

audio research

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SP6C PREAMPLIFIER

OWNER'S MANUAL

SCHEMATIC
7/1/81

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Congratulations on your purchase! You have what is widely recognized to be the finest stereo preamplifier ever offered for the reproduction of music.

SP-6C DISCUSSION

With the introduction of power amplifiers such as the D60, D79B, D90 and D120, and the availability of a number of brands of high performance recordings, pickups and speaker systems, the need for a new and higher level of preamplifier for the best systems has occurred.

After a significant amount of research and study we have determined that from performance and cost-effectiveness standpoints once again, the vacuum tube must be used.

We then felt that if such a project were to be undertaken, it would be desirable to execute it to the highest standards reasonable, recognizing that in all probability it would be the last significant vacuum tube preamp offered to the music world.

One of the expensive (and little recognized) requirements for such a concept would be power supplies capable of providing isolating regulated voltages for the various circuit sections. This has been accomplished in the SP-6C by utilizing highly stable, electronically regulated solid-state power supplies.

With such a power supply available it now becomes possible to increase the bandwidth of an AC coupled vacuum tube design without compromising the all-important circuit stability. We have done this, drawing upon the SP-3 basic circuit design. Increased interstage time constants, larger and sonically selected output coupling capacitors and "DC concept" feedback circuit innovations, all combine with the new power supply to provide a new standard of sound reproduction.

For best results, only high quality turntables with stable pickup arms and cartridges should be used with this preamplifier.

We suggest that the SP-6C preamplifier will provide state-of-the-art reference well into the '80s. We further suggest that inclusion of this unit in any otherwise good music reproducing system will effect more improvement than any other single component change.

For further discussion of performance and system requirements we encourage you to see your Audio Research dealer.

SP-6C INSTRUCTIONS

The front panel has a total of 4 controls and 4 switches:

GAIN: This controls volume or loudness, and is a special metal film segmented control with approximately 2dB steps and accurate tracking. Although useable results can be obtained with settings anywhere in the operating range, more convenient control, best sound quality and signal-to-noise ratio will be obtained if the input signal levels and amplifier input sensitivity allow normal listening to occur in the 11 o'clock to 2 o'clock range of the volume control.

In the case of some high efficiency speakers (such as Klipschorn, etc.) and/or high output cartridges it may be found with some high gain amplifiers (that do not have an input volume control) that normal listening will occur with the gain control just barely on, or up to the 9 o'clock position. If this proves to be the case, move the gain range switch on the rear chassis panel to the "low" gain setting. This will reduce the overall gain by 6dB and allow better use of the front panel gain control.

BALANCE: A conventional stereo control. Moves the sound from left to right or vice versa when rotated. Normally should remain centered.

MODE: Also a conventional stereo control. Allows operation as indicated.

INPUT SELECTOR: Chooses between various possible source material for listening choice.

The "phono" input is an RIAA compensated high gain input for use with most magnetic cartridges. The input is 50K ohms, with very low (40 pF) input capacitance. If your cartridge needs more capacitance, there is built-in provision to add whatever is required. Contact your dealer or our Customer Service Department if you need help with this.

PRE-AMP ON SWITCH AND INDICATOR: Turns the unit on in the up position, and the associated green LED will light up indicating that power is reaching the unit. During the 2 minute warmup period the green LED will blink slowly, indicating that the output is muted.

OUTLETS ON: Turns the power receptacles on the rear chassis panel on in the up position, and the associated LED will light up indicating that they are on. This switch is specifically provided to allow the amplifier to be turned on after the preamplifier is "warmed up." A vacuum tube device requires up to several minutes to fully stabilize its operating parameters. Power amplifiers should be turned off with the outlet switch before the SP-6C is turned off to avoid turn-off thumps. The SP-6C mutes just after turn-off to minimize any excessive output surges.

MUTE OPERATE SWITCH: Shorts the output of the preamplifier for the warmup (and cooldown) period. Also, to allow changing records (and maintaining a previous gain setting), answering the telephone and the like.

INPUT MONITOR: Primarily aimed for use with tape recorders, but may be used with any line level signal source where bypassing the input selector is desirable.

The rear panel has one switch, 4 power receptacles, a fuse holder, a ground terminal, 4 output jacks, 12 input jacks and a pair of banana jacks:

RECEPTACLES: There is one unswitched outlet which may be used for a turntable, or the like, where switching is not needed or wanted. There are 3 outlets, relay controlled, capable of providing power to large amplifiers and the like. Incidentally, the "click" you hear internally when activating the receptacle switch is the relay operating. (The line cord is a 3 conductor, #14 guage, providing ample safe grounded power to these 3 outlets.)

