

Price: \$5.00

MODEL LS1 LINE STAGE AMPLIFIER
OWNER'S MANUAL

8-25-89

audio research corporation

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PREFACE

Please take the time to carefully read this Instruction Manual prior to installation or use of your LSI Line Stage Amplifier. Because it is a highly advanced electronic instrument, there are several facts and procedures you should know before you place it in operation.

Just as you would not purchase and attempt to operate an expensive camera, computer system or high-performance automobile without first learning something about performance parameters and correct operating procedures, so too your line stage amplifier requires some familiarization before you make it part of your music reproduction system. Your reward, in terms of maximum performance and a long service life, will be well worth the effort.

INTRODUCTION

The Audio Research LSI Line Stage Amplifier is designed to accommodate music lovers who exclusively use line-level input sources -- digital or analog -- for the reproduction and enjoyment of music in their home audio systems.

In technology, the LSI draws heavily upon the proven hybrid circuitry used in Audio Research preamplifiers. A single 6DJ8 dual triode vacuum tube is used to provide most of the 20dB overall gain, while associated FET devices provide initial gain at input, and current gain following the vacuum tube. Power supply design is virtually identical to the SP9 pre-amplifier, giving the LSI a lifelike sense of ease and dynamic expression.

The front panel of the LSI offers a useful range of controls and switching functions without extraneous "bells and whistles." Included are Gain, Balance, Mode and Input Selectors. Muting is automatic at turn-on and in brown-out conditions, as well as manually switchable. In addition, the LSI includes an important new signal route called Direct Gain Path. This set of inputs offers the user a high-purity signal path for audiophile-quality program sources (CD players, DAC processors, etc.) -- a route which bypasses all controls and switching functions except for Gain. The Direct Gain Path is selectable from a front panel toggle switch, while other inputs are chosen through the Input Selector. See the appropriate sections of this Manual on Controls and Switches for detailed operating instructions.

Also included on the LSI are two sets of main outputs for use with bi-wired systems, surround-sound or other signal processors.

In design and manufacture, the LSI exhibits legendary Audio Research quality throughout. While it is inherently a simpler product than our traditional-format preamplifiers, the LSI is in no way compromised -- sonic performance and reliability will prove second-to-none as you enjoy your LSI over the coming years.

With familiarity, you will find the LSI capable of a degree of resolution never before encountered in a product in this price range. Source material will be revealed within a truly musical envelope. And, of course, the LSI is backed by the 20-year reputation of Audio Research Corporation for excellence in product design, manufacture and customer support. In the LSI it all adds up to superb value in a product you will find difficult to outgrow.

WARNINGS

1. To prevent fire, or shock hazard, do not expose your LSI to rain or moisture.
2. This unit contains voltages which can cause serious injury or death. Do not operate with cover removed. Refer servicing to your authorized Audio Research dealer or other qualified personnel.
3. The power cord on your LSI is equipped with an 18-gauge, 3-conductor cable and a standard three-prong grounding plug. In addition, your LSI uses an isolating power transformer with 4 KV-rated insulation. For absolute protection, do not defeat the ground power plug. This provides powerline grounding of the LSI chassis to provide absolute protection from electrical shock.
4. For continued protection against fire hazard, replace the fuse only with the same type and rating as specified at the fuse holder.

PACKAGING

Save all packaging in a dry place away from fire hazard. Your LSI line stage amplifier is a precision electronic instrument and should be properly cartoned any time shipment is made. You may not have occasion to return your unit to the factory for service, but if that should prove necessary, or other occasion requiring shipment occurs, the original packaging will protect your LSI from unnecessary damage or delay.

Note that your LSI has been shipped with the vacuum tube installed in its proper high-retention socket. You may do likewise if the complete, original packaging is used for shipment.

DESCRIPTION OF CONTROLS

GAIN CONTROL: A high-quality, metal-film segmented control with 31 steps and accurate tracking. Use it to control loudness or volume. Rotation to the left attenuates gain, rotation to the right increases gain. Best sonic performance and best signal-to-noise ratio will result if the input signal and amplifier input sensitivity allow normal listening when GAIN is set between 10 o'clock and 2 o'clock.

