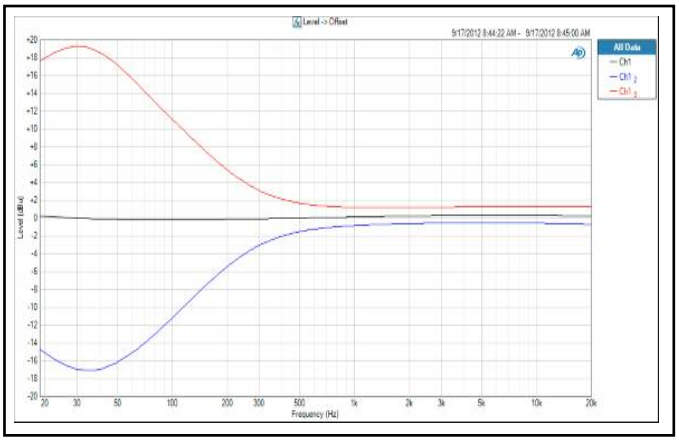

Fig. 6 Bass response

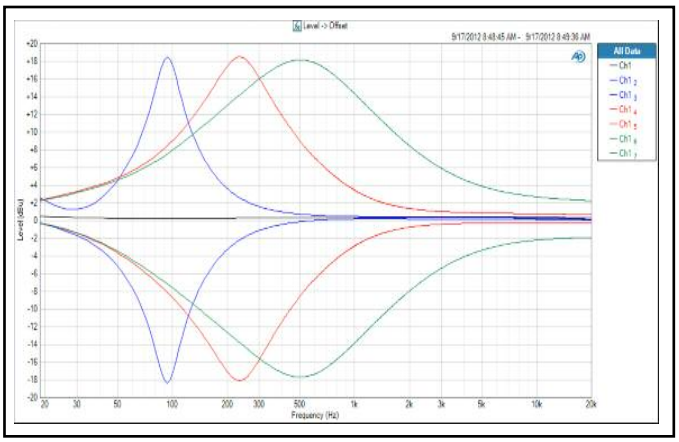

Fig. 7 Low Mid Response

each switch should be able to perform a few million switching cycles before failure. Third, because the switching is performed by a relay (having gold contacts), the switching noise is almost negligible. There is no annoying "click" sound, which can be distracting in certain performance environments.

Referring to *Fig. 3*, a side profile yields another view of the actuator buttons, and also shows another cool feature of this device. Situated in cooperation with the knobs is a riser feature. This riser protects the knobs from unintended turning and serves as a barrier to protect the knobs, e.g., from a large boot or from someone inadvertently stepping on the device.

Operation

One of the best ways to get a sense of how the Basswitch IQ DI works is by taking a few minutes to familiarize yourself with the schematic, which is included in the manual and is reproduced herein as *Fig. 4*. The schematic should be read with the unit in front of you so that you can compare the flow to the input/output options found on the back and side panels of the unit – see *Fig. 5*.

As a quick overview of the features, working right to left, first across the back panel, the Basswitch IQ DI includes two inputs (INST A and INST B), an impedance selector switch for the first input (INST A), a line out, a tuner out, two loops including a serial loop (SER LOOP) and a parallel loop (MIX Loop), and a power input. The DI is on the side panel and includes a balanced XLR output, as well as buttons for ground lift, pad and pre/post EQ. The Basswitch IQ DI also boasts three footswitches on the top panel which, from right to left include, a first footswitch to control selection between two internal channels (Channel A or Channel B); a middle footswitch to control MUTE ON/OFF; and a third footswitch to control MIX LOOP/BOOST ON/OFF. The top panel also features a number of user controls, including a volume control, equalization controls and boost and mix controls.

The Basswitch IQ DI has two internal channels, Channel A and Channel B. Channel A has a user-selectable impedance option, which is controlled by the impedance selector switch on the back panel, followed by a preamp that is controlled by the Volume knob. A tap of the signal is taken after the volume control and before an equalization section to provide a non-equalized option for the DI. The signal then passes through a four-band, semi-parametric equalizer that features bass, a user variable low-mid band (user-adjustable gain and center frequency), a user variable hi-mid band (user-adjustable gain and center frequency) and treble controls. Channel B, by comparison, is intended to provide a pure path that does not include either a user adjustable gain or equalization. Thus, if you are using both channels, any desired volume leveling must be done using the volume knob of Channel A. Because of this, the preamp of Channel A is configured to provide a range of adjustments from cut to boost.

