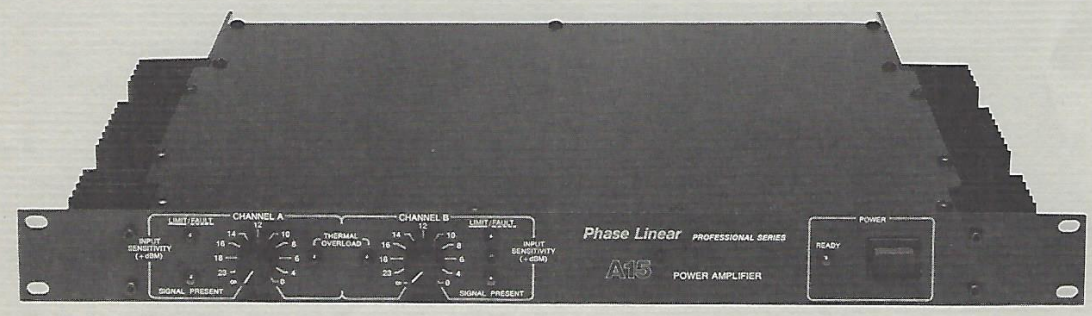
A15 POWER AMPLIFIER

OWNER'S MANUAL



Phase Linear ***PROFESSIONAL SERIES***

INTRODUCTION

Welcome to the realm of Phase Linear professional high-fidelity sound reinforcement.

We are very proud of the Model A15 Power Amplifier and are confident that you will be just as proud of its outstanding performance and reliability. To insure the maximum performance and long life of your Model A15, we urge you to thoroughly read the following manual.

The Model A15 represents a new dimension in single rack space amplifier design. Two separate precision variable slope limiters built into the A15 provide 15dB of overload protection beyond the rated power output level which is equivalent to over 2,000 watts per channel of clipping headroom. This allows the application of this compact amplifier as a compression driver amp in a bi- or tri-amped system with virtually no danger of hazardous clipping and subsequent voice coil damage. In addition, the A15 makes a perfect stage monitor amplifier, since the limiter allows significant reduction of acoustic feedback by surpressing peaks which are commonly a source of feedback.

The output circuitry of each channel incorporates two 250 watt power transistors providing a power handling capability of 500 watts per channel. The entire amplifier operates in a complementary configuration which exhibits excellent linearity and long term reliability. An efficient heatsink provides more than adequate cooling capability for loads down to 4 ohms.

Your A15 is equipped with overload protection systems designed to insure safe and reliable operation. If the amplifier is accidentally connected to a short circuit or a very low impedance load, a precision electronic protection system instantaneously prevents the output amplifiers from being damaged.

Output from the A15 to the loudspeaker is controlled by an electronically activated relay. For approximately 5 seconds after turn-on and immediately after turn-off, the speakers are disconnected from the amplifier to prevent any switching transients applied to the inputs of the amplifer from being passed on to the speakers. The relay activation system will also detect the presence of any DC output voltage or unusually large subsonic signals and automatically prevent such potentially dangerous energy from reaching the speakers. Audio frequencies will not cause the relays to open.

Before leaving the factory, your Phase Linear A15 Power Amplifier was tested and certified to be in perfect operating condition and to meet or exceed all of its published specifications. This manual will assist you in the proper operation of the A15 as well as supply information on keeping it in perfect condition. With the same care befitting all fine instruments, your A15 will provide many years of high quality sound reinforcement.