It should be noted that the SP-6C line cord grounds the convenience outlet grounds only. The preamplifier chassis is not connected to the line cord ground in order to minimize system ground loops.

FUSE: Always use the same size and type as indicated on the rear of the chassis for safety. For best results use Buss MDL or MDX fuses.

GAIN SWITCH: See discussion under "Gain" on Pages 1 and 2. Note that this switch must be locked in place when unit is operating.

OUTPUT CONNECTORS:

Main outputs should be connected to your power amplifier inputs.

Tape outputs should be connected to your tape recorder AUX inputs.

INPUT CONNECTORS: These are all clearly marked and are all 50K ohms.

GROUND TERMINAL: To be used for "grounding" associated input equipment, such as tonearms, turntables and the like. Should not be connected to tape recorders and/or amplifiers.

"CHASSIS" AND "B-" BANANA JACKS: Special emphasis has been placed in the design of this product to reduce and/or eliminate "hum," "TVI," "RFI" and "CB" type interferences.

For normal use a jumper MUST be placed between these connectors. Otherwise, severe hum and/or oscillation will occur.

(Special off-chassis construction is employed to accomplish these interference reduction methods, and this connection is the only one from the "common" or "B-" circuit to the chassis so that it can act as a shield to outside interferences.)

For rack cabinet mounting, when ground connections are used (via inputs/outputs), this jumper may be removed to allow only one shield ground path, thereby eliminating what is known as "ground-loop" induced hum. Note that this may or may not necessarily be helpful in a given system.

If your SP-6C is ever removed from the rack, be sure to remember that a jumper must be reinstalled.

Discussion, feature and specification sheets are also included herewith to provide you with additional information you may want or need.

A schematic diagram, complete with voltages, references, values, etc., is also included. These three items should provide all the basic information you will need.

SERVICING

First of all, a very serious caution: This unit contains over 500 volts of DC, with sufficient voltage and current available to be lethal. So, please, do not poke around inside the unit. Refer any needed service to a qualified technician. (Even with the unit turned off, a charge remains in the energy storage filter for some time.)

Basically, this unit is constructed to the highest commercial standards and should require a very minimum amount of service over the years.

The vacuum tubes furnished with your SP-6C are long life industrial reference tubes, and will not have to be changed for several thousand hours of use. Even these tubes can fail, however, and the following service hints are offered:

If excessive noise should develop in the phono section only, it is most likely V1.

If degraded sound should occur in the phone section only, it is most likely V2.

V3 is not normally critical, although occasionally excessive hum can be caused by failure of this tube.

If excessive noise develops in the high level section (ie, inputs other than phono), it is most likely V4.

If degraded sound develops in the high level section, it is most likely V5.

V6 is also not normally critical, although it also can introduce hum.

If tube changing is to be done, the unit should be disconnected from the amplifier and turned off while the change is made.

BIAS ADJUSTMENTS (Refer to Schematic Diagram)

These adjustments are for best linearity to match individual tube characteristics. Readjust only if V1, V2, V4 or V5 are changed, or after at least 1000 hours of operation.

Allow 1 hour warmup prior to adjustments. Some selection of tubes may be needed to achieve low distortion.

Phono Section: Adjust TP-1, TP-2 for minimum 2nd harmonic distortion at 2V RMS 1 kHz at tape output jacks, from phono input. (Typical .0002% to .0008%.) Use "phono" position of SP-6C input selector switch.

Line Section: Adjust TP-3, TP-4 for minimum 2nd harmonic distortion at 2V RMS 1 kHz at main output jacks, from tape input. (Typical .0002% to .0008%.) Short C25 and C26 to disable auto-mute for this test. Use "tape" position of SP-6C input selector switch.

If an ultra-low distortion oscillator, distortion meter and selective wave analyzer are not available, adjust TP-1, TP-2 for approximately 160V DC at V3 cathodes, and adjust TP-3, TP-4 for approximately 165V DC at V6 cathodes. Allow up to 60 seconds for V6 voltages to stabilize after each adjustment.

If V1, V2, V4 and V5 are not ARC "India" ECC83 tubes, adjust to 150V DC for V3 and 155V DC for V6.

CAUTION: Do not trim for these DC voltages if the pots have been recently optimized for low distortion. DC voltages may vary ± 10 volts on some tubes at lowest distortion.

DISCUSSION OF SP-6C MUTING PROVISIONS

The SP-6C has 5 provisions to guard against possible misuse of the exceptional dynamic range and wide bandwidth that it offers. The SP-6C 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 to give a flawless listening experience with unprecedented realism, while giving protection against operator error or other improper conditions beyond the operator's control.

