



MODEL LP2250[©] *LP Series TO-3P*

INSTALLATION AND OPERATION MANUAL

INTRODUCTION

Congratulations. With so much lower-quality car audio equipment currently on the market, you have found one of the highest-grade, **All American**-made amplifiers produced today. Since **1975** we have manufactured the very best audio equipment for your car. Yes, we are **American owned, designed, engineered and built in the USA**, and we are proud of it! All **LP Series[©]** amplifiers, also have a **4-year warranty**** to assure your investment in a **LINEAR POWER[™]** product was a wise choice. Our products are simple, yet flexible, and we are concerned about giving you the absolute best sound quality and reliability possible. As you would expect, you will, in the near future, see other new ideas and innovative products ranging from more amplifiers, crossovers and preamps, from one of the industry's oldest and most-respected amplifier companies.

TECHNICAL DISCRPTION

POWER SUPPLY: Our mosfet-driven converter utilizes some of the highest current fets on the market today as switching transistors. These transistors are protected by a unique non-interactive over-current protection that does not regulate the power supply until maximum current is achieved, unlike other manufacturers' designs that fully regulate the power supply and, thus, limit headroom and dynamic response. The power supply is extremely over built, with the transformer capable of delivering more than 5 times the energy needed to run the output stage at rated power. The power supply is also highly efficient, with the efficiency levels above 90 percent.

OUTPUT STAGES: Transformer-less, direct coupled and fully complimentary, output transistors are high current and low distortion and are the highest-sound-quality devices currently offered from **On Semiconductor** (Motorola). These **TO-3P** devices are operating at a fraction of their limitations and utilize the same style internal electronics as our old amps did, using the **TO-3 Metal**-cased transistors but just with a newer and better SQ part number. In **4-ohm stereo**, the output devices in the **LP2250[©]** work at approximately **15%** of their design capabilities as engineered by Motorola. Power is supplied to the outputs thru heavy-gauge, solid copper buss bars, and the power is triple filtered at three separate locations to ensure the lowest noise and distortion from the amplifier as well as the highest slew rate and transient response by having the last filter and storage stage directly at the bank of output devices. **Linear Power[™]** products are designed for serious sound quality, extremely over built and made to last!

****4-year warranty on all amplifiers that are dealer purchased and dealer installed; 1-year warranty on all over-the-counter and Internet sales.**

PROTECTION: Since the **LP2250©** is capable of enormous amounts of output power, it is protected very well. Protections include: reverse polarity, short circuit and low impedance load conditions, as well as, over-current protection of the power supply. The amplifier also monitors battery voltage, and the **Green “ON” LED** will flash when the battery voltage drops dangerously low. The amp will shut down if voltage drops below 8.5 volts. It is also protected against high ambient temperatures by a two stage thermal protection. At **60 degrees C**, the amp turns the fan output circuit on, providing up to 10 amps of current to drive almost any custom fan array you could conceive. Or you can just plug our optional low-noise floor fan shroud into the connector provided. At **80 degrees C**, the amplifier will shut itself off from a few seconds up to a 3-minute period to cool to within a normal operating temperature range. It will then cycle itself back on.

OPTIONAL FAN CIRCUIT: As noted above in the paragraph on protection, the **LP2250©**, as well as all of our new models of amplifiers, are equipped with a fan circuit. In most cases you will not need the use of the fan circuit or the optional fan shroud. It has been added for the occasion of installing the amplifier in small spaces with minimal air flow or high ambient temperature. The fan connector is located on the rear butt plate centered between and to the bottom of the right pair of output binding posts. Our optional fan shroud plugs into this two-pin mini-Molex connector. If you will be using this connector with your own custom cooling system, the pin toward the pointed end of the Molex connector is the 12 volt positive output connection. This circuit and connector can support up to 10 amps of current to run most any custom fan system. The fan circuit switches ground not 12 volts to the fan system. You can use the 12 volts provided in the connector or use your own 12 volt source and use the ground in the fan connector to switch ground to your fan system. The fan circuit is also reverse polarity protected, so daisy chaining multiple amps into one custom fan system is possible, with any one of the amps being able to trigger the fan system when needed without damaging the other amplifier fan circuits.