Due to the generally high output levels of many compact disc players, the gain in the CD input has been reduced by 10dB. This will allow operation of the gain control closer to its 12 o'clock position for enhanced performance, while leaving all other inputs with normal gain for lower input program sources. If a gain level adjustment needs to be made, please contact your authorized Audio Research dealer for assistance.

BALANCE CONTROL: When rotated, adjusts the relative sound levels of the left and right channels. The 12 o'clock position marks the point of equal balance. Rotating the knob to the right decreases the level of the left channel proportionally, shifting the sonic image to the right. Rotating the knob to the left shifts the sonic image to the left.

MODE CONTROL: Allows selection of various single-channel (mono) and two-channel (stereo) listening modes. Detents mark each selection option during rotation of knob. "Mono" reproduces identical sonic information in both right and left channels. "Reverse" switches left-channel information to the right, right-channel information to the left.

"Stereo" is the normally preferred mode for most program material, producing the most realistic spatial image. "Left" cancels all right-channel information and presents left-channel information to both channels. In the same way, "Right" cancels all left-channel information, etc.

INPUT SELECTOR: Detents mark selection of various source material options: "CD" for compact digital disc players; "Tuner" for AM/FM radio tuners; "Video" for audio input from Beta or VHS videotape players; "Spare 1" and "Spare 2" for any additional high level sources - tape, tuner, CD, video, etc.

The signal source chosen by the Input Selector is fed to the Main and Tape outputs when the Monitor/Source switch is set to "Source," and the Direct/Normal switch is set to "Normal." (See description of Monitor/Source and Direct/Normal switches below.)

POWER SWITCH: Supplies power from AC wall outlet to LSI when in "Power" position. Although not strictly necessary, it is nonetheless good practice to put the LSI in "Mute" before turning on power for maximum protection of your power amplifier(s) and speakers.

MUTE/OPERATE SWITCH: In "Mute" position, shorts the main outputs of the line stage amplifier to allow listening interruptions for telephone answering or other reasons. This switch should always be activated between listening uses or switching of inputs, in addition to turning the Gain (volume) control counter-clockwise. These two simple precautions will prevent inadvertent misuse of your LSI and help protect your power amplifier(s) and speakers from unexpected transient signal pulses. In "Operate" position, this switch allows the signal to pass normally to the outputs.

CAUTION: Do not turn up the gain control beyond normal listening positions when the LSI is in the Mute mode. Always turn the gain control down when changing program sources, even when it is muted. The LSI has an extremely wide dynamic range, and switching to Operate at loud levels may be too much for amplifiers, speakers or ears. Furthermore, at extremely high signal levels in the Mute mode, the LSI may overload internally. This will not harm the LSI, but it may take 10-15 seconds to stabilize from the overload. If you switch to Operate before the LSI has recovered from the overload, you will hear a "pop" when the mute switch is actuated, indicating the presence of unwanted subsonic energy that may damage some amplifiers and poorly-fused speakers, if the LSI is left in Operate. If you hear a "pop," switch immediately back to Mute, turn down the gain control and wait 15 seconds or so and try again. Under normal conditions the LSI muting has no "pops." Subsonic program energy may also cause small, harmless mute "pops." These "pops" may be eliminated by turning down the LSI gain control before muting.

POWER/MUTING CIRCUIT LED: Glows green to indicate unit is on and receiving power from the power supply. Note that for approximately 45 seconds after start-up or in "Mute" mode, this LED will glow more dimly, indicating proper operation of the muting circuit. In the "Operate" mode (after warm-up) the LED brightens and your LSI is ready for normal operation.

DIRECT/NORMAL SWITCH: Allows the use of either the "Direct Gain Path" set of inputs or the "Normal" inputs otherwise found on either the Input Selector or Monitor switch. The "Direct" position provides the highest possible resolution for the high level source (CD player, DAC processor, etc.) routed through it, bypassing the "Balance," "Mode" and "Input Selector" controls. Since the Direct Gain Path inputs are wholly independent from the other inputs and the (tape) Monitor loop, it is not possible to record off the "Direct" inputs (see also "Tape Dubbing Procedure").