1. OUTLET SWITCH to allow the power amplifier to be off during warmup or shutdown of the SP-6C. A minimum of 5 minutes warmup time is recommended to insure optimum performance.

2. MUTE/OPERATE SWITCH to manually disable the SP-6C outputs during any moving of the tone arm or switching of equipment. This will minimize stress on your power amplifier even when it is off.

3. AUTOMATIC MUTING of the SP-6C outputs to sense and limit unwanted subsonic output, without restricting the useable dynamic range for program material. These unwanted signals could result from:

- A. Severe power line disturbances or poor wall receptacles.
- B. Disconnecting input cables, or bad cables.
- C. Failure to use the manual mute switch when moving a tone arm or when switching equipment.
- D. Driving the preamp momentarily into clipping, such as by connecting a line level program source into the phono input.
- E. Residual subsonic output from pre-preamps, tuners or other signal sources.
- F. Servicing procedures such as tube changing or tube defects.

4. WARMUP TIMER that mutes the SP-6C outputs for 2 minutes after the power switch is turned "ON," to ensure complete circuit stabilization to well within the limits of the automatic muting threshold, before the outputs come "ON."

5. IMPROVED POWER SUPPLY to tolerate power line disturbances or "brown-outs" down to 100VAC or less, without degradation of circuit performance.

The automatic muting operates as follows:

1. The main pilot lamp slowly blinks between dim and bright at about 1/2 second in each state to indicate that the outputs are automatically disabled by either the warmup timer or the output "fault sensors." This visual indication occurs independent of the position of the manual mute switch so you will know if the SP-6C is ready to perform before the mute switch is set to "Operate."

2. The manual mute switch always disables both outputs and overrides any automatic provisions, even when the SP-6C is turned off. There is no visual indication of manual mute condition other than the position of the switch handle. (The "Operate" position of the manual mute switch is functional only after the unit is no longer in automatic mute mode.)

3. The main outputs of both channels are switched off and on simultaneously even if an unwanted signal is sensed in only one channel. The tape outputs are not muted.

4. The 2-minute warmup timer will restart automatically if the power is temporarily interrupted for 0.2 seconds or more, which is sufficient time to disturb the heater temperature in the tubes.

5. Automatic output sensing thresholds are designed to limit both amplitude and duration of unwanted subsonic signals, so that heating effects in power amplifiers or speakers are kept well within safe limits. High amplitude disturbances are muted much more quickly than those of lower amplitude. Slowly changing disturbances of \pm one volt at the SP-6C output are muted in about 1 second, and 2 volt signals in less than .5 seconds, etc. Large surges are muted in less than .05 seconds. Disturbances of less than \pm 0.3 volts are not muted at all.

6. The automatic output sensors detect only "silent" subsonic energy below 1Hz, and they do not sense excessive output in the normal audio or ultrasonic spectrum that could damage speakers. Proper fusing of speakers is essential to protect against excessive audio level or power amplifier faults.

7. Assymetrical program wavefronts or single "DC step" signals are not muted regardless of duration if they are one volt or less in amplitude at the SP-6C outputs. The gradual decay of these signals due to the .05Hz low frequency limit of the amplifier presents a sufficiently low average level during the sensor's one second time constant to prevent reaching the .3V threshold at the output sensors. Very short assymetrical transients of as high as 60 volts are unmuted.

8. The muting is accomplished without clicks by "soft-switching" photocouplers, with pure resistive photoconductive elements. Series-shunt switching is used to provide better than 100dB of signal attenuation during muting. No electrical contacts or moving parts are used in the audio path to insure no degradation of sonic performance. All photocoupler lamps are light-emitting diodes to provide essentially infinite service life.

9. Qualified service personnel may wish to disable the warmup muting and output sensor muting for testing purposes. This may be done by desoldering jumper J16 near the mute switch. Manual mute is still operational.

SUMMARY OF SP-6C FEATURES

As expected with a product of this caliber, the SP-6C offers many outstanding features to the audiophile perfectionist.

AUTOMATIC MUTING: A two minute warmup timer insures muting of undesirable subsonic output during circuit stabilization. Continuous protection against unwanted DC output due to any cause is provided by four output sensors that automatically mute both main outputs. No troublesome relays or electrical contacts are used. A blinking front panel LED provides a visual indication when the automatic mute is activated.

MANUAL MUTING: A front panel mute switch is included for repeat settings, interruptions, etc.

HIGH ACCURACY, CLOSE TRACKING, SEGMENTED GAIN CONTROL: A metal-film stereo volume control assures trouble free, close tracking volume selection in 2dB steps (guaranteed 1.5dB tracking, .5dB typical).

