

OPERATION AND MAINTENANCE MANUAL

PARAMETRIC EQUALIZER

MODEL 621A/B

orban

ADDENDUM TO ACCOMPANY 621 A/R and 621B/R PARAMETRIC EQUALIZERS

(This information supersedes PAGE 3, PARAGRAPHS 3, 4, and 5.)

The 621A/R and 621B/R Parametric Equalizers are identical to the older 621A and 621B units except for the DC power supply circuitry.

The older units required ± 15 to ± 16 volts DC with relatively low ripple and good regulation; the newer /R units include an integrated regulator circuit to permit their being powered by a wider range of supply voltages.

The /R units are shipped with the regulator circuit active. The power requirement is ± 18.2 to ± 25 volts. Almost any ripple content is permissible, as long as the peak voltage stays within the 18.2 to 25 volt limit.

An accessory power supply (Model 85A) which supplies this unregulated and filtered voltage is available. It attaches conveniently to the rear of the equalizer and connects, externally, to the barrier strips. The accessory power supply will power up to two channels. If a great many equalizers are used simultaneously, the customer may find it more practical or economical to purchase a high-current supply from a power supply manufacturer such as Lambda, Inc. or Power-One, Inc. in order to power all units simultaneously from one power supply.

Customers who have existing ± 15 - 16 VDC power supplies with line and load regulation better than 1% and ripple and noise below 2 millivolts rms may defeat the internal regulator in the equalizer according to the diagrams below. It is strongly advised to equip any such power supply with over-voltage protection to crowbar the supply 'off' if the output exceeds ± 18 volts in order to avoid destroying all of the semiconductors in the equalizer.

The regulator IC is located on a small printed-circuit board mounted under the main board, and is accessible by removing the bottom cover. When reconnecting the jumpers, it may be necessary to remove the heat dissipator fins from the RC4195 regulator IC by gently pulling the fins off the IC. This job may be expedited with a Heathkit nut starter. Slip the fins onto the narrow end of the nut starter. Place the wide end of the nut starter on the top of the RC4195, and slide the fins down the nut starter and onto the RC4195.

CAUTION: Excess pressure may bend the leads on the IC, and/or permanently deform the fins. Use of the nut starter minimizes this risk. When the fins are installed, make sure that they don't short to any of the fork-type terminals.

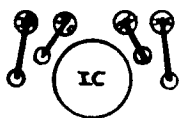


Figure 1

Connection for ± 22 VDC (nominal)
Operating Internal Regulator (as shipped)

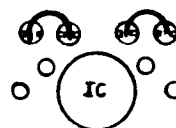


Figure 2

Connection for ± 16 VDC Regulated
(Defeating Internal Regulator)

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PARAMETRIC EQUALIZER

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WARNING!

TO PREVENT FIRE OR SHOCK HAZARD,
DO NOT EXPOSE THIS APPLIANCE TO
RAIN OR MOISTURE.

orban

ORBAN ASSOCIATES INC.

645 BRYANT STREET

SAN FRANCISCO, CA 94107

(415) 957-1067

ORBAN PARAMETRIC EQUALIZER

MODEL 621A/B

INSTRUCTION MANUAL

REGISTRATION

The original purchaser of this unit should have received a registration card with this instruction manual. If that card has become misplaced, or if the unit has been resold, the present owner may register his ownership with us for the purpose of enabling us to inform him of new applications, recommended modifications, news of new products, or other information which would be of interest to the owner of the 621 Parametric Equalizer.

If you have not returned the printed registration card, please send us a postcard stating your name, company, mailing address and zip, the model and serial number of your unit, and the date that you or your company purchased the unit.

If you were also to mention the nature of your business, the nature of your application for our product, why you selected it over others, and where you bought it we would be most interested and grateful.

The return of this card in no way affects the validity of our warranty, which applies only to the original purchaser

INTRODUCTION

The Orban/Parasound 621 Parametric Equalizer represents a significant price/performance breakthrough in the professional audio equalizer field. The 621 uses a proprietary Orban/Parasound circuit to provide the user with continuously variable control of the three parameters of equalization: frequency of maximum equalization, bandwidth, and amount of peaking or dipping. Each channel of the 621 provides four such equalization sections connected in series, so that the total equal-

ization is simply the sum (in dB) of the equalizations of the individual sections.

