



Tortuga LDR3.V2 Passive Preamplifier

A Straight Wire Without Gain

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Back in the old days, at the dawn of the hi-fi age, most audiophiles built some, if not all, of their systems themselves. Fresh from service stints during WWII and the Korean War, veterans used the knowledge they'd gained in military electronics courses to assemble their own audio components. While a far lower percentage of audiophiles take advantage of this do-it-yourself approach today than in the early days of hi-fi, there are still a few companies whose business models include DIYers, such as the speaker-kit maker GR Research, and Tortuga Audio, a company that manufactures passive preamps but also sells related electronics to the DIY community.

Cape Coral, Florida-based Tortuga Audio opened its Internet portal in October 2012, and sells its products exclusively through its website. From the outset, Tortuga specialized in a unique type of passive preamp (more correctly called a "passive attenuator") design that utilizes light-dependent resistors. Tortuga Audio's latest single-ended passive preamp is the LDR3.V3 priced at \$1195 fully assembled (you can also buy a kit version for \$695). The LDR3.V2 has the potential to completely fulfill half of the audiophile dream—a straight wire with gain—just without the gain part.

A Better Volume Control Than Stepped Resistors?

The most commonly used method for adjusting the volume in a preamp, be it passive or active, is with a potentiometer. Another approach is to use resistors, either in an array or in a stepped configuration. Tortuga's Audio's president and designer Morten Sissener spent years exploring alternatives to conventional resistive volume control before he produced his first preamplifier.

One such alternative that Sissener considered was the use of light-dependent resistors (LDR)—the combination of a photoresistor with a light-emitting diode (LED). The resistance of an LDR varies in proportion to the brightness of the LED, is, in turn, is dependent on the electrical current passing through it. Attenuation is achieved through the variation of the resistance levels of the series and shunt LDRs to achieve specific resistance ratios.

The LDR3.V2 uses two LDRs on the input side of each channel. They are connected in a series-shunt configuration and are controlled via a software-driven digital control unit (DCU). The DCU uses proprietary software to maintain minimum input impedance while delivering a 60dB attenuation range from 0 or unity gain to -60dB in 70 steps of slightly less than 1dB per step. LDRs are also used as on/off switches in lieu of conventional relays to select the input source. Because LDRs have a life of only 50,000

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hours or 5.7 years (if on continuously at max rating), the LDRs in the LDR3.V2 are socketed so they can be easily replaced.

The reason few firms have used LDRs in a preamplifier design is because the relationship between current and resistance within LDRs is nonlinear, and can vary considerably from one LDR to the next. Because of these nonlinear variations, Tortuga initially instituted rigorous testing to match LDRs in pairs. However, as DCU (digital control unit) technology evolved Tortuga developed proprietary, adaptive, auto-calibration technologies that eliminated the need to pre-match LDRs and that also corrected for aging and drift. According to Tortuga, "Auto-calibration is a closed-loop system employing both DACs (digital-to-analog converters) and ADCs (analog-to-digital converters) to calibrate each LDR against an absolute 70-step attenuation schedule. Calibration results are stored in memory tables and then used to accurately control each LDR during normal operation. Overall accuracy is generally within 0.2 percent."

The same software that controls the LDR3.V2's input impedance also allows the impedance to be adjusted anywhere from 1k to 99k ohms. A user can configure five different impedance settings and switch among them while playing music to determine which setting is optimal.

As is the case with a conventional potentiometer, the output impedance of the LDR3.V2 is the effective paralleled resistance of the series and shunt LDRs. Its output impedance starts at approximately 100 ohms and remains relatively constant until step 16 of the 70-step scale; it then begins to increase along with the shunt resistance, and peaks at approximately 5000 ohms (25 percent of the nominal input impedance) at step 59 or -6dB of attenuation (specific values will vary depending on the input impedance setting).