MONITOR/SOURCE SWITCH: IN "Monitor" position, this switch "bypasses" the Input Selector and presents the signal to the main outputs from sources (tape recorders., etc.) connected to the "Tape" input jacks on the rear panel. In the "Source" position, the program

CONNECTIONS

INPUT CONNECTORS: All are clearly marked to indicate use. The inputs are 50K ohms impedance, except the CD input is 150K ohms, and the "Direct" input is 100K ohms.

MAIN OUTPUT CONNECTORS: There are two sets of output connectors, which should be connected to your electronic crossover or power amplifier(s).

The input impedance (load) of the power amplifier or electronic crossover to the LSI main outputs should be at least 20K ohms for maximum sonic benefit.

NOTE: At the performance level of the LSI, high-quality audio signal interconnect cables are critical to preserving maximum fidelity. Audio Research RFI-shielded or unshielded interconnect cables are highly recommended for connection to your power amplifier(s) and to other ancillary equipment. See your authorized Audio Research dealer for recommended lengths and prices.

TAPE OUTPUT CONNECTORS: The LSI's Tape Outputs should be connected to your tape deck's "REC" or "LINE" inputs. These outputs supply whatever is selected by the Input Selector Control to the tape deck for recording. Level is non-variable and approximately the same as the selected input source. The "Direct" inputs cannot be routed to the Tape Outputs in any way.

"Hot rodding" the LSI by connecting a power amplifier to the "Tape" outputs instead of the "Main" outputs is not recommended. Sound quality will be degraded somewhat, instead of being enhanced, when routed in this manner.

All input/output connectors have heavy gold plating and connect "ground" before "hot." (On disconnect, "hot is first.")

INSTALLATION INSTRUCTIONS

While the LSI does not dissipate an unusual amount of heat, it is important that it be provided with reasonable airflow to assure long, trouble-free operation. In addition, the following installation guidelines will help insure maximum sonic performance as well as reliable service.

1. Upright and horizontal mounting is suggested if extended operation (longer than one hour) is contemplated.
2. Do not "stack" the LSI on top of a power amplifier: not only could this cause overheating, but "hum" may be introduced into the LSI from the proximity of the amplifier's power transformer.
3. Do not place or operate your LSI on a soft or irregular surface such as a rug. This will prevent proper ventilation.
4. Do not operate your LSI without the top and bottom covers installed. These are required both for safety as well as shielding from interference (except in service operations, obviously).
5. If rack mounting is employed, use Audio Research Rack Mount Ventilators (RMV-3) below and above your LSI.

6. If side-by-side mounting with other equipment is employed, place the LSI to the left of the other chassis, so as to provide maximum spacing between the transformer of the LSI and the other component.

7. In a cabinet or rack-mount installation which has an enclosed back, an exhaust fan is desirable so as not to operate the LSI in overheated ambient air. Operation of vacuum tube equipment for long periods of time in hot ambient air will shorten tube life and increase chance of failure of other component parts.

OPERATING PROCEDURE

START-UP:

1. Make sure Power switch is set of "Off" position; Mute switch should be in "Mute" position; and "Gain" Control should be at minimum (full counter-clockwise rotation).

2. Secure all rear-panel connections between LSI, power amplifier(s) and input sources. Note: Given the advanced performance capabilities of the LSI, it is extremely important that high-quality interconnects be used for connection to ancillary electronics. Audio Research brand interconnects, in either unshielded or RFI-shielded configurations, are strongly recommended. Your authorized Audio Research dealer can assist you in determining optimal lengths for your system.

3. Plug 3-prong powerline cord from rear of LSI into grounded AC wall receptacle.

4. Turn Power switch to "On." Green LED will glow dimly for approximately 45 seconds while power supply stabilizes, indicating operation of automatic muting circuit. After this warm-up muting period, the LED will brighten when "Operate" is selected, indicating that your LSI is ready for operation.