A sophisticated "peak-stretching" overload indicator circuit continuously monitors the output of each section, and flashes a front-panel LED overload indicator for 1/2 second if peak clipping occurs at the output of any section.

Approximately 12 dB of gain is available, as well as an input level control. Thus the 621 can be used to make up gain, or to interface medium-level circuits with line-level circuits. The input level control also permits instant and straight-forward correction of overloads.

Each section of the 621 tunes over a 20:1 (4.3 octave) frequency range. For versatility, the frequency coverages of the various sections overlap widely.

The equalization control permits a maximum boost of 16 dB, and a maximum dip of minus infinity. This notching provision permits the 621 to be used to remove hum or other fixed-pitch interference with negligible effect on the sound quality. In sound-reinforcement applications, it permits extremely easy removal of major ring modes.

The use of "active R-C" circuitry means that the 621 is resistant to magnetically induced hum. Overload-to-noise ratio is typically 106 dB, and harmonic distortion at most frequencies and output levels is less than 0.03%.

The 621 is an ideal replacement for any kind of equalizer currently used in professional sound, with the exception of 1/3-octave types used for "room tuning". The 621 can even do a surprisingly effective job in that application, particularly if a dual-channel 621B is used, with one channel notching the four major ring modes and the other channel providing broadband equalization.

INSTALLATION

When the 621 is unpacked, it should be immediately examined for shipping damage. The unit was in perfect condition when it left the factory, and any damage should be reported to the carrier immediately.

Both the 621A and the 621B are mounted on a 3 1/2" x 19" rack panel. The 621B contains two independent equalizers side-by-side. The 621A uses the same chassis as the 621B, but omits half of the electronics.

The 621 was carefully designed for stacking in multiple-equalizer installations. When multiple units are mounted one above the other, controls are unencumbered, and the in/out switches can be operated with a single sweep of the hand.

Because of the 19" rack-mount format, the customer has great flexibility in installation, and can use the wide variety of hardware available from a large number of manufacturers to put the equalizers in a location which is maximally effective in the particular installation involved.

Once the customer has chosen an appropriate rack, the equalizer(s) should be mounted using the four #10-32x3/8" screws provided. Be sure to measure the resistance between chassis and rack after installation and correct any high-resistance situations before proceeding. It may be necessary to scrape the paint from the rack and/or the rear of the panel before proceeding further. It is advisable to make sure that the rack is grounded to the system ground, because grounding of racks and other equipment to the power line ground as a sole means of grounding often creates troublesome problems. In rack mounting the 621, considerations should also be given to strong AC magnetic fields nearby and to the proximity to heat-producing equipment. Ambient temperature should not exceed 45°C (113°F) when the electronics are powered and operating.

The signal and chassis grounds appear separately on the Jones barrier strip on the rear chassis apron. In most installations these grounds will remain separate if the 621 is installed in a rack and will be jumpered together if the 621 is used portably.

INFORMATION IN THESE PARAGRAPHS SUPERSEDED BY ADDENDUM INSIDE FRONT COVER

~~This barrier strip also contains the input and output connections, as well as the connection to the required bipolar DC power supply. The ideal power supply voltage is + and - 16 volts with less than 2 mv rms ripple and noise. Standard + and - 15 volt supplies can be used with a small (0.6 dB) loss in headroom.~~

~~WARNING!!! UNDER NO CIRCUMSTANCES PERMIT THE APPLIED VOLTAGE TO EXCEED + AND - 18 VOLTS!!! THIS WILL DESTROY ALL SEMICONDUCTORS IN THE EQUALIZER AND VOID THE WARRANTY!!! It is strongly advised that the system power supply be fitted with SCR crowbar overvoltage protection.~~

~~Orban/Parasound does not manufacture power supplies, and we suggest that you obtain a supply directly from a volume manufacturer of such supplies such as Powertec or Power/Mate. If you experience any difficulty in obtaining a supply, we can supply further information if you contact us directly. Choose a supply that can provide + and - 16 volts at 50 ma per equalizer on a continuous duty basis. A 16 track installation can be adequately served by a 1 amp supply; a 1.5 amp supply is suggested for a 24 track installation.~~

Connect the power supply to the equalizers according to the markings on the barrier strip. Each equalizer has a power-supply decoupling filter built-in, so the power line can be bussed from equalizer to equalizer, rather than running separate power lines from each equalizer to the supply.