Fit, Finish, and Ergonomics

If you prefer understated cosmetics, the LDR3.V2's straightforward appearance, such as a single knob located on the right half of its 6"-wide front panel, will appeal to you. The left half of the front panel also looks basic, occupied by a pair of blue LED displays that supplies info on volume level and input choices. Overall, the diminutive LDR3.V2 measures only 10" deep by 6" wide by 3.25" high. The chassis is what I would call a high-quality generic project box, although you can choose from a variety of finish options: a lacquered carbonized bamboo or custom-wood front panel (\$100 upcharge), as well as anodized silver or black.

The LDR3.V2's rear panel has room for three pairs of single-ended RCA inputs, two pairs of RCA outputs, a power connector, a 12-volt connector, and a USB slot. The RCA inputs and outputs are spaced so that even my largest barreled connectors attached easily.

Instead of a conventional volume-control potentiometer, the manual control knob on the LDR3.V2 turns a rotary encoder connected to the DCU. The DCU actually adjusts the analog volume LDRs. According to Tortuga, "The DCU and related control circuitry, which are optically and electrically isolated from the audio signal, calibrate and store the software-based attenuation schedule, regulate the LDRs for volume control, switch inputs, provide status/display information, and manage user-control input via both a remote and a manual encoder located on the front panel. The DCU is driven by proprietary software that as of May, 2014, can be updated by the owner via a

SPECS & PRICING

Preamplifier type: Passive stereo attenuator	attenuation setting Left/Right channel balance: 0.4dB or less
Inputs: Three single-ended RCA	Control system: 8-bit/16MHz software-driven digital microcontroller
Outputs: Two parallel single-ended RCA outputs	Accessories included: Apple remote, external power supply, USB cable
Attenuation technology: Resistive attenuation via light-dependent resistors in series/shunt (L-Pad) configuration	Dimensions: 5.4" x 1.75" x 8.7"
Attenuation range/increments: Discrete 71 steps (70+ mute) between -60dB and 0dB	Weight: 6.5 lbs.
Gain: Passive unity gain (1.0x) without buffer; no active amplification	Price: \$1995
Output impedance: 100 ohms to 5k ohms, depending on	
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USB connection to a PC."

This DCU knob not only turns but also can be pushed inwards, which allows for vastly expanded control functions. When the unit is off, a momentary push/release of the knob will turn it back on. When the power is on, a push/hold for between two and five seconds will shut the unit off, while a momentary push/release will mute it. As you would expect, turning the encoder clockwise raises the volume while turning the encoder counter-clockwise lowers the volume. To change inputs, a push/hold while also turning the encoder (left or right) will put the unit into input-select mode. And if you push/hold the knob for between five and ten seconds, the unit will go into balance-adjustment mode. Once you've made adjustments, a brief push/release will lock in the new balance setting. To revert to equal-channel output you need to push/hold the knob for greater than 10 seconds but less than 20 seconds. Other control functions include auto-calibration, start/stop, and Apple remote-control pairing.

Notwithstanding the encoder control, the primary means of controlling the LDR3.V2 is via the simple Apple remote. To use an Apple remote it must first be "paired" or linked to the LDR3.V2. The process is simple, and once done need not be repeated unless you lose or break the remote (at which point you would need only buy another one and pair it with your LDR3.V2). With the remote's seven buttons you can access every function, although some, such as the impedance adjustments, do require multiple, choreographed keypunches.

The LDR3.V2's control functions are not intuitive, but after a couple of days of consulting the user manual (which is among the more complete I've come across) I had memorized the commands I use regularly. The only criticism I have about the Tortuga's controls is that when you turn the volume level down to 0 or mute, the front panel LEDs flash "0 0" continuously, like a narcoleptic owl.

Installing the LDR3.V2 within a system is the same as it is for most analog preamplifiers: Connect it up, turn it on, and begin listening. With three inputs and two variable-level outputs, the LDR3.V2 fits easily into most 2- and 2.1-channel systems. I commend Tortuga for including two variable outputs, making it possible to connect one stereo pair to the main amplifier while the second pair can go to a headphone amplifier and/or a subwoofer.