CONTENTS

INTRODUCTION 1

CONTENTS 2

PANEL FUNCTIONS 3

INSTALLATION 5

OPERATING INSTRUCTIONS 7

TECHNICAL INFORMATION 9

MAINTENANCE AND SERVICE 11

SPECIFICATIONS 12

PANEL FUNCTIONS

FRONT PANEL DESCRIPTION

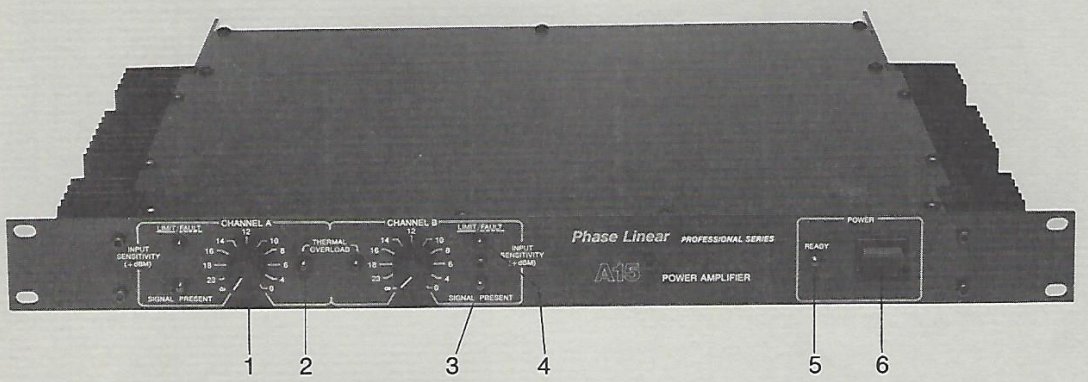


Illustration 1

1. **INPUT SENSITIVITY CONTROL:** Attenuators for each channel allow the input sensitivity of the A15 to be matched for optimum performance to any source input. These attenuators are calibrated in "dBm" required at the input for full output. For example, when the attenuator is set at 0 dBm, an output from the mixing board or electronic crossover of .775 volts will result in 65 watts output.
2. **THERMAL OVERLOAD INDICATOR:** This red LED will light any time the temperature of the heatsink exceeds its thermal limit. All incoming signals will be muted during the overload condition (for as long as the thermal overload indicator is lit) allowing the amplifier to cool. When the amplifier has cooled sufficiently, full gain will be restored and the thermal overload indicator will extinguish.
3. **SIGNAL PRESENT INDICATOR:** A green LED which lights whenever audio signals are present at the amplifier's output.
4. **LIMIT/FAULT INDICATOR:** A dual function red LED is used to indicate limiter operation *or* a fault condition. The LED will light in a *steady* fashion any time the limiter is operating; it will *flash* whenever there is a fault condition. A fault condition overrides limiter indication. Refer to OPERATING INSTRUCTIONS section for further details.
5. **READY INDICATOR:** This green LED will light up approximately five (5) seconds after the power switch is turned on to indicate that the output relay is closed and the amplfier is ready for operation.
6. **POWER SWITCH:** Allows independent switching of the amplifier.