Since the inputs and outputs of the equalizers are unbalanced, careful planning of the power supply grounding system is essential. In most cases, the best approach is a separate ground wire from each equalizer to the master ground point in the system. Inputs and outputs are connected through wires with discontinuous shields, grounded at one end only. It should be noted that the power supply ground is directly connected to the input and output ground screws, so that these are essentially equivalent. Note too that the ground return carries essentially no DC current -- this all flows in the positive and negative power supply busses. In any case, a single ground return to the main system is necessary to avoid ground loops. Often it is necessary to determine by experimentation where the optimum ground return point in the system is. Some-

times better results are obtained if each equalizer is grounded to a separate point, such as an individual input module.

In very complex systems, or in high RF environments, it is sometimes impossible to find a solution to the grounding problem. In this case, the only solution is to add an input and/or output transformer. High-quality transformers capable of handling +20 dBm should be employed, and this expedient should be considered only after all else has failed, as any transformer will substantially compromise the excellent electrical performance of the 621.

Symptoms of grounding difficulties can include hum, buzz, and high noise.

Input impedance of the 621 is 10k unbalanced bridging; output impedance is less than 1 ohm. Output drive capability is typically +20 dBm into 500 ohms or any higher impedance; output termination is neither necessary nor desirable when the 621 is driving bridging inputs.

OPERATING INSTRUCTIONS

For those who have never used a parametric equalizer before, the best thing to do is to experiment with actual program material. Discover for yourself the subtle shelving effects available from broadband peaking, as well as the "ringy" quality of narrowband peaking. While in the narrowband peak mode, sweep the tuning control throughout its range and discover the "phasing" sound it makes. Note how a narrowband dip is essentially inaudible but permits tuning out of sounds of fixed frequency. Note that the midpoint of the bandwidth control gives equalization similar to currently available "three-knob" or "four-knob" modular console equalizers.

There are few specific instructions that can be given other than "use your ears." The dial calibrations are intended to serve as guides, rather than laboratory instrument standards. This means that you cannot adjust two equalizers to give identical response on the basis of dial markings alone. If this must be done (in an installation requiring fixed equalization), then instruments must be used to match the responses exactly. If the frequency responses are matched, the phase responses will match automatically.

The in/out switch defeats the equalization, but retains the input buffer amplifier and the output amplifier so that no gain changes occur regardless of the setting of the input level control. The overload lamp will operate in the "out" position as if full equalization were still occurring. The equalizer is non-inverting (does not cause a phase reversal between input and output) in both the "in" and "out" positions.

It is often necessary to use substantial amounts of input attenuation with large amounts of equalization in order to avoid overloading the output amplifier, which clips at +20. Experience with the 621 in an individual application will soon indicate what attenuation is appropriate for most work. In any case, the overload light will always warn of excessive gain.

In sound reinforcement work, the 621 provides an extremely fast and easy way to notch out ring modes. With the equalizer "out", advance system gain until acoustic feedback just begins. Choose an equalizer channel that can be tuned to the frequency of the ring (this can be easily done by ear). Adjust the bandwidth control to "narrow" and the equalization control to "minus infinity". Now tune the tuning control until the ringing disappears. Move the equalization control towards "0" until the ringing returns; back off slightly. Now advance the system gain until a new ringing mode appears and repeat the procedure, using another channel. Repeat until all four channels have been used. Sometimes it is necessary to change a given mode to a different channel if the remaining one or two channels cannot be tuned to the modes that appear after the first two or three modes have been eliminated.

In recording studios and cinema dubbing theaters, the mixer can use some of the bands to eliminate hum or other fixed-frequency interference while using the remaining bands to effect desired broadband equalization. The extremely large overlaps in frequency coverage between the various bands makes this highly practical in most situations.

