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tnewcamp (2145 ★)

Member since 10-Nov-02 in Canada

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ACOUSTAT

MODEL ONE
MODEL THREE
MODEL ONE + ONE
MODEL TWO + TWO

MK 121 & MK 141 VERSIONS

ACOUSTAT Electrostatic Speaker Systems

OWNER'S MANUAL
AND
ASSEMBLY INSTRUCTIONS

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SPECIFICATIONS

MODEL ONE – Frequency Resoonse: 30-18kHz +/-3dB, Sound Pressure Level: 108 dBmeasured @ 15' in a 14' x 18' room. (music Peaks); Minimum Power Requirements: 75 Watts/Channel; Nominal Impedance: 4 ohms; Power Consumption: 5 Watts (120V, 50/60Hz); Dimensions: 72" x 11" x 3 1/2"; Bass Model Dimensions: 18 1/2" x 18 1/2" x 18 1/2"; Weight: 65 Lbs. (Speaker and Interface). 37 Lbs (Bass Module)

MODEL 1 + 1 – Frequency Response: 35-20kHz +/-3dB; Sound Pressure Level: 108 db @ 18' in a 14' x 22 room. (Music Peaks); Minimum Power Requirements: 100 Watts/Channel; Nominal Impedance: 4 Ohms; Power Consumption: 5 watts (120V, 50/60Hz); Dimensions: Model 1 + 1, 94" x 11½" x 3⅝"; Weight: 72 Lbs. (Speaker and Interface)

MODEL THREE – Frequency Response: 30-20kHz ±2db; Sound Pressure Level: 140 db @ 18' in a 14 x 22 room. (Music Peaks); Minimum Power Requirements: 70 Watts/Channel; Nominal Impedance: 4 Ohms; Power Consumption: 5 Watts (120V, 50/60 Hz); Dimensions: 72" x 28 x 3½"; Weight 98 Lbs.

MODEL 2 + 2 – Frequency Response: 28-20kHz ±2db; Sound Pressure Level: 115 db @ 22' in a 16' x 26' room. (Music Peaks); Minimum Power Requirements: 60 Watts/Channel; Nominal Impedance: 4 Ohms; Power Consumption: 5 Watts (120V, 50/60 Hz); Dimensions: 94 x 20" x 3½"; Weight: 95 Lbs.

LIMITED WARRANTY STATEMENT

Acoustat warrants to the owner that the Acoustat [illegible] System (including Sub Woofer) will [illegible] specified and be free of defects in materials and workmanship for as long as the product remains in service, subject tot he conditions below

Acoustat will [illegible] defective units without charge for labor or parts, subject to the conditions below:

a) The [illegible] must not have been altered or damaged through [illegible], abuse, negligence, accident, or improper operation.

b) All [illegible] undertaken at [illegible] or [illegible] by Acoustat. Units submitted for warranty service must be properly packed in the [illegible] king carton tc Acoustat directly, or through an authorized Acoustat dealer. All units will be returned to same freight and [illegible] prepaid by Acoustat

c) Normal wear and maintenance are not covered by the warranty

d) Fuses have not been bypassed and only fuses of the proper value and type have been used.

ACOUSTAT SHALL NOT BE RESPONSIBLE IN ANY WAY FOR [illegible] OR [illegible] OR LIABILITIES RESULTING FROM THE USE AND OPERATION OF THE PRODUCT COVERED HEREIN OR RESULTING FROM ANY BREACH OF THIS WARRANTY OR ANY IMPLIED WARRANTY RELATING TO THE SAID PRODUCT.

[illegible] not allow exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not [illegible] you.

INTRODUCTION

Congratulations on your purchase of the ACOUSTAT ELECTROSTATIC LOUDSPEAKER SYSTEM. Please review the entire owner's manual before uou begin to assemble your new speakers to assure you of reaching the speaker's full sonic potential. When assembled, placed correctly in the room, and used with fhe proper electronics, the Acoustat electrostatic loudspeakers will provide you with years of listening enjoyment.

REGISTRATION CARDS

Please complete and return the enclosed purchase registration card within ten days of purchased your new speakem. *This* card does not determine your eligibility for warranty, but will allow Acoustat to inform you of updafes and other product news that would be of interest to speaker owners. Any additional information you provide will aid Acoustat in continuing to bring music lovers everywhere the finest audio components available today.

PACKAGING

SAVE ALL PACKAGING MATERIALS! Your Acoustat electrostatic loudspeakers are finely crafted pieces cl equipment, and must be property cartoned whenever shipment is necessary. ONLY the original packaging materials may be obtained from Acoustat at a nominal charge.

FUSES

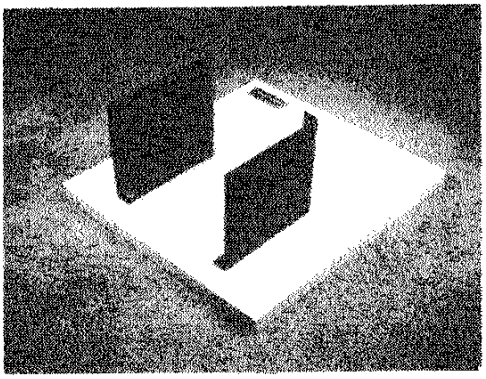
All ACOUSTAT loudspeakers utilize 5-Amp Slo-Blo type fuses In the audio signal path. This fuse is located on the rear panel d t h e interface unit at the base of each loudspeaker. When replacing fuse(s) only those of similar value and type can be used or the warranty may become invalid.

LOW-FREQUENCY TRANSFORMER TAP (FULL RANGE MODELS ONLY)

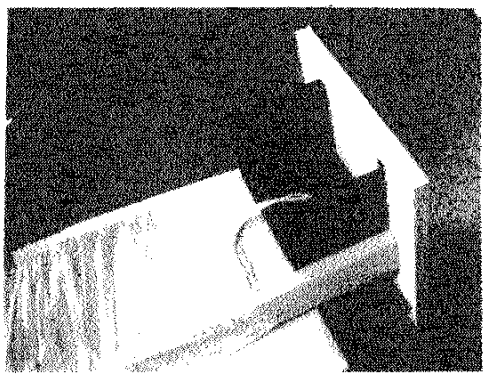
Before assembly, locate fhe low frequency transformer tap terminal strip (identified by a bright tag) and verify that the setting is correct for your particular model as p e r below:

MI + 1	Red Wire to Red Lug
M 3	Red Wire to Orange Lug
M 2 + 2	Red Wire to Yellow Lug

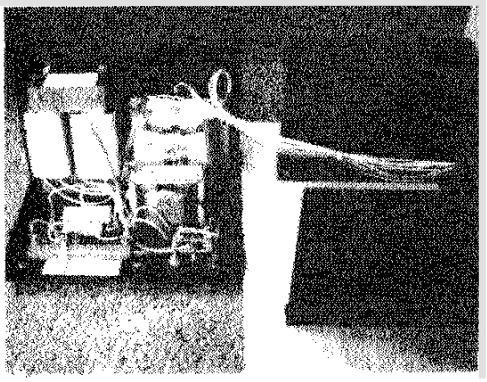
This setting determines the proper bass rewponse for the different speaker models. Improper setfing will result in bass response that is weaker stronger than normal.



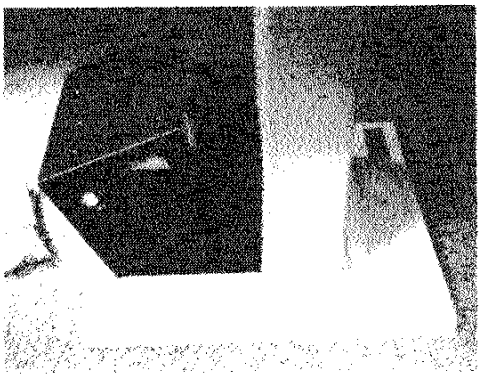
(1)



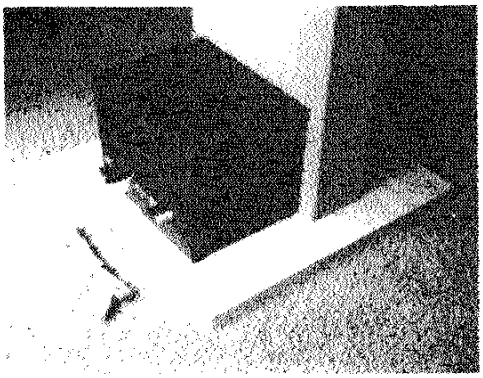
(2)



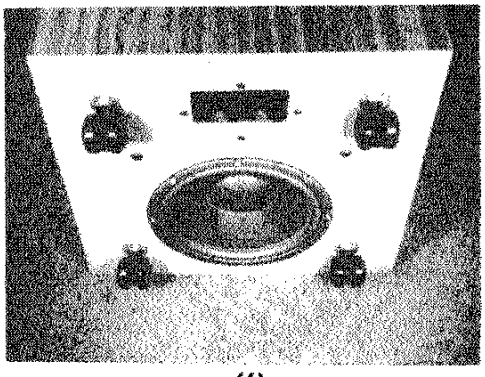
(3)



(4)



(5)



(6)

ASSEMBLY INSTRUCTIONS

FOR ALL MODELS

PLEASE READ COMPLETELY BEFORE YOU BEGIN ASSEMBLY.

For assembly you will require a targe Phillips type screwdriver, and the small hex-wrench attached to the interface line cord.

1. Remove bases, speaker panels and interface units from their packing cartons. To minimize soiling of panel fabric during assembly, leave the plastic bags on the panels, exposing only the lower 12" of the panels for assembly.
2. Using the small hex wrench provided, the disassemble the side plates from the main interface assembly. Set the screws and wrench aside unfil they are required later.
3. Set a speaker base on the floor. nameplate side up. Erect the side plates on the base as shown (1), securing them with two slot head screws per plate. Leave screws loose.
4. Lay a speaker panel GENTLY on the floor, with the wiring harness facing up. DO NOT DROP! The frapped air under fhe panel can rupture fhe speaker diaphragm. Have a helper raise the lower end of the panel, or support it on the box.
5. Place the completed base assembly against the panel as shown (2), aligning the holes in the side plates to the holes in the speaker back panel. Tighten all screws securely.
5. Standing the compfeted speaker up vertically. position the interface assembly behind the speaker as shown (3). Locate the wiring harness emerging from the hole in the back of the speaker panel. Separate the three wire bundles into the RED group, with the pin plug on the end: the BLUE group With the blue sleeved hook on the end; and the WHITE gmup, with the plain hook on the end.
7. Referring to diagram (3), insert the pin plug (RED group) into the RED socket on the circuit board of the interface unit. Affach BLUE hook to the board on the right side identified by the blue dot on the nylon spacer below the thumbscrew, and the word 'BLUE'. Loosen the thumbscrew several turns, top surface of the thumbscrew and washer and tighten securely. Repeaf this procedure for the WHITE hook on fhe other side of the circuit board.
8. Carefully, assemble the inferface unit to the side plates, GENTLY feeding the excess wiring back into the hole in the speaker panel. Align the holes on the interface flanges to the side plates. keeping the flanges on the OUTSIDE of the side plates as shown (4) & (5). Insert the four allen head screws info fhe hofes in the sides of the inferface. and ttghfen securely with the hex wrench provided (5).
9. Position fhe assembled speaker systems in the room, allowing two or three feet from the backwall and at least 18" from the side walls. Adjust speaker 'toe-in' angle according to the 'SPEAKER PLACEMENT' section of the manual. Plug the line cord info an unswitched wall outlet. Connect speaker terminals to amplifier, making sure that proper phasing is maintained (i.e. positive (RED) terminal on speaker is connected to positive (RED) terminal on amplifier, and similarly for negative (BLACK)).

SUB-WOOFER/MK 1411 B INTERFACE SYSTEM

CONNECTION

GENTLY lay fhe woofer module on its side, exposing the woofer cone and left and right terminal connections (6). Connect the woofer terminals on the left to the terminals labeled 'woofer' on the back of the left speaker inferface. Repeat this procedure for the right channel. Be sure to maintain proper phasing (see section on phasing in the placement section of the manual.)

When complete, there will be a left and a right cable leading to the single bass module. Return the bass module to its operating position (woofer cone facing down).

While it is generally advisable to place the bass module at a central location between the speakers, some room arrangements may not permit this. Our listening tests revealed balanced bass performance when the module was placed within the shaded area in the "PLACEMENT DIAGRAM". Close proximity to walls or corners will result in uneven response, with these placements typically yielding increased bass at the expense of low-frequency linearity.

NOTE: Due to the break-in requirement of the electrostatic portion of the speaker system, the first few days of playing time will produce sonic improvement and an increase in efficiency.

RECOMMENDED SET-UP AND SPEAKER PLACEMENT

DISTANCE FROM WALL

Leave at least three feef from the speakers to the rear wall. To determine this distance, measure from f he center of the back of the speaker to the rear wall. This measurement should be taken on a perpendicular to the speaker. Allow at least two feet from the side of the speakers to the side walls.

PLACEMENT WITHIN THE ROOM

By placing the speakers far apart against a tong wall, you wilt obtain the largest "listening window" without loss of center All. Race the speakers so that they form an equilateral triangle with the listening posifion at the apex. (Refer to Figure IA).

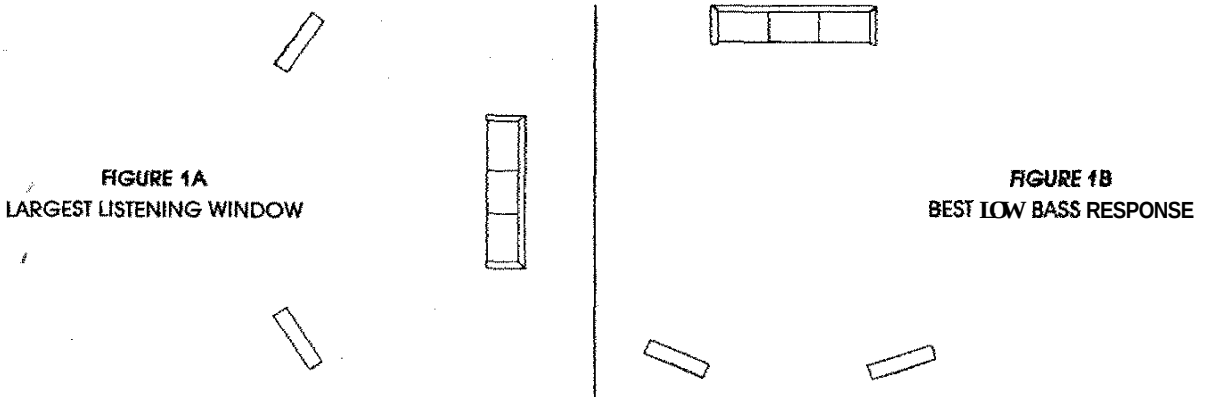


FIGURE 1A
LARGEST LISTENING WINDOW

FIGURE 1B
BEST LOW BASS RESPONSE

By placing the speakers against the short wall of the room, with the rear of the speakers projecting into the corners, the deepest possible bass will be obtained. It may be impossible to retain the two feet suggested distance from the stde of the speaker tot he wall in a narrow room. In this case, it is preferable to use the available space to separate the two speakers, and locafe them closer to the side walls. (Refer to Figure 1B).

ANGLING

Angle the speakers with the panels directed toward the listening position. There are two general methods for angling or toe in (Refer to Figure 2 on following page). 1) Angle the speakers so that the "apex" is slightly in front of the listener. (See Position A). This arrangement offers the widest listening window. enabling you to move your listening position with a minimum of tonal change; OR 2) Angle the speakers so that the "apex" is slightly behind the listener. (See Position B). This

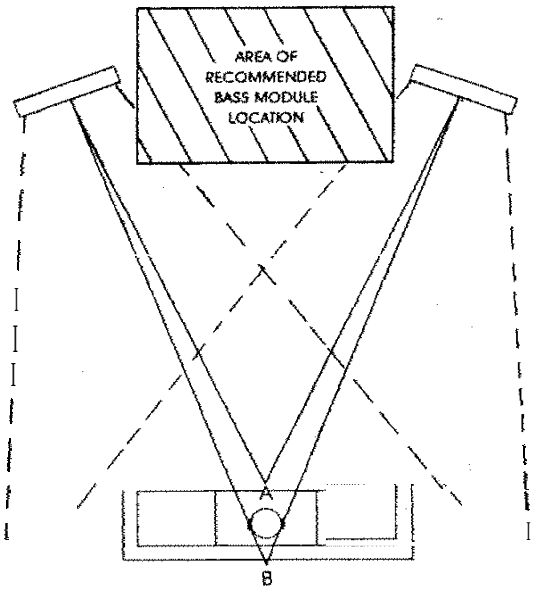
arrangement reduces the "Listening window," but provides a more focused sound. It requires less angling, therefore. the speakers are angled outward slightly to achieve this "apex" position.

NOTE Neither position is in all cases superior to the other. Personaf taste and room placement will determine which is the best for you. Experiment!

ACOUSTICAL PROPERTIES OF THE WALLS

A live end-dead end sef-up in the listening room can sometimes improve the sonic characteristics of a speaker system. This can be accomplished by using materials behind the speakers such as Sonex, fiberglass panels, carpet. tapestry, etc. Treating the walls can yield more precise imaging and superior focus from your speakers. Perform a listening test before you treat fhe walls permanently, using a heavy blanket suspended temporarily while you listen.

FIGURE 2



THE SOLID LINES ARE SHOWN TO FACILITATE ANGLING ONLV WHEN THE PANELS ARE PERPENDICULAR TO THE RESPECTIVE SOLID LINE THAT APEX IS ACHIEVED

THE DASHED LINES REPRESENT THE SONIC RADIATION OF THE SPEAKERS

NOTE SPEAKERS SHOWN ARE DRAWN WITH THE FRONT PLANE OF ME SPEAKER PERPENDICULAR TO THE LISTENER IN A ROOM THIS SET—UP WOULD MELD THE APEX IN THE B POSITION TO ACHIEVE THE APEX IN POSITION A THE SPEAKERS WOULD HAVE TO BE ANGLED IN SLIGHTLY

PHASING

Acoustat speakers are designed to preserve the correct absolute phase throughouf the system, including the final coupling of the signal to the air. The ensures that both vocalists and instruments will sound as natural as possible. Phasing depends on the correct connecflonsh-om the interface. Be sure these connections are correctly orientred, i.e., red (+) to red, and black(—·) to black.

ELECTRIC FEEDBACK

Electrostatic speakers produce a strong electric Reld which can influence the operation of any low level electronic circuitry in close proximity. This can result in feedback well above the audio spectrum, which has the effect of power dissipation and decreased headroom in the system. For this reason, the turntable/cartridge leads and the phono inputs of the preamplifier should be kept at Least six to eight feef from the nearest speaker to ensure that no feedback can occur.

WARNING! DO NOT apply audio signal to the intelface with the AC Power removed, hence no panel bias! Connection to switched outlets is not recommended. DO NOT exceed fuse ratings or bypass fuse receptacle. Either of the above conditions will result in damage to the low frequency transformer if the interface is overdriven, requiring and expensive repair not covered by the warranty.

CLEANING

Speakercloth may be cteoned with any commercial cleaning fluid, or any cleaner designed fo be used with polyester knit fabrics. Use a cleaner such as K2R for small concenffated spots.

REMOVAL OF INTERFACE FOR ALL MODELS

WARNING: ALWAYS UNPLUG THE LINE CORD BEFORE REMOVING THE INTERFACE!

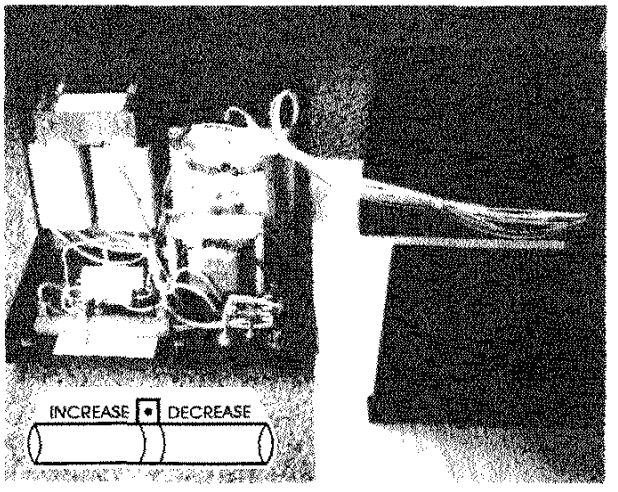
If the interface must be removed from the speaker, the following procedure is necessary to discharge the panels:

1. UNPLUG the interface from the A.C. outlet and disconnect the speaker leads from the amplifier.
2. Remove the four allen head screws that secure the main interface assembly, using the hex-wrech provided.
3. Separate the interface unit from the side support brackets only.
4. Set the interface unit on the Boor directly behind the speaker, being careful not to unpfug the three wire groups or strain the wiring harness.
5. Remove the center RED pin plug. Hold the wire an inch behind the pin and GENTLY pull. DO NOT GRAB THE PLUG! Touch the RED tip to either the BLUE or WHITE terminal on the circuit board.
6. Loosen the two thumbscrews and remove the hooks.