REAR PANEL DESCRIPTION

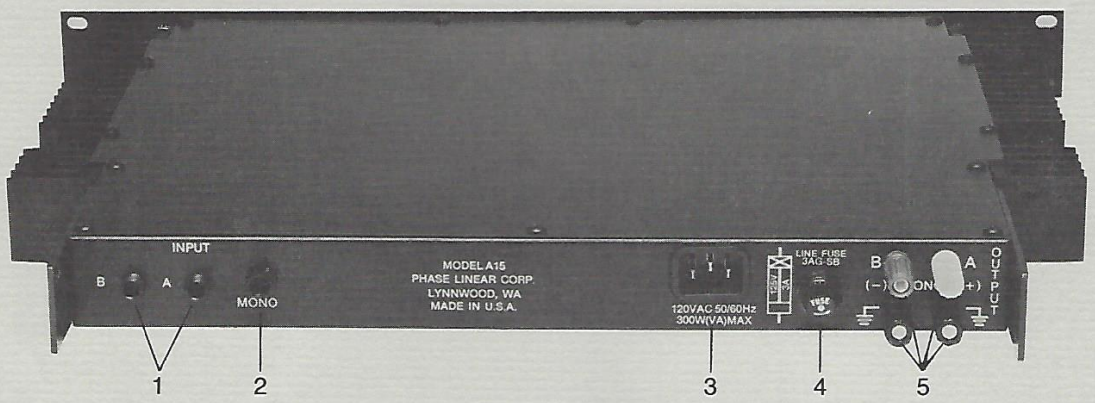


Illustration 2

1. **STEREO INPUTS:** These inputs will accept standard 1/4" phone plugs carrying line level balanced *or* unbalanced signals. Plugging in a *three conductor* phone jack allows balanced operation, while plugging in a *two conductor* phone jack *automatically* switches the system to unbalanced operation.
2. **MONO (Bridged) INPUT:** Inserting an input plug into the MONO input *automatically* places the amplifier in its bridged mode. (See Mono Operation in the TECHNICAL INFORMATION section for further details.)
3. **POWER CORD:** Power is supplied to the A15 via the detachable line cord supplied with the amplifier. The line cord is of the three conductor variety, the third prong being a safety ground. **(CAUTION: Do not cut the third grounding prong from the plug.)**
4. **LINE FUSE:** Fuseholder for the primary fuse of the transformer; required to ensure the transformer does not exceed its safe operating limits.
5. **OUTPUT TERMINALS:** For stereo operation, connect each speaker line so that the positive terminal of the speaker is connected to the positive terminal of the amplifier (red, white) and the common or ground of the speaker is connected to the black or ground terminal of the amplifier. For mono (bridged) operation, connect the plus terminal of the speaker to Channel A positive terminal (white) and the common or ground terminal of the speaker to the positive (red) terminal of Channel B.

INSTALLATION

POWER CONNECTION

Power is supplied to the A15 via the detachable line cord supplied with the unit. The line cord is of the three conductor variety, the third prong being a safety ground. If an extension cord is required, be sure to use the heavy-duty variety (16 gauge or larger) and keep the length short to prevent power loss. CAUTION: Be sure the amplifier is plugged into the proper power source. Operation of a 120 volt version on a 240 volt line will cause certain damage. For voltage conversion, refer to service manual or contact an authorized dealer or the factory.

GROUNDING

Input and output grounds are internally connected to the chassis of the A15 in such a fashion (inputs grounded; outputs floating) to minimize the possible ground loops that result in hum when units are rack mounted. Grounding of the power amplifier to the preceding line level components is accomplished through the shielded input cable. No further grounding of the A15 should be necessary.

VENTILATION

The A15 Power Amplifier requires a generous supply of cooling air to dissipate the relatively large amounts of heat generated by any power amplifier. The amplifier must be installed allowing unrestricted ventilation with adequate clearance for the heatsinks to breathe. In rack installations involving several high power amplifiers or other equipment which restricts normal convection air flow through the rack, forced air ventilation must be provided by the installation of an exhaust fan in the rack to provide a minimum of 60 cubic feet per minute air exchange to avoid overheating of all the equipment in the rack.

INPUT/OUTPUT CONNECTIONS

Stereo Operation: To connect the input of the A15 to a line source, such as a mixer or electronic crossover, always use shielded wire with 1/4″ phone plugs – ground being applied to the sleeve and positive signal connected to the tip and negative signal connected to the ring for balanced or positive to the tip only for unbalanced operation. The inputs to the A15 are either balanced or unbalanced high impedance (20k ohms). For balanced systems use *stereo* phone jacks and for unbalanced systems use *mono* phone jacks. The switching is done automatically.

Low impedance speaker wires should be connected between the A15 and the speakers. A large wire gauge is necessary to handle the potentially high output current of the amplifier and not reduce the damping factor significantly. Sixteen-gauge wire or larger is recommended for this purpose.

Care should be taken to insure all speaker connections are made properly. Dual banana plugs are recommended to minimize the chance of short circuiting the output of the amplifier.

CAUTION: NEVER CONNECT THE OUTPUTS OF THE TWO CHANNELS TOGETHER OR WITH ANOTHER AMPLIFIER'S OUTPUT AS THIS WILL LEAD TO POSSIBLE AMPLIFIER DAMAGE. BE CERTAIN THAT THE POWER IS OFF WHEN HOOKING UP ANY SPEAKERS TO THE AMPLIFIER.

Correct phasing of the speakers should be maintained when connecting them to the amplifier. If the speakers are connected out of phase, sound cancellations will occur at some frequencies. Proper phasing can be assured by connecting the "Hot" and "Common" terminals of the amplifier to the corresponding terminals on the speakers.