The routing scheme is deceptively flexible for such a simple layout, so stay with me here. When an instrument is plugged into the INST A jack, and INST B is left unconnected, the signal at Input A is fed to both channels. The A/B footswitch toggles between internal Channel A and internal Channel B. Thus, two switchable settings can be applied to the same signal.

The Volume control of Channel A controls the overall volume by providing about 16dB of attenuation when turned off, to

about 12.5dB of gain when turned to full on. Unity gain is just between 12-1 o'clock. When switched to Channel B, I measured a gain of about 0.9dB, so the output is not quite unity gain.

When an instrument is plugged into INST B, the signal is routed to Channel B only. Thus, if no instrument is plugged into the INST A jack, the operation of the A/B footswitch will be similar to a Mute when Channel A is selected. [I would recommend that if you only have one cable, plug into the INST A jack, as a Mute function is already provided by the middle footswitch.] Otherwise, if you have two instruments that you want plugged in at the same time, plug the instrument you want volume and EQ control over, into the INST A jack, and the instrument that you do not need volume and EQ control over, into the INST B jack. Here, the A/B footswitch will select between instruments.

Keeping with the schematic, the tuner out is taken after the Channel A and Channel B outputs. Here, the A/B footswitch will select which channel is fed to the tuner. The Mute footswitch controls a mute function, which is located just after the Channel A and Channel B outputs. As such, muting the device kills the signal to the DI, line out, serial effects loop and parallel effects loop, but not the tuner.

The parallel loop is positioned just before the series loop and after the Mute switch. The parallel circuit integrates a cool boost feature. If the parallel loop is used, the Boost control can be used to level shift the send to get an appropriate level to the device inserted into the loop. If no device is plugged into the Mix Loop Return jack, the Boost control can be used in cooperation with the phase shift and mix controls to alter the signal, e.g., to provide a switchable solo boost to the selected channel.

The Channel A Tone Stack

The frequency response of the EQ section of Channel A is illustrated in *Figs. 6-9*. Notably, the Bass control is a peaking (bandpass) control, having a center just over 30Hz. The Low-Mid control provides a user-adjustable sweep from just under 100Hz to about 500Hz. As the user-selected center frequency increases, the bandwidth also increases. The Mid-High control provides user-adjustable sweep from around 800Hz to over 5kHz. Again, as the user-selected center frequency increases, the bandwidth also increases. The High control is a fixed shelf type control. By providing about +/- 18dB of control for each EQ section, quite a bit of tone shaping is possible with this equalizer.

The technical data included in the manual for this device lists the frequency range as 20Hz-100kHz, so I decided to put this to the test. I ran a frequency response test from 10Hz to 80kHz with all tone controls about noon and measured a frequency response +/- 0.93 on Channel A (+/- 0.26 from 20 Hz - 20 kHz), and +/- 0.7 on channel B (+/- 0.18 from 20 Hz - 20 kHz). For those keeping track of scores at home, I would check this off in the "awesome" category if you dig flat response devices.

Performance

The Basswitch IQ DI is capable of handling a wide range of input levels in a clean manner. Referring to *Fig. 10*, a 1 Vrms, 1kHz signal produced exceptionally low distortion, with both first and second harmonics almost 100dB down. *Fig. 11* shows a chart of THD+N as a function of input level. As this chart