Note: For superior sonic performance, a warm-up period of at least one hour is recommended. In addition, your LSI may be safely left "on" continuously for maximum performance at all times, but at the expense of high maintenance costs (more frequent tube replacement).

5. Rotate input selector to source desired; set switch options to positions desired.

6. Activate input source, then deactivate Mute switch and adjust Gain Control as necessary.

TAPE RECORDING PROCEDURE:

When using the LSI as a control center for recording, the program source to be recorded must be connected to one of the five inputs controlled by the "Input Selector." This routes the selected program to the Tape outputs. (Check to make sure that your tape recorder does not short its inputs when not in the "record" mode. If it does, it may severely load or distort the LSI's output signal.) The "Direct" inputs cannot be routed through the Tape outputs at any time.

When the Monitor/Source switch is set to "Monitor," you can monitor the output of a tape deck during playback. When making a recording with a three head tape deck (and the deck set to "Tape" or "Monitor"), a true "A-B" comparison of signals before and after recording can be compared by switching from "Source" to "Monitor," respectively.

It is possible to dub from one tape deck to another. Simply connect the output from one tape deck to an unused set of inputs controlled by the "Input Selector" (Spare 1 or 2, Video, etc.) on the LSI.

MUTING PROVISIONS:

The LSI has several provisions to help protect against misuse of the exceptional dynamic range and wide bandwidth that it offers. It is not subject to damage itself, but some power amplifiers and speakers are more limited in their ability to withstand signal extremes. These provisions, both manual and automatic, are designed not to interfere with a flawless listening experience of unprecedented realism, while giving reasonable protection against warm-up surges and power line interruptions. However, for absolute protection of associated equipment some operator understanding, and responsibility, is required.

Initial "settling" time of all circuit parameters within the LSI requires approximately 5 to 10 minutes. The automatic muting circuitry timer is adjusted for about 45 seconds. (This is because recurrent interruption "settling" time is much less. You would not want to wait for 5-10 minutes each time such an interruption occurred.)

The Mute/Operate Switch allows manual disabling of the LSI outputs during the switching of equipment. Use of this switch will minimize stress on your amplifier even if it is "off." It is also highly recommended that manual muting be employed during the initial 45 second warm-up period as well as during turn-off for maximum protection.

While it is true that the automatic muting will provide reasonably adequate protection against speaker burnout during these periods, it has limitations. At the 45 second point the automatic timer "releases" the output, and since full subsonic stabilization has not yet occurred, some sonic unpleasantness may occur. Although this is normally adequate protection, utilization of the manual mute provision will completely avoid this stress to your speakers, as well as the associated sonic unpleasantness.

Some solid-state power amplifiers have a DC offset present at their input connections. (This, of course, should not be.) Operation of the manual muting switch with such an amplifier connected will result in a "click" or "pop" in your loudspeaker (commensurate in level with the amount of the offset) each time the switch is activated. Repair or replacement of such amplifiers is suggested.

The automatic muting operates as follows:

1. The manual mute switch always disables both "main" outputs and overrides any automatic provisions, even when the LSI is turned off. (The "Operate" position of the manual mute switch is functional only when the unit is not in the automatic mute mode.)
2. The 45 second warm-up timer will restart automatically and the LED will dim if the power is temporarily interrupted for 0.1 second or more. Note: Power supply regulation of the LSI is effective down to 100VAC without serious sonic degradation.
3. The automatic muting of the LSI is designed to be effective only against power line interruptions and power line failures. It will not mute against subsonic signal transmissions from your input source. Proper fusing of speakers is essential to protect against excessive audio level or power amplifier faults.

SHUT-DOWN:

1. Set "Mute" switch to "mute" position.
2. Rotate "Gain" control counter-clockwise to minimum setting.
3. Deactivate power amplifier(s).
4. Deactivate all input sources.
5. Set LSI Power Switch to "Off" position.