STATUS LEDES: On the face of the amp are three status LEDES that indicate the amplifier's condition.

1. GREEN LED is indication that the power supply is on and operational and providing power to the output stages. The **GREEN LED** will also flash when battery voltage goes below acceptable limits. If the **GREEN LED** flashes, all wiring, connections and power source should be checked for issues that might cause a low voltage condition. The amp will shut down if voltage goes below 8.5 volts.

2. YELLOW LED indicates that the amplifier is in a high temperature condition and has turned itself off for a short period to cool. The amp will auto-reset and turn back on without the stereo being restarted.

3. RED LED indicates that the amp is in one of its protection modes. The amp should be shut off and checked for issues that would trigger these protection modes, such as a shorted speaker wire or binding post connection, a lower speaker impedance load than recommended, or a damaged speaker voice coil.

CONSTRUCTION: Features: Double sided MIL SPEC heavyweight glass epoxy circuit board with 3 oz. copper plating, and all high current paths are backed up further with solid copper buss bars. High quality, low **ESR** (Effective Series Resistance), high temperature, and high voltage filter capacitors for lower power supply losses. Audio-grade capacitors in output and pre-amp stages with bypass filtering on all electrolytic caps. Heat sinks were custom designed in house. Based on our old designs we have improved the heat sinks to work even better than before. These new heat sinks have more surface area than our old sinks but are physically smaller.

QUALITY CONTROL: In-house construction of critical components like transformer and chassis, as well as total assembly, allows **LINEAR POWER™** to maintain uniform quality. **100%** of the finished units are tested then burned in for four hours and tested again. Amplifiers that pass this rigorous test have truly earned the **LINEAR POWER™** logo. All **LINEAR POWER™** amplifiers are designed and hand assembled in house and built totally in the **USA**.

MOUNTING

1. The amplifier will work best if it is kept as cool as possible. Mount in a position that would allow the circulation of air. Mounting the amplifier so that the heat sink fins are vertical provides convection air flow and provides the best cooling option. If mounting the amp horizontally, you should provide a minimum of 2 inches of overhead clearance above the amplifier for heat to rise from the heat sink. If using the optional fan shroud, be sure not to block the intake side of the fan and also allow the exhaust side to blow freely into an open area.

2. Wire all connections as shown in instructions. If using the optional fan shroud or your own fan system, connect fan power plug to the amp. Place fan shroud into position over amplifier and mount securely.

3. When mounting the amplifier **DO NOT** allow the case (heat sink) of the amplifier to come in contact with any other metal or chassis ground of the vehicle. Doing so can result in system noise resulting from a ground loop created from the secondary ground connection between the case of the amp and the body of the car. Use the amp's mounting holes and the installed rubber grommets to mount the amplifier securely and insulate it from other metal and ground. If any of the grommets are ever damaged, replace them with new grommets. Installing the amplifier on an amp board or in an amp rack to further isolate it from the vehicle is recommended.

WIRING

1. Disconnect the **negative ground cable** from your vehicle's battery before making any power connections and/or pull **MAIN power fuse** at battery for audio system. **DO NOT** reconnect main system power fuse and/or ground cable until installation is complete!

2. **DO NOT connect RCA inputs to amp until all other wiring is finished.** This will protect radio RCA grounds from damage from 12 volts possibly shorting to case of amp and thru to RCA cable grounds and into head unit! **DO NOT disconnect or re-connect RCA cables when amp is on!** (See **RCA GROUND** section on page 4)

3. Connect the negative ground wire from the amp to a solid frame member via bolt or self-tapping screw. This connection must be to a clean, unpainted surface. Always attach the ground wire first when installing this amplifier and disconnect the ground last when removing this amp from the system. Ground cables must be of the same size as power since DC is a loop condition and the same amount of current is passed thru the ground as is the power.

4. Fuses of the proper size (**3 x 20 ATC**) must be installed internal of the amp to protect the vehicle's electrical system and the amplifier from damage. There should be a master system fuse installed within 18 inches of the car battery to protect the battery and power cable in case there is a wiring short between the battery and the amplifier(s). This master fuse should be connected to the battery's positive terminal and should be of a large enough size to provide needed current to all amplifiers without limiting current to the system. (i.e., the fuse should be larger than 40 amps.) The power connection block on the end of the amplifier will accept up to 4 gauge cable, a minimum of 6 gauge power and ground is recommended.

