

# ZOTL40 Mk.II

## POWER AMPLIFIER

## USER GUIDE

**Linear Tube Audio**  
**Takoma Park, MD, USA**

**WARNING:** For safety, the cover of this amplifier should be secured at all times. DC voltages as high as 1000V and peak AC voltages as high as 800V are present inside. The service information contained in this manual is intended only for trained service personnel. Furthermore, this amplifier generates radio-frequency energy that can interfere with communications equipment.

Note: The circuitry is different in the ZOTL40 than any other tube amplifier. **Do not attempt to service this yourself even if you are familiar with tube amplifier circuitry.**

Call or email Linear Tube Audio if you have any need to service this amplifier.

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### **Introduction**

The ZOTL40 is a high quality Class AB tube Power amplifier utilizing ZOTL (Zero hysteresis Output Transformer-Less) technology.

### **Features**

- ZOTL technology eliminates the need for output transformers,
- ZOTL technology enables the correct turns ratio coupling between amplifier and speakers (which cannot be done using output transformers)
- ZOTL technology operates tubes operated in a manner to last as long as 10,000 hours
- Very low hum
- Uses 4 KT77s, 2 12AU7s, and 2 12AX7 tubes. Supplied with Russian Genalex Gold Lion KT77 and NOS mil-spec versions of the 12AU7 and 12AX7 tubes.
- One set of RCA inputs is direct and one set of RCA inputs goes through a volume control. (Older ZOTL40s also have an (unbalanced) XLR/phone jack input.)
- Sophisticated protection circuitry monitors the amplifier and will shut down it down if DC or over-current is detected. Bright white LEDs inside the case will light if the amplifier is in protection, and the tubes will not be lit if the power to the amplifier is turned on. The

amplifier is not damaged by operating without a load, but we recommend having speakers hooked up to ensure optimal function of the protection circuitry.

- Auto-bias circuitry for automatic tube biasing.
- Universal voltage power supply custom designed by David Berning - works automatically in any country.
- Low impedance output (below 2 ohms) easily matches wide range of speakers
- Both audio circuit and power supply designed by by David Berning, one of world's leading amplifier designers
- No heavy power or audio transformers – unit weighs under 15 lbs.
- Patented power supply and impedance conversion technology

### Operation

Operation of the ZOTL40 amplifier is straightforward. Though it is not an integrated amplifier, the ZOTL40 can be used with a high-level source such as a preamp, CD player, DAC or electronic crossover. The amplifier has one set of speaker binding posts per channel. There is a volume control on the front panel that can be used or not depending on which input the source is connected. There should be only one source connected to any of the three inputs. Speakers from 2 ohms to 16 ohms can be connected to the speaker terminals.

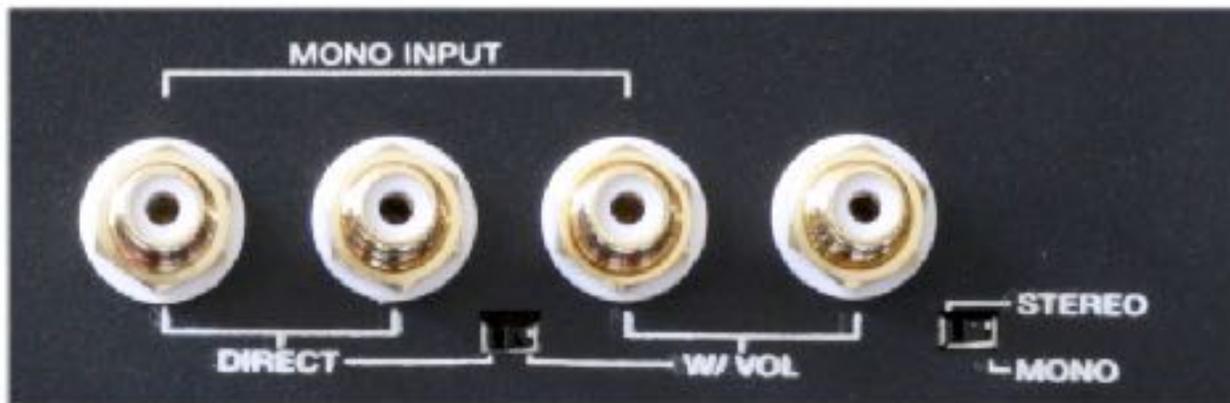
When the amplifier is powered, the tube high voltage is delayed until the tubes are heated. This takes about 45 seconds. A brief burst of electronic noise that sounds like static or distortion is normal. The amplifier should quickly smooth out into its normal musical output. Be sure that the amplifier is operating in a well ventilated environment to ensure the heat from the tubes adequately dissipates.