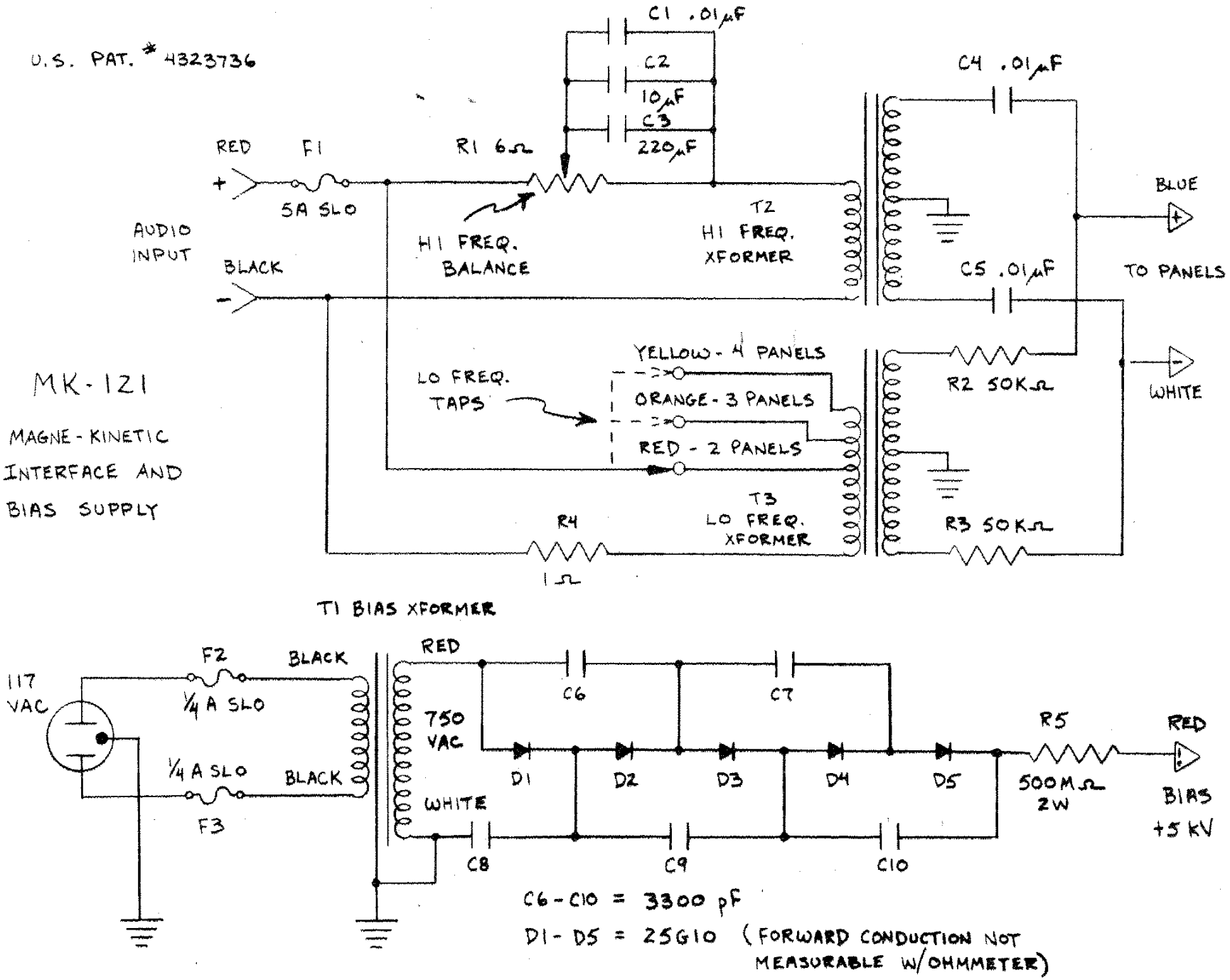
WARNING: High static voltages are present in the charged panel. Failure to fallow these procedures will result in an annoying but harmless electrical shack.

HIGH – FREQUENCY BALANCE CONTROL

The high frequency balance is pre-set at the factory for optimum performance in a room with "typical" acoustics. This level can be adjusted for extreme situations in fhe following manner. Follow the instructions for "REMOVAL OF INTERFACE" at fhe end of the manual. Referring to diagram (6), locate the high frequency batance resistor in the interface assembty. Loosen the center tap and slide left or right, according to the diagram for increase or decrease. After adjustment, tighten tap securely. NOTE For optimum performance and stereo imaging be SURE that both speaker taps are adjusted IDENTICALLY. preferably checked with an ohmmeter.



U.S. PAT. # 4323736



MK-121

MAGNE-KINETIC INTERFACE AND BIAS SUPPLY

C6 - C10 = 3300 pF

D1 - D5 = 25G10 (FORWARD CONDUCTION NOT MEASURABLE W/OHMMETER)

2000 TUE 21:57 FAX 704 ≋1 048; LEE NICHOLS ARCH 010/014

Component Values List – MK-121

C1	.01	uF	Polystyrene
c 2	10	uF	Polypropylene
c 3	220	uF	Non-polar lytic
c4, C5	.01	uF	*6* KV Polypropylene
C6, C7, C8, C9, C10	*3300*	pF	6KV

R1	*6* ohm	50 w	slider adjust
R2. *R3*	50 K ohm	50 w	
R4	1 ohm	20 w	
R5	500 M ohm	2 W	

D1-D5	25G10 High voltage diode

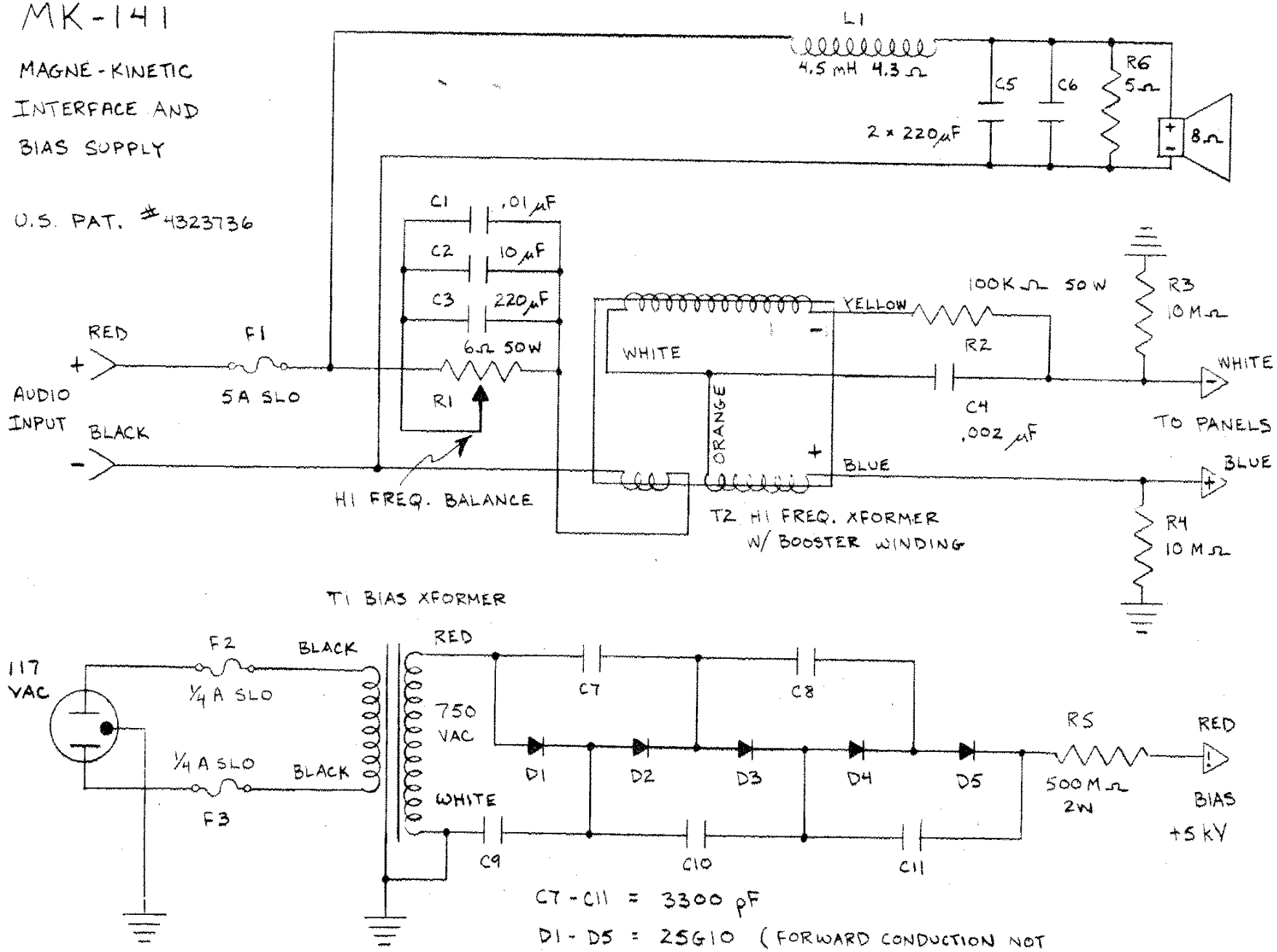
'T1	Acoustat Bias Transformer
T2	Acoustat MK121 Hi Frequency Transformer
' T3	Acousfaf MK121 Lo Frequency Transformer

F1	5 Amp Slo-Blo
F2, *F3*	1/4 Amp Slo-Blo

MK-141

MAGNE-KINETIC
INTERFACE AND
BIAS SUPPLY

U.S. PAT. #4323736



C7 - C11 = 3300 pF

D1 - D5 = 25G10 (FORWARD CONDUCTION NOT MEASURABLE W/ OHMMETER)

Component Values *List* – MK-141

C1	.01	uF	Polystyrene
c2	40	uF	Polypropylene
c3	220	uF	Non-polar lytic
C4	.002	uF	6 KV Ceramic disc
C5, C6	220	UF	Non-polar lytic
C7, C8, C9, CI 0, C11	3300	pF	3 KV Ceramic *disc*

R1	6 ohm	50 w	slider adjust
R2	100 K ohm	50 w	
R3, R4	10 M ohm	3w	
R5	500 M ohm	2 w	
R6	5 ohm	20w	

D1-D5	25610	High voltage diode

L1	45 mH/4.3 ohm	Air core indicator

T1	Acoustat Bias Transformer
T2	Acoustat MK141 Transformer

F1	5 Amp Slo-Blo
F2, F3	1/4 Amp Slo-Blo

ACOUSTAT

3101 Southwest First Terrace / Fort Lauderdale, Florida 33315
phone: (305) 462-6700

The concept of the electrostatic loudspeaker, or ESL, is simple and goes back about sixty years. The idea is to use electrostatic forces to move a very low mass diaphragm with even pressure over its entire area. The successful application of this principle can give considerable sonic benefits over conventional high mass loudspeaker cones or diaphragms. It promises full range coverage without crossovers, with very low distortion, and with superior transient performance with consequent clarity and smoothness of reproduction.

The promise of ESLs stimulated designers for many years, and about 30 years ago advances in materials and technology permitted the first commercial units to appear. Unfortunately, technology of that period restricted those units to limited range devices such as tweeters or to units with greatly restricted sound output capabilities. Attempts to drive them hard resulted in internal breakdowns. These early units indicated the promise of ESLs but were not successful in surmounting their limitations.

However, in the past 15 years Acoustat has pioneered in overcoming the obstacles which faced the ESL. Acoustat has developed breakdown-proof panels which can be combined into various configurations for different loudspeaker models–and Acoustat has developed an interfacing element which permits conventional high quality amplifiers to drive the Acoustat to concert hall sound pressure levels.

The range of Acoustat models also now includes a smaller, lower priced speaker, the Model One which uses a dynamic woofer but preserves the electrostatic principle over all but the lowest frequencies. So now Acoustat offers a full choice of electrostatic loudspeaker systems–loudspeakers that are the culmination of many years of development which was applied with the bold premise that the theoretical promise of Electrostatic Loudspeakers could be brought to successful practical fruition.

At last this ideal music transducer is no longer a goal of the future, but is here today in a manageable size and price range that will appeal to every music lover and to every audiophile.

And, it is not only sonically superb, it is reliable to the point of being virtually indestructible.

What makes the Acoustat Speakers unique?

ELECTROSTATIC ELEMENT:

The Acoustat pure electrostatic speakers (One + One, Three, Two + Two) and the Professional Series–(Models SIX and EIGHT) utilize full-range element electrostatic panels to reproduce all frequencies in the audible range without splitting the frequency spectrum with separate drivers and crossovers. The ideal method of reproducing musical wave forms would be to exactly reverse the process of the recording microphone..and for that matter, the full range element function of the human ear.

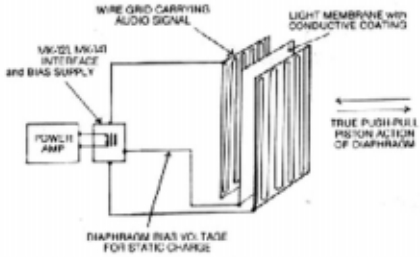


FIGURE 1 Electrostatic Operating Principle:

The electrostatic transducer is composed of a thin Mylar membrane (diaphragm) stretched and contained between two acoustically open wire grids. The diaphragm is connected to a high-voltage, low-current bias supply, which provides an electrostatic charge that becomes trapped in the diaphragm. The two wire grids, receiving a high-voltage audio signal from the plus/minus outputs of the MK-121 interface, provide an electric field equivalent to the audio signal. In the presence of an audio signal, the electric field exerts forces on the electrostatic charge that is trapped in the diaphragm. These forces are transferred to the diaphragm, causing the diaphragm to move in synchronization with these forces.

Only with the electrostatic transducer can this ideal method be realized. With the subwoofered version (Model One) most of this ideal is preserved because of the low crossover frequency of the woofer.

Each speaker contains one, two, three or four electrostatic panels which are angled for horizontal dispersion, but electrically they perform as a single unit. All are driven full range in the pure electrostatic versions and "nearly" full range in the Model One.

LOW-MASS RADIATOR WITH INTIMATE DRIVE:

Again, the human ear, the microphone, and Acoustat speakers all utilize a very low mass diaphragm, intimately driven over its entire surface. The diaphragm of the Acoustat speaker is only .00065 inches thick, and weighs as much as an equivalent size volume of air only 7 millimeters thick! This super light diaphragm is then driven over its entire surface by the audio signal. This gives the audio signal several million times more control over air motion than is possible with a multi-way cone system and several hundred thousand times more control than a planar magnetic or ribbon type speaker, where the audio signal force is only present at the voice coils–not on the actual diaphragm that moves the air.

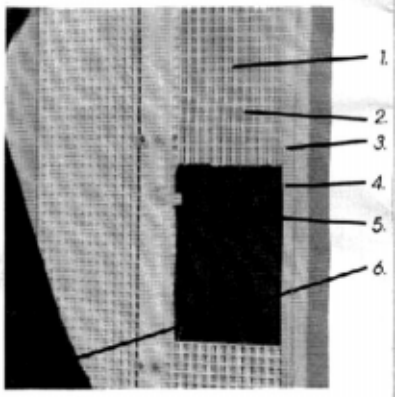
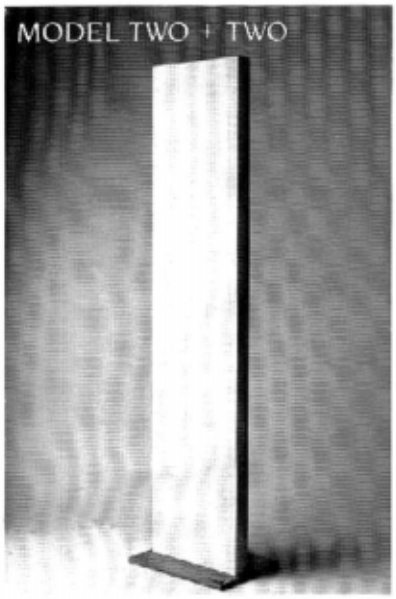


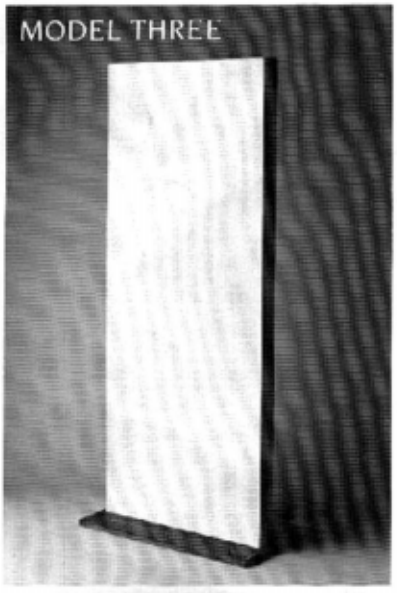
FIGURE 2 Acoustat Speaker Cutaway

1. Wire grids carrying high-voltage audio signal, positioned on either side of the diaphragm.
2. Mylar Diaphragm, only .00065 inches thick.
3. Rigid, monolithic construction, using only the finest materials available.
4. Bias Feed, carries the static charging voltage to the diaphragm.
5. Conductive coating on diaphragm holds static charge.
6. Special acoustically transparent grille cloth.

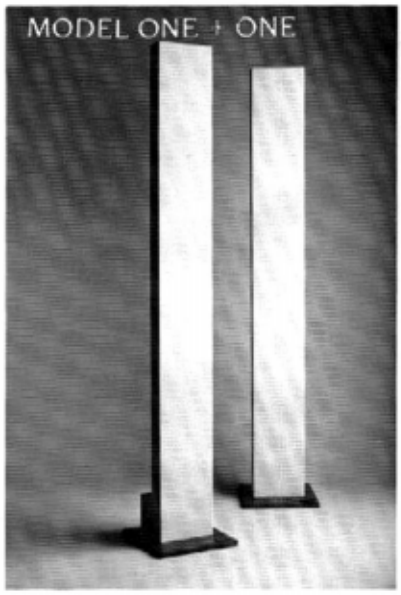


The TWO + TWO represents the pinnacle of Acoustat's pure electrostatic technology for the home (given an average to moderately large listening environment). Critically acclaimed for their openness, transparency, efficiency, dynamic range, bass response and sheer musicality, they have quickly become the reference standard for a majority of reviewers and critics of fine audio equipment and recordings. They provide the ideal vertical line source, uniform horizontal dispersion and integrate beautifully into any room with a standard eight foot ceiling.

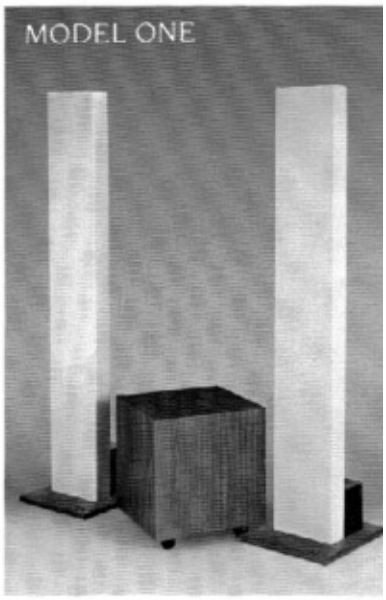
Never before has a speaker offered so much quality at such a reasonable cost, in such a versatile size.



The Acoustat Model THREE is the culmination of 10 years of experience in design and construction of state-of-the-art electrostatic speaker technology. The Model Three features a unique "curved array" panel design which maintains optimal frequency and phase response across a broad listener arc. The output of the Model Three precisely and accurately mirrors the input signal, without crossover phase shift or typical cone driver degradation. The Model Three is best matched to a 15' x 20' room (or other large room with ceilings lower than 8') where it will deliver superb bass response and 110 db (program material Peaks) sound pressure level with a minimum of 70 watts per channel.



In designing the Acoustat Model ONE + ONE, our reference was live music–The ultimate test. Because the One + One is free from the distortions and colorations of conventional multi-way box-type speakers, music emerges with all the harmonics and sonic detail of the original performance. The One + One's revolutionary floor-to-ceiling coherent line source array recreates the height and depth of the concert hall with realism unmatched by the most exotic designs, at an amazingly affordable price.



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ONE is Acoustats smallest speaker. I
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A diaphragm of such extreme lightness, in combination with an actuating force that is uniformly distributed over the entire surface of the diaphragm, results in a transducer whose transient response closely duplicates the electrical input. The net result is a diaphragm motion that is a replica of the electrical forces acting upon it, with all sections of the diaphragm surface moving with highly accurate phase and amplitude linearity throughout its excursion, at all frequencies. This characteristic of Acoustat loudspeakers results in an amazingly open, well-defined sound, with preservation of detail at all listening levels.

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It is hard to describe just how revolutionary this new method for driving fullrange-element electrostatic speakers really is. It solves a 30-year old problem originally defined by the introduction of the first somewhat fullrange electrostatic speakers in the mid-50's.

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The MK-121 is of "biformer" design. Two optimized Acoustat Medallion transformers (single transformer in MK-141 with double core and windings and operation to 100 Hz) cooperatively overlap to handle the critical midrange band. Each has special properties to extend uncompromised performance in its own exclusive domain (bass and high frequencies respectively). It can be said without contradiction that never before has such a nearly perfect power-impedance match been possible. The result is a quantum leap in efficiency, allowing most 50-100 watt-per-channel amplifiers to work very well in nearly all listening situations. In addition, the load presented to the amplifier is an extremely manageable 4 ohms, more linear than many conventional speaker systems.

