

Lunchbox2 Advanced Users Guide

The ZT Amplifiers Lunchbox2 is a product unlike any other musical instrument amplifier currently available. This Application Guide was developed to help the advanced user understand its unique features and characteristics. The Guide is not intended to replace the Owner's Manual. It is assumed that the reader is already familiar with the basic features and operations of the Lunchbox2. Our purpose here is to explain more detailed technical concepts to help the serious user get the most from their sound.

Topics Include:

- Lunchbox design philosophy.
- Initial setup.
- Signal path.
- Gain and volume controls.
- Minimizing noise in real-use situations.
- Reverb vs. Ambience.
- External speaker output.
- Additional inputs and outputs.
- Using the Lunchbox with other instruments and sound sources.
- Mic'ing the Lunchbox.
- Understanding amplifier power.
- About "modding."

Design Philosophy:

The ZT Lunchbox is the result of many years of study into the sound, feel and science of the world's best musical instrument amplifiers. Our goal was not to clone or "model" any particular product. Rather, we have tried to understand, in a methodical way, what technical factors give an amp great tone, flexibility and playability. As a group of experienced audio scientists and passionate musicians, we set out to learn what makes a classic amp survive for generations, giving artists of many styles and genres a consistently great playing experience over the years. ZT's research investigation was "clean slate." We didn't assume we knew any secret, magic formula; we set our own techno-biases aside. Likewise, we did not assume that conventional wisdom is always all that wise.

What we found is that guitar amps are fantastically complex systems. Many aspects of the overall product design interact with one another under real-world playing conditions. Sections of the electrical circuit influence each other, the electrical system interacts with the acoustical system, etc. Some of these interactions are well known to amp aficionados and designers. Others have been underrated, or overlooked entirely. Thus, we soon came to realize that guitar amps have plenty of mysteries to reveal, and plenty of room for improvement in areas that musicians would appreciate.

Eventually, ZT started collecting real, practical insight into what makes great amps tick. In our view, optimization between electrical, acoustical and mechanical subsystems is the key to bringing more tone, power, smaller size, and lower costs into the picture. By applying sophisticated technical understanding to overcome limitations that have previously been considered facts of life, ZT is able to re-write some of the rules while working in complete harmony with more traditional approaches. We believe it is time to re-think the fundamental design of the guitar amp, bringing in advanced audio technology without losing the wonderful benefits of proven classics.

We offer the Lunchbox amp as proof that ZT has "cracked the code." It's an amp that is small, simple and affordable, bringing a whole new level of sound and tone to portable applications. And, it's an amp with a personality all its own; a flexible and adaptable problem-solver in the hands of a musician. The Lunchbox is layered with responsive tone, but powerful and seriously fun to play at the same time. Isn't that what "classic" is all about, anyway?

Initial Setup:

When first connecting your Lunchbox, before power is applied, please be sure to set the controls as follows:

- ✓ REVERB AMBIENCE set to off. (Fully counter-clockwise.)
- ✓ TONE set to mid-point. (12 o'clock position.)
- ✓ VOLUME set to off. (Fully counter-clockwise.)
- ✓ GAIN set to mid-point. (12 o'clock position.)
- ✓ SPEAKER switch on rear panel set to "On" position. (Towards left side.)
- ✓ Now you can apply power, and turn up your instrument to the desired level using the VOLUME knob.

The Signal Path:

The main input to the Lunchbox is via a standard ¼" input on the top panel. This input has an impedance of 1MΩ, (2MΩ @ DC), and can accept working signals up to 6Vpp. It is protected against RF interference and ground-error overloads. After the input stage preamp, the signal is sent to an analog GAIN pot on the front panel, and then into a diode overdrive network. Thus, the GAIN knob controls the input sensitivity, and allows an analog overdrive to be applied to the signal, if desired.

Following this analog input preamp, the signal is converted to 24bit PCM digital at a 44.1 KHz sampling rate. In the digital domain, ZT's proprietary dynamics and EQ signal processing are implemented. Also, a TONE control with characteristics closely following a vintage stack is applied. Finally, adjustable "Ambience" processing is done, allowing the user to obtain the sound of an open back cabinet, a closed back cabinet, or anything in between. At this point, the signal is converted back to analog and routed to the power amplifier.