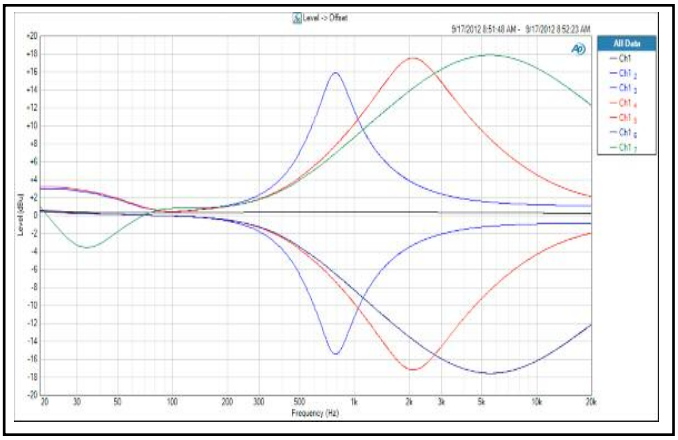

Fig. 8 High-Mid Response

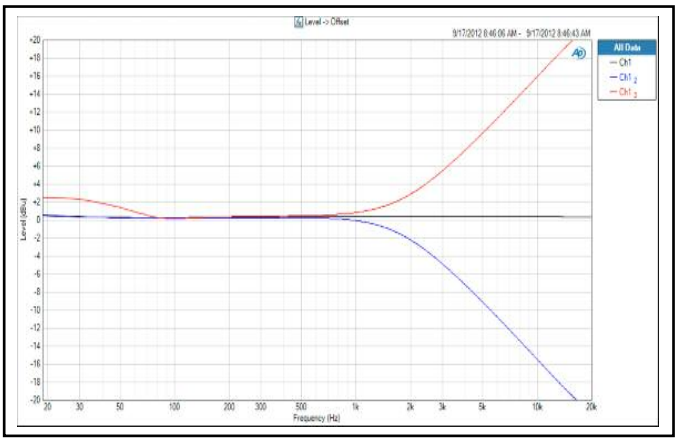

Fig. 9 Treble Response

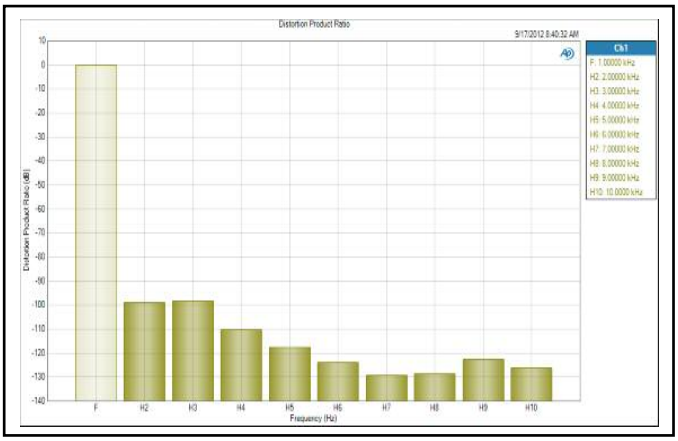

Fig. 10 Distortion Product Ratio

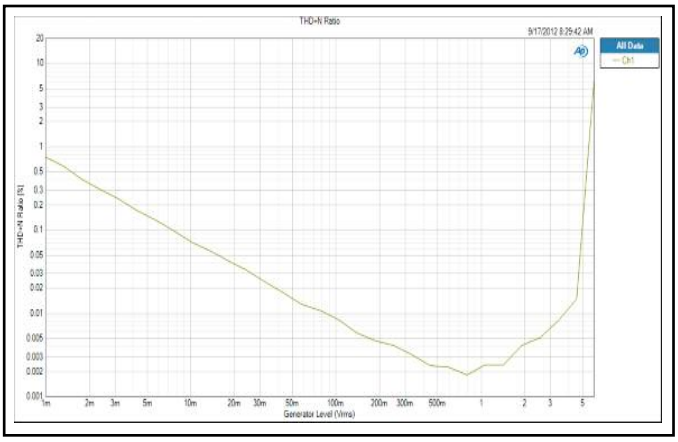

Fig. 11 THD+N Ratio

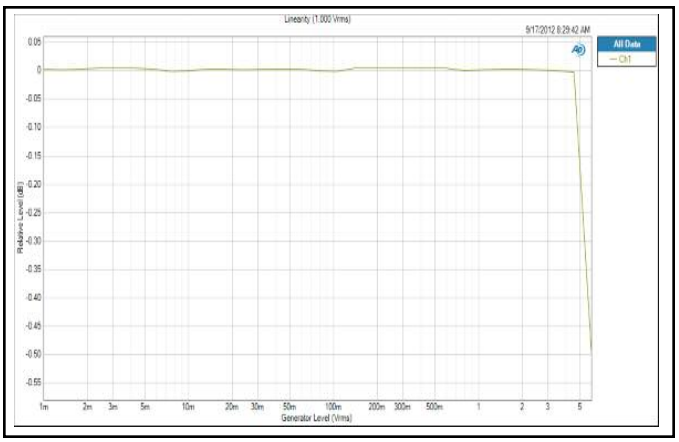

Fig. 12 Linearity

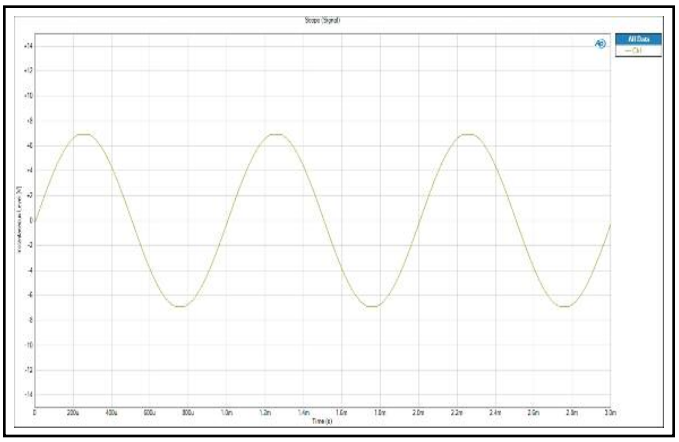

Fig. 13 Channel B Input 5.5 Vrms

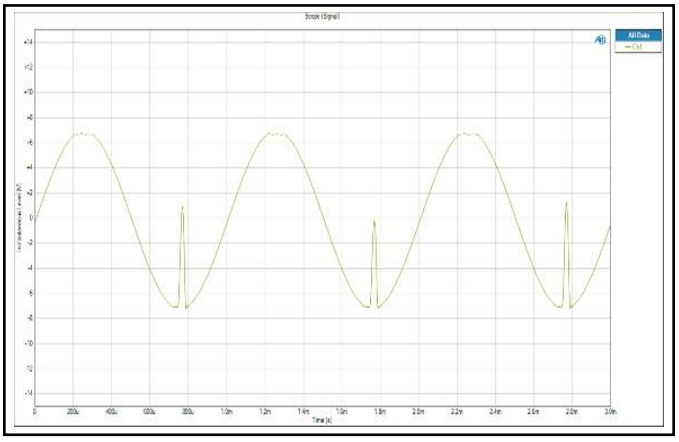

Fig. 14 Channel B Input 5.6 Vrms

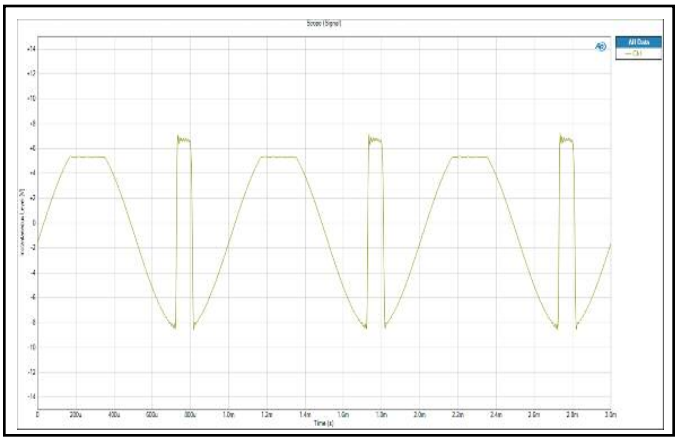

Fig. 15 Channel B Input 6 Vrms

shows, for input signals up to about 5 Vrms, distortion remains well below 1%, and is well below 0.01% for signal levels between about 100 mVrms and about 4 Vrms. Moreover, referring to *Fig. 12*, linearity is excellent over a range of input signal levels. Here, linearity refers to the relationship of input to output. I dialed in the output for about unity gain. As the chart shows, the relationship of input to output is pretty much flat until the input is overloaded, which happens pretty close to 5 Vrms. This is a healthy input signal and is likely well in excess of what your instrument puts out under normal playing conditions.

However, the clean, linear nature of this device is not limitless. Speaking of limitless, there is no limiter on this device, and hitting the limit (rail) of this device is like driving into a brick wall. Referring to *Figs. 13-15*, I pushed a 1kHz input signal into Channel B and brought up the level to see how the Basswitch IQ DI would handle an overload situation. At 5.5 Vrms in (*Fig. 13*), the device was cruising, outputting a 4.93 Vrms signal (remember, Channel B is just under unity gain) at less than 0.5 % THD+N. By 5.6 Vrms in (*Fig. 14*), the output distortion swiftly rose to 19.7% THD+N, with an ugly distortion in the negative swinging peak. By the time the input reached 6 Vrms (*Fig. 15*), distortion was measured at 73.15% THD+N, with squaring of the peaks and a fold over of the negative going peak into a square spike.