Broadcasters will find that the 621 can provide some wild production gimmicks and sound effects, particularly when swept in the narrowband peaking mode. The 621 can also tailor the station's air sound to suit the requirements of the program director.

MAINTENANCE

Preventive Maintenance:

As the 621 is entirely solid state, the only preventive maintenance necessary is keeping the unit physically clean, both inside and out. Dust buildup can destroy the natural airflow necessary for ventilation. It can also cause high-resistance shorts in a humid environment.

The electronics per-se are extremely stable. However, with use the carbon controls will wear, and their total resistance will change. The alignment trimmers are necessary for the sole purpose of compensating for the non-ideal characteristics of the controls. Therefore, yearly alignment would be indicated if the equalizer receives heavy use of the sort that would tend to wear the controls. This alignment is only necessary if the owner wishes to maintain "like new" calibration. In all probability, drift due to control wear will not be detected audibly. Such drift has no effect on the noise or distortion performance, and manifests itself mainly as changes in bandshape as the equalizer is tuned, and in changes in maximum boost or dip as the bandwidth control is varied.

The controls have been sealed with glass tape against dust. If a control becomes noisy, it is possible to remove the tape and treat the control with any one of a number of commercially available control lubrication/cleaning compounds.

If a control deteriorates to the point where replacement is necessary, the

replacement control should be obtained through Orban/Parasound, as the controls are custom and have no commercial replacement equivalents.

Alignment instructions are included in the appendix. If the customer lacks the requisite test equipment or expertise, the 621 can be returned to the factory for realignment. A reasonable charge will be made for such service. In addition, factory service for any problem is available throughout the life of the 621. After expiration of the warranty, a reasonable charge will be made for such service.

ALWAYS PHONE OR WRITE FOR AUTHORIZATION BEFORE RETURNING A UNIT FOR FACTORY SERVICE. Many problems can be solved by mail or phone without the necessity of returning the unit physically.

CIRCUIT DESCRIPTION (with troubleshooting hints)

The signal enters the unit and is attenuated by R1, the input level control. It is then amplified by the input buffer amplifier, IC1. IC1 is capable of providing 12 dB of gain. Supersonic rolloff is provided by C1 working with R3. IC1 is connected as a non-inverting operational amplifier.

IC1 drives the first of four equalization sections connected in series. Each equalization section consists of a bandpass filter with independently adjustable center-frequency and bandwidth, and a summing amplifier. The output of the bandpass filter is added to its input signal in this summing amplifier to obtain peak boost, and subtracted from its input signal to obtain peak cut.

The summing amplifiers are IC3, IC5, IC7, and IC9. IC9 also serves as an output buffer amplifier, and is provided with a discrete output stage to permit it to drive 500 ohms or higher impedances. These summing amplifiers are premium 1556C-types. Replacements are manufactured by Motorola and Raytheon, with Raytheon parts preferred.

Except for tuning capacitor values, the four sections are identical. Let us examine the first (high-frequency) section. The signal from IC1 enters the bandwidth generator module (Orban/Parasound part# 30045). The output of this module, A1, is applied to a passive RC bandpass filter, consisting of C2, R6, R7, R9, R10, and C3. The two sections of the tuning control, R6, are made to track as proportionally as possible by means of trimmer R10. If the sections of R6 track perfectly, then the bandpass network is moved along the frequency scale with no change in gain or shape. C2 and C3 are factory-matched to provide a correct ratio, which determines the range of the bandwidth control.

The output of this bandpass network is amplified by the high-input-impedance, non-inverting amplifier IC2a. The gain of IC2a can be varied over a narrow range by R5. It turns out that this compensates for variations in C2/C3 ratios, R6 value, and the value of R4 (the bandwidth control) and is adjusted to obtain constant peak

gain as the bandwidth control is adjusted from "broad" to "narrow".

The output of IC2a is unity-gain inverted by IC2b. The output of IC2b is fed back into the module A1. It is this feedback which makes the control of bandwidth possible. In addition, the outputs of IC2a and IC2b are equal and out-of-phase, and drive the equalization control, R13, and its associated taper-adjusting network, R14, R15, R16, R17, and R18. These resistors are chosen to provide symmetrical locations for the +4 dB and -4 dB control positions, and then provide full scale boost of +16 dB and full-scale dip of minus infinity. The minus infinity position is trimmed by adjusting R17 to obtain a null.