Mono (Bridged) Operation: The mono or bridged mode of the A15 allows the amplifier to deliver 190 watts power capability into a single speaker load of 8 ohms connected across the hot terminals of Channel A and B. Should mono operations be desired, one cable carrying the desired audio should be connected to the mono input which will *automatically place the amplifier in the bridged mode.* The input sensitivity is then controlled for both halves of the mono output signal by *Channel A level control only.* The speaker is connected between the plus terminal of Channel A, and the plus terminal of Channel B. *Do not make any connection to the minus or ground terminals when the A15 is in mono operation.* Note: If the speakers are connected in the mono configuration and signal is improperly applied to the Channel A or B inputs and not the mono input, no damage will occur but the silence will be obvious.

OPERATING INSTRUCTIONS

INITIAL USE

Before turning the A15 on for the first time, double check to see that all connections are made according to the "Installation" section. The A15 may be switched on by means of the Power switch located on the front panel. The Limiter/Fault LED's may flash very briefly as the power comes on, however they should not remain on. Power on indication is provided by the green "Ready" LED which will illuminate only after the five second period has elapsed during which the amplifier's output relay is open. If, at any time while the amplifier is being operated the output relay should open, the ready light will extinguish to indicate the amplifier's refusal to pass inappropriate signals on to the speakers.

INPUT SENSITIVITY CONTROLS

The input attenuators are calibrated in dBm – 0dBm being the most sensitive position. At this fully clockwise position, an input level of .775 VRMS (0dBm) will result in an output voltage of 22.8 VRMS. This is the voltage required to produce 65 watts in an 8 ohm load. The counter-clockwise positions of the attenuators reduce the input sensitivity by the indicated amounts.

SIGNAL PRESENT INDICATORS

The Signal Present LED's monitor the output of each amplifier, lighting whenever there is audio present. Input signals greater than approximately –20dBm (70mV) will light the LED's. Each channel is monitored independently.

LIMITER/FAULT INDICATORS

The Channel A and B Limiter/Fault LED's will *flash* for the duration of any of the following *Fault* conditions.

1. Clipping
2. Current limiting
3. Blown power supply fuses
4. Slew Rate limiting
5. Anytime the output of the amplifier does not precisely follow the input.

The Limiter/Fault LED's will illuminate *steady* anytime that the *limiter* circuitry is operating. The limit light will come on approximately 1.5dB prior to the limiter becoming active which serves to allow the operator greater ease in the proper setting of Levels.

THERMAL OVERLOAD INDICATORS

The Thermal Overload LED's will illuminate anytime the temperature of the heatsink exceeds its thermal limit. All incoming signals will be muted during the overload condition allowing the amplifier to cool, and the Thermal Overload LED's will serve to verify this condition.

READY INDICATOR

The Ready LED will illuminate anytime the speaker relay is closed indicating the amplifier's willingness to faithfully serve in the quest for elevated sound pressure levels.

AMPLIFIER FUSING

The A15 contains internal "melt-down" only fuses which are not easily replaceable and provide two important functions: 1. These fuses will only blow in case of definite failure which, by definition, requires servicing before the fuses can be replaced. This protects internal components from further damage possible from a catastrophic output failure. 2. Separate fusing of Channel A and B provides a means of disconnecting one channel from the power supply in the event of a failure so that the remaining channel may still be used until repairs can be made to the faulty channel.

OPERATING CHARACTERISTICS

When operating at or near maximum power output, the amplifier will be warm to the touch. This is quite normal, and will not cause damage. The output transistors in the amplifier are rated to run at a maximum temperature of 150°C (302°F). They will never get that warm due to thermal safeguards employed internally. To keep the amplifier within its safe operating temperature, proper ventilation must be maintained and speaker impedance limits observed. (4 ohms or greater in stereo and 8 ohms or greater in bridged mode.)

TECHNICAL INFORMATION

CIRCUIT DESCRIPTIONS

The Phase Linear A15 consists of two independent direct-coupled analog power amplifiers combined to form one stereo unit capable of very high power output, with extremely low distortion and noise. Refer to the schematic diagram and following description for a brief explanation of the technical aspects of this amplifier.