WARNING: USE OF OVERSIZE FUSES INTERNALLY WILL VOID THE WARRANTY

AMPLIFIER TURN ON MODES

Turning your amplifier on can be accomplished in one of two ways by selecting the desired position on an internal switch. This switch is located in the power supply section over to the side of the amp away from the transformer. Traditional **12 volt remote** from the radio, other source unit or processor can be selected by setting the internal switch to the position marked "**REM**". Your amp already comes set to this mode from the factory and uses normal 12 volt remote turn on. For **DC SENSE (audio sense)** the switch will be set to the position marked "**DC SEN**", this allows the amplifier to be used with any source unit **not** having a direct 12 volt remote output lead (OEM head units). In **DC SENSE or "audio sense" mode** the normal 12 volt remote input terminal on the power block of the amplifier becomes a **12 volt remote OUTPUT** terminal capable of turning on other pieces of audio equipment in the system. The RCA Input Mode **will** have to also be properly selected to the "**DIFF/BAL**" mode, when using the "**DC SEN**" turn on option; see next paragraph.

RCA GROUNDS

DO NOT remove or install RCA cables from or into the amplifier with the amplifier on! This may cause a loud pop or squeal which can damage the speakers or your hearing. It may also blow one or both of the RCA ground micro-fuses located on each input channel on the circuit board of the amplifier. These fuses are there to protect the ground to each channel of the amplifier from external issues. These fuses are **NOT** user/dealer replaceable and must be installed by a qualified technician or factory re-installed if they are ever blown.

Our **Linear Power "LP" Series** amplifiers have input and output grounds that are isolated from the chassis ground (main power ground) of the power supply of the amplifier. Unlike most other current amplifier designs, we do this to reduce chances of a ground loop and to reduce induced noise thru the power supply ground plane. Keeping the audio ground plane and the power supply ground plane separate greatly reduces the chance for additional noises to enter the audio path.

Removing or installing the RCA cables while the amp is on and functioning disconnects all ground to the pre-amp and output stages, also running the amplifier with no RCA cables connected can cause the amplifier to pick up RF (radio frequency) noise due to the wide bandwidth of the amplifier. This can cause a hiss/noise thru the speakers and/or cause the amplifier to idle excessively warm and pull extra current. If you are running the system to isolate or troubleshoot noises and need to disconnect the RCA cables from the amplifier(s) during testing, install a dummy load on each channel, consisting of a pair of RCA connectors with a 10K ohm 1/8 or 1/4 W resistor between the center pin and the shell (ground) of each connector. This will give the amplifier a "closed loop" and will stop any external noise from entering the audio path of the amp thru the RCA inputs. Do these procedures prior to turning the amplifier on and disconnect dummy loads only after turning the amplifier off, then reconnect the RCA cables again for normal use, before turning it back on.

Testing to see if micro-fuses for each channel are still functional and the amp still has audio ground continuity can be performed by taking a **DMM (digital multi-meter)** set to continuity test (beep) or to ohms. **With RCA cables DISCONNECTED and amp OFF**, test from **left RCA ground shield** on end of amplifier to **left negative** speaker output 5 way binding post (far left speaker terminal). Test from **right RCA ground shield** on end of amplifier to the **right positive** speaker output 5 way binding post (far right speaker terminal), right channel is inverted, it is actually speaker negative! The meter should beep or the ohm meter scale should read a very low resistance (below 1 or 2 ohms). If there is no beep or if the ohm meter scale reads a very high resistance or no resistance at all (open circuit) the fuse has been blown. The amp will have to be serviced and the micro-board fuses replaced. These 4 amp fuses **will not fail** unless an external issue has occurred and the amplifier needs to protect the input grounds; such as foreign voltage on RCA cable ground or from spikes from installing or removing the cables when amp is on.