The arrangement of the trimmers in the circuit has been very carefully worked out so that it is possible to obtain characteristics very close to ideal with controls having normal production tolerances.

IC3 is connected as an inverting summing amplifier. The in- or out-of-phase output from the bandpass filter is summed with the input signal to the bandpass filter through the equalization control resistive network described above. The output of IC3 drives the next section, which operates on identical principles to the section already described.

The last (low-frequency) section contains a variation, because its summing amplifier is also the output amplifier. This amplifier (IC9 and associated circuitry) can be switched directly to the input buffer by means of the in/out switch. The in/out switch changes the operation of IC9 from inverting (in) to non-inverting (out) so that there is no polarity reversal when the in/out switch is operated. The C10/R67 and C11/R68 networks eliminate the small DC offsets that have built up so that there are no audible clicks when the in/out switch is operated. IC9 operates with unity gain in both the "in" and the "out" position.

Q1-Q4 serve as a complementary-symmetry output stage for IC9. The stage is operated class AB, with diode-connected Q2 and Q3 serving as bias dividers for the output stage. Thermal feedback to prevent thermal runaway is obtained by mounting Q2 in contact with Q1 and Q3 in contact with Q4. R71 and R72 provide emitter degeneration to help stabilize the bias current through Q1 and Q4. In addition, R71-72 work with CR1 and CR2 to current limit the output stage to protect it against short circuits. If the current through the output stage causes the voltage across R71 or R72 to build up to 0.6 volts, CR1-2 turn on and shunt base drive away from Q1-4.

R73 is the load resistor from the bias string including Q2-3. C13 eliminates residual DC offsets; R74 assures that the output side of C13 will remain at ground for DC.

CR5-14 form a logic gate to detect overloads. Each diode pair monitors the positive and negative peak levels at the output of a given through-channel amplifier. The junctions of the diodes are biased at +11 volts (for positive peaks) and -11 volts (for negative peaks). If a peak exceeds 11.6 volts (bias plus the diode turn-on voltage), then the diode conducts a pulse. Negative pulses are passed through C15 and fire IC10, a monostable multivibrator. Positive pulses pass through C14, are inverted by

Q5, and then fire IC10 through C15.

IC10 is ordinarily held "off" by the R80/R83 voltage divider. A negative-going pulse through C15 turns IC10 "on", thus lighting the LED. It also pulls C16 up, thus keeping IC10 on until C16 has discharged through R82 and the R80/83 parallel combination. If there are no more pulses, IC10 will then suddenly turn off. It is normal for the LED to flash under conditions of continuous overload. A flashing light is more easily noted than a light that is steadily illuminated.

Power supply decoupling for the signal-processing circuitry is provided by CR3, CR4, C17, and C20. C18-22 provide local power bus decoupling to avoid oscillations in the operational amplifiers. CR3-4 also protect the unit from inadvertent power supply polarity reversal. A voltage drop of about 0.7 volts across CR3-4 is normal. Power for the overload light is obtained directly from the power supply bus, thus avoiding putting disturbances on the internal power distribution system when the overload light switches on.

Repair Procedure:

It is easy to compromise the reliability of a piece of electronic equipment by sloppy workmanship when replacing parts. Printed-circuit boards are particularly subject to damage from crude repair techniques. If it is necessary to remove parts from the PC board, the following technique is strongly recommended to avoid damage.

First, avoid overheating the board by using a 30 watt pencil-type iron. Overheating can cause the foil to separate from the board. Heat the joint to be unsoldered. After the solder is molten, vacuum it away with a desoldering tool like the Edsyn "Soldapult" or a Teflon solder syringe. The lead can usually be removed from the board easily.

Before replacing the part, be sure the hole in the board is not filled with solder. Replacing a part by heating the solder-filled hole to melt the solder will almost guarantee a foil/board separation. After the component has been replaced and carefully resoldered, use a solvent like the widely available "Energine" fireproof spot remover (gold can) to remove residual flux. Flux left on the board will absorb moisture from the air and eventually cause high-resistance short-circuits. A "Q-Tip" can be used to apply the solvent. Be sure no residue is left on the board after the solvent evaporates.