The output amp section is carefully designed to constantly adapt to the signal characteristics and the instantaneous power supply behavior. The amp itself is a pair of Class A/B output stages, running fully bridged across the speaker load. The result is very high RMS power, with extraordinary additional peak dynamics on top of that, together with a natural, progressive overdrive characteristic.

Gain and Volume Controls:

Normal adjustments to the sound level should be made using the **VOLUME** control only. This knob affects the signal levels at all inputs and outputs.

The **GAIN** control is used to set the amount of signal drive and natural distortion that is achieved. In almost all cases, this control should be set high up, well above the 50% point on its range. This will assure a good tone, and low operating noise. The only time the gain should be turned down is when a very clean tone is needed for an excessively high signal input, such as when certain external effects units are used with the Lunchbox.

Minimizing Noise:

The ZT Lunchbox can deliver peak sound pressure levels in excess of 134 dB to a listener sitting 1 ft., (0.3 m) in front of it. Thus, even boasting an excellent Signal-to-Noise Ratio of 85 dB, with certain control settings there can still be a residual peak noise level of almost 50 dB in the near field! This can be quite audible, and is simply a function of how loud the amp is capable of playing, and the high gain (>4,000) that is potentially available. (We could have put an aggressive noise “gate” in the circuit, like many modern amps do, but the tone, touch and sustain of the amp would have been negatively impacted.)

The key to low noise is to, Keep The GAIN Knob High,

and,

Use the VOLUME Knob To Adjust your sound level!

Yes, we realize now that we probably should have reversed the position of these two knobs on the top panel. Hindsight is a painful thing! We hope you love the Lunchbox so much in other ways, that you can forgive us, and get used to the drill. You can, perhaps, console yourself with the knowledge that you own a first-generation Lunchbox, sure to be admired by future historians and coveted by amp collectors for all its little quirks.

Reverb vs. Ambience:

Speaking of quirks, the Lunchbox has another one we should probably explain. The labeling on our “Reverb” control may be confusing, and really should be called “AMBIENCE.” What this control actually does is add the type of natural short-term reflections that emanate from the rear of an open-back cabinet. These reflections are a big part of why open-back amps have such a rich and dimensional sound.

You can use this knob on your Lunchbox to dial-in some nice dimensionality and fullness to your sound. But, it’s a subtle effect, and you won’t get a Surf sound out of it, even if you turn it up farther than you probably should. We did it this way because we could; the effect was a natural outgrowth of the proprietary technology we use in our signal chain. If you want a more conventional reverb sound, you will need to plug in an external unit. Or, of course, go record in the bathroom. Hey, it can be fun. Just stay out of the tub, (that’s for the drummer), and make sure your wall sockets all have Ground Fault Interrupters!

Seriously, what we would like for you to do if you love your Lunchbox, but need a more traditional reverb tone, is consider ZT’s new 12” Club-Series amp. It has all of the sound character of a Lunchbox, and more, in an incredibly powerful and compact enclosure. Plus, it has a very good sounding, more traditional reverb.

The External Speaker Output:

There is a ¼” external speaker output connector on the rear of the Lunchbox, which can be used to power an external cabinet. The Lunchbox makes a really good sounding, very powerful head. With the right cabinet, we think you will be stunned by the results. If you decide to try this, please note the following IMPORTANT rules:

- ✓ This output is fully balanced and high power. Connect it only to a speaker cab.
- ✓ Do not use this output for recording or connect it to other amps.
- ✓ Use a speaker cabinet rated at 8Ω, or higher.
- ✓ Be sure your external cabinet can handle at least 100W.

It’s usually a good idea to turn off the Lunchbox’s internal speaker when using an external cabinet, to make 100% of the amp’s power available to the output. This is done by setting the rear panel SPEAKER switch to “Off.”

Additional Inputs and Outputs:

The Lunchbox can accept a line input from an audio source such as an MP3 player, via a standard 1/8" Stereo jack on the rear panel, labeled AUX INPUT. This input is not affected by the GAIN control, but does run through all the other Lunchbox controls. The input impedance is 22K Ω , and the expected signal level is 50mVrms. If you need to tweak the relative balance between your guitar and your MP3 player, you can use the GAIN control to do it, or adjust the output level on your player. It is recommended that you disconnect any cables from the AUX INPUT when it is not in use.