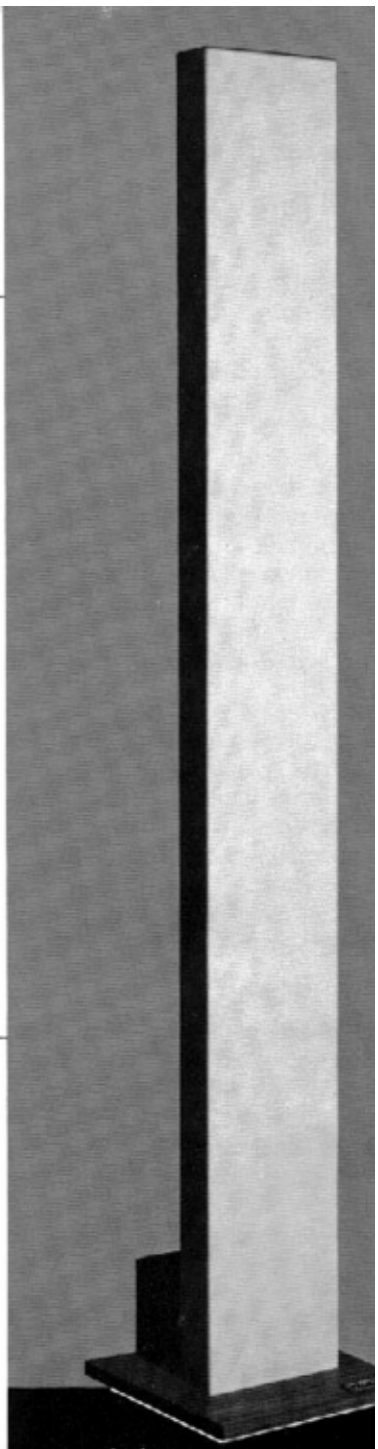
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WARRANTY:
Limited Lifetime Warranty.
See Warranty Statement for Details.

*U.S. Patent No. 4,323,736



Model One + One

Frequency Response:
30-20K Hz ± 2 dB

Sound Pressure Level:
110 dB @ 18' in a 14'x 22' room
(Program Material Peaks)

Minimum Power Requirements:
70 Watts per channel

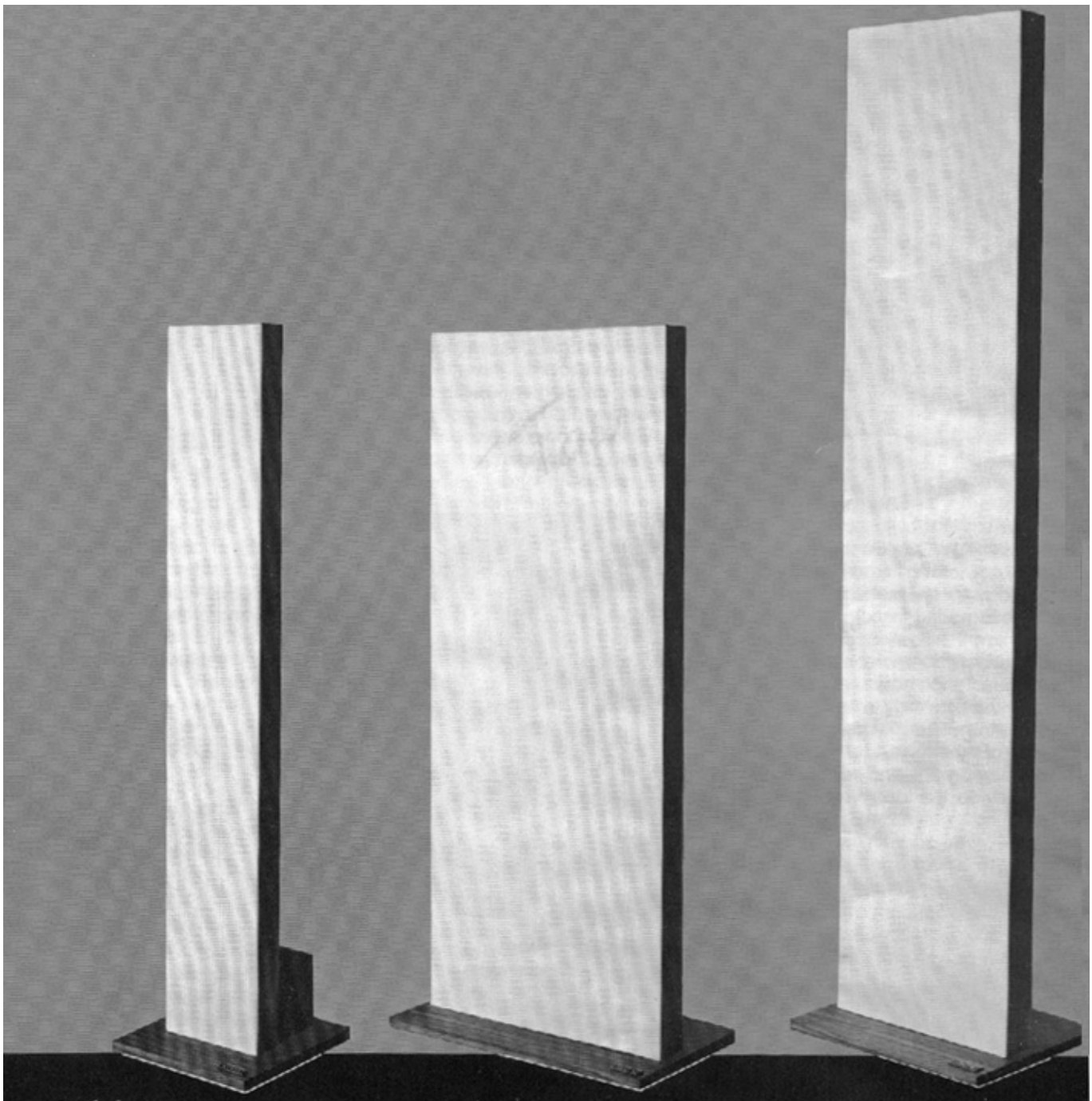
Nominal Impedence: 4 ohms

Power Consumption:
5 Watts (120v, 50/60 Hz)

Control: High Frequency Balanc
(Controls frequencies above

Dimensions: 93"x11"x3½"

Weight: 72 lbs. (Net weight for
speaker with interface)



Model One

Frequency Response:
30-18K Hz ± 3 dB

Sound Pressure Level:
108 dB @ 15' in a 14'x18' room.
(Program Material Peaks)

Minimum Power Requirements:
75 Watts per channel

Nominal Impedence: 4 ohms

Power Consumption:
5 Watts (120v, 50/60 Hz)

Control: High Frequency Balance
(Controls frequencies above 10K Hz)

Dimensions: panels 72"x11"x3½"
Woofer Cube: 18½x18½x18½ *(not pictured)*

Weight: 65 lbs. (one speaker with interface) 55 lbs. woofer cube

Model Three

Frequency Response:
30-20K Hz ± 2 dB

Sound Pressure Level:
110 dB @ 18' in a 14'x 22' room.
(Program Material Peaks)

Minimum Power Requirements:
70 Watts per channel

Nominal Impedence: 4 ohms

Power Consumption:
5 Watts (120v, 50/60 Hz)

Control: High Frequency Balance
(Controls frequencies above 10K Hz)

Dimensions: 72"x28"x3½"

Weight: 98 lbs. (Net weight for one speaker with interface)

Model Two + Two

Frequency Response:
28-20K Hz ± 2 dB

Sound Pressure Level:
115 dB @ 20' in a 15'x24' room.
(Program Material Peaks)

Minimum Power Requirements:
50 Watts per channel

Nominal Impedence: 4 ohms

Power Consumption:
5 Watts (120v, 50/60 Hz)

Control: High Frequency Balance
(Controls frequencies above 10K

Dimensions: 93"x20"x3½"

Weight: 95 lbs. (Net weight for one speaker with interface)

approach

EXCEEDINGLY FLAT RESPONSE:

Acoustat speakers are capable of extremely uniform amplitude throughout their range, as well as freedom from local peaks and valleys in their response. This locally flat nature of the electrostatic transducer cannot be duplicated with any dynamic driver, and results in a total absence of the typical loudspeaker tonal colorations. The speaker in effect "disappears," allowing the music to pass through it unaltered.

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With five to ten times lower distortion across the frequency spectrum than a full dynamic (magnetic) type speaker, the listener enjoys extended listening sessions without the typical "listener fatigue" associated with most audio systems.

Which model is right for you?

In general, your primary considerations, other than cost, are room size and volume levels desired. The return for the larger size speakers is higher efficiency (less power required for a given volume level in the same size room), greater maximum sound pressure level, and slightly extended bass response. Your Acoustat dealer can help you choose the model best suited to your specific listening situation.

Available cosmetic finishes:

Acoustat speakers come standard from the factory covered with high quality polyester knit grill cloth in a rich beige color that will complement any decor. Speaker bases (all models) and woofer cubes (Model One only) are made of high density particle board (to resist warping) and are finished in handsome teak formica. Black grille cloth, as well as Oak, Walnut, Rosewood, and Gloss Black formica bases and cubes are available on a special order basis at a slight extra charge.

Most American technological achievements evolved in a classic pattern:

Typically, small groups of creative individuals achieve technological breakthroughs, but find the large companies which employ them unwilling to implement new designs without an assured market.

In frustration, these individuals break away from the parent companies to build and market their new designs on their own–on the faith that the consumer will recognize the advantages of their superior products.

American technology has reached its present pinnacle largely due to this process. Acoustat, as well as many other high-end audiophile companies, has been created in precisely this way. Most high-innovation and growth semi-conductor companies have also evolved in a similar fashion.

Acoustat's research started 25 years ago. Some milestones have been:

1972: Development of hybrid direct drive, high-voltage amplifiers. U.S. Patent #4,324,950. Perfection of indestructible full-range-element electrostatic panels and practical construction techniques.

1976-1977: First commercial introduction of the critically acclaimed Model X with built-in direct-drive, high-voltage amplifier, followed by the larger Monitor Series speakers.

1980: Invention of Magne-Kinetic passive (transformer) drive system. MK-121 U.S. Patent #4,323,736.

1980-1981: Introduction of the Slimline Series Model TWO, followed by Models THREE and FOUR.

1980-1981: Selection of Acoustat Speakers as a reference standard by numerous high-end audio component manufacturers, quality recording studios and audiophile record producers.

1982: Introduction of Trans-Nova® Twin-200 Amplifier and Trans-Nova® Pre Amplifier.

1982: Introduction of Professional Series Model SIX and Model EIGHT followed by the Model TWO + TWO.

1983: Introduction of Modular-Hybrid Speaker Series.

1984: Introduction of the Vertical Line Source Model ONE + ONE.

1985: Development of the Acoustat Medallion Audio Transformers.

1985: Introduction of the Single Panel Model One.

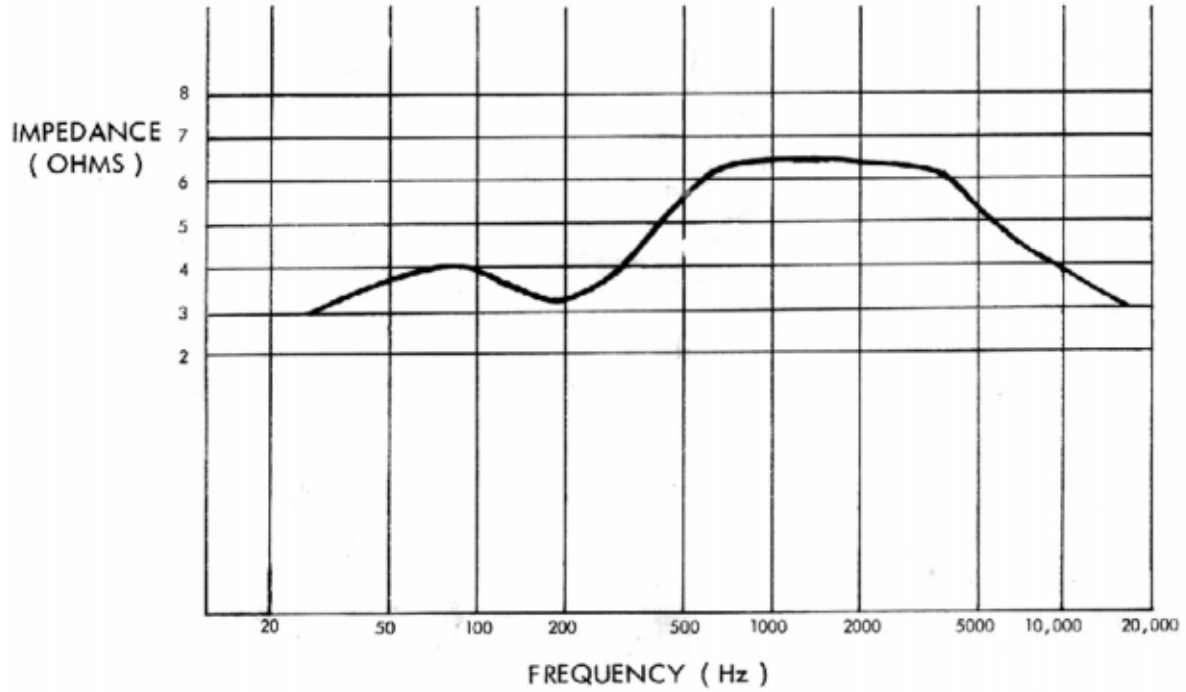
ACOUSTAT
A DIVISION OF THE DAVID HAFLER COMPANY

Revolutionary By Design

3101 Southwest First Terrace
Fort Lauderdale, Florida 33315
Phone 305/462-6700

Authorized Dealer

FIGURE 5 IMPEDANCE CURVE OF ACOUSTAT MK-121 LOUDSPEAKER SYSTEMS
(MEASUREMENTS MADE ON ACOUSTAT VECTOR-IMPEDANCE METER)



High-Frequency Control at Two o'clock Position
Maximum Phase Angle : ± 30 degrees

ACOUSTAT
corporation

3101 Southwest First Terrace, Fort Lauderdale, Florida 33315

Phone: 305/462-6700

Model One
Model One + One
Model Two + Two
Model Three

ELECTROSTATIC SPEAKER SYSTEMS



ACOUSTAT

SPEAKERS ▫ ELECTRONICS

Revolutionary By Design

The concept of the electrostatic loudspeaker, or ESL, is simple and goes back about sixty years. The idea is to use electrostatic forces to move a very low mass diaphragm with even pressure over its entire area. The successful application of this principle can give considerable sonic benefits over conventional high mass loudspeaker cones or diaphragms. It promises full range coverage without crossovers, with very low distortion, and with superior transient performance with consequent clarity and smoothness of reproduction.

The promise of ESLs stimulated designers for many years, and about 30 years ago advances in materials and technology permitted the first commercial units to appear. Unfortunately, technology of that period restricted those units to limited range devices such as tweeters or to units with greatly restricted sound output capabilities. Attempts to drive them hard resulted in internal breakdowns. These early units indicated the promise of ESLs but were not successful in surmounting their limitations..

However, in the past 15 years Acoustat has pioneered in overcoming the obstacles which faced the ESL. Acoustat has developed breakdown-proof panels which can be combined into various configurations for different loudspeaker models–and Acoustat has developed an interfacing element which permits conventional high quality amplifiers to drive the Acoustat to concert hall sound pressure levels.

The range of Acoustat models also now includes a smaller, lower priced speaker, the Model One which uses a dynamic woofer but preserves the electrostatic principle over all but the lowest frequencies. So now Acoustat offers a full choice of electrostatic loudspeaker systems–loudspeakers that are the culmination of many years of development which was applied with the bold premise that the theoretical promise of Electrostatic Loudspeakers could be brought to successful practical fruition.

At last this ideal music transducer is no longer a goal of the future, but is here today in a manageable size and price range that will appeal to every music lover and to every audiophile. And, it is not only sonically superb, it is reliable to the point of being virtually indestructible.

What makes the Acoustat Speakers unique?

ELECTROSTATIC ELEMENT:

The Acoustat pure electrostatic speakers (One + One, Three, Two + Two) and the Professional Series–(Models SIX and EIGHT) utilize full-range element electrostatic panels to reproduce all frequencies in the audible range without splitting the frequency spectrum with separate drivers and crossovers. The ideal method of reproducing musical wave forms would be to exactly reverse the process of the recording microphone...and for that matter, the full range element function of the human ear.

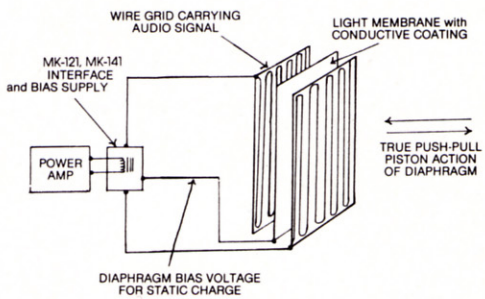


FIGURE 1 Electrostatic Operating Principle:

The electrostatic transducer is composed of a thin Mylar membrane (diaphragm) stretched and contained between two acoustically open wire grids. The diaphragm is connected to a high-voltage, low-current bias supply, which provides an electrostatic charge that becomes trapped in the diaphragm. The two wire grids, receiving a high-voltage audio signal from the plus/minus outputs of the MK-121 interface, provide an electric field equivalent to the audio signal. In the presence of an audio signal, the electric field exerts forces on the electrostatic charge that is trapped in the diaphragm. These forces are transferred to the diaphragm, causing the diaphragm to move in synchronization with these forces.

Only with the electrostatic transducer can this ideal method be realized. With the subwoofered version (Model One) most of this ideal is preserved because of the low crossover frequency of the woofer.

Each speaker contains one, two, three or four electrostatic panels which are angled for horizontal dispersion, but electrically they perform as a single unit. All are driven full range in the pure electrostatic versions and "nearly" full range in the Model One.

LOW-MASS RADIATOR WITH INTIMATE DRIVE:

Again, the human ear, the microphone, and Acoustat speakers all utilize a very low mass diaphragm, intimately driven over its entire surface. The diaphragm of the Acoustat speaker is only .00065 inches thick, and weighs as much as an equivalent size volume of air only 7 millimeters thick! This super light diaphragm is then driven over its entire surface by the audio signal. This gives the audio signal several million times more control over air motion than is possible with a multi-way cone system and several hundred thousand times more control than a planar magnetic or ribbon type speaker, where the audio signal force is only present at the voice coils–not on the actual diaphragm that moves the air.