DISTORTION - NULL ADJUSTMENTS: Four internal trim-pots allow for optimizing circuit linearity for individual tube characteristics, both initially and throughout tube life.

SELECTABLE GAIN "RANGE" SWITCH: A rear panel switch allows for better gain matching of high efficiency loudspeakers, high output cartridges, transformers, etc.

SEPARATE FRONT PANEL POWER RECEPTACLE SWITCH: A front panel switch operates 3 relay-controlled outlets with a 1600 watt capacity for power amplifiers and other outboard devices.

SPECIAL OFF-CHASSIS CONSTRUCTION: The special isolated ground construction floats all inputs and outputs from the chassis. Special rejection filters are also included to minimize or eliminate RFI, TVI and CB interference.

SONICALLY SELECTED COMPONENTS: Exclusive use of long life industrial grade tubes, special metal film resistors and multiple shunt capacitors provide optimum sonic accuracy.

OTHER FEATURES INCLUDE: A rear panel provision for disconnecting the common ground from the chassis so that rack mount installations may be accomplished without ground loop induced hum. Front and rear panels are of two-color anodized aluminum construction for permanent finish and lettering. Industrial grade components and construction are used for long service life.

This unit is offered with a limited warranty as follows:

1. 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. To obtain this Warranty, THE ORIGINAL PURCHASER MUST MAIL TO AUDIO RESEARCH WITHIN THIRTY (30) DAYS OF THE DATE OF PURCHASE THIS WARRANTY REGISTRATION FORM COMPLETED, DATED, AND SIGNED BY BOTH THE PURCHASER AND THE SELLING DEALER TOGETHER WITH A COPY OF THE BILL OF SALE OR OTHER PROOF OF PURCHASE OF THE PRODUCT. Audio Research will then validate the Warranty and return the validated Warranty to the purchaser.

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. A RETURNED PRODUCT MUST BE ACCOMPANIED BY A WRITTEN DESCRIPTION OF THE DEFECT AND A PHOTOCOPY OF THIS VALIDATED WARRANTY. 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 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 7 below).

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. During the first ninety (90) day period following the date of purchase by the original purchaser, the Audio Research Limited 90-Day Warranty supersedes this Warranty.

6. Vacuum Tubes. Vacuum tubes and replacement thereof are warranted for the original 90-day period only.

7. 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.

SP-6C SPECIFICATIONS (AC line set @120V 60Hz for these specifications)

Frequency Response:

High level section: ± 0.25 dB, 5Hz to 30Hz
-3dB points below 1Hz and above 100kHz

Magnetic phono: ± 0.25 dB of RIAA, 30Hz to 40kHz

Harmonic Distortion:

Less than .01% at 2V RMS output, 20Hz to 20kHz (Typically less than .0002% in midband)

Intermodulation Distortion:

Less than .002% at 2V RMS output

Gain:

Magnetic phono input to tape output: 34dB

High level inputs to tape output: 0dB

Magnetic phono input to main output: 60dB

High level inputs to main output: 26dB

Input Impedance:

50K ohms, all inputs (Magnetic phono may have any value from 10 ohms to 100K ohms substituted. Also has provision to add to the 40pF input capacitance for matching certain magnetic cartridges.)

Output Impedance:

1000 ohms main output and tape output. Recommended minimum load for maximum audio quality 20K ohms and .001 μ F maximum capacitance.

Maximum Inputs:

Magnetic phono, 900mV at 1kHz. (3.5V RMS, 10kHz) High level inputs essentially overload-proof.

Rated Outputs:

2V RMS 5Hz to 30kHz, all outputs; 60K ohm load (main output capability is 60V RMS output at 1/2% THD at 1kHz into a 100K ohm load with 3V RMS high level input)

Power Supplies:

Electronically-regulated solid-state supplies. Frequency-compensated high-voltage supplies have a total equivalent low-frequency stability of greater than 1 farad of capacitance. Line regulation better than .001%.

Noise:

High Level:

(1) 250 μ V RMS maximum residual unweighted wide band noise at main output with gain control minimum (86dB below 5V RMS output)

(2) More than 90dB below 1V RMS input (less than 20 μ V equivalent input noise)

Magnetic Phono:

5 μ V equivalent input noise, wideband RMS (-66dB reference 10mV input)

(Approximately 1 μ V above 200Hz or -80dB reference 10mV input)

Tube Complement:

2 - reference grade 6DJ8 or equivalent dual triodes

4 - reference grade E83CC or equivalent dual triodes

Power Requirements:

100-125VAC 60Hz (190-240VAC 50Hz) 50 Watts

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:

22 lbs. (10 kg Net, 30 lbs. (13.75 kg) Shipping