## Power Sources

The universal input automatically adapts to the input voltage almost anywhere in the world. The voltage is rated to work with any voltage between 100VAC and 240VAC, and from 50Hz or 60 Hz.

## Inputs



There are two sets of inputs. However, **only one input can be used at one time**. There is a small switch between the RCA pairs to select which input to use, to ensure complete separation between the direct and volume controlled input.

Direct Input: a stereo pair of RCA jacks go straight to the amplifier input without a volume control.

Volume Control Inputs: There is another pair of RCA jacks that go through the volume control located on the front panel. It is a Japanese ALPS Blue Velvet volume control.

(On older units: XLR Inputs: a stereo pair of combo XLR and ¼ inch phone plug jacks are also available. Each 3 pin XLR contains one stereo channel. The XLR is standard Pin 2 hot. The XLR inputs are single ended and not balanced.)

Mono-Stereo Switch: On the back panel next to the RCA inputs there is a mono-stereo slide switch. Normal operation with Right and Left inputs and Right and Left speaker outputs are enabled with the switch in the Stereo position. The ZOTL40 can be operated as a mono amplifier, with both channels bridged into one speaker to provide approximately 1.7 times the single channel output (with an 8 Ohm load). To operate in the mono bridged mode:

1. Set the mono-stereo switch to Mono.
2. Use either of the Left inputs for one channel of input to be sent to both of the amplifier channels.

3. Connect the two red speaker output terminals together to be the Mono+ speaker output and connect the two black speaker output terminals together to be the Mono-speaker output. DO NOT CONNECT the red and black speaker output terminals together, as the SHORTS the amplifier output.

### **Speaker Outputs**

The amplifier outputs about 45 watts at 8 Ohms. One set of stereo 5-way binding posts are provided. Speakers from 2 ohms to 16 ohms can be used. Not having speakers connected when the amplifier is on will not damage the amplifier, though it is recommended to have speakers connected in order for the protection circuit to operate optimally.

### **Protection Circuitry**

The amplifier has a sophisticated protection system that monitors the output for DC voltage (usually present if a component fails and also during turn-on and turn-off thumps). Depending on the duration and amplitude of the DC, the protection circuitry disconnects the amplifier power supply. When the DC is no longer present the protection circuit automatically turns the amplifier back on. Two very bright LEDs are inside the unit and come on and flash when the protection circuit is activated. There is one LED for each channel. If the light stays on all the time, it would be a strong indication that the amplifier needs service. Also, it is normal and no action is taken to have the protection lights briefly flash if a connected source component is turned on or off. If the amplifier is substantially over-driven it will keep going into protection until the input is reduced. Turn down the volume of the source device if this occurs.

### **Mono/Stereo Switch**

There is a mono/stereo switch on the back panel, below the RCA inputs. This will enable the amp to be safely used as a mono-block, but in order to use the full wattage of the amps in mono mode the outputs will need to be bridged. We will provide a set of four (two for each amp) double banana plug to single 5-way binding post adapter to anyone with two ZOTL40s; you can also use shorting cables or rods to bridge the outputs.

### **Technology**

In 1996 David Berning developed a new and technically advanced vacuum tube architecture designated as ZOTL. ZOTL stands for Zero-Hysteresis Output-Transformer-Less amplifiers. The ZOTL architecture eliminated the problematic sound quality issues that audio-output transformers caused.

As in all ZOTL amplifiers, the ZOTL40 Power Amplifier uses radio frequency to change the voltage-current transfer characteristics of the output tube from its normal impedance plane to one suitable for driving a dynamic loudspeaker. The radio-frequency remapping is implemented using special high-frequency power-conversion techniques. The high-voltage, low-current tube impedance plane is remapped to the high-current speaker impedance plane through special transformers operating at a constant RF carrier frequency of 460kHz. Because the audio signal is riding on a carrier, it is not subject to parasitic elements of the transformer that would distort the

audio signal. Unlike the conventional audio-output transformer, this impedance transformation operates on both the AC and DC components of the signal.