REDUCING GAIN

When using the LSI with very high-output sources or high-sensitivity power amplifiers or high-efficiency speakers, you may find that you typically set the LSI Gain control at 9-11 o'clock, where the detented gain increments may be too large for setting the desired listening volume. For more precise setting of the desired listening level, the LSI includes a simple internal provision to reduce the gain of the line section by 6dB. This affects all signal sources, when using the normal Main Output jacks. The signal level at the Recorder Output jacks is unaffected. Note: the CD input of the LSI has a built-in gain reduction of 10dB. Other line inputs have normal gain. To reduce the gain by 6dB, merely remove the bottom cover and unsolder the gain change connection for each channel. These connections are located in the central area of the bottom of the main circuit board near V2, where the pads identified by the letter "A" connect to the large central ground path.

To restore the LSI to its original gain, merely resolder across these small gaps at "A." For best results use special alloy solder. Please consult your authorized Audio Research dealer before performing any modifications.

SERVICING

Because of its careful design and exacting standards of manufacture, your LSI should normally require only minimal routine service to maintain its high level of performance.

CAUTION: Your LSI contains sufficient levels of voltage and current to be lethal. Do not tamper with a component or part inside the unit. Refer any needed service to your authorized Audio Research dealer or other qualified technician.

The vacuum tube inside your LSI is a quality 6DJ8 type, and with normal use should not need to be changed for approximately 5,000 to 10,000 hours of use. Replacement 6DJ8 tubes need not be low-noise or matched for gain characteristics, and are available from Audio Research.

At the back of the Manual you will find a schematic diagram for your LSI which is fully annotated with operating voltages and component part values. Your service technician will require this information when servicing your unit.

CLEANING

To maintain the visual appearance of your LSI line stage amplifier, occasionally wipe the front panel and top cover surfaces with a soft, damp (not wet) cloth to remove dust. A mild, non-alkaline soap solution may be used to remove fingerprints or similar smudges. Cleaners containing abrasives should not be used as they will damage the "brushed" grain of the front panel finish.

3-YEAR LIMITED WARRANTY TERMS AND CONDITIONS

1. **LIMITED WARRANTY.** Audio Research warrants the product designated herein to be free of manufacturing defects in material and workmanship, subject to the conditions hereinafter set forth, for a period of three (3) years from the date of purchase by the original purchaser or no later than five (5) years from the date of shipment to the authorized Audio Research dealer, whichever comes first, excepting vacuum tubes which are warranted for 90 days only (See 6).
2. **CONDITIONS.** This Warranty is subject to the following conditions and limitations. The Warranty is void and inapplicable if the product has been used or handled other than in accordance with the instructions in the owner's manual, abused or misused, damaged by accident or neglect or in being transported, or the defect is due to the product being repaired or tampered with by anyone other than Audio Research or an authorized Audio Research repair center. The product must be packed and returned to Audio Research or an authorized Audio Research repair center by the customer at his or her sole expense. Audio Research will pay return freight of its choice. A RETURNED PRODUCT MUST BE ACCOMPANIED BY A WRITTEN DESCRIPTION OF THE DEFECT AND A PHOTOCOPY OF THE ORIGINAL PURCHASE RECEIPT. This receipt must clearly list model and serial number, the date of purchase, the name and address of the purchaser and authorized dealer and the price paid by the purchaser. Audio Research reserves the right to modify the design of any product without obligation to purchasers of previously manufactured products and to change the prices or specifications of any product without notice or obligation to any person.
3. **REMEDY.** In the event the above product fails to meet the above Warranty and the above conditions have been met, the purchaser's sole remedy under this Limited Warranty shall be to return the product to Audio Research or an authorized Audio Research repair center where the defect will be rectified without charge for parts or labor, except vacuum tubes (See 6).
4. **LIMITED TO ORIGINAL PURCHASER.** This Warranty is for the sole benefit of the original purchaser of the covered product and shall not be transferred to a subsequent purchaser of the product.
5. **DURATION OF WARRANTY.** This Warranty expires on the third anniversary of the date of purchase or no later than the fifth anniversary of the date of shipment to the authorized Audio Research dealer, whichever comes first.
6. **VACUUM TUBES.** Vacuum tubes are warranted for the original 90-day period only.
7. **DEMONSTRATION EQUIPMENT.** Equipment used by an authorized dealer for demonstration purposes is warranted to be free of manufacturing defects in materials and workmanship for a period of three (3) years from the date of shipment to the dealer. Vacuum tubes are warranted for 90 days. Demo equipment needing warranty service must be packed and returned to Audio Research by the dealer at his sole expense. Audio Research will pay return freight of its choice. A returned product must be accompanied by a written description of the defect on an AUDIO RESEARCH RETURNED GOODS AUTHORIZATION form. Dealer-owned demonstration equipment sold at retail within three (3) years of date of shipment to the dealer is warranted to the first retail customer to be free of manufacturing defects in materials and workmanship for the duration of the 3-Year Limited Warranty remaining (as measured from the date of shipment of the equipment to the dealer). Vacuum tubes are not warranted for any period under these conditions of sale. In the event warranty service is needed under these conditions,