The low-level input section employs a wideband FET input differential control amplifier. This amplifier peforms all of the linearizing functions required to correct for the small irregularities found in a high gain, high current power amplifier. The input signal applied to this stage is processed and modified to obtain the properly processed input signal for the final stage of voltage amplication.

The voltage amplifier between the control amplifier and the current amplifiers is a common base type, performing both level shifting and voltage gain to supply the proper level and drive currents for the final stage of voltage gain.

Pre-driver transistors provide the final voltage and current gain necessary to drive the output transistors.

A resistor and capacitor network provide level and frequency scaling of the negative feedback which is applied to the inverting port of the control amplifier to set the overall system gain and closed loop frequency response of the amplifier. This negative feedback also reduces any open loop nonlinearities, which may exist, to virtually unmeasurable amounts.

The speaker relay is driven by a transistor network and is pulled low to its "on" state only when there is no DC voltage present. Any AC appearing on the input to this circuit is shunted to ground by capacitors. The series combination of a resistor and a capacitor provide the approximately 5 second turn-on delay of the relay system when power is first applied to the unit.

The inverter which is used to drive Channel B during mono operations is comprised of two operational amplifiers, one of which is a unity gain non-inverting buffer which drives an inverting amplifier from a constant impedance which delivers the proper polarity for bridged operation.

The input limiter is controlled by a full wave precision rectifier which monitors the output voltage of the A15. If at any time the output of the rectifier exceeds the preset comparator reference, the comparator's output will change state allowing the limiter to "unlock" from its fixed gain state and begin compressing the input signal.

The attack and release times of the limiter are set such that no spiking will occur at the onset of compression, and no rapid expansion will occur when the limit threshold has been cleared by the reduction of the input signal.

MODULE REPLACEMENT

The Phase Linear A15 was designed with ease of service as a prime design consideration. The amplifier is modular which lends itself to replacement of a damaged channel, however only qualified technicians should attempt such repair. Phase Linear Corporation and its authorized warranty stations have the personnel and equipment to repair the A15. However, replacement modules are available from the factory and replacement involves only four screws. If module replacement is attempted great care must be exercised in the process to ensure every connection is properly made prior to reapply power.

MONO OPERATION

Operating a stereo amplifier in the mono mode (sometimes known as bridging or strapping) is achieved by inverting the signal polarity of one channel and connecting the speaker load from the hot side of one channel to the hot side of the other. The result, then, is that when one channel is driven to a certain amplitude, the other channel is driven to the exact same level, but the polarity is reversed. This exactly doubles the voltage applied to the loudspeaker for any given input. Since the power applied to

the load $= \frac{E^2}{R}$, then it follows that $\frac{(2E)^2}{R}$ = four times the power in that load.

For example, assume the output voltage of the A15 = 19 VRMS then $\frac{(19)^2}{8} = \frac{361}{8}$ or 45.1 watts.

If we double the voltage we then have $\frac{(38)^2}{8}$ or $\frac{1444}{8} = 180.5$ watts. As you can see from this example, a speaker of less than 8 ohms would be asking the amplifier for an enormous amount of power. For this reason, *do not operate the A15 in mono mode with speakers of less than 8 ohms* (nominal).

Of course all of this power does not come free of charge. When driving a load in the mono mode, each channel of the amplifier is actually driving only one half of the total load impedance. Therefore thermal loading on the heatsinks will be greater due to higher current flow in the output devices. (When the two channels each drive the load from different ends and at opposite polarity, there is an effective ground placed at the center of the load, thus one half of the impedance is seen by each channel.)

SCHEMATIC

A complete schematic diagram is included as a separate insert to this manual. Replacement copies are available by ordering diagram number 157-0077-0 from the Factor Service Department, 20121 48th Avenue West, Lynnwood, WA 98036, phone (206) 774-8848.