The signal is amplified in a much more linear manner when amplified on the carrier. For this reason, the bass response is flat down to 6Hz, far below what a conventional tube amplifier can achieve.

In the transformer-coupled amplifier, the turns ratio of the output transformer determines the impedance matching between the output tube(s) and the speaker. There are practical limits to how large this ratio can be made because of the parasitic elements of the windings, and it is difficult to make an output transformer with more than a 25:1 ratio.

With the ZOTL technology, the impedance matching is determined by the effective turns ratio of the RF converter transformers. Without the parasitics of an iron transformer core to affect the audio, these RF transformers can have much higher effective ratios, and actually provide the correct turns ratio to properly couple to the tube. This is more than twice the maximum turns ratio that can be achieved with an output transformer.

The ZOTL technology results in very wide, linear frequency response, along with no coloration and a very transparent presentation of the recording.

### **Amplifier Maintenance**

The amplifier is self-biasing, and needs no adjustments.

The amplifier operates the tubes in a low current manner that maximizes tube life. The tubes are expected to give up to 10 years of service based on several hours of use per day. See the section on Vacuum Tube Replacement.

### **Fuses**

The ZOTL40 has four fuses, two of the fast blow 5x20mm type 3.1A, in the AC power input assembly (where the on-off switch is). There is a 4A slow blow 0.25x1.25" and a 2.5A fast blow 5x20mm fuse on the power board in the power supply in the lower section of the amplifier enclosure. If this fuse is blown, it is likely that something is seriously wrong with the amplifier and you should call the factory for service.

### **Vacuum Tube Replacement**

The amplifier comes with tubes chosen to sound great and not require upgrading, but we know how personal tube choice can be. Changing or "rolling" the tubes is at your own risk. If you choose to change the tubes, be extremely careful to ensure the unit is off for at least 5 minutes to allow voltages to dissipate. **Avoid touching the board, especially the impedance converters, as high voltages may still be present even if the unit is off.** Ensure the pins of the tubes are aligned with the tube socket. The power tubes are self-biasing, so there are no adjustments necessary, nor is a matched quad necessary. Due to the space available on the board, large bottle

types of EL34 equivalents will not work in the amplifier. It is recommended you use matched pairs for the 12AU7 and 12AX7 tubes. The amplifier is constructed using fairly tight tube sockets, so gentle persistence will be required to change tubes. Any damage caused by changing the tubes is not under warranty.

### **Specifications (Typical Performance Values)**

- Sensitivity: 1.2V RMS for 40 watts output
- Output impedance 1.6 ohms
- Input impedance: 50k
- 100V / 120V / 240V operation: Auto-switching
- Hum and noise: 94dB below full output (measured between 20Hz-20kHz)
- Power output with 4-ohm load: up to 51W, 0.5% THD
- Power output with 8-ohm load: up to 46W, 0.5% THD
- Frequency response (8-ohm load): 8Hz to 50kHz, +0, -.5dB
- Amplifier class: Push-pull Class AB
- Size: 9 inches (23 cm) wide, 8 1/2 inches (22 cm) tall, 18 inches (46 cm) deep (including connectors)
- Net weight: 9.7 lbs. or 4.4 kg
- Finish: Aluminum case
- Tube complement: two 12AX7s, two 12AU7s, and four KT77s

### **Limited One-Year Warranty\***

1. Your new product is covered by a limited one-year warranty against defects in material and workmanship. Any repairs required will be made at no charge within the first year after purchase as a new unit.
2. Any units returned for warranty repair must be shipped prepaid after receiving return authorization. For safe handling, and if at all possible, the unit should be shipped in its original carton. If such is not possible, the unit should be well packed with particular attention paid to protection of all corners and avoidance of any looseness in the carton.
3. This warranty does not apply to damage resulting from physical abuse or unauthorized alterations or repairs; or from tube rolling, or damage to exterior finish resulting from careless use. The warranty is void if the serial number has been removed, altered, or defaced.
4. This warranty is void if improper voltage is applied to any input or output.
5. Linear Tube Audio reserves the right to improve or change its products without obligation to modify previously manufactured units.

\* Applicable for domestic sales only. There is a one year warranty for overseas customers. Handling and shipping costs are the responsibility of the overseas customer.