USING WITH EQ'S, CROSSOVERS, PROCESSORS OR LINE LEVEL CONVERTORS

Most accessory electronics today come with a ground switchable option for “**Isolated Ground**”, “**200 Ohms to Ground**” or “**Ground**” (pass thru ground) on the RCA outputs of the accessory. These units come set primarily to “**Isolated Ground**” for use with amplifiers and equipment with common ground to chassis ground through the power supply section of the amplifier. Our amplifiers use a floating ground pre-amp and output stage and have no connection to the amps power supply ground which could cause noise. In this case, **our amplifiers need to see ground on the RCA cables** when the amp is used in single ended mode. We ship all our amps in single ended input mode, with this being the recommended input mode unless you are using the amp with a high level output radio, then follow the instructions in the next section. Please be sure the accessory electronics RCA output is selected for “**Ground**” and **not** for “**Isolation**” or “**200 Ohms to Ground**”. If our amplifiers are used with “**Isolated Ground**” or “**200 ohms to Ground**” there can be noises generated since the amplifier section has no ground reference.

RCA INPUT MODE SELECTION

As shipped from the factory your amplifier is set for **Single Ended** RCA input, which in most cases will be what you will need. If you are going to use the amplifier with an “**OEM**” factory head unit and will need the amplifier to turn on by DC SENSE “audio sense mode”(see above), unscrew the bottom cover and slide it back. Located on the circuit board near the left and right side of the input sensitivity (gain) control, are two sets of push-pin connectors, one set of 3 pins for left channel and one set of 3 pins for right channel. To set the amplifier for **Differential Input** mode, remove the shorting connector from across the two pins marked “**SE**” and move them across the two pins marked “**DIFF/BAL**”. In the case of noise, experimenting with changing the two input modes may help reduce system noise.

USING AMP WITH “OEM” FACTORY RADIO

The new line of **Linear Power “LP” Series** amplifiers can be used with an “**OEM**” factory radio **without the use of a line level converter**. Removing the line level converter from the signal path improves the sound quality of the factory head unit significantly, simplifies the installation and saves money. Most of the amplifiers on the market cannot do this! The pre-amp section in our amplifiers can take up to a 15 volt peak input from the head unit or around 10 volts RMS maximum. Start your install by setting the input gain on the amplifier to the minimum setting, then the speaker output leads from the radio can be wired directly into the RCA inputs of the amplifier using a section of RCA cable. The left speaker positive will wire to the signal or center pin of an RCA jack and the left speaker negative output will wire directly to the RCA ground shield of the cable for the left channel, repeat the operation for the right channel. Once you have the speaker leads connected to an RCA cable, connect the RCA cable to the amplifier like you would normally install a low level set of RCAs to the amplifier. The amplifier must be in **DIFFERENTIAL INPUT MODE**, and the **REMOTE SELECTION SWITCH** must be set properly. See the two paragraphs directly above detailing these operations.

TRI-MODE/STEREO/MONO OPERATION

All Linear Power “LP” series amplifiers are capable of running **TRI-MODE**, or what is also known as **MIXED MONO OPERATION**. This means that the amplifiers can play a simultaneous stereo and mono mode at the same time. This can be accomplished by running a **4 ohm stereo load** and an **8 ohm bridged load** with the power supply tap settings, set to the taps marked **2 ohm**. This arrangement presents the same load to the amp as a **2 ohm stereo load**. **ONLY** the impedances given above should be used, combining lower impedance loads will result in the amp switching into protection mode or possible damage to amplifier.

Note, that running the amplifier in this configuration would require a passive inductor to be placed on the bridged woofer to illuminate high frequency to the sub. These inductors are quiet large and would have to be constructed from heavy enough gauge wire to handle the output capability of the amplifier used.

Electrically the inductor will cause a phase shift in the subwoofer from the rest of the system, as well as, absorb a percentage of power of the amplifier going to the subwoofer. It will also lower the channel separation between the two channels since it has electrically strapped the two channels together. Even though our amps are capable of this operation, it is discouraged from doing so because of the above negative effects. These negative characteristics are inherent to any model or brand of stereo amp capable of running this mode. It is understandable that one would attempt this operation as a cost savings measure to have one amp run the entire system.