Shipping Instructions:

If it is necessary to return the unit to the factory at any time, the following instructions should be followed.

First, write or telephone describing the problem. If it is necessary to return the unit for repair, we can tell you at that time.

If the original packing material is available, it should be employed. Otherwise,

a carton of at least 200 lbs. bursting test should be obtained. The unit should be packed such that it is protected by at least 1 1/2" of packing material at every point.

Cushioning materials such as Air-Cap, Bubble-Pak, foam "popcorn", or fiber blankets are acceptable. Folded newspaper is not suitable. Blanket-type material should be tightly wrapped around the unit and taped in place to prevent the unit from shifting out of its packing and contacting the walls of the carton.

The carton should be packed evenly and fully with the packing material filling all voids such that the unit cannot shift in the carton. Test for this by closing but not sealing the carton and shaking it vigorously. If the unit can be heard or felt moving, use more packing.

The carton should be well-sealed with 3" reinforced sealing tape. Narrower or parcel-post type tapes will not withstand the stresses applied to commercial shipments. The package should be marked with the name of the shipper, and the words in red: DELICATE INSTRUMENTS, FRAGILE!

Even so, the freight people will throw the box around as if it were filled with junk. The survival of the unit depends primarily on the care taken in packing!

WARRANTY

The Orban Associates Division of the Kurt Orban Co., Inc., guarantees the Orban/Parasound model 621A/B against failures due to defective parts or faulty workmanship for a period of one year after delivery to the original customer as evidenced by the invoice date. Orban Associates Division will repair the 621A/B during this period without charge for parts or labor, but not including shipping. Repairs effected by others are not included in this warranty, except that defective parts will be replaced upon presentation and verification of said allegedly defective parts.

Claims under this warranty must be accompanied by a copy of the customer's invoice showing the date of purchase and the serial number.

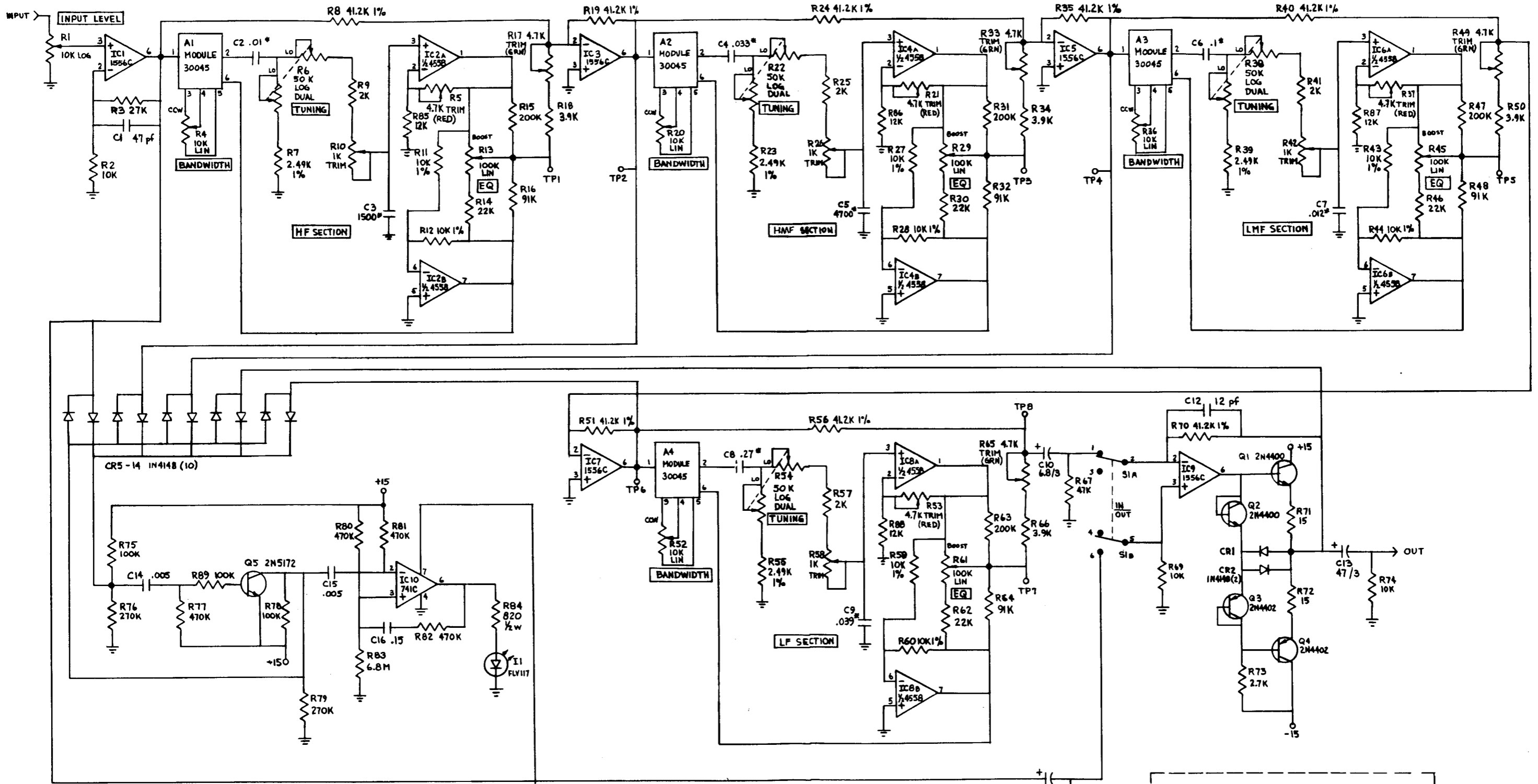
This warranty applies only to the original purchaser and is not transferable.

