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Radial JDI Mk3 & Radial J48 DI Boxes

A direct box (also called a DI, for Direct Inject) basically does three things: it transforms a high impedance (high voltage, low current) input into a low impedance (high current, low voltage) output, it balances the output, and it provides isolation between the input and output to reduce noise and break ground loops. (If the functions of DI boxes and the concepts behind impedance in general are all Greek to you, check out Mike Rivers' article on the subject that starts in this issue.)

Direct boxes come in passive and active variants, and Radial has one of each for us to look at.

Radial JDI Mk3

The Radial JDI Mk3 is a conventional passive direct box, which is to say that it's basically a high-Z to low-Z transformer in a box, with some switching stuff to drop in a resistive attenuator and lift grounds. The unit I tested was the single-channel model; Radial makes a 2-channel model called the JDI Mk3 Duplex that has the same innards and controls.

The transformer is doing the impedance conversion, the balancing, and provides all the isolation. Because passive direct boxes are basically just a transformer, and because transformers with fairly high ratios are difficult to build, the real difference between passive



*Passive or active—
good ideas shine through*

BY SCOTT DORSEY

boxes is entirely due to the quality and sound of the transformer. A better transformer will sound better, will have a higher input impedance, and will have better noise rejection.

The JDI Mk3 has a Jensen JT-DB-EPC transformer, which is more or less the industry standard. It's used in a lot of the higher-end custom DI boxes, and if you have used the house DI in almost any large studio, it's probably been the same transformer. It's a good sound, a pretty clean one, and one that you'll find very familiar. It's about the most transparent that you will ever get in a completely passive DI, and if you're used to a cheap DI you'll find it an enormous improvement. I tried a quick A/B and I couldn't tell any difference between the Radial

and my own custom units (which use the same transformer).

Transformer specs

This transformer has a 20K ohm input impedance, which is very flat across the spectrum, and it'll handle a +22 dBu input at 30 Hz and higher. The box itself has an additional 45 dB of pads—with them in it'll handle +67 dBu, which is a higher level than I ever expect to see, and a whole lot of headroom to say the least. My previous experience with this transformer has shown it can pass a 1 kHz square wave without it looking bad on a scope, which is more than any other transformer with such a high (1:12) ratio that I have tested.

Unlike most of the custom units, though, the JDI has a phase reverse switch and also both 30 dB and 15 dB pads so you can even deal with speaker-level signals. This is very handy, and it's all put together into a very solid and rugged steel case.

My quick RFI test of keying up a two-watt VHF transceiver (an old Motorola HT220... we use them a lot at festival gigs) was flawless, with no RF pickup even with the antenna very near the cable.

Great choice

The JDI Mk3 is a great choice when you need a DI box for a synth, an instrument amp, an instrument with active pickups, or any other active source where the absolute highest input impedance isn't necessary. (It'll also work in reverse for some re-amping applications.) For a passive pickup, you might want to look into an active DI because sometimes 20K ohms isn't enough.

Radial J48

The Radial J48 is an active box, which is to say that it's a lower-ratio transformer with a FET input stage in front of it. The FET stage is the real impedance conversion stage, and the output transformer really just provides isolation. It's easier to build a clean-sounding low-ratio transformer, and because the input stage is active, it can be built with much, much higher input impedances. This means it will sound much cleaner on a very high-Z source like a guitar or bass.

One of the problems with a lot of active boxes is that if you lift the ground on the output, phantom power can no longer pass through, and therefore you have to use an internal battery when you are lifting the output ground. The Radial folks get around this by using a tiny switching supply built with a common and inexpensive oscillator chip, which turns the 48V input into a 140 kHz AC signal, which is then passed through a small power transformer and then rectified back into an isolated DC line.

Because the signal goes through that little power transformer, we now have an independent DC supply that is totally isolated from the rest of the system, so the ground connection between the output amplifier and the actual output

can be safely broken, while still allowing phantom power to be used. This is just plain *ingenious*, and also incredibly convenient—as anyone who has found himself with a dead battery the one time he needs to use the ground lift on his DI will attest to.

The one disadvantage of this approach is this: now you have a 140 kHz noise source sitting around. While a 140 kHz fundamental is much too high to be audible, if you have other noise sources in the same region, they could beat together and form audible mixing products. Note that I didn't find any case of this in my testing, but it is



worth mentioning if only because I have seen similar interactions between switching supplies on portable products before.

Front end specs

The actual front end of the J48 is built with an LM833 dual FET-input op-amp in a simple non-inverting configuration. It has a 270 K ohm input impedance which drops to 120 K with the 15 dB pad engaged. This is rather low when compared with some other active devices, but it's entirely acceptable. And while the LM833 isn't the sexiest and latest thing, it's still a very fine choice in applications where low power and high input impedance are needed. A good quality film capacitor is used for DC blocking on the input.

Some active boxes use an output transformer, but the Radial just uses the

dual op-amp to drive a differential output without a transformer. Eliminating the transformer means that the overall bandwidth of the system is wider. This will mean cleaner tone (distortion and phase shift so low they aren't even worth measuring) but it can also mean more trouble with RFI, and indeed with the walkie-talkie test I found RF to be much more of a problem with the J48 than with the JDI. This could be a problem in some situations.

Comparisons and conclusions

I compared the J48 with the Countryman DI and with my homebrew DI from the March 1998 issue, in a quick listening test with a Fender guitar, an old Fender bass, and a piezo pickup on a cheap acoustic. I found the top end to be a bit more mellow on the J48, possibly due to the lower input Z, but the overall sound was very close, very clean, and with good solid low end. Not as etched and detailed in the top end as the Countryman and homebrew units, which you might find an advantage in a lot of situations. Especially on bass I found it quite clean, and with a vast amount of headroom.

Although no service information is available from the manufacturer, opening the box makes it very clear that it was designed to be repaired and to last a lifetime. All integrated circuits are socketed and high-grade electrolytics used throughout.

Both of these DI units are good boxes to have around, and the really ingenious design of the J48 that allows you to use phantom power and still break signal grounds is incredibly handy.

Prices: JDI Mk3, \$200; JDI Mk3 Duplex, \$350; J48, \$200

More from: Radial Engineering, a division of JP CableTek Electronics Ltd., 1638 Kebet Way, Bldg. 100, Port Coquitlam, BC V3C 5W9 Canada. 604/942-1001, fax 604/942-1010, www.radialeng.com.

Note: all impedances here were measured at 1 KHz with a 1948 vintage General Radio bridge.

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