OPTIONAL CROSSOVER CARD

An optional **FACTORY INSTALLED** crossover card is available for the **LP2250©**. The crossover plugs into the main board via a header connector. The crossover is available for those situations in which there is no external crossover capability, such as in factory “**OEM**” head units. The crossover option can be ordered with the amp as a production option, or the amplifier returned after original purchase to be added to the circuit at a later date. This is a high-quality crossover using high-grade parts, including sound quality op amps and processors. The crossover uses two infinitely variable crossover potentiometers to set the crossover points exactly where you want them. The low-pass filter network uses a Butterworth alignment and the high-pass circuitry uses a Bessel crossover filter. There is a three-way crossover switch to choose between **high pass**, **bypass** or **low pass** operation. The upper limit frequency range for **low pass** operation will be from **30 Hz up to 3 KHz** and the lower limit range for **high pass** operation will be from **3 KHz down to 30 Hz**. The crossover is handled as a separate **factory installed option**, this is done so it is not in the normal musical path in every amplifier, for the musical purist who does not want a crossover in the audio path or who already have crossover capabilities with a head unit or outboard processor.

FOUR-OHM CAPABILITY

As shipped from the factory, the **LP2250©** will be set up to run a **4-ohm stereo or 8-ohm mono** load. To correctly run a **2-ohm stereo or 4-ohm mono** load, remove the cover and change the power supply taps to the **2-ohm taps** (2-ohm stereo or 4-ohm bridged) located on the board next to the **4-ohm taps** (4-ohm stereo or 8-ohm bridged). There are **NO** power increases for running the lower loads when the proper power supply taps are used; this is done for convenience if you already have a 2-ohm stereo or 4-ohm mono speaker arrangement. Running the amplifier with improper speaker loads in the wrong power supply taps may cause the protection circuits to activate, and using the amplifier incorrectly is not recommended and will void the warranty. This IS NOT a high-current amplifier, it is a high-voltage amplifier that does not have to be used in a low impedance load to make power.

SPEAKER OUTPUT

The speaker output connectors on the **LP2250**© are two pairs of 5-way binding posts. Attach a lead from the positive terminal of the speaker to the left speaker positive terminal of the amplifier, and the negative speaker terminal to the left negative terminal of the amp, repeat for the right channel. The 5-way binding posts should have a red color band for positive and a black color band for negative. The speaker terminal, with the terminals facing you, fins up, from left to right, is as follows:

Left speaker (-), Left speaker (+), Right speaker (-), Right speaker (+)

For Bridging the **Left (+)** and the **Right (-)** are used. All the terminals are also marked on the end of the amplifier.

GAIN ADJUSTMENT

In a basic system, using a single amplifier, set the amp to minimum, turn the deck up until it just starts to distort, then back the deck down slightly. This is the point where the output of the deck is cleanest. Now, bring the gain of the amp up until it just starts to distort, and back it down slightly. This will allow the deck and amp to reach maximum useable output at the same time.

WARNING

Your new **LINEAR POWER**™ amplifier, when used in conjunction with many of the efficient speaker systems on the market today, can produce sound pressure levels that are considered harmful to your hearing. Exposure to loud music may lead to loss in hearing. This effect may not be readily appreciated because the damage to hearing is progressive.

Those who are exposed to excessive sound pressure should utilize direct individual protection in the form of earplugs or earmuffs specifically designed for noise reduction.

In accordance with the **OSHA** (Occupational Safety and Health Act) regulations for noise levels as they relate to the work area, excessive sound pressure is defined as **115 db** (a) continuous for any length of time.

We recommend that you exercise restraint while enjoying the performance of this and other high-powered mobile audio equipment.

GENERAL TROUBLESHOOTING

NO SOUND: Check all connections. Check main power fuses. Check internal fuse(s). Check LED status indicators, is the Green LED lit? Are any of the other LED indicators lit? With a trouble light or DVM meter, be sure +12V is present at the amplifier on the large positive cable and on the small red/white turn-on wire. Check for a good ground connection. Check by substitution or other method for proper operation of music source. Be sure the **Turn on Switch** mode is in correct position.