This warranty shall be voidable by Orban Associates Division if the 621A/B is subjected to physical or electrical abuse, is electrically or physically modified without written permission from Orban Associates Division, or is operated contrary to the instructions in this manual.

APPENDIX: ALIGNMENT INSTRUCTIONS

Required Test Equipment: Oscilloscope with DC-coupled X/Y display capabilities;
Audio sweep generator with sinewave output and logarithmic sweep.

- 1) Setup: Connect the output of the sweep generator to the input of the 621. Connect the output of the 621 to the Y-axis of the oscilloscope. Connect the sweep ramp output of the generator to the X-axis of the oscilloscope. Adjust the output level of the sweep generator for a -10 dBm output. With all equalization controls on the 621 flat, adjust the 621 input level control for -10 dBm output. Adjust vertical and horizontal gains on the oscilloscope until the output of the 621 is swept all the way across the screen.
- 2) Each section of the 621 is adjusted separately, starting at the input and moving toward the output (high-frequency to low-frequency). Adjust the HF Bandwidth to "minimum" and advance the HF Equalization control until a peak is observed on the scope. Operate the HF Tuning control from one end of its range to the other and note the variations in peak gain as you do this. Now adjust R10 (no color) until the gain variations are minimized.
- 3) Choose a frequency for the HF Tuning control which results in an average peak gain. Adjust the HF Bandwidth control throughout its range repeatedly, and simultaneously adjust R5 (red) so that the peak gain stays constant regardless of the setting of the HF Bandwidth control. Turn the HF Bandwidth control to "broad".
- 4) Increase the output of the sweep generator to +10 dBm. Turn the HF Equalization control to minus infinity. Adjust R17 (green) for a perfect null at the frequency of maximum attenuation. This completes the alignment of the HF section. Turn the HF Equalization control to "0" and the HF Bandwidth control to "broad".
- 5) Repeat steps 2 through 4 for the High-Mid, Low-Mid, and Low-Frequency sections in order. This completes the alignment.