Sound

Ideally a preamp should be neither an additive nor a subtractive sonic element in the audio-signal chain. Given that primary requirement, it is reasonable to assume that a top-echelon preamplifier, whether active or passive, should be as transparent as possible. But how do you analyze transparency? In the past, part of the review process for a preamp involved placing it in the tape loop circuit of another preamplifier and then comparing the sound with it both in and out of the signal chain. If the preamp under review is sufficiently transparent, there should be no audible difference between having it in or out of the circuit. In the old days, this outcome was rarely the case, but as preamps have become more neutral this test has lost much of its usefulness. Why? Because when you get a “no difference” result in an A/B test, it does not mean that the two components in question are identical-sounding—or that a device is perfectly transparent—but merely that the differences were not detectable. This could be because the switcher is not transparent enough to allow the differences to emerge. All told, using an entire preamplifier as a switcher is no longer the best way to assess transparency.

To see if the LDR3.V2 had anything that could be considered an intrinsic sound or sonic personality I did some bare-wire A/B tests. My methodology was simple: Instead of the regular 1-meter length of cable running from the Oppo HA-1 DAC/Pre or Moon 230 HAD DAC/Pre to the NuPrime ST-10 power amplifier, I installed two 1-meter lengths of cable with a female-to-female adapter between them. For the test, I replaced the 2" adapter with the LDR3.V2; therefore I was comparing the LDR3.V2 with a 2"-long adapter. I did the same test in my room-based system, but with a much longer interconnect cable between the LDR.V2 and the adapter.

After numerous tests I gave up. I could not hear any differences in the sound quality when the LDR3.V2 was inserted into the circuit at regular listening levels. At lower volume levels, I did notice the system had slightly more midbass impact with the LDR3.V2 in the circuit—perhaps its impedance settings were a better match than what was originally coming from the DAC/preamps. But

apart from this difference, I could not hear any variations in resolution, soundstaging, harmonic balance, or pace.

I used the LDR3.V2 in two systems and ran tests with both. And while testing with only two systems does not ensure universal results, I do suspect that you would be hard-pressed to find a system where you could not use the LDR3.V2 in lieu of a conventional active preamplifier. Sure, there are some systems where an active preamplifier is needed because of a low-sensitivity speaker or because a lower-than-normal-gain amplifier requires using a preamp with gain, but in my experience such systems are rare. I think many audiophiles would be shocked to discover that they actually seldom use their preamps as gain-increasing devices; instead, preamplifiers spend 99.9 percent of their time reducing rather than augmenting a system's signal strength. Reducing signal strength is something the LDR3.V2 passive preamp can do with aplomb.

Conclusion

For many audiophiles the “best” preamplifier is the one that does the least damage to the signal. If you are one of these audiophiles, the Tortuga Audio LDR3.V2 could be your best and your last preamplifier. Sure, it may not be flashy-looking, and it's not going to add to your system's warmth or euphony, but if you want the ultimate in transparency you would be hard-pressed—regardless of budget—to find a preamplifier, passive or active, that delivers your music with less editorializing than the Tortuga Audio LDR3.V2. **tas**



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Perla Audio is proud to release three brand new products this year! The Maestro Pre Amplifier, Righello Monoblock & the astounding new USB DAC, the Composer. These astonishing hand crafted products offer a uniquely rare sound quality, and astonishing build quality, all designed and hand assembled in the U.S.A.

“The system from Perla Audio was impressive, with a smooth tonal balance, natural dynamics, and absolutely spectacular imaging. Instrumental and vocal images had a rare tangibility and vividness, existing in space completely detached from the loud speakers.”

the absolute sound
-Robert Harley
The Absolute Sound, January 2014

The Perla Audio Signature 50 has many superlative qualities to offer the music lover searching for an integrated amplifier.

hometheater
review.com
-Terry London
Home Theater Review, May 2015

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