There is also a line-level OUT on the rear panel. This 1/4" Stereo connector can be used to run most stereo headphones. (However, the signal itself is always mono.) The line output is also useful for running into house sound, or a recording rig. It has its own level adjustment, so that you can adjust the level of your phones once the Lunchbox controls are set where you want them.

Unlike most headphone outputs, this one doesn't mute the internal speaker. If you want to do that, just use the SPEAKER switch. This approach give you total control of what is on or off at any given time. For example, you can use the Lunchbox to monitor the sound on stage, even when routing into the board via the line out.

Using The Lunchbox With Other Instruments:

The Lunchbox is not just for guitars. In fact, the Lunchbox loves a very wide variety of instruments and sound sources. Excellent results have been achieved with acoustic guitar pickups, harmonica, electric piano, sax, accordion, electronic organ, traditional string instruments, and synths. We've even seen people successfully run an electric bass through the Lunchbox in a small venue.

Start with the GAIN, TONE and REVERB controls all set at midpoint, and the VOLUME all the way down. Then inch up the VOLUME, step by step. Season to taste. Because of the high available gain, some acoustic instruments may tend to feedback if the GAIN control is accidentally set too far up.

Mic'ing The Lunchbox.

When making a recording, or running through a house PA, a great sounding amp really deserves to be mic'd. Direct feeds are convenient, sometimes necessary, but they rarely capture the full tone the player is hearing. Because the Lunchbox uses a very unique speaker, which is also smaller than most, adjustments to your usual approach might be worth trying. Getting really good recordings always involves experimentation, but here are some general tips:

- ✓ Start with the microphone directly in front of the driver's dustcap, about 6" back from the grille.
- ✓ Cardioid LD condensers are the first choice, if available.
- ✓ Cardioid SD's are good, too.
- ✓ An Omni SD can capture a very accurate sound, but you might have to move it in closer to the grille, and play with side-to-side positioning. A spot about halfway between the center ("dustcap") and the outer edge ("surround") of the speaker will often work well.
- ✓ The classic dynamic guitar amp mics can work, of course, but be prepared to try a variety of setup positions to get the tonal balance you want.
- ✓ Remember, the Lunchbox can be Loud, and it concentrates a great deal of sound energy into a small area. Unless you are an unusually soft player, you will probably have to engage the pad on your mic.
- ✓ Using a foam windscreen is also a good idea, since the driver can create bursts of air when driven very hard.

Understanding Amplifier Power.

Nobody has come up with one number that can fully represent the power capability of a guitar amp. RMS is a very conservative approach, but it misses the issue of dynamic power and real world musical signals. At the other extreme, Peak Power can readily be inflated to the point where it is not a reliable indicator of anything. In fact, the actual power of any given amplifier varies widely at different frequencies. Every amplifier company has their own procedure for stating the power capability of their products, which ideally should be done within the boundaries of accepted technical standards and legal requirements. Here is our thinking on the matter, which we believe results in specifications that are both conservative and useful.

The internal speaker of the Lunchbox is nominally 6Ω , with a DC resistance of 5.3Ω . Electrically, the amplifier output stage runs differentially, using a 48V rail. The output stage can source in excess of 41Vp or 28Vrms into the speaker load. This yields the following typical specs:

Maximum Instantaneous Peak Power: 280W.

Musical Peak Power: 236W.

RMS Power: 130W.

Sustained Average Music Power: 200W.

Finally, Two Words About Modding: Please Don't.

Sooner or later, most of us get the urge to modify or improve our amps by replacing various parts. But, remember, the Lunchbox is not like other guitar amps. It is a highly integrated and optimized system, combining electrical, acoustical and mechanical subsystems. Replacing any element of this combination is sure to upset the balance and operation of the whole. For example, our speaker driver is fully custom, and built using special high-power components. You won't find anything else quite like it.

So enjoy your Lunchbox, and please do send us any and all suggestions you have. We take our customers' input very seriously. (Oh, and we like compliments, too!)

Thanks!