Curiously, the user-adjustable impedance of Channel A intrigued me. The idea of having a high impedance of 10 Mohm for piezo and other high-impedance devices seems like a great idea. However, I measured 507 kOhm at the 1 MOhm setting, and 940 kOhm at the 10 Mohm setting, at 200 mVrms 1 kHz input. The Channel B input fared better, measuring at 1.2 Mohm.

Conclusions

For many bass players, Basswitch IQ DI may just be a must-have accessory. The EQ is flexible, the routing and two available loops provide options galore, the ability to convert the parallel loop into a boost function is useful and practically implemented, and the transformer isolated DI provides a full featured routing to the mixer. The device cannot be run on batteries. However, the flexible nature of the power supply section allows the use of virtually any wall-wart that a typical musician will have sitting around. I also really like the manual. The manual is chock full of useful information and tips, and presents the use of the device in an easy to read and follow format.

I do have two small issues. I love the idea of the footswitches. However, as *Fig. 2* illustrates, the button “caps” mushroom out over the actuator stem providing a flat undercut. Moreover, the spring that biases the button up is pretty thin. During use, I got a thin cord caught under the switch, which prevented the button to depress enough to trigger the device. Of course, I could feel the switch not depress fully, and could visually see that the device did not switch by the color of the indicator light. It was an easy remedy to pull out the cord. Still, it was a nuisance. Also, I found it interesting that I measured a higher input impedance on Channel B than on Channel A, even with the switch set to 10 MOhm. On the whole, though, the Basswitch IQ DI is an impressive technical accomplishment. BGM

Corrections for issue #8:
On the Quick Look review of the Eden WTDI Direct Box/Preamp, on page 11, we incorrectly stated that it was "Made in: USA." The review should have read, "Made in: China."

In the fEARful Phenomenon article, the text on pages 57 and 58 should have been switched, one for the other.

Manufacturer's Response:

Jacques Ruppert, Ruppert Musical Instruments
We would like to thank Tom Lees for this detailed test that confirms our own measurements. On the very first series of Basswitch IQ DI pedals, both inputs have to be in use to achieve correct impedance values on channel A. For all Basswitch pedals now on sale in the US, this is no longer needed. We have at the same time improved the design of the push buttons so that they work smother, now. In our strive for excellence in quality and service, we offer all customers that would have a problem with their Basswitch in this area a free upgrade and shipping back, if they return us the pedal.

Roger Baer, Baer Amplification
As the mid driver is naturally balanced very well in sensitivity to the woofer, we felt that an L-Pad for the midrange wasn't worth the trade off of adding extra circuitry to the crossover.

John Pirruccelloo, Lakland
With regard to the comments about the DJ-5's price point, we believe that MAP (minimum advertised price), a.k.a "street price," is much more representative of the actual price a customer will pay. Street price for the DJ-5 is $1,349, which is $350 less than an American Standard Deluxe Jazz V (street). I feel this puts us in a slightly lower price point category, which may change a reader's perception of value. I sure wish the music industry would let go of the MSRP game. It can be somewhat confusing for people!

The pickups in this bass are our own design vintage-style pickups, wound right here in our Chicago shop with hand built bobbins made from vintage spec materials. The fact that they don't look like anything special is by design, since our aim was to offer a vintage spec, high quality USA-made pickup with class-leading tone.

With regard to the neck setup analysis, we are constantly reviewing our processes to improve our products and the issues you pointed out with regards to the neck fit tolerance and nut fit and finish are being addressed! Just to brag a bit, for the last three years, Lakland's return/repair authorizations have been well below 2%. All after-sale customers are treated like royalty! Regarding the treble side neck pocket design and "possible lateral instability," I can honestly say that this has never been an issue since we debuted this design in 1994.

Passive basses and shielding. Since the introduction of our first passive basses in the mid 1990s, Lakland's position has been that vintage basses from the late '50s to '60s without cavity shielding sounded livelier than shielded versions, that to our ears sounded considerably duller. All Lakland passive instruments default to this vintage spec and achieve what we feel is a superior tone. However, Lakland will shield passive models at no extra charge upon special order or as post sale support. It should be noted that our vintage style pickups are fully wax potted to prevent micro phonics (in case there is any confusion between shielding and potting).

Gerald Marleaux, Marleaux BassGuitars
We now use a different trussrod than what was used in these instruments. All of the basses we build have a pre-tension in the neck – when under string tension, the trussrod needs no power – so we have much more than enough headroom in both directions.