the owner of the equipment must provide a copy of his purchase receipt, fulfilling the requirements described under "2. Conditions" above. The product must be packed and returned to Audio Research or an authorized Audio Research repair center by the customer at his or her sole expense. Audio Research will pay return freight of its choice.

8. MISCELLANEOUS. ANY IMPLIED WARRANTIES RELATING TO THE ABOVE PRODUCT SHALL BE LIMITED TO THE DURATION OF THIS WARRANTY. THE WARRANTY DOES NOT EXTEND TO ANY INCIDENTAL OR CONSEQUENTIAL COSTS OR DAMAGES TO THE PURCHASER. Some states do not allow limitations on how long an implied warranty lasts or an exclusion or limitation of incidental or consequential damages, so the above limitations or exclusions may not apply to you. This Warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

9. WARRANTOR. Inquiries regarding the above Limited Warranty may be sent to the following address:

Audio Research Corporation
6801 Shingle Creek Parkway
Minneapolis, MN 55430

WARRANTY OUTSIDE THE USA

Audio Research has formal distribution in many of the countries of the free world. In each country the Audio Research Importer has contractually accepted the responsibility for product warranty. Warranty should normally be obtained from the importing dealer or distributor from whom you obtain your product.

In the unlikely event of service need beyond the capability of the Importer, Audio Research does, of course, back up the warranty. Such product would need to be returned to Audio Research, together with a photostatic copy of the bill of sale.

LS1 LINE STAGE AMPLIFIER SPECIFICATIONS

Frequency Response:

± 0.5 dB, 5Hz to 50kHz
-3dB points below 1Hz and above 200kHz

Distortion:

Less than .01% at 2V RMS output. (Typically less than .005% in midband)

Gain:

Direct input to main output:	21dB	High level inputs to tape output:	0dB
CD input to main output:	11dB	High level inputs to main output:	21dB

Input Impedance:

50K ohms (150K ohms CD, 100K ohms Direct)

Output Impedance:

250 ohms main output. Recommended load 60K ohms and 100pF. (20K ohms minimum and 1000pF maximum)

Maximum Input:

20V maximum.

Rated Outputs:

2V RMS 5Hz to 50kHz, all outputs, 60K ohm load (main output capability is 50V RMS output at 1/2% THD at 1kHz into a 100K ohm load with 5V RMS input)

Power Supplies:

Electronically-regulated low and high voltage supplies.
Shielded toroid transformer. Line regulation better than .01%

Noise:

- (1) 70uV RMS maximum residual unweighted wideband noise at main output with gain control minimum (98dB below 5V RMS output)
- (2) More than 100dB below 1V RMS input (less than 7uV equivalent input noise)

Tube Complement:

1 - 6DJ8/ECC88 dual triode
(Hybrid FET/Tube audio circuit, solid-state power supply)

Power Requirements:

100-135VAC 60Hz (200-270VAC 50/60Hz) 50 Watts maximum

Dimensions:

19" (48 cm) W x 5 1/4" (13.4 cm) H (standard rack panel) x 10 1/4" (26 cm) D.
Handles extend 1 5/8" (4.1 cm) forward of front panel. Rear chassis fittings extend 7/8" (2.3 cm)

Weight:

12 lbs. (5.5 kg) Net; 21 lbs. (9.5 kg) Shipping