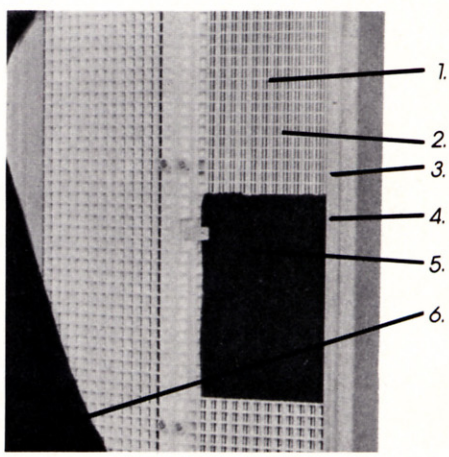


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1. Wire grids carrying high-voltage audio signal, positioned on either side of the diaphragm.
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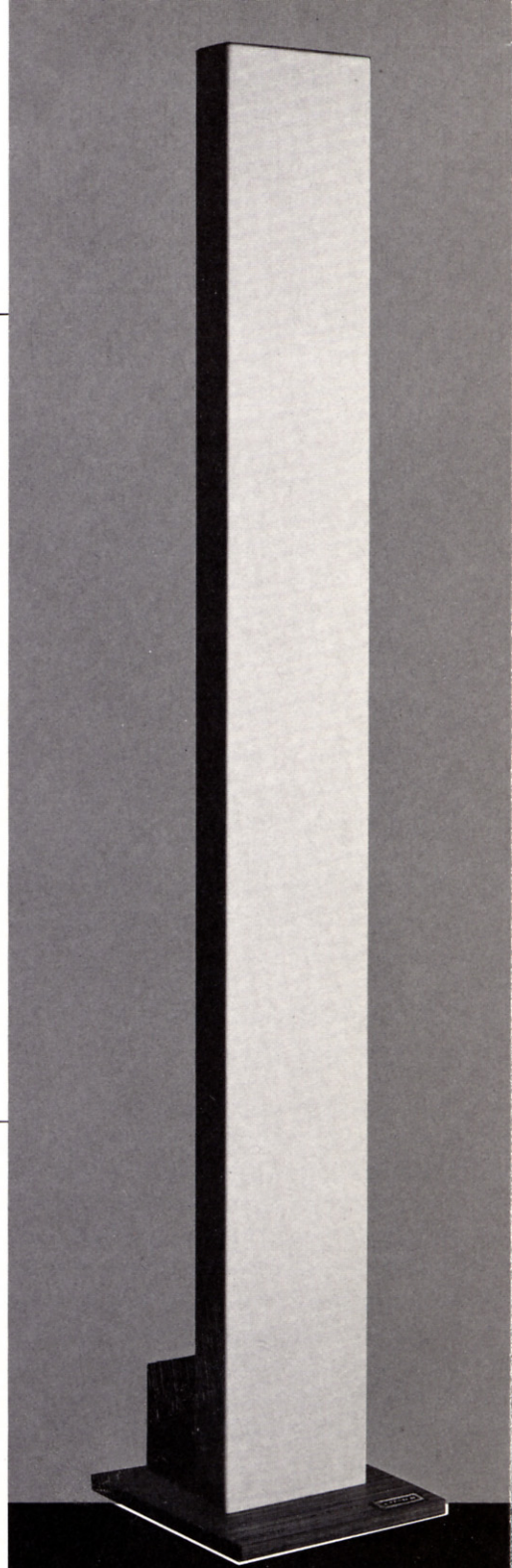
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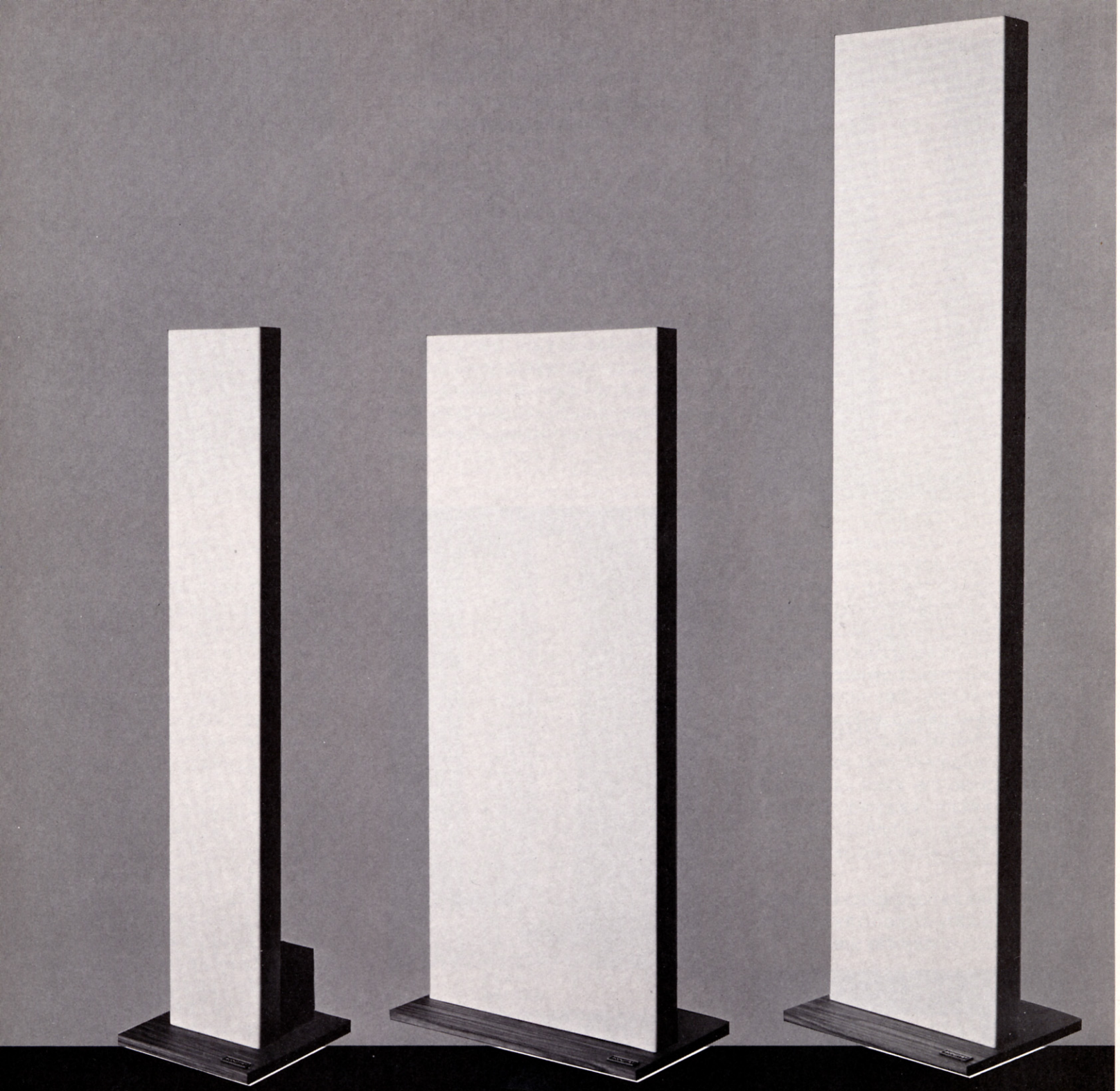
WARRANTY:
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*U.S. Patent No. 4,323,736



Model One + One

Frequency Response: 30-20K Hz ± 2 dB
Sound Pressure Level: 110 dB @ 18' in a 14'x 22' room. (Program Material Peaks)
Minimum Power Requirements: 70 Watts per channel
Nominal Impedence: 4 ohms
Power Consumption: 5 Watts (120v, 50/60 Hz)
Control: High Frequency Balance (Controls frequencies above 10K Hz)
Dimensions: 93"x11"x3½"
Weight: 72 lbs. (Net weight for one speaker with interface)



Model One

Frequency Response:
30-18K Hz ± 3 dB

Sound Pressure Level:
108 dB @ 15' in a 14'x18' room.
(Program Material Peaks)

Minimum Power Requirements:
75 Watts per channel

Nominal Impedence: 4 ohms

Power Consumption:
5 Watts (120v, 50/60 Hz)

Control: High Frequency Balance
(Controls frequencies above 10K Hz)

Dimensions: panels 72"x11"x3½"
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Weight: 65 lbs. (one speaker with interface) 55 lbs. woofer cube

Model Three

Frequency Response:
30-20K Hz ± 2 dB

Sound Pressure Level:
110 dB @ 18' in a 14'x 22' room.
(Program Material Peaks)

Minimum Power Requirements:
70 Watts per channel

Nominal Impedence: 4 ohms

Power Consumption:
5 Watts (120v, 50/60 Hz)

Control: High Frequency Balance
(Controls frequencies above 10K Hz)

Dimensions: 72"x28"x3½"

Weight: 98 lbs. (Net weight for one speaker with interface)

Model Two + Two

Frequency Response:
28-20K Hz ± 2 dB

Sound Pressure Level:
115 dB @ 20' in a 15'x24' room.
(Program Material Peaks)

Minimum Power Requirements:
50 Watts per channel

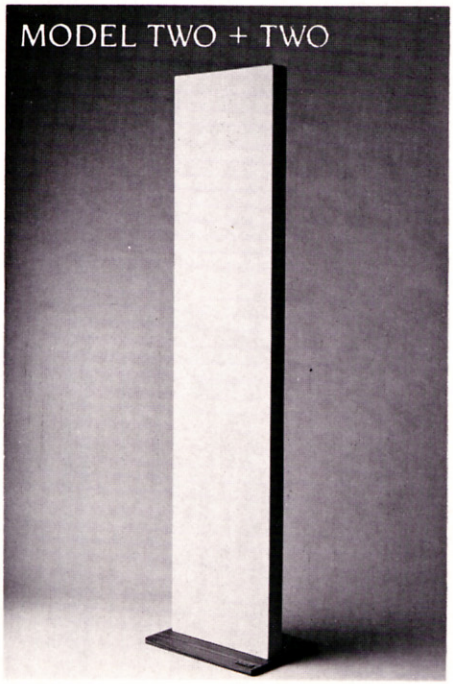
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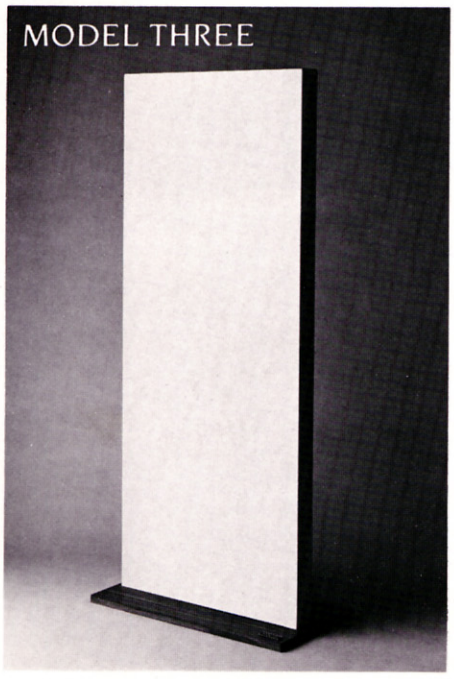
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Weight: 95 lbs. (Net weight for one speaker with interface)

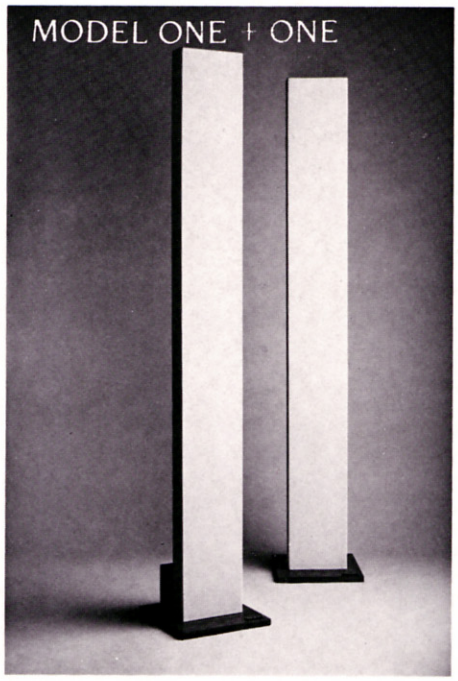


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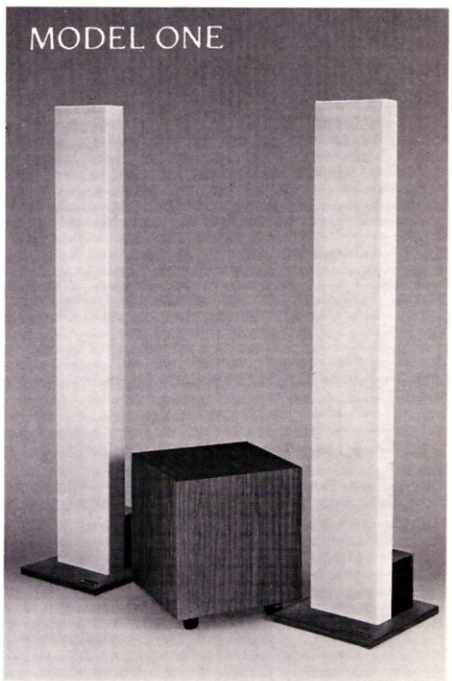
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The single panel, six foot tall, Model ONE is Acoustats smallest speaker. It is the ideal electrostatic for apartment dwellers and others whose listening rooms are in the small-moderate size category. It is a fact of the physics of the electrostatic transducer that as the size of the overall panel area decreases, one reaches a point where sub-woofer augmentation is desirable to maintain satisfactory bass response efficiency and dynamic authority. While the frequency range covered by the sub-woofer comprises (by ratio) only 3 or 4% of the frequency spectrum, to handle that last 3 or 4% electrostatically requires a greatly increased panel area and a more complex and expensive transformer drive system. Therefore, the Model One is a hybrid system utilizing a 10" dual voice coil floor-firing dynamic sub-woofer. The woofer is mounted in an 80.5 liter enclosure. The 18 inch woofer cube is finished in an attractive teak mica (other finishes available) and mounted on casters for ease in placement. The woofer cone itself is made of polypropylene and exhibits far less cone break-up than conventional drivers. The Model One's crossover point is well below the crucial midrange where crossovers and multiple drivers do the most damage, hence the midrange coloration and sonic degradation that are typical of conventional two-way speaker systems are totally eliminated.

Other advantages of the Acoustat approach:

EXCEEDINGLY FLAT RESPONSE:

Acoustat speakers are capable of extremely uniform amplitude throughout their range, as well as freedom from local peaks and valleys in their response. This locally flat nature of the electrostatic transducer cannot be duplicated with any dynamic driver, and results in a total absence of the typical loudspeaker tonal colorations. The speaker in effect "disappears," allowing the music to pass through it unaltered.

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American technology has reached its present pinnacle largely due to this process. Acoustat, as well as many other high-end audiophile companies, has been created in precisely this way. Most high-innovation and growth semi-conductor companies have also evolved in a similar fashion.

Acoustat's research started 25 years ago. Some milestones have been:

1972: Development of hybrid direct drive, high-voltage amplifiers. U.S. Patent #4,324,950. Perfection of indestructible full-range-element electrostatic panels and practical construction techniques.

1976-1977: First commercial introduction of the critically acclaimed Model X with built-in direct-drive, high-voltage amplifier, followed by the larger Monitor Series speakers.

1980: Invention of Magne-Kinetic passive (transformer) drive system, MK-121 U.S. Patent #4,323,736.

1980-1981: Introduction of the Slimline Series Model TWO, followed by Models THREE and FOUR.

1980-1981: Selection of Acoustat Speakers as a reference standard by numerous high-end audio component manufacturers, quality recording studios and audiophile record producers.

1982: Introduction of Trans-Nova® Twin-200 Amplifier and Trans-Nova® Pre Amplifier.

1982: Introduction of Professional Series Model SIX and Model EIGHT followed by the Model TWO + TWO.

1983: Introduction of Modular-Hybrid Speaker Series.

1984: Introduction of the Vertical Line Source Model ONE + ONE.

1985: Development of the Acoustat Medallion Audio Transformers.

1985: Introduction of the Single Panel Model One.

ACOUSTAT
A DIVISION OF THE DAVID HAFLER COMPANY

Revolutionary By Design

3101 Southwest First Terrace
Fort Lauderdale, Florida 33315
Phone 305/462-6700

Authorized Dealer

ACOUSTAT

Full Range Electrostatic Loudspeakers

With MK-121 Drive System



MODEL TWO



MODEL THREE



MODEL FOUR

THE SLIMLINE SERIES

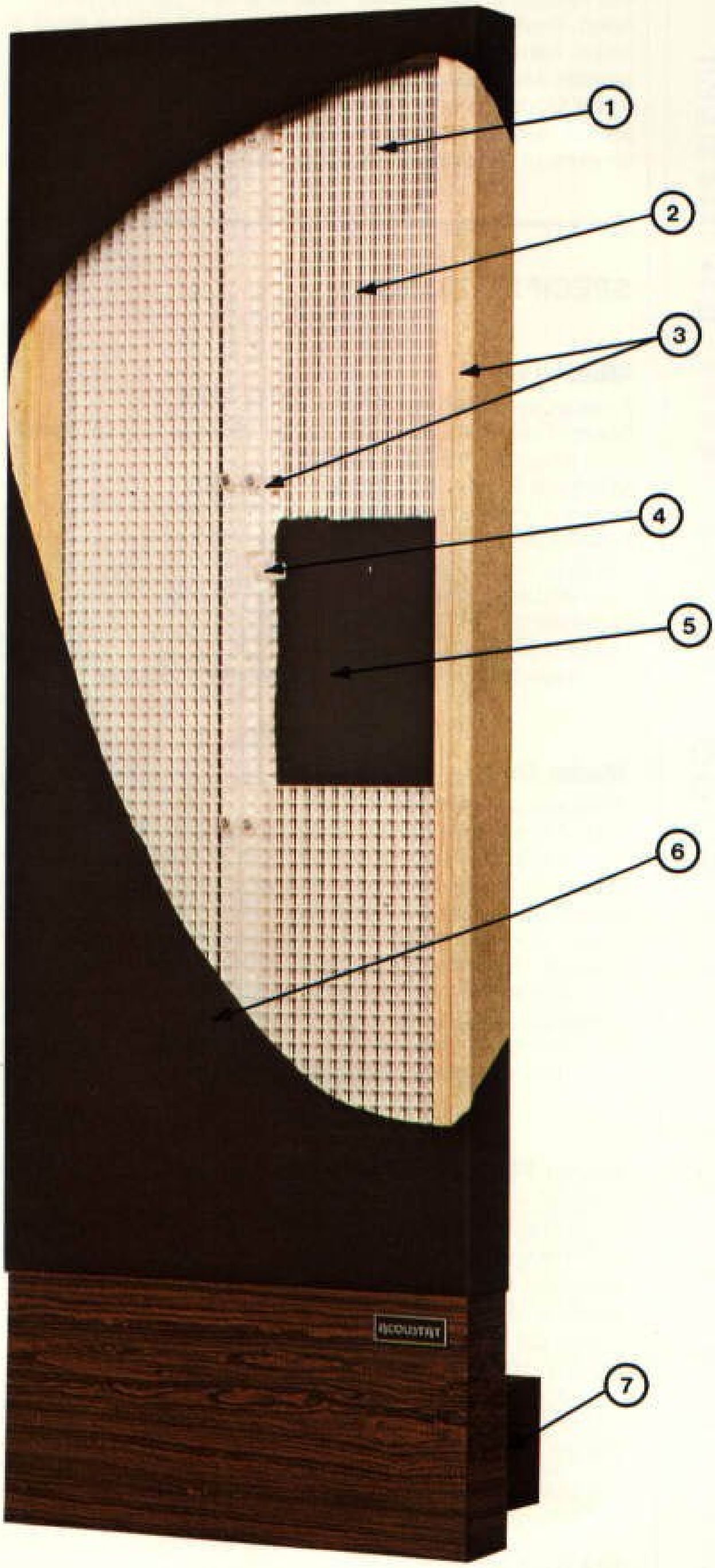


FIGURE 3
Acoustat Loudspeaker Cutaway

1. Audio Signal Carrying Wire Grids, Positioned on Either Side of the Diaphragm
2. Mylar Diaphragm, Radiates all Frequencies, is only .00065 inches Thick
3. Rigid, Monolithic Construction, Using Only The Finest Materials Available
4. Bias Feed, Carries The Static Charging Voltage to the Diaphragm
5. Conductive Coating on Diaphragm Holds Static Charge
6. Special Acoustically Transparent Grille Cloth
7. The Revolutionary MK-121 Interface and Bias Supply (Patent Pending)

The **Acoustat Slimline Series**

A UNIQUE FULFILLMENT OF MUSICAL ACCURACY

From the time the first generation of full-range electrostatic loudspeakers was introduced, about two decades ago, it was apparent that someday this technology could yield speakers of truly superb performance. That day has arrived.

The Acoustat full-range-element electrostatic loudspeaker systems represent the culmination of over 20 years of design and development — beginning with the bold assumption that it was possible to build an electrostatic speaker system of no compromise, one that would be of full range design, capable of high sound pressure levels, have no crossovers, and be more reliable than any speaker of any type.

The new Acoustat Slimline Series loudspeaker systems have achieved all these goals — and much more. Finally, the ideal music transducer (the electrostatic) is available in a full-range-element, crossoverless design, in a manageable size and price range — and is not only reliable, but virtually indestructible.

WHAT MAKES THE ACOUSTAT LOUDSPEAKERS UNIQUE?

The Electrostatic Element: **All** Acoustat loudspeakers utilize full-range-element electrostatic panels to reproduce all frequencies in the audible spectrum — without splitting the frequency spectrum with separate woofer, mid-range and tweeter drivers, and without crossovers and the phase distortion penalty they exact. The ideal method of reproducing musical waveforms would be to exactly reverse the process of the recording microphone, and for that matter the full-range-element function of the human ear. Only with the electrostatic transducer can this ideal method be realized.

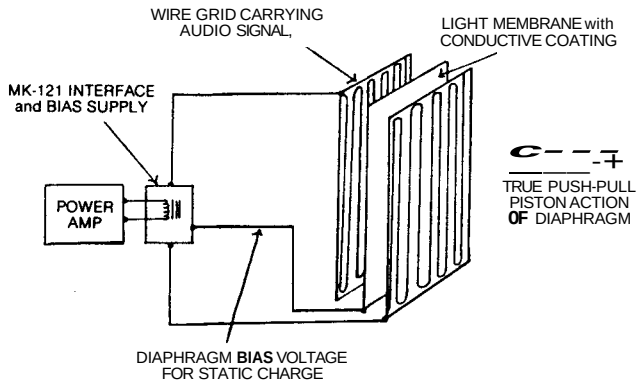


Figure 1 — Electrostatic Operating Principle

The electrostatic transducer is composed of a thin membrane (diaphragm) made of Mylar that is stretched and contained between two acoustically open wire grids. The two grids are connected to the plus/minus outputs of the MK-121 interface, which provides the high-voltage audio signal. The diaphragm is connected to a high voltage, low current bias supply, which provides an electrostatic charge that becomes trapped in the diaphragm. The two wire grids provide an electric field that is the voltage equivalent of the audio signal. In the presence of an audio signal, the electric field exerts forces on the electrostatic charge that is trapped in the diaphragm. These forces are transfered to the diaphragm, causing the diaphragm to move in synchronization with these forces.

Full-Range Elements: The human ear, the microphone, and the Acoustat loudspeakers all employ a single diaphragm to cover all frequencies, from the deepest bass to the highest treble notes. This means the original waveform is not broken into pieces, pieces that would be very disimilar in terms of colorations, time of arrival, and phase. (It has been well documented that quite small changes in phase are readibly audible, and can degrade the clarity and definition of musical transients and upset the homogeneity and coherence of the stereo image.)