BLOWS FUSES: Check all connections to be sure all power wires, ground wires and speaker wires do not short to each other or ground to vehicle. Re-check polarity of main power wires. Check for proper speaker impedance. Check for proper sized fuse(s) **DO NOT install oversized internal fuse(s)!**

SHUTS OFF: Check the **GREEN LED** to see if it is lit. If the **GREEN LED** is off check for power, ground and remote turn on to amp. Also check the internal fuse(s). This amplifier is equipped with a thermal shutdown system; in the unlikely event of excessive temperatures due to high ambient or operating temperatures the **YELLOW LED (Thermal)** will light and the amp will shut down for a short period. The thermal circuit **will auto reset**, cycling the amplifier off and on is not needed to re-start amp. The amp also has a short circuit and over current protection system. Improper speaker impedance, wiring shorts or damaged speakers may cause the **RED LED (Protection)** to trigger shutting the amp down until the problem is corrected and the amp restarted. The amplifier will actually have to be shut down and restarted to unlock the Protection circuit. Check all the Status LEDs to help diagnose the situation. To avoid damage to the speakers, turn the volume to a minimum while waiting for the amp to turn itself back on.

NOISE SUPPRESSION

The vehicle's battery forms a huge capacitor bank that does a fantastic job of filtering noise. Unfortunately, batteries grow old and lose their ability to hold a charge. At the same time, they lose their ability to filter noise; even corrosion on the battery terminals will cause increased noise as it isolates the battery.

If the vehicle is in need of ignition repair or tune up, increased noise will result. Specifically, on older model vehicles, check the condition of points and condenser, as well as the spark plug leads. Don't forget to check for resistor plugs too.

TROUBLESHOOTING NOISE

Once the type of noise has been determined, the entry method must be isolated. The easiest place to start is the amplifier. Unplug the RCA jacks with the **amplifier off** and install RCA dummy loads (see **RCA GROUND section on page 4**). After turning amp back on, listen for a change in the noise level. If little or no change occurs, the amplifier's input power source (battery/alternator) is contaminated or you have bad chassis ground connections to amplifier. If the noise is gone, the possibilities are: a ground loop between the radio and some other piece of equipment inline or between the amplifier(s), no RCA ground getting to amp, or a noise problem earlier in the system. If the problem is a ground loop, the best solution is to check grounding on all equipment inline and/or a better ground for the amp(s). If one side of the speaker wires has made partial or full contact to the metal of the vehicle or speaker frame, this also will cause a ground loop, and might also cause a squeal thru the speaker or system. It can also back-feed and cause the amplifier to run warmer than usual or possibly go into protection.

The next check is for radiated noise. With the deck still electrically connected to the vehicle, slowly remove it from its installation, and listen for a change in noise level. Any reduction would indicate that noise was being radiated directly into the deck while it was in the dash. If you are dealing with radiated noise, the only solution is isolation. The easiest method is usually to move the contaminated wiring away from the stereo's wiring.

The best way to eliminate power line noise is to install a filter capacitor across the noise source. The best capacitors to use are .5mfd 25v bypass capacitors for the coil, as well as any accessory

In vehicles today there are all types of advanced electronics built into the vehicle or added to the vehicle by the owner that can cause interference. It is even more important to pay attention to where you run your wiring and signal cables so they do not pick up noise from these other electronics. It is important to use any noise inductors that an aftermarket radio manufacturer may provide for USB, iPod, iPhone or other cables on their radios. These cables act as antennas and can cause noise to enter the stereo system. The line inductors that some radio manufacturers

provide will stop or reduce unwanted noise from entering these cables. Keeping these cables from the RCA audio cables for the stereo system is also a very good idea. CAN-bus systems in today's automobiles can be extremely noisy, stay away from the vehicle wiring as much as possible, even with speaker leads and passive crossovers. High frequency energy can bleed into the audio system.

SERVICE OR REPAIR

To obtain service or repair, please go to www.linearpower.com. There you will find a service page that you can download and print a RA Form from. This form will have all the information you need to send the unit in for repair and areas for you to enter all your information. If you are sending a product in for warranty, you must also send proof of purchase from an authorized dealer or direct purchase receipt from the factory. You can also contact our authorized **LINEAR POWER™** Product Service Center:

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