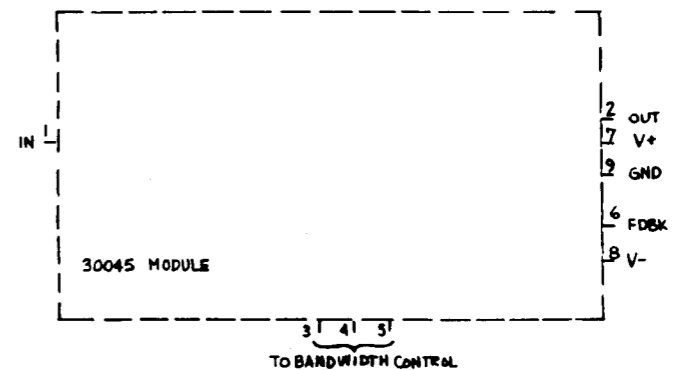
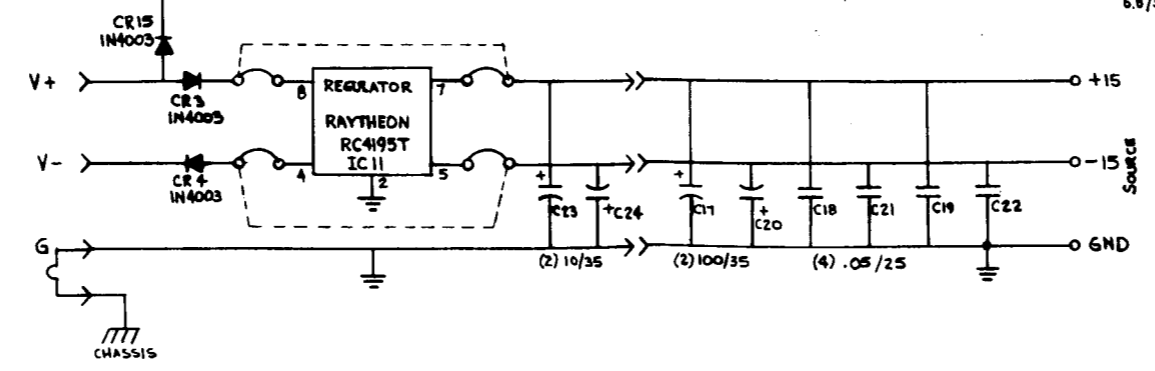


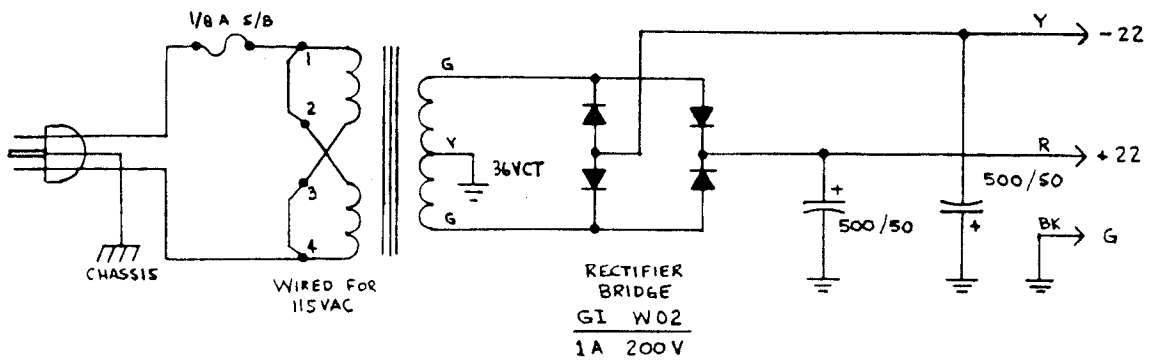
- NOTES:
- * 8 CAPACITORS ARE SELECTED & MATCHED
 - POTS (EXCEPT INPUT) ARE SPECIAL TAPER, TIGHT TOLERANCE & MATCHED
 - 1% RESISTORS ARE RN55D STYLE
 - ALL OTHER RESISTORS ARE 1/4 W, 5% UNLESS OTHERWISE NOTED

POWER PINS

	V+	V-	G
4558	8	4	-
1556	7	4	-
MODULE	7	8	9

IC PIN 1 IS MARKED WITH DOT - PINS ARE COUNTED CW VIEWED FROM BOTTOM





INPUT: 105-130VAC
OR 210-260VAC 50/60Hz

OUTPUT: \pm 20-25VDC 125mA

SCHMATIC
ORBAN/PARASOUND
POWER SUPPLY ACCESSORY
MODEL 85A
DOC. NO. 60007-000-01