Each speaker contains two, three or four panels which are angled for horizontal dispersion, but electrically they are one, and all are driven full range.

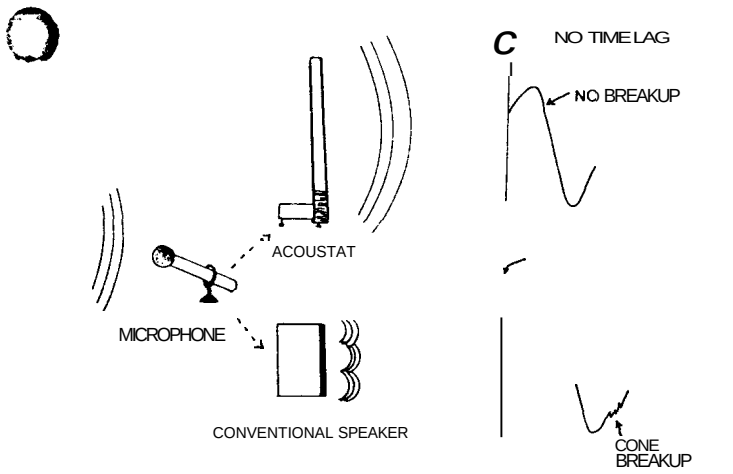


Figure 2 — The Musical Wavefront

The lorces acting lo move the dynamic transducer's cone produce very **dif-**ferent results than the electrostatic transducer. The application of the driving force only to the apex of the cone necessitates a sufficiently stiff cone to prevent buckling and deformation of the cone structure. Such a stiff cone (even **if** it is made of an exotic "low-mass" material) must have considerable mass which degrades its transient response capability significantly. In addition, the forces applied to the apex do not act uniformly over the cone surface and cause it to "break-up" into numerous vibrational modes, only one of which is representative of the original signal.

Figure 2 illustrates the problems of the typical loudspeaker which are due to the limitations of dynamic (magnetic) type drivers. The uniform wavefront of the Acoustat speakers contains all the spatial and harmonic information as it was originally recorded, to give the breathtaking imaging and accurate depth perspective that approaches that of a live concert. A multi-element system with crossovers simply cannot reproduce all this music information correctly — and the truly accurate recreation of the original musical performance is impossible.

Low-Mass Radiator with Intimate Drive: Again, the human ear, the microphone and the Acoustat loudspeaker all utilize a very low mass diaphragm, intimately driven over its entire surface. The diaphragm of the Acoustat loudspeaker is only .00065inches thick, and weighs only as much as an equivalent size volume of air only 7 mm thick! In addition, just like the condenser microphone, the diaphragm is driven over its entire surface by the audio signal. This gives the audio signal several million times more control over air motion than a cone, and several hundred thousand times more control than a planar magnetic or ribbon type speaker, where the audio signal force is only present at the voice — not on the actual diaphragm that moves the air. A coil diaphragm of such extreme lightness, combination with an actuating force that is uniformly distributed over the entire surface of the diaphragm, results in a transducer whose transient response closely duplicates the electrical input. The net result is a diaphragm motion that is a good replica of the electrical forces acting upon it, with all sections of the diaphragm surface moving with highly accurate phase and amplitude linearity throughout its excursion, at all frequencies. This characteristic of the Acoustat speakers results in an amazingly open, well defined sound with preservation of detail at all listening levels.

	Mass of Radiator	Uniformity of Applied Force Over Radiating Area
Dynamic	High	Poor
Planar Magnetic	Lower	Better
Electrostatic	Lowest	Best

Because the radiating area of dynamic (cone) drivers tends to be small, their impedance match to the air is quite poor. The Acoustat electrostatic, with its large radiating area is a much better acoustic impedance match to air, particularly in the difficult low frequency range. This is the reason for the excellent low bass response of which Acoustat speakers are capable.

OTHER ADVANTAGES OF THE ACOUSTAT APPROACH

Exceedingly Flat Frequency Response: Since the Acoustat speakers don't rely on multiple drivers and crossovers to reproduce the audible range of frequencies, they are capable of both extremely uniform amplitude throughout that range, as well as a freedom from local peaks and valleys in their response. This locally flat nature of the electrostatic transducer cannot be duplicated with any dynamic driver, and results in a total absence *of* the typical loudspeaker tonal colorations, which enables the speaker to "disappear", allowing the music to pass through unaltered.

Vanishingly Low Distortion: With 5 to 10 times lower distortion across the frequency spectrum than a dynamic (magnetic) type speaker, the listener can enjoy extended listening sessions without the typical "listener fatigue" associated with most audio systems.

Indestructability and Consistency: Due to the unique panel construction methods pioneered by Acoustat, the loudspeaker system cannot be damaged by over or under powering. The Acoustat speaker systems stand alone in this ability to withstand all audio applications without damage or failure. In addition, the panels maintain extraordinary unit to unit consistency, with no measureable variations between panels. Whereas no two woofers or two tweeters are exactly the same, every Acoustat electrostatic panel is exactly like every other Acoustat panel.

Superb Construction: In order to get the performance that the electrostatic panel is capable of, the panels must be mounted in an extremely rigid, monolithic frame. The Acoustat speaker's frames are made of the strongest, most durable materials available, and are all hand made and assembled at our Florida factory. The Acoustat loudspeaker system is both rigid and remarkably attractive.

THE REVOLUTIONARY MK-121 DRIVE*

It is hard to describe in simple terms just how revolutionary this method for driving full-range-element electrostatic speakers really is. It solves a twenty-five year old problem originally defined by the introduction of the first somewhat full-range electrostatic loudspeakers in the mid nineteen-fifties.

The introduction of the MK-121 Magne-Kinetic Interface* culminates one of the most intensive studies ever made of the overall interactive nature of the electrostatic transducer characteristics, transformer theory, network theory and complex vector impedance. Special in-house instrumentation was used to help perfect the design.

The MK-121 is of "biformer" design. Two optimized transformers cooperatively overlap to handle the critical midrange band. Each has special properties to extend uncompromised performance in its own exclusive domain (bass and high frequencies respectively). It can be said without contradiction that never before has such a near perfect power-impedance match been possible. The result is a quantum leap in efficiency, allowing most 50-100 watt per channel amplifiers to work very well in nearly all listening situations. In addition, the load presented to the amplifier is an extremely peaceful 4 ohm load, more linear than many conventional speaker systems.

The MK-121 is not, however, shy about dealing with much higher powered amplifiers if more incremental headroom is desired. The MK-121 is extremely well built, utilizing military grade, conservatively rated parts. Combined with Acoustat's proven near "bullet-proof" panel technology, the result is a system you can listen to at concert levels without apprehension.

WHICH OF THE MODELS IS RIGHT FOR YOU?

In general, your primary consideration, other than cost, are room size and volume levels required. The return for the larger size speakers is higher efficiency (less power required for a given volume level in the same size room), greater maximum sound pressure level, and slightly extended bass response. For example, a Model Two in a large room would be a poor choice, since a great deal of power would be required to play the system at reasonable volume levels. On the other hand, the Model Four would tend to overload too small a room, resulting in a less well defined image than a smaller Model would provide. In general, however, the three Models are virtually identical in the quality of sound they reproduce, the only difference being the total amount of radiating area employed.

SPECIFICAT10NS

Model Two

Frequency Response: 35-20K Hz & 2 dB
Sound Pressure Level: 105 dB @ 15' in a 12'x18' room
(Program Material Peaks)
Minimum Power Requirement: 100 watts
Nominal Impedance: 4 ohms
Power Consumption: 5 watts (120v, 50160 Hz)
Control: High Frequency Balance
(Controls Frequencies Above 10K Hz)
Dimensions: 58"x20"~31/2"
Weight: 64 Ibs.
(Net Weight for one Speaker with Interface)

Model Three

Frequency Response: 30-20K Hz rf: 2 dB
Sound Pressure Level: 110 dB @ 18' in a room
(Program Material Peaks)
Minimum Power Required: 70 watts
Nominal Impedance: **4** ohms
Power Consumption: 5 watts (120v, 50160 Hz)
Control: High Frequency Balance
(Controls Frequencies Above 10K Hz)
Dimensions: 59"~28"~3'/z"
Weight: 75 Ibs.
(Net Weight for one Speaker with Interface)

Model Four

Frequency Response: 28-20K Hz f 2dB
Sound Pressure Level: 115 dB @ 22' in a 16'x26' room
(Program Material Peaks)
Minimum Power Required: 50 watts
Nominal Impedance: **4** ohms
Power Consumption: 5 watts (120v, 50160 Hz)
Control: High Frequency Balance
(Controls Frequencies Above 10 k Hz)
Dimensions: 59' x 36' x4"
Weight: 86 Ibs.
(Net Weight for one Speaker with Interface)

WARRANTY

Lifetime, See warranty statement for details.

'PATENT PENDING

SPECIFICATIONS

MODEL TWO

Frequency Response: 35 - 20K + or – 2 dB
Sound Pressure Level: 105 dB @ 15′ in a 12′ x 18′ room
(Program Material Peaks)
Minimum Power Requirement: 100 watts
Nominal Impedance: 4 ohms
Power Consumption: 5 watts (120v, 50/60 Hz)
Control: High Frequency Balance (Controls Frequencies Above 10K Hz)
Dimensions: 58″ x 20″ x 3½″
Weight: 64 lbs. (Net Weight for one Speaker with Interface)

MODEL THREE

Frequency Response: 30 - 20K Hz + or – 2 dB
Sound Pressure Level: 110 dB @ 18′ in a 14′ x 22′ room
(Program Material Peaks)
Minimum Power Required: 70 watts
Nominal Impedance: 4 ohms
Power Consumption: 5 watts (120v, 50/60 Hz)
Control: High Frequency Balance (Controls Frequencies Above 10K Hz)
Dimensions: 59″ x 28″ x 3½″
Weight: 75 lbs. (Net Weight for one Speaker with Interface)

MODEL FOUR

Frequency Response: 28 - 20K Hz + or – 2 dB
Sound Pressure Level: 115 dB @ 22′ in a 16′ x 26′ room
(Program Material Peaks)
Minimum Power Required: 50 watts
Nominal Impedance: 4 ohms
Power Consumption: 5 watts (120v, 50/60 Hz)
Control: High Frequency Balance (Controls Frequencies Above 10K Hz)
Dimensions: 59″ x 36″ x 4″
Weight: 86 lbs. (Net Weight for one Speaker with Interface)

WARRANTY: Lifetime, see warranty statement for details.

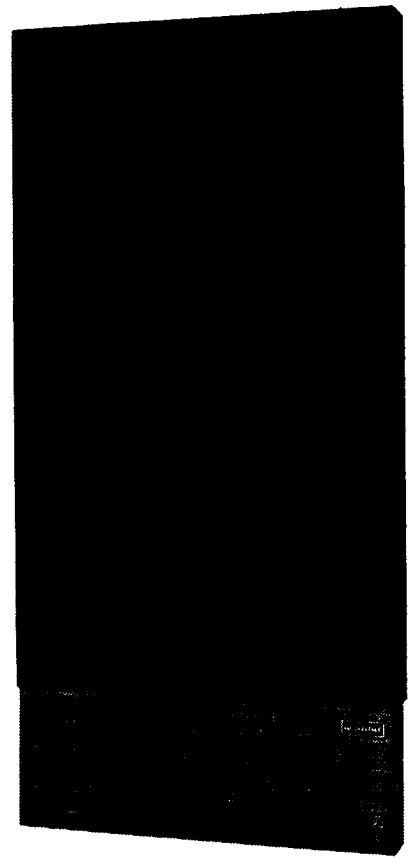
ACOUSTAT corporation

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Fort Lauderdale, Florida 33315
Phone: 305/462-6700

ACOUSTAT

ELECTROSTATIC LOUDSPEAKER SYSTEMS

SLIMLINE SERIES



OWNER'S MANUAL & ASSEMBLY INSTRUCTIONS

LIMITED WARRANTY

FOR ACOUSTAT LOUDSPEAKER SYSTEMS

ACOUSTAT CORPORATION warrants to the owner that the ACOUSTAT loudspeaker system will perform as specified and that it will be free of defects in materials and workmanship for a period of FIVE YEARS from the date of original manufacture.

In addition, due to the superlative quality of construction employed in the ACOUSTAT loudspeaker systems, and the feeling that a high-quality product should be free of defects in materials and workmanship indefinitely, ACOUSTAT CORPORATION will continue to warrant the product (at their option) as long as it is in service, subject to the conditions below.

ACOUSTAT CORPORATION will repair defective units without charge for labor or parts, subject to the following conditions:

a) The unit must not have been altered or damaged through misuse, abuse, negligence, accident, or improper operation.
b) All repairs must be undertaken at the factory or other service center designated by ACOUSTAT CORPORATION. Units submitted for warranty repairs must be shipped in the factory packing carton to ACOUSTAT CORPORATION or its designated service center, freight and insurance prepaid by the owner, and will be returned to the owner freight and insurance prepaid by ACOUSTAT CORPORATION.
c) Normal wear and maintenance are not covered by this warranty.

ACOUSTAT CORPORATION SHALL NOT BE RESPONSIBLE IN ANY WAY FOR CONSEQUENTIAL OR INDIRECT DAMAGES OR LIABILITIES RESULTING FROM THE USE AND OPERATION OF THE PRODUCT COVERED HEREIN OR RESULTING FROM ANY BREACH OF THIS WARRANTY OR ANY IMPLIED WARRANTY RELATING TO THE SAID PRODUCT.

Some states do not allow exclusion of limitation of incidental or consequential damages so the above limitation or exclusion may not apply to you.

This warranty gives you specific legal rights and you may have other rights which vary from state to state.

INTRODUCTION

Congratulations on your purchase of the world's finest loudspeaker system, the ACOUSTAT full-range element electrostatic with Magne-Kinetic Interface*. If you will take just a few minutes to review the assembly and set-up instructions provided with your new speakers, you can be assured of many years of listening enjoyment as the system's full potential is realized.

PLEASE NOTE: THE SYSTEM WILL REQUIRE SEVERAL HOURS OF INITIAL PANEL CHARGE-UP AND PLAYING TIME TO REACH FULL EFFICIENCY.

We have determined that many systems fail to function at their full potential because of deficiencies in the initial set-up. Therefore, a section has been included outlining the preferred procedure for the placement and connection of a newly installed system.

The acoustics of the room will play a major role in the ultimate performance of the speaker system, and we have found that it is far more rewarding in terms of the quality of the results obtained to tune the speakers to the room than to add line equalization. A reasonably absorbent and unobstructed wall should be directly behind the speakers, and any required tuning of the room can normally be accomplished with slight changes in the placement of drapes or other wall hangings.

ASSEMBLY

1) Lay the speaker face down on the carpet, CAREFULLY ! DO NOT allow the speaker to fall to the ground. SLOWLY lay it down. Dropping the speaker face down may rupture the diaphragm with trapped air.

2) Remove two of the screw-in feet provided from the hardware packet. Screw these into the threaded holes on the bottom of the speaker's base. For now, screw them all the way in. Some adjustment may be needed later for the speaker to sit squarely and have the correct amount of tiltback.

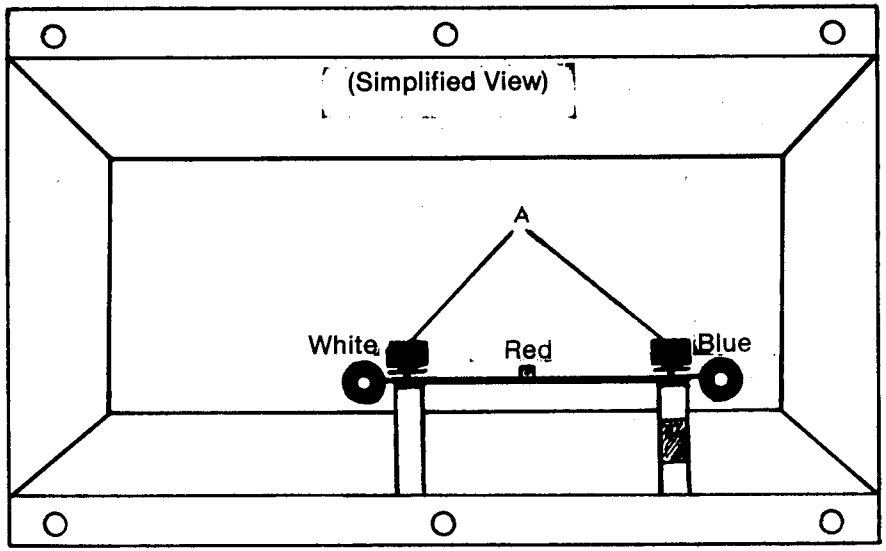
3) Set the interface on the floor at the base of the speaker, with the opening facing forward toward the speaker. (As in Figure 1.)

4) Note the three groups of wires coming through the rubber grommet on the back of the speaker's base. Visually identify them as: the RED group, with a pin plug on the end; the BLUE group, with a blue-sleeved hook on the end; and, the WHITE group, with a plain hook on the end.

*Patent Pending

5) Refer to FIGURE 1. Insert the pin plug into the RED socket on the circuit board. The BLUE hook is attached to the board on the right side, identified by the blue tape on the nylon spacer below the thumb screw (A), and the word "BLUE" on the board at this point. This is accomplished by loosening the thumb screw (A) three turns, placing the hook between the thumb screw and the washer, and then tightening the thumb screw securely. Repeat this procedure on the other hook on the WHITE side of the circuit board.

FIGURE 1.



6) Push any excess wire back through the grommet on the back of the speaker's base.

7) CAREFULLY, place the interface on the back of the speaker's base, so that the six mounting holes align. Be careful not to pinch any wires when you set the interface down on the metal firewall plate. Using the six screws provided in your hardware packet, attach the interface to the speaker's base.

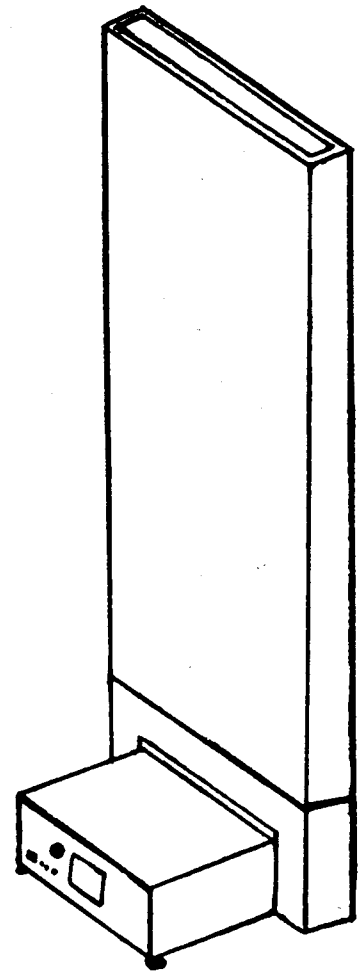
8) Select the other two screw-in feet provided. These are attached at the bottom rear of the interface, one in each corner. Screw these in, leaving approximately ½" of thread showing.

9) Carefully stand the speaker upright in the approximate location it will be used. (See fig. 2, and "Recommended Set-Up Procedure").

10) Make an initial setting of the tiltback of the speaker using the screw-in feet at the front and back of the speaker system. A good initial setting is achieved by tilting the speaker so that the top of the speaker is two or three inches behind the bottom of the speaker. This can be easily gauged by dangling a broomstick behind the speaker. The degree of tiltback of each speaker must be equal for best imaging.

11) Plug the interface into the wall. Set the high frequency control pot on the interface to approximately the two o'clock position for your initial listening tests. PLEASE NOTE: This control effects primarily the last octave (10-20K Hz) of the musical spectrum, and the proper setting will be that which yields the correct degree of "sparkle" or "airiness" to the sound. Therefore only source material with the widest range will be suitable for this adjustment.

12) Repeat the above procedures on the other speaker system.



REMOVAL OF INTERFACE

WARNING: ALWAYS UNPLUG THE LINE CORD BEFORE REMOVING INTERFACE !

WARNING: HIGH VOLTAGES ARE PRESENT IN A CHARGED PANEL. If the interface must be removed from the speaker, the following procedure is necessary to discharge the panels. 1) UN-PLUG the interface from AC outlet and amplifier. 2) CAREFULLY lay the speaker down. DO NOT drop it down ! 3) Un-bolt the interface. 4) Set the interface on the floor behind the speaker, being careful to not unplug the three wires from the speaker. 5) Remove the center RED pin plug, and touch the tip (while holding the wire, NOT the plug) to either the BLUE or WHITE terminal on the circuit board. 6) Loosen the two thumb screws and remove the hooks.

RECOMMENDED SET-UP PROCEDURE

The set-up procedure and assembly instructions are the same for all models of Acoustat electrostatic speaker systems. We advise that the following instructions be followed fully to obtain the best performance from your new speakers. Errors in initial set-up can prohibit the system's performance at low frequencies, as well as lower the system's overall efficiency.

Some of the principal considerations which will determine the performance potential of the speaker system as installed are:

1) **The Wall Behind the Speakers** – This wall should be reasonably absorbent, and sufficiently rigid so that it will not rattle.

2) **The Orientation of the Speaker System Within the Room** – (See Fig. 2) For deepest low bass performance, the speakers should project sound along the longer axis of the room. This is a universal rule of speaker placement, and is in no way peculiar to Acoustat speakers. If this is not possible in your room, the performance of the speaker system will not be significantly compromised other than a slight loss of deep bass performance. In addition, we have found that a rather wide separation of the speakers (up to the point where the two speakers and the listening area form an equal sided triangle) provides a very large "listening window" without loss of center-fill. Therefore, set-up along the long wall has certain virtues as well.

3) **Distance From the Rear Wall** – Since the Acoustat loudspeaker is a dipolar radiator, placing the speaker too close to the rear wall will yield substantially reduced low bass output, due to rear wave cancellations, and a somewhat muffled sound. We recommend for most rooms a MINIMUM rear wall distance of three feet, measured from the back of the panels to the rear wall.

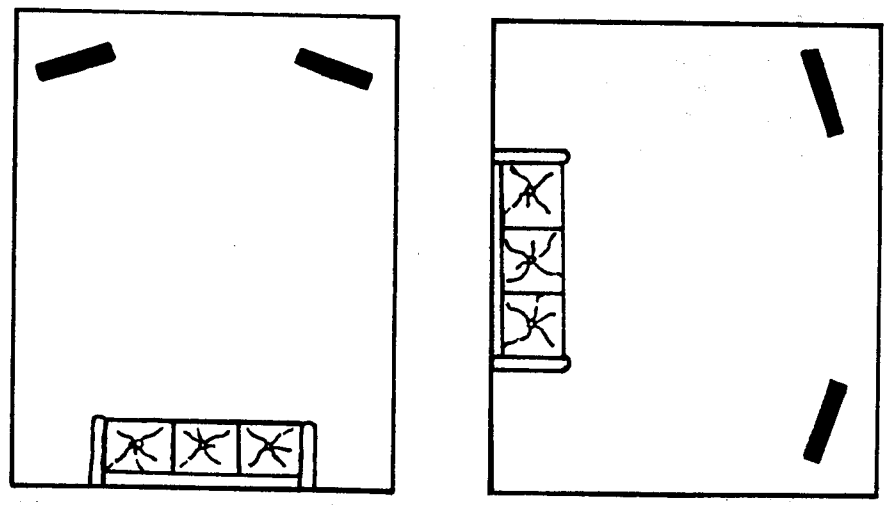
4) **Toe-In and Distance Between Speakers** – There are numerous combinations of toe-in and distance between the speakers that will provide excellent sonic performance. Our general recommendations, however, are to place the speakers AS FAR APART AS POSSIBLE, yet keeping them at least two feet from the side walls, and then angle the speakers towards the center listening position. (Again, see Figure 2.)

5) **Tiltback** – The tiltback of the speakers has the combined effect of improving the vertical dispersion of the system and of breaking up standing waves in the room. Two or three degrees of tilt is a good setting for most SEATED listening positions. This corresponds to about two inches of rearward displacement of the top of the speaker.

6) **The Area Between the Speakers** – This area should be kept clear of major obstructions to airflow if optimum imaging is to be achieved. The size and shape of any objects placed between the speakers will determine the extent of any deleterious effects on the imaging. Objects such as record cabinets that stand fairly tall or equipment racks should be avoided.

7) **Phasing** – Acoustat speakers are designed to preserve the correct absolute phase throughout the system, including the final coupling of the signal to the air. This ensures that vocalists and instruments will sound as natural as possible. Therefore, make sure that connections from the interface are correctly oriented: i.e., red (+) and black (–).

8) **Electric Feedback** – Electrostatic loudspeakers produce a strong electric field which can influence the operation of any low level electronic circuitry in close proximity. This can result in feedback well above the audio spectrum, which has the effect of high power dissipation and decreased headroom in the system. For this reason, the turntable-cartridge leads and the phono inputs of the preamplifier should be kept at least six to eight feet from the nearest speaker to ensure that no feedback can occur.



BEST LOW BASS RESPONSE

LARGEST LISTENING WINDOW

Figure 2 – Room Placement

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BEHIND THE SCENES

BERT **WHYTE**

Electrostatic loudspeakers in their various manifestations have been around the hi-fi scene for a long time and have held a peculiar fascination for many audiophiles. Such speakers have always been admired for their clean, open sound: low distortion, transparency and, above all, their lightning-fast transient response. Many people fail to realize that music primarily consists of transient sounds, and therefore accurate reproduction of such transients is of paramount importance.

Many audiophiles have been aware that the desirable attributes of electrostatic loudspeakers are usually offset by many basic problems inherent in this design. Fragility of the thin film of the speaker diaphragm, especially before the advent of Mylar, causes frequent failure due to discrete arcing when overdriven. Efficiency is low, dynamic range restricted, and in those speakers which are supposed to be "full-range" units, bass response usually falls off rapidly below 50 Hz. Added to this is the difficult capacitive load these speakers present to the amplifier.

Despite **all** of these problems, many audiophiles have continued to admire the special qualities of electrostatic loudspeakers. New models are a fairly rare occurrence in comparison to the neverending flow of dynamic speakers to the hi-fi market. Hence the hearty welcome to the new Quad ESL-63 and several new electrostatic loudspeakers from the Acoustat Corp. of Fort Lauderdale.

Acoustat introduced its first electrostatic loudspeaker, Model X, in 1976. In recognition of the fact that all electrostatic loudspeakers present a highly capacitive load to an amplifier, the Model **X** had its own built-in direct-drive. solid-state/tube hybrid amplifier. The tubed output stage of the amplifier mated well with the capacitive load, but there were some problems associated with this unit. Of course, the basic idea of the built-in drive amplifier was to eliminate the input transformer that is common to all other electrostatic loudspeakers. The transformer is a source of various nonlinearities and exhibits other undesirable properties. While Acoustat had some technical problems with the drive amplifier, a more difficult problem was that most audiophiles already had their own amplifiers and resented the fact that they could not use them to power this electrostatic speaker. Thus, after considerable research, in 1980 Acoustat introduced the MK-121 Magne-Kinetic Interface passive drive system. This device (previously described in my May 1981 column) essentially is a "b-former" design. Two specially optimized transformers cooperatively "overlap" at about 1500 Hz and handle the midrange frequencies, while one of the two handles bass frequencies and the other one, treble frequencies. Acoustat calls the MK-121 "revolutionary' and claims it is a near-perfect power/impedance match. Efficiency is very high and impedance **is** rated at **4** ohms — and is claimed never to drop below 3 ohms. The design is said to eliminate the spurious resonances and "ringing" of conventional transformers. With the MK-121 Interface, all solid-state and tube amplifiers can be used to drive Acoustat ES systems, and since most amplifiers deliver more power at **4** ohms, this is an added bonus.

The current Acoustat Models Two, Three and Four all use the same electrostatic panels. Acoustat hand-makes these panels in their Florida plant. Sheathed conductor grids are chemically welded to extremely rigid "honeycomb" plastic panels. Sandwiched between the grids is the conductive Mylar diaphragm, only 0,00065-inch 'thick with an equivalent mass of 7 mm of air! The MK-121 Interface accepts the incoming audio signals from a power amplifier, routes them through the special transformers, and thence to the wire grids. A bias transformer imparts a static charge to the conductive Mylar diaphragm. This grid "sandwich" permits true push-pull piston action over the entire surface of the diaphragm. The result is audio output with extremely low distor-

tion and ultra-fast transient response.. The electrostatic panels on the Models Two, Three and Four differ only in their number, with Acoustat claiming exceptional uniformity and consistency of performance.

I have had the pleasure of living with the Acoustat Model Four for some months now. This is the largest of the Acoustat electrostatic speakers, standing 59 inches high by 36 inches wide by 3 1/2 inches deep:. It has four of the electrostatic panels. the outer two panels being 9 inches wide and the inner two being 8 inches wide. The idea of the different widths is to stagger the individual resonances of the panels to avoid any possible reinforcement of a particular frequency. Two criticisms often directed at electrostatic speakers are their marginal bass response and their inability to reproduce music at high loudness levels. The Model Four's frequency response is listed at 28 Hz to 20 kHz, +/2 dB. The speaker is said to be capable of an output of 115 dB SPL at 22 feet in a 16 x 26-foot room on program peaks. I have been driving the Model Four with a Levinson ML-3 200-watt power amplifier and have played many recordings with substantial bass response, including my own Virgil Fox organ recording which has pedal frequencies below 20 Hz. While the Model Four cannot reproduce fundamentals of such low frequencies. it acquitted itself quite well with clean, smooth bass response down to 35 to 40 Hz. With heavy bass drum strokes and lower pitched tympani, the sound from these instruments was very clean, well defined, and of considerable impact. I am not saying that the bass response was of the full-blown, highenergy level available from a good subwoofer, such as that made by Janis Audio. (Incidentally, the Janis W-1 mates especially well with the Model Four if you are inclined to augment its bass response.) As for high-level playback, the Model Four meets its published specifications. and then some. Certainly in the average domestic listening situation, there is more output available than most music lovers would accept. The Model Four does quite well in coping with wide dynamic range, but when I hooked up a JVC 16-bit recording system for direct digital playback, there were some distressful sounds!

Like all of the Acoustat speakers, the Model Four is a dipole radiator. I have used them positioned well away from a panelled wall, with good results as to imaging and depth, but when I placed them in my Sonex-treated "live end/ dead end" listening room, the absorption of the back wave was quite an aid. Such treatment with this sound absorber removes most first-order reflections and damps the back wave, so with no reflections arriving later in time, there is a dramatic increase in imaging and depth perception as well as more precise localization of orchestral instruments. Speaking of secondary arrival times, the panels of the Model Four are slightly curved (six degrees of arc), but the total displacement from a plane is less than an inch and therefore arrival times from all four panels are substantially the same.

The Acoustat Model Four is a mercilessly revealing speaker. It really is a reflection of the old computer adage "garbage in — garbage out." Play some analog or digital master tapes and the Model Four can give you gloriously realistic sound. Play some really high-quality records and your ear will delight in the clean. smooth response and incomparable transient attack. and accuracy. But play some poor recording with "crackly" scratched surfaces, and the Model Four will give you a mirror image of this sonic horror. It should also be noted that in addition to the Model Four's clinical view of program material, it can be equally devastating in showing up poor quality links in the entire chain of reproduction. Try to use an inferior phono cartridge, for example, and the resulting screechy first violins in a symphony recording will cut your ears off! With fine recordings, the Model Four can reproduce violins with that magical sheen and airy transparency so sought after by the dedicated audiophile. Play something like the Sheffield drum record or M&K's *Hot Stix,* and the revelation of transient attack capabilities will help you understand what all the fuss is about.

I should mention that since Acoustat introduced the Models Two, Three and Four, there have been some worthwhile updates and modifications. The necessary parts, including a newer type of bias transformer, and the substitution of polystyrene and polypropylene caps for the original types, come in kit form and are available for $65.00. The modifications provide about a 1.5-dB increase in output, tighter low bass response, smoother midrange and top end, and even less distortion. These modifications were installed on the Model Fours which I have, and it does indeed make a fine speaker even better. There are no protection circuits in these speakers. Acoustat claims the panels are virtually "indestructible." and with more than 24,000 panels in the field, they have never had a failure! I can sum up my impression of the Acoustat Model Four by stating that it combines the near-legendary performance values of electrostatic loudspeakers while eliminating most of the drawbacks and establishing a very high standard of reliability.

FOR MORE INFORMATION ABOUT THE ACOUSTAT PRODUCTS WRITE TO:

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The New Acoustats

Explaining This Review

Upon rereading this review, we see that ads choppily; therefore, it may need a bit of explanation. The comments about the new Acoustat speakers were written according to the chronological order of events: the Monitor 3s were updated first, then the model 2s arrived only to be followed by the Model 3s. We tried to provide enough information for those unfamilar with Acoustat's products without being repetitive so as not to bore those readers that are familar with our reviews on the earlier Acoustat speakers. We hope we have done an adequate job.

Introduction

Several years ago, when nobody really had a good way to interface a conventional power amp with an electrostatic speaker, Acoustat Corporation had a solution. It was called the servo-charge amplifier, and it had the ability to take the signal from the preamp and drive the Acoustat electrostatic panels directly without step-up transformers or other intermediate devices in-between. This system allowed Acoustat to produce an electrostaticspeaker capable of wide (full-range) frequency response and high sound pressure levels. In these respects, the Acoustat excelled every electrostatic ever built. The serv0-charge system was a rousing success; it did what it was supposed to do, and did it well.

However, there were problems. The servo-charge amplifier proved to be an eccentric creature, reliable in some installations and anything but in others. The ones that weren't reliable became a constant headache for everyone involved - the manufacturer, the dealer, and certainly, the consumer. And there were sonicproblems too not obvious or disastrous, but problems nonetheless. The servecharge amplifier did not seem to have complete control over the diaphragm resulting in a underdamped bass reproduction. Very large bass transients (as on some digital recordings) often could not be handled without break-up. There was also a certain graininess to the sound and a coloration or ringing, if you will, to the higher frequencies. Acoustat constantly updated the amplifier, and it did become better and better both in reliability and sound

During the intervening years since the original Acoustat, though, a number of factors have come into play. Conventional power amplifier design has improved resulting in units more able to handle complex loads. Audiophiles have expressed the desire for an electrostatic loudspeaker with which they could use their regular power amps. With the tightening of the economy in the last couple of years, the desirability of a less expensive electrostatic speaker has become increasingly obvious. Once again, Acoustat has come up with a solution. They have developed a way to successfully mate a conventional amp with their speaker, have made it reliable, have made it less expensive, and have improved the sound all at the same time.

What Acoustat calls their MK-121 magne-kinetic interface has made all this possible. Yes, it is a step-ep/bias supply unit utilizing transformers. It differs from previous designs, however, in its use of two transformers in a band-overlapconfiguration. The larger transformer is able to handle the large currents necessary for bass frequencies without saturating. Due to its many turns of wire (and the resulting self-inductance), the frequency response of the larger transformer droops in the end The smaller transformer takes over and extends the response in the higher frequencies. The combination results in a wider response than either transformer could produce by itself.

According to Acoustat, this biformer arrangement also results in a more civilized load for the power amp. A graph of the speaker's impedance shows a value of about 3 ohms at 20 hz, rising to a high of about 6 ohms at midband, and then falling to about 3 ohms again at 20 khz. Since the impedance never falls below 3 ohms (approximately), any recent amplifier worth its salt shouldn't have any particular problem with the load.

Resurrecting The Monitor 3s

Our first experience with the new Acoustat sound came when we retrofitted an older pair of Monitor 3s with the new MK-121 interface units. wow!!! They became a decidedly different and better sounding speaker than before. The new Monitor 3 had a more extended frequency response at both extremes. They didn't leave us wanting more at the fringes. There was more control over the bass and much less problem handling large bass transients. The speaker had a heretofore unknown transparency, focus and quickness. There was much less coloration overall, especially noticeable in the treble region.

Just the reduction in noise made the change worthhile The servo-charge amps always had a good bit of residual noise in their output The MK-121 hasn't any noise (ste-up transformers are passive devices), and most power amps have very little noise to speak of. The result was music coming out of a dead quiet backgr-ound. You can't imagine how much of an improvement this makes unless you experience it for yourself.

The performance of the MK-121/Monitor 3 could easily be described as "reference quality". The speaker has all the electrostatic qualities (tremendous definition. clarity, focus, and quick transient response) plus low coloration and wide frequency response. Perhaps the quality that will be most cherished by enthusiasts, though, is the "rightness" in the mid-range. Instruments are reproduced with a natural character, that is, they are smooth yet have the correct "bite" that characterizes live music. Vocals have a natural presence and a round, glowing character. The speaker has marvelous front-to-back depth and a resulting spacious. airy, and three-dimensional sound. The new Acoustat sound is less like that of a speaker than any other system in recent memory.

Monitor 3 and Monitor 4 are still avialable on special order in a slightly revised version thatt acceptss the MK-121 interface. However the Acoustats energies are being concentrated on the new Model series which are proving to be better speakers than the theearlier Monitor series. The servo-charge system has been discontinued

The Model 2

The Model 2 is the first of a new line of three, cosmetically updated speakers from Acoustat all using the MK-121 interface., The Model 2 has two electrostatic panels per side, and is the least expensive speaker Acoustat has ever built The speaker has a slim, flat appearance somewhat similar to a MG Magneplanar The wraparound grill cloth fits like a sock over the entire speaker, and the only visible cabinetry is a finished wood bottom. The MK-121interface attaches to the rear bottom and doubles as a dead weight stand. The new cosmetics are very attractive, looking more like a polished product than the earlier Monitor series.

Acoustat claims that the new Model series not only looks better but sounds better as well. They are constructed so that only the grill cloth (no cabinetry) lies in front of the electrostatic panels. Since there are no obstructions, there can be no reflections. Acoustat has also decreased the spray (the angle) of the panels. This decreases dispersion but yields more concise imaging. The manufacturer felt it was a worthwhile trade-off.

Well, the Model 2 has the same basic sound as the updated Monitor 3s. But, it has limitations due to its smaller radiating area. The speaker is very inefficient. It needs a good 75-100 watts per channel to develop average listening levels. Even larger amps can be used, but the additional power isn't much help because of the speaker's limited dynamic headroom over its inefficiency. The diaphragm area of the Model 2 can only move so far - once you reach that point it won't get much louder no matter how much power you dump into it. (Don't worry; the panels are virtually indestructible.)

The bass performance of the Model 2 is remarkably good for an electrostat if its size, but the response drops off fast in the last two octaves. We didn't have the opportunity, but someone should try mating the Model 2 with a really good subwoofer. This would help efficiency and take up the slack on the lowest octaves.

Predictably, the Model 2 has limited dispersion. Its small radiating area just can't have the coverage of the three or four panel Acoustats. If it is used as a personal speaker, the sweet spot is easy to find, but don't expect to use it at a party.

The sound of the Model 2 per se is excellent The potential buyer, however, should be aware if its limitations and decide whether or not they would interfere with his enjoyment. If you listen primarily to chamber music, for instance, the Model 2 is the perfect speaker.

The three models differ only in the number of electrostatic panels,

The Model 3

This is it! This is the best speaker Acoustat has ever made. Acoustat has taken three panels of the Monitor 3 and transplated them into the new style cabinetry. The Model 3 has all the sonic qualities we described in the updated Monitor 3 plus better imaging and a bit more transparency. It also has the attractive cosmetics of the Model 2 in a slightly larger physical package but none of the Model 2's limitations. The Model 3 is the most complete, most refined Acoustat to date and certainly one of the best speakers currently available.

Charging The Acoustats

Anyone auditioning the new Acoustats should be aware of the initial charging time. Like other electrostats, the sound changes dramatically after a period of time. (The bias supplies are intended to stay "on" at all times.) When first plugged-in, the Acoustats have a decided strangeness about them, as if there were big gaps in the sound The sound is impotent and lifeless, without impact. As they charge, the sound begins to fill in and have w . Acoustat claims a charge-up time of eight hours, but our experience is that it takes about a week or two before they sound their best

The Model 4

You'll have to wait until the next issue to find out about these!

Acoustat Model 2 & Model 3, stereo speaker systems / Manufactured by Acoustat Corp., 3101 Southwest First Terrace, Ft. Lauderdale, FL 33315 / Serial Numbers Tested: Model 2: 101137, 101138; Model 3: 103118. 103117 / Prices: Model 2: $1195.00; Model 3: $1595.00.

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The Acoustat Model Two

The Acoustat Model Two represents, in many ways, the fulfillment of the heretofore unrealized promise of earlier Acoustat designs. This is, by this writer's measure, a remarkable achievement considering the strengths of past Acoustat speakers.

The Two's story is one of incremental development wrought through refinement of the principles upon which the original Acoustat. the Model X, was based. In a sense, the proficiency of the Two may be considered a vindication of Acoustat's ideas about speaker design and construction, ideas that have remained largely unmodified since the time of the X model's initial appearance some five years ago. Comparing the Two to its predecessors, one notices that it employs the same electrostatic elements, the same panel angling 'nciples, the same crossoverless design. . ose readers with a sensitivity to such matters will recall much noise to the effect that some of the design features of the original, and especially Acoustat's built-in amplifiers, were natural impediments to the firm's ever achieving mechanical reliability, sonic excellence or commercial success. After having suffered with cabinet resonances in the X and conflagrant tube failures in the Monitor [see Issues 11 and 12). I felt a powerful temptation to capitulate to Acoustat's critics, at least on the matter of the company's failure to produce a reliable product.

Acoustat has carried on, nevertheless, tweaking and refining the electrostatic elements, and, most significantly, eliminating the tube amp from its designs. To readers attuned to the evolutionary aspects of audio, it will be recognized that this pattern of continual refinement is similar to that which occurs in respect to some of the world's most highly regarded audio components, classics such as the Thresholds, the Audio Research preamps and, most recently, the Infinity induction speaker elements (used in the QRS and IRS). For Acoustat, like the classics aforementioned, each succeeding product generation surpassed the performance of that which preceded it. In the case of the Model Two, the improvement over earlier designs can only be characterized as dramatic. In the unimposing on of these two small panels, Acoustat carried forward not only its own design rationale but has also provided new support for the often stated proposition that electrostatic speakers are inherently superior to 'other types.

By way of elaboration, I should state that, while I have historically gravitated toward electrostatics for their transient accuracy and relative freedom from distortion, I have often found them somewhat flatfooted in the areas of dynamic range, harmonic accuracy and low bass output. Because of the relatively large radiating surfaces of most electrostatics, proper imaging is rarely achieved. In units with separate radiators for the highs and lows, crossover distortion and phase-related anomalies have been al: the more apparent because of the swiftness of response of the typical electrostatic.

The Model Two does not suffer in significant measure from any of the flaws mentioned above. It has the dynamic range of your garden variety enclosed speaker, the imaging specificity of the Rogers Ls3/5A and harmonic accuracy second to none (really). In sum, it is an electrostatic with few sonic fingerprints to identify its design.

In this connection, it might be observed that the Acoustat is in good company lately. Recent technology has brought us several other components which are *so* good that the usual abberations associated with their design principles are not evident from their sound. The Grace F-9E cartridge, a moving magnet which hardly sounds it, is one example. The recent Definitive LER-1, a tube preamp that surpasses even the best transistor designs for quiet operation and freedom from distortion, is another. But the Model Two is perhaps the most striking example of this phenomenon, if only because of the cavernous differences between the sound of most electrostatic and conventional speakers.

Since the Two's excellence is *so* much a function of its history, it will perhaps be beneficial to examine the Acoustats that preceded it.

The same drive panels which comprise the Two were first permanently connected to an Acoustat amplifier and housed in a somewhat stylish-looking plywood cabinet. This model, introduced in 1976, was called the Acoustat X. Chief among its deficiencies was an inability to produce satisfying volumes. In addition, its sound, while undeniably pleasant, was always quite identifiable, largely because of a profound cabinet resonance in the midbass region. Still, the X was a step forward for electrostatic loudspeakers; its low bass—which was abundant—was among the tightest and clearest produced by any speaker of its kind. Its rendition of complex harmonic textures, such as alto saxophone or clarinet, was superb.

The next Acoustat offering, the Monitor, inspired some hysteria from this reviewer [Issue 1 3 Its sound was expansive and harmonically attractive, even if deficient

extreme highs and lows. The design a p proach used in the Monitor was to double the number of electrostatic panels used in the X (thereby increasing efficiency) and remove the **X's** wooden cabinet. The salutary effect of these modifications was to make clear what I had suspected for some time: Many of the Acoustat's problems were caused not by the speaker elements themselves, but by the Acoustat amplifier. That amplifier, it now turns out, was the single determining factor in the earlier Acoustat models' failure to really fly. Apparently, it alone was responsible for the speaker's difficulties at the frequency extremes. It was certainly underpowered for *so* demanding a load and, despite even the intervention of one Frank Van Alstine, it was unable to operate reliably for much longer than a single lunar cycle.

The elimination of that errant amplifier was arguably the most significant step in the development of the Model Two. In its place was installed a black box (not of the Spiegel variety) which houses a sophisticated transformer that permits connection of amplifiers of the user's own choosing. The box is mounted behind the two connected Acoustat panels (at an offset angle to each other) that are handsomely covered with black (or white) grillcloth, atop an attractive walnut base. In all, the system looks clean and modern.

Sonically, the Two belongs to that special class of component which combines two or more areas of exemplary performance to create an impression that the quality of the sound far exceeds that of the sum of **its** parts. Rare indeed are those units whose authenticity far exceeds that of virtually all the competition. A similar encomium is deserved by the Infinity/Magnepan QRS-1D, a speaker whose midrange fidelity will likely become legendary. In my opinion, the Acoustat is the more amazing, simply because it was not conceived as a state-of-the-art product, but rather, to quote Bob Reiman, as "a smaller full-range ... system at an affordable price."

Without belaboring that irony here, let us proceed to the issues. The characteristics of the Acoustat that operate in tandem to create a superior musical illusion are transient accuracy, sonic coherency and imaging precision. It might be observed that of the three, only one—transient accuracy-has been traditionally associated with electrostatic speakers. Certainly, imaging precision has not and coherency, arguably, almost never has been, in reality, since most electrostatics are multi-driver systems.

When think of precise imaging, I think of

speakers like the Metronomes and Rogers LSA/5A. The Twos, like these, produce a sound so well focused and precisely placed that one is immediately impressed with a sense of order and logicality. Images which sound fuzzy on other systems appear with definite sonic outlines; faulty microphoning is now evident at spots where, before, it had escaped detection.

An additional bit of legerdemain is the Two's ability to project an image beyond the edge of the speaker grills. Under optimal conditions, the Dahlquist speakers have this quality. But what is merely suggested by the DO-10's is boldly asserted by the Twos. At times, in my modest chambers, it seems that the sound originates from the side walls themselves, thereby reducing one's awareness of room size.

This ability to project images to the left or right is not achieved at the expense of centerfill, which, as JTH points out, exists in quite satisfying measure. Just as images are thrust from the outside edges of the speakers, so, too, are images projected toward the center. Thus, with a centrally located voice, for example, there is no sensation of two speakers operating together to create a single image but rather that of a voice suspended between the grills, and with definite sonic dimension. And these imaging characteristics are nowhere more evident than in the bass, the most difficult region in which to achieve accuracy. When properly set up, the Twos will deliver bass with very tight outlines and a definite sense of directionality (try, for example, the cut "Popsicle Toes" on Michael Franks' ***The Art of Tea).*** This is another area in which the Acoustats outshine competing electrostatics. Since most other designs depend on crossovers and dynamic woofers for their bass, they simply cannot produce tightness and accuracy in that region. Consequently, in comparison with the Acoustats, such speakers sound hooded and incoherent.

Which brings us to the second of the Two's excellences: sonic coherency. The absence of a crossover and multiple drivers in the Two results in a sound that exhibits a sameness of character throughout its frequency range that is simply extraordinary. While I had previously believed the presence or absence of this characteristic to have a relatively subtle impact on the whole phase-aberrant, notch-distorted multidriver sound, I simply did not know what I was missing—until now. Instruments with a wide frequency range, such as piano or guitar, are reproduced with the proper harmonic structure from the top to the bottom of their ranges. Even flaws in related componentry are made the more obvious. The upper midrange constriction of the Conrad-Johnson preamplifier, for example, is made much more evident, as is the soft coloration in the highs of the Stax DA-80Mamplifiers.

The third area of performance in which the Twos excel is transient response. In this respect, the Two is typical of other speakers of its kind in responding swiftly to even the most subtle transients (such as the snare drum which appears at the rear of the orchestra during "Jupiter" in EMI's Hoist ***The Planets,*** Previn conducting). As one might expect, percussive sounds are sharp and clear. But such is only the most obvious evidence of the Two's speed. More amazing is the speaker's ability to retain its crispness and transparency at even the lowest sound levels. This means that, even after the neighbors have complained, there is no serious loss of detailing or clarity. Additionally, because the Twos are so precise. there will never be any **doubt** in your mind whether a given distortion is related to amplifiers clipping or cartridge mistracking or whether your source material is just plain bad.

Having digested my notions of the Two's performance in each of these three areas, consider now how these three sonic features could enhance one another. Cymbals, for example, not only sound delicate and crisp, their complex overtone structure is alsocorrectly re-constituted. All is placed in space with seemingly scientific accuracy. The result is a stunningly convincing illusion of a real cymbal being struck in a specific, well-defined acoustic environment. One such example is a disc, ***Great Guitars/Straight Tracks*** (Concord **CKD-1002),** which features three guitars, each with a distinctive sound, arranged on the soundstage from left to right. With the Acoustats, more so than with other speakers, it is instantly clear that there are three different guitars with three different sonic textures. With some excellent dynamic speakers, this record sounds confused. The leading edge of plucked strings seems to get out of the speaker long after the "twang"; in short, by comparison to the Acoustats, the sound is a mess.

As JTH remarked in Issue 20, the Twos are remarkably flat in frequency response from just above the lower midrange up to the ultrahighs. This largely flat performance may be responsible, I think, for the near-absence of sonic personality in the Two, at least from the lower midrange on up. Since frequency response aberrations are usually the most obvious of speaker colorations, they would naturally figure most prominently in one's impression of a speaker's sound. And because all speakers have response aberrations, we have become accustomed ***to*** using them as a means of identifying or characterizing the sound of different units. One of the most interesting aspects of the Twos is that their response is so true to their input that the listener must look to characteristics more subtle than frequency balance to get a mental fix on the "sound."

Like many another dipole, the Acoustats are highly sensitive to room placement—so sensitive, in fact, that movement of a panel by just a few—seemingly inconsequential—inches will substanttially alter the sound. When placed any closer to the rear wall than three feet, the system sounds constricted and raw in the midrange and treble. If they are too close to the side walls, the bass becomes flabby and the highs strained. Place an object of any considerable mass—for example, a subwoofer-behind (or, for that matter, in front of) one of the panels and you will get an imbalance in favor of the other panel. Experiment. Your patience will be rewarded, upon achieving optimal positioning, with a sensation that the sound has suddenly popped into fine focus.

Unfortunately, there are several problems with the Two that cannot be cured through careful placement. The most serious of these is a sense of thinness in the midbass. The affected frequencies begin at about 150 Hz and extend down to about 60 Hz. The sonic effect of this coloration varies depending upon the recording and what you use in the way of related equipment. When used with cartridges that are peaked in the midbass, such as the Sonus, ADC, Sumo or Decca, the stage is set for a happy synergy. Used with a cartridge of heavy low end (like the Grace), the presence of true low bass tends to distract one from the midbass. Listen to a recording (such as the Beatles' Abbey ***Road*** [Mobile Fidelity]) which has a great deal of midbass information, and all appears well. But listen to your favorite tenor and you will find something missing. The effect is subtle at first, and perhaps even attractive for a while, but, in time, you'll wish that what's missing would return.

A second problem concerns the While there is no doubt that the highs of Two are far better than those of previous Acoustat designs (and the vast majority of the competition), there is, nevertheless, a slight sense of high-frequency opacity evident here. To analogize, the Acoustat's highs sound similar to those of the finest moving magnet cartridges, solid, crisp, full-bodied, but not transparent, open and delicate like those of the finest moving coil designs.

Another problem area is that of finding an amplifier suitable to drive these things. The first requirement is high wattage (the Twos, unlike the larger Acoustats. are quite inefficient). Since amplifier power usually comes cheaply, this would present only a slight problem in most cases; however, in this instance, things are complicated by the Two's great accuracy and reactive load properties. Cheap stuff tends to sound cheap. And some good stuff just doesn't sound it because of the demanding load presented by this system. Serendipity has been visited upon me in the form of the Stax DA-80M's but not before I had to interpose about a half-dozen other amplifiers. A related problem is the Two's somewhat limited dynamic range. To be sure, your average ported speaker is capable of greater dynamic contrasts. Yet the Two's limitations in my room are not so severe as they seemed to be in JTH's.

The least significant, in my judgment, the Two's areas of difficulty is its tender: to beam in the high frequencies. Since most of my listening is done alone and in a seated position, this is a non-problem for me. But if you are one who prefers group therapy to a private session, be prepared to have some unhappy participants, most likely all your pals at the other listening positions. My suggestion: Act with alacrity, grab that middle seat and let friendship be damned.

Overall, the Acoustat Model Two is a spellbinding device. For the experienced audiophile, one listen will probably be enough to set the book. For the newcomer to high-end, there is no finer example of how modern technology can be used in the service of art. A stupendous product. **-RJS**

Manufacturer: Acoustat, 3101 Southwest First Terrace, Fort Lauderdale, Florida 33315. Source: Manufacturer's loan. Serial **Nos:** 110365, 110366. Price: $1,195 per pair.

HP Comments:

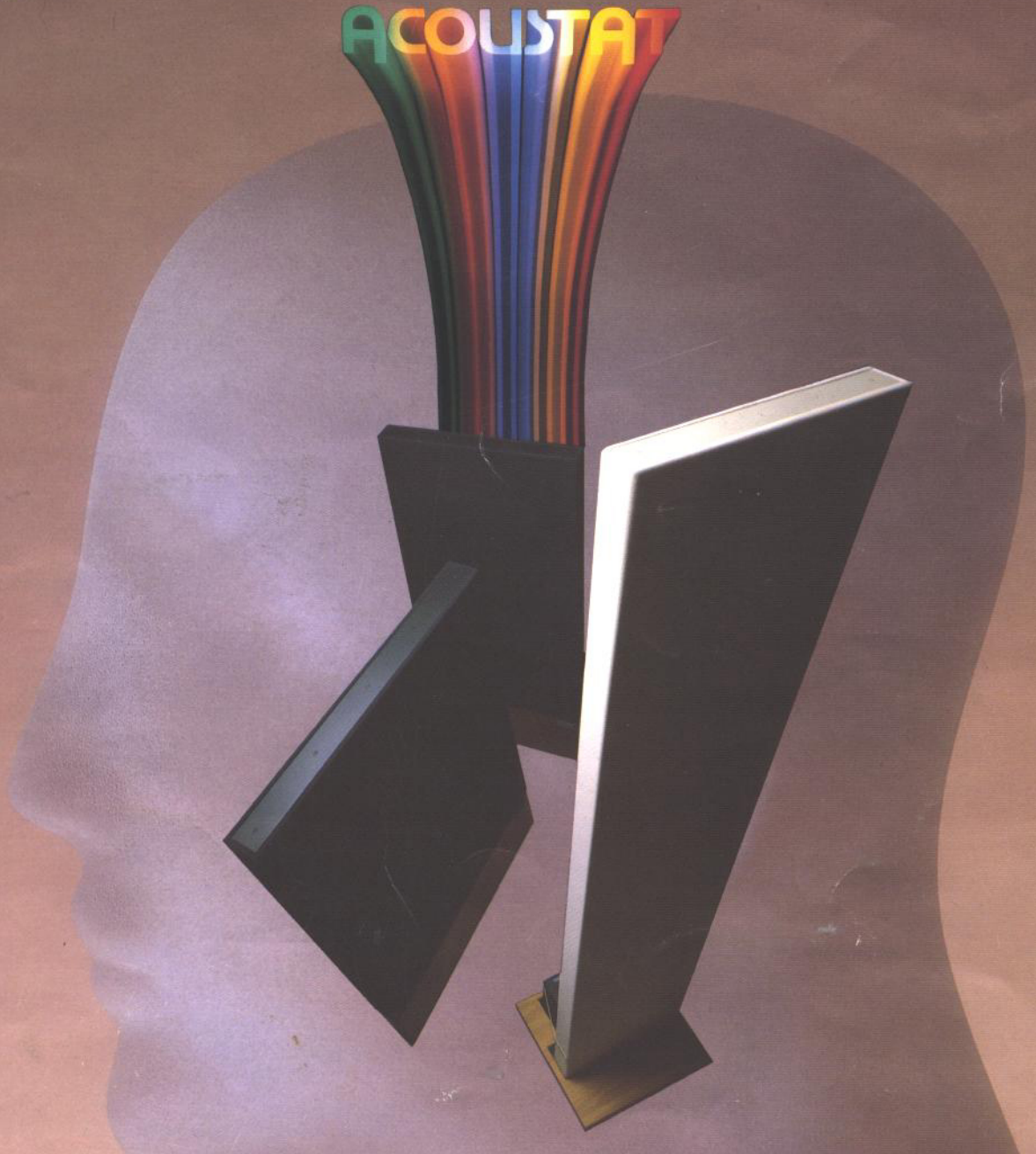
It was my decision to re-review these speakers. For this magazine, such a move is unusual, though not unprecedented. It isn't that I found fault with JTH's review of the Model Two. It is very nearly a model review—and if you've heard the speakers, yo- know just how very nearly. But I think estimable Aries friend was guilty of understatement. This Acoustat is really one of the best speakers of its kind ever made. It has that elusive quality which we shall call, for want of a more inventive vocabulary, *magic*.

If I slept through JTH's review. it was only because I had fallen lo the Acoustat

ACOUSTAT

FULL-RANGE ELEMENT ELECTROSTATIC SPEAKERS

Model Two + Two
Model Three
Model Four



When full-range electrostatic speakers were introduced about two decades ago, it was immediately apparent that this technology would yield the truly superb speakers of the future. The future has arrived.

The Acoustat full-range-element electrostatic speaker systems represent the culmination of over 20 years of design and development, beginning with the bold assumption that it was possible to build such a system without compromise...one capable of high sound pressure levels, without crossovers, one that would be more reliable than any speaker of any type.

The new Acoustat speaker systems have achieved these goals—and more. At last, the ideal music transducer (the electrostatic) is available in a manageable size and price range. And not only is it reliable, it is virtually indestructible.

What makes the Acoustat Speakers Unique?

ELECTROSTATIC ELEMENT

All Acoustat speakers utilize full-range-element electrostatic panels to reproduce all frequencies in the audible spectrum without splitting the frequency spectrum with separate woofer, mid-range, and tweeter drivers. This crossoverless design does not suffer from the distortions that crossovers cause. The ideal method of reproducing musical waveforms would be to exactly reverse the process of the recording microphone...and for that matter, the full-range-element function of the human ear. Only with the electrostatic transducer can this ideal method be realized.

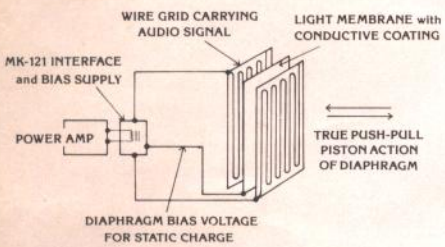


FIGURE 1 Electrostatic Operating Principle

The electrostatic transducer is composed of a thin Mylar membrane (diaphragm) stretched and contained between two acoustically open wire grids. The diaphragm is connected to a high-voltage, low-current bias supply, which provides an electrostatic charge that becomes trapped in the diaphragm. The two wire grids, receiving a high-voltage audio signal from the plus/minus outputs of the MK-121 interface, provide an electric field equivalent to the audio signal. In the presence of an audio signal, the electric field exerts forces on the electrostatic charge that is trapped in the diaphragm. These forces are transferred to the diaphragm, causing the diaphragm to move in synchronization with these forces.

FULL RANGE ELEMENT

Just like the human ear and the microphone, Acoustat speakers employ a single diaphragm covering all frequencies, from deepest bass to highest treble. This means the original waveform is not broken into pieces dissimilar in terms of colorations, time of arrival, and phase. It has been well documented that even small changes in phase are readily audible, and can degrade the clarity and definition of musical transients, upsetting the homogeneity and coherence of the stereo image.

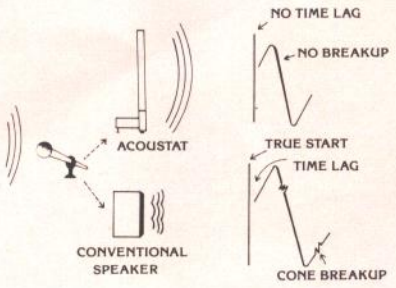


FIGURE 2—The Musical Wavefront

The forces acting to move the dynamic transducer's cone produce very different results than the electrostatic transducer. With a dynamic transducer, the application of the driving force only to the apex of the cone necessitates a sufficiently stiff cone to prevent buckling and deformation of the cone structure. Such a stiff cone, even if it is made of an exotic "low-mass" material must have considerable mass which degrades its transient response capability significantly. In addition, the forces applied to the apex do not act uniformly over the cone surface and cause it to "break-up" into numerous vibrational modes, only one of which is representative of the original signal.

Each speaker contains several panels angled for horizontal dispersion, but electrically they perform as a single unit. All are driven full-range.

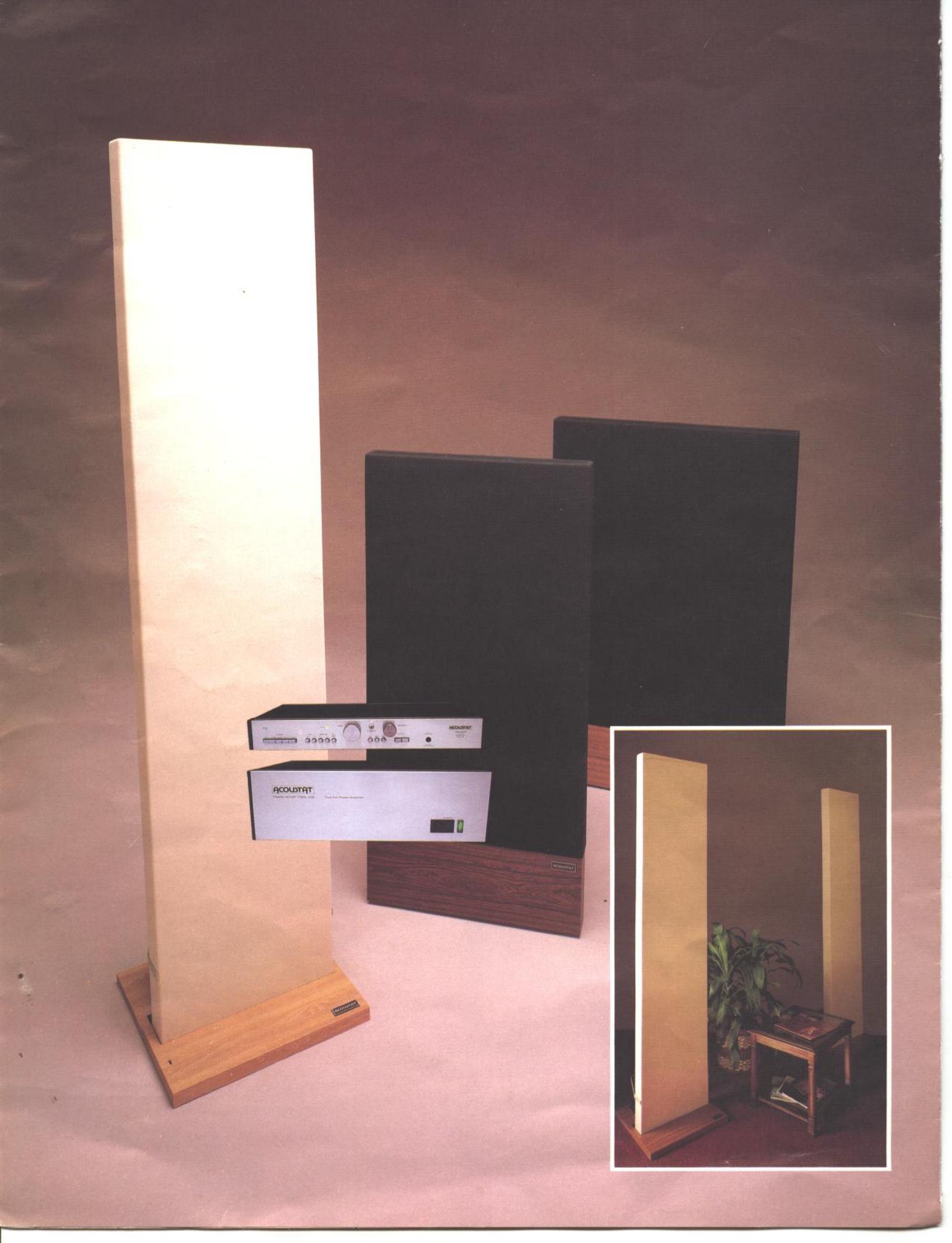
Figure 2 illustrates the problems of the typical loudspeaker which are due to the limitations of dynamic (magnetic) type drivers. The uniform wavefront of the Acoustat speakers contain all the spatial and harmonic information as originally recorded. It gives breathtaking imaging and accurate depth perspective that are reminiscent of a live concert. Since a multi-element system with crossovers simply cannot reproduce all this music information correctly, truly accurate recreation of the original musical performance is impossible.

LOW MASS RADIATOR WITH INTIMATE DRIVE

Again, the human ear, the microphone, and Acoustat speakers all utilize a very low mass diaphragm, intimately driven over its *entire* surface. The diaphragm of the Acoustat speaker is only .00065 inches thick, and weighs only as much as an equivalent size volume of air only 7 millimeters thick! This superlight diaphragm is then driven over its entire surface by the audio signal. This gives the audio signal *several million times* more control over air motion than is possible with a cone or dome type speaker, and several hundred thousand times more control than a planar magnetic or ribbon type speaker, where the audio signal force is only present at the voice coils—not on the actual diaphragm that moves the air.

A diaphragm of such extreme lightness, in combination with an actuating force that is uniformly distributed over the entire surface of the diaphragm, results in a transducer whose transient response closely duplicates the electrical input. The net result is a diaphragm motion that is a replica of the electrical forces acting upon it, with all sections of the diaphragm surface moving with highly accurate phase and amplitude linearity throughout its excursion, at all frequencies. This characteristic of Acoustat loudspeakers results in an amazingly open, well-defined sound, with preservation of detail at all listening levels.

Because the radiating area of dynamic (cone) drivers tends to be small, their impedance match to the air is quite poor. The Acoustat electrostatic, with its large radiating area, is a much better acoustic impedance match to air, particularly in the difficult low frequency range. This in conjunction with the patented MK-121 interface, is the reason for the excellent low bass response of the Acoustat speakers.


ACOUSTAT

Other advantages of the Acoustat approach

EXCEEDINGLY FLAT FREQUENCY RESPONSE:

Since Acoustat speakers do not rely on multiple drivers and cross-overs to reproduce the audible range of frequencies, they are capable of extremely uniform amplitude throughout that range, as well as freedom from local peaks and valleys in their response. This *locally* flat nature of the electrostatic transducer cannot be duplicated with any dynamic driver, and results in a total absence of the typical loudspeaker tonal colorations. The speaker in effect "disappears," allowing the music to pass through it unaltered.

VANISHING LOW DISTORTION:

With five to ten times lower distortion across the frequency spectrum than a dynamic (magnetic) type speaker, the listener enjoys extended listening sessions without the typical "listener fatigue" associated with most audio systems.

INDESTRUCTIBILITY AND CONSISTENCY:

Due to the unique panel construction methods pioneered by Acoustat, the speaker system cannot be damaged by over- or under-powering. Acoustat speaker systems stand alone in this ability to withstand all audio applications without damage or failure. In addition, the panels maintain extraordinary unit to unit consistency, with no measurable variations between panels. Whereas no two woofers nor two tweeters are exactly the same, every Acoustat electrostatic panel is exactly like every other Acoustat panel.

SUPERB CONSTRUCTION:

In order for the electrostatic element to reach its potential the panels must be mounted in an extremely rigid, monolithic frame. Acoustat's speaker frames are made of the strongest, most durable materials available, and are all hand-made and assembled at our Florida factory. The Acoustat speaker system attains this rigidity with remarkable beauty.

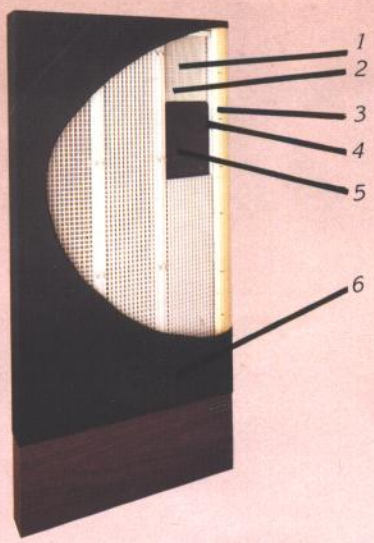


FIGURE 3 Acoustat Speaker Cutaway

1. Wire grids carrying high-voltage audio signal, positioned on either side of the diaphragm.
2. Mylar Diaphragm, Radiates all Frequencies, only .00065 inches Thick.
3. Rigid, Monolithic Construction, Using Only The Finest Materials Available.
4. Bias Feed, Carries The Static Charging Voltage to the Diaphragm.
5. Conductive Coating on Diaphragm Holds Static Charge.
6. Special Acoustically Transparent Grille Cloth

The revolutionary MK-121 drive*

It is hard to describe just how revolutionary this new method for driving full-range-element electrostatic speakers really is. It solves a 25-year-old problem originally defined by the introduction of the first somewhat full-range electrostatic speakers in the mid-50's.

The introduction of the MK-121 Magne-Kinetic Interface* culminates one of the most intensive studies ever made of the overall interactive nature of: the electrostatic transducer's characteristics; transformer theory; network theory and complex vector impedance. Special in-house instrumentation was used to help perfect the design.

The MK-121 is of "biformer" design. Two optimized transformers cooperatively overlap to handle the critical midrange band. Each has special properties to extend uncompromised performance in its own exclusive domain (bass and high frequencies respectively). It can be said without contradiction that never before has such a nearly perfect power-impedance match been possible. The result is a quantum leap in efficiency, allowing most 50-100 watt-per-channel amplifiers to work very well in nearly all listening situations. In addition, the load presented to the amplifier is an extremely peaceful 4 ohms, more linear than many conventional speaker systems.

The MK-121 is not, however, shy about dealing with much higher-powered amplifiers if more incremental headroom is desired.
The MK-121 is exceptionally well built, utilizing military grade, conservatively rated parts. Combined with Acoustat's proven "bullet-proof" panel technology, the result is a speaker system capable of producing very high sound-pressure levels, without reason for user apprehension.

*U.S. Patent No. 4,323,736

Which model is right for you?

In general, your primary considerations, other than cost, are room size and volume levels desired. The return for the larger size speakers is higher efficiency (less power required for a given volume level in the same size room), greater maximum sound pressure level, and slightly extended bass response. Your Acoustat dealer can help you choose the model best suited to your specific listening situation.

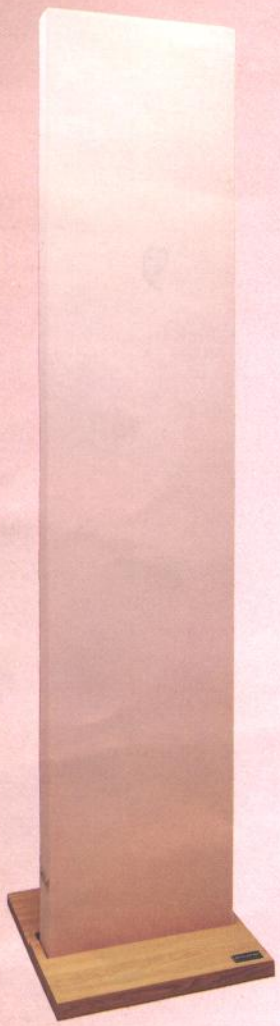
Some general guidelines are as follows: The Model Three was designed for the average-size listening room, and moderate-to-high volume levels (98-105 dB average music program peaks.) The Model Four is best suited to a larger-than-average listening room (16' x 24' minimum) and will produce higher average volumes with more dynamic range at the very lowest frequencies.

The Model Two + Two is designed to perform well in a wide variety of room sizes (with eight-foot ceilings). It combines the efficiency, dynamic range and maximum SPL capabilities of the Model Four with the advantages of a vertical line source; i.e. an extremely uniform horizontal and vertical dispersion pattern.

Most importantly, the three models are virtually identical in the quality of sound they reproduce, and in their ability to transport the listener into the performance hall.

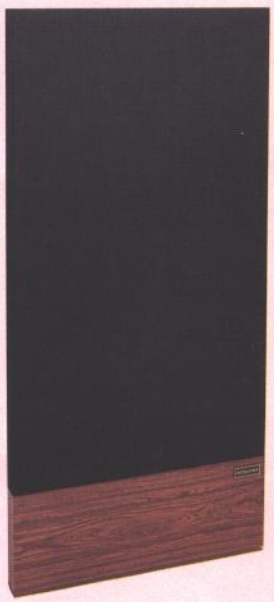
SPECIFICATIONS

WARRANTY: Lifetime. See warranty statement for details.



MODEL TWO + TWO

Frequency Response:
28-28K Hz ± 2 dB
Sound Pressure Level: 115 dB @ 20′ in a 15′ x 24′ room. (Program Material Peaks)
Minimum Power Requirements: 50 Watts
Nominal Impedance: 4 Ohms
Power Consumption: 5 Watts (120v, 50/60 Hz)
Control: High Frequency Balance (Controls frequencies above 10K Hz)
Dimensions: 94″ x 20″ x 3½″
Weight: 95 lbs. (Net weight for one speaker with interface)



MODEL THREE

Frequency Response:
30-20K Hz ± 2 dB
Sound Pressure Level: 110 dB @ 18′ in a 14′ x 22′ room. (Program Material Peaks)
Minimum Power Requirements: 70 Watts
Nominal Impedance: 4 Ohms
Power Consumption: 5 Watts (120v, 50/60 Hz)
Control: High Frequency Balance (Controls frequencies above 10K Hz)
Dimensions: 59″ x 28″ x 3½″
Weight: 75 lbs. (Net weight for one speaker with interface)



MODEL FOUR

Frequency Response:
28-20K Hz ± 2 dB
Sound Pressure Level: 115 dB @ 22′ in a 16′ x 26′ room. (Program Material Peaks)
Minimum Power Requirements: 50 Watts
Nominal Impedance: 4 Ohms
Power Consumption: 5 Watts (120v, 50/60 Hz)
Control: High Frequency Balance (Controls frequencies above 10K Hz)
Dimensions: 59″ x 36″ x 4″
Weight: 95 lbs. (Net weight for one speaker with interface)

A short history

Most American technological achievements evolve in a classic pattern:

Typically, a small group of creative individuals achieve a technological breakthrough, but find the large company which employs them unwilling to implement new designs without an assured market.

In frustration, these individuals break away from the parent company to build and market their new design on their own—on the faith that the consumer will recognize the advantages of their superior product.

American technology has reached its present pinnacle largely due to this process. Acoustat, as well as many other high-end audiophile companies, has been created in precisely this way. Most of our high-innovation and growth semi-conductor companies have also evolved in a similar fashion.

Acoustat's research started 20 years ago. Some milestones have been:

1972: Development of hybrid, direct-drive, high-voltage amplifiers. U.S. Patent #4,324,950 Perfection of indestructible full-range-element electrostatic panels and practical construction techniques.

1976-77: First commercial introduction of the critically acclaimed Model X with built-in, direct-drive, high-voltage amplifier, followed by the larger Monitor Series speakers.

1980: Invention of Magne-Kinetic passive (transformer) drive system, MK-121. U.S. Patent #4,323,736.

1980-81: Introduction of the Slimline Series Model Two, followed by Models Three and Four.

1980-81: Selection of Acoustat Speakers as a reference standard by numerous high-end audio component manufacturers, quality recording studios and audiophile record producers.

1982: Introduction of Trans-Nova® Twin-200 Amplifier and Trans-Nova® Pre Amplifier.*
**Multiple Patents Pending*

1982: Introduction of Professional Series Model 6 and Model 8, followed by the Model 2 + 2.

ACOUSTAT

BRINGING MUSIC TO LIFE

3101 Southwest First Terrace
Fort Lauderdale, Florida 33315
Phone: 305/462-6700 or Toll Free 800/327-3136

Authorized Dealer

SPECIFICATIONS

WARRANTY: Lifetime. See warranty statement for details.



MODEL TWO + TWO

Frequency Response:
28-28K Hz ± 2 dB
Sound Pressure Level: 115 dB @ 20' in a 15' x 24' room. (Program Material Peaks)
Minimum Power Requirements: 50 Watts
Nominal Impedance: 4 Ohms
Power Consumption: 5 Watts (120v, 50/60 Hz)
Control: High Frequency Balance (Controls frequencies above 10K Hz)
Dimensions: 94" x 20" x 3½"
Weight: 95 lbs. (Net weight for one speaker with interface)



MODEL THREE

Frequency Response:
30-20K Hz ± 2 dB
Sound Pressure Level: 110 dB @ 18' in a 14' x 22' room. (Program Material Peaks)
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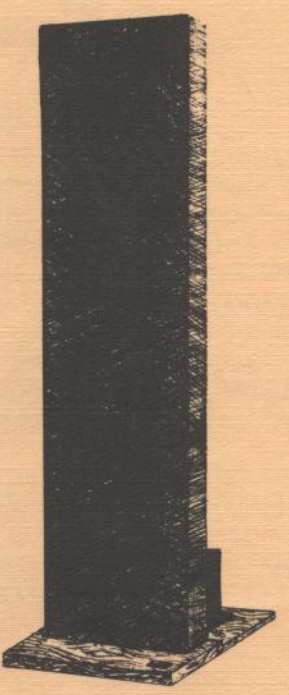
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Dimensions: 59" x 36" x 4"
Weight: 95 lbs. (Net weight for one speaker with interface)

ACOUSTAT

ELECTROSTATIC LOUDSPEAKER SYSTEMS

MODEL TWO + TWO



OWNER'S MANUAL & ASSEMBLY INSTRUCTIONS

LIMITED WARRANTY

FOR ACOUSTAT LOUDSPEAKER SYSTEMS

ACOUSTAT CORPORATION warrants to the owner that the ACOUSTAT loudspeaker system will perform as specified and that it will be free of defects in materials and workmanship for a period of FIVE YEARS from the date of original manufacture.

In addition, due to the superlative quality of construction employed in the ACOUSTAT loudspeaker systems, and the feeling that a high-quality product should be free of defects in materials and workmanship indefinitely, ACOUSTAT CORPORATION will continue to warrant the product (at their option) as long as it is in service, subject to the conditions below.

ACOUSTAT CORPORATION will repair defective units without charge for labor or parts, subject to the following conditions:

a) The unit must not have been altered or damaged through misuse, abuse, negligence, accident, or improper operation.

b) All repairs must be undertaken at the factory or other service center designated by ACOUSTAT CORPORATION. Units submitted for warranty repairs must be shipped in the factory packing carton to ACOUSTAT CORPORATION or its designated service center, freight and insurance prepaid by the owner, and will be returned to the owner freight and insurance prepaid by ACOUSTAT CORPORATION.

c) Normal wear and maintenance are not covered by this warranty.

ACOUSTAT CORPORATION SHALL NOT BE RESPONSIBLE IN ANY WAY FOR CONSEQUENTIAL OR INDIRECT DAMAGES OR LIABILITIES RESULTING FROM THE USE AND OPERATION OF THE PRODUCT COVERED HEREIN OR RESULTING FROM ANY BREACH OF THIS WARRANTY OR ANY IMPLIED WARRANTY RELATING TO THE SAID PRODUCT.

Some states do not allow exclusion of limitation of incidental or consequential damages so the above limitation or exclusion may not apply to you.

This warranty gives you specific legal rights and you may have other rights which vary from state to state.

INTRODUCTION

Congratulations on your purchase of the world's finest loudspeaker system, the ACOUSTAT full-range element electrostatic with Magne-Kinetic Interface*. If you will take just a few minutes to review the assembly and set-up instructions provided with your new speakers, you can be assured of many years of listening enjoyment as the system's full potential is realized.

PLEASE NOTE: THE SYSTEM WILL REQUIRE SEVERAL DAYS OF INITIAL PANEL CHARGE-UP AND PLAYING TIME TO REACH FULL EFFICIENCY & SONIC PERFORMANCE.

We have determined that many systems fail to function at their full potential because of deficiencies in the initial set-up. Therefore, a section has been included outlining the preferred procedure for the placement and connection of a newly installed system.

The acoustics of the room will play a major role in the ultimate performance of the speaker system, and we have found that it is far more rewarding in terms of the quality of the results obtained to tune the speakers to the room than to add line equalization. A reasonably absorbent and unobstructed wall should be directly behind the speakers, and any required tuning of the room can normally be accomplished with slight changes in the placement of drapes or other wall hangings.

ASSEMBLY

PLEASE NOTE: 2 PEOPLE ARE REQUIRED FOR SYSTEM ASSEMBLY

1) Remove the two bases from their box, being careful not to bump them together. Set one base aside. Take the other base and lay it face up (firewall plate up) with the thicker side of the base facing forward. Note the location of the color dot on the firewall plate so they can be readily re-installed in the same position. Set the (4) metal straps and (12) Truss-Head screws (packed in the base box) aside for now.

2) Position the base on the floor such that there is an unobstructed path a full 8 feet in front of the base. If the system is being installed in a carpeted room, the assembled system can be easily moved into its proper position by sliding it along the carpet. If the system is being installed on a wood or tile floor, the base will have to be placed in its proper position BEFORE further assembly can be done. (Refer to room placement suggestions at the end of these

*Patent Pending

instructions for proper speaker system positioning in the listening room.)

3) Remove ALL the Truss-Head screws on the base using a large flat-blade screwdriver. Remove the three hex-head screws and set aside the firewall plate. At this point the base should have NO hardware on it.

4) Remove one of the speaker panels from its box and remove the two plastic bags. Lay the speaker on the plastic bags face down (with the metal splice-plate leg on the bottom of the speaker pointing up) and position the bottom front of the speaker on the base. See Figure 1.

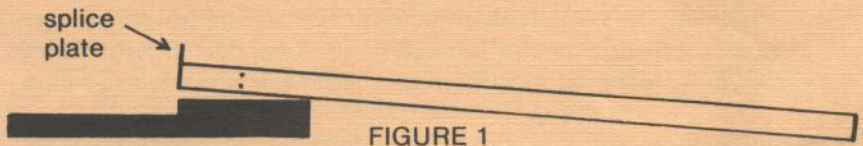


FIGURE 1

5) At this point two people are required in order to stand the speaker up on the base. One person should guide the splice plate of the speaker into place on the base as the speaker is raised. As the speaker is being stood up, the wire groups must be guided into the channel in the base – being VERY CAREFUL not to pinch any wires (or fingers!) while the speaker is being positioned. Person #2 should slowly raise the speaker (pushing on the center of the speaker is best) as person #1 prevents the bottom of the speaker from sliding. When the speaker is almost upright, person #1 should verify to person #2 that the wires have been positioned in their slots.

6) Finish raising the speaker to a full upright position, making sure the front bottom of the speaker is pushed fully forward in its slot on the base. At this point the speaker will stand unassisted, but a hand should be kept on the speaker to prevent accidental jarring.

7) Using the Truss-Head screws previously removed from the base, screw the speaker splice plate to the base, but DO NOT TIGHTEN COMPLETELY YET. The speaker can be moved slightly left and right to align the holes in the splice plate with the holes in the base.

NOTE: IF THE HOLES DO NOT ALIGN: 1) Note carefully which direction they are off, and then lower the speaker back down. 2) Loosen the splice plate screws