MAINTENANCE & SERVICING

GENERAL CARE

The Phase Linear Professional Series of products has been designed for the harsh and difficult environment associated with live and studio use. Chassis are manufactured from rugged cold-rolled steel and painted with a tough, wear-resistant finish which will withstand the expected use. In general, no special care need be taken for the product to endure for many years; however, good practice suggests reasonable precautions be used in safeguarding the front panel.

REPAIR FACILITIES

Only qualified technicans should be allowed to repair the Phase Linear Professional Series of products. Phase Linear Corporation and its authorized warranty stations have the personnel and equipment to repair the unit. Should any problems occur with the unit, BE SURE to consult the dealer nearest you, or call or write the Factory Service Department BEFORE sending it anywhere for repairs. This will help you to identify and locate any specific malfunctions and possibly avoid needless shipment.

PLEASE INCLUDE THE SERIAL NUMBER OF THE UNIT IN ANY CORRESPONDENCE.

If the unit is in need of service, either send it to the factory or take it to the nearest warranty station described on the enclosed list. In either case, BE SURE TO ENCLOSE A COMPLETE DESCRIPTION OF ANY PROBLEM WITH THE RETURNED UNIT, along with your NAME, RETURN ADDRESS, and a copy of the WARRANTY CARD or SALES SLIP, if applicable.

If assistance of any kind is required, please feel free to contact the Factory Service Department, 20121 48th Avenue West, Lynnwood, WA 98036, phone (206) 774-8848.

Never ship the unit in any shipping carton other than the original or a replacement supplied by Phase Linear. Ship only via a reputable carrier. DO NOT USE PARCEL POST! Insure the unit for the full value and double check to ensure the unit is properly packaged.

CAUTION: Remove any units in need of repair from rack or cabinet prior to shipping to the Factory Service Department.

SPECIFICATIONS

ELECTRICAL PERFORMANCE

POWER OUTPUT
65 watts output power minimum RMS per channel both channels driven into 8 ohms with no more than .05% total harmonic distortion (20-20kHz).

100 watts RMS per channel into 4 ohms
190 watts RMS mono mode into 8 ohms

FREQUENCY RESPONSE
11Hz to 190kHz +0, –1dB

INTERMODULATION DISTORTION
(60Hz: 7kHz @ 4:1)

Less than .005% at rated power into 8 ohms
Less than .005% at rated power into 4 ohms

SIGNAL-TO-NOISE RATIO
90dB (IHF A-Weighted)

DAMPING FACTOR: 330:1 @ 1,000 Hz
800:1 @ 50 Hz

INPUT IMPEDANCE: Balanced – 20k ohms, each leg to ground. Unbalanced – 20k ohms.

INPUT SENSITIVITY
.775 VRMS (0dBm) at maximum level for 65 watts output.

SPEAKER IMPEDANCE
No less than 4 ohms in stereo
No less than 8 ohms in mono

SLEW RATE
100 volts per microsecond

RISE TIME
Less than 1.0 microsecond

PHASE SHIFT
0° at 20Hz
–3.1° at 20kHz

PROTECTION:
Output transistor protection: Electronic limiters together with power supply fuses prevent excursions into unsafe operating areas, regardless of load impedance.

An electronically activated relay disconnects the amplifier's output from the speakers:
1. For approximately five seconds after turn-on.
2. Immediately after turn-off.
3. In the presence of DC output voltage or high level subsonic signals.

GENERAL

POWER REQUIREMENTS:
a. 120 VAC ±10%, 50/60Hz (USA & selected export markets)
b. 240 VAC ±10%, 50/60 Hz (General export models)

POWER CONSUMPTION: 360 watts (maximum)

LINE CORD: Three-conductor, grounded, removable type.

MECHANICAL

UNIT:

Dimensions: 19″w × 1¾″h × 13¼″d (rack depth)
(48.3cm × 4.45cm × 33.7cm)
(Standard EIA rack-mountable)

Weight: 15 lbs (6.8 kgs)

SHIPPING:

Dimensions: 22¾″w × 5″h × 17½″d (rack depth)
(57.8cm × 12.7cm × 44.5cm)
(Standard EIA rack-mountable)

Weight: 16.5 lbs (7.5 kgs)

Specifications are subject to change without notice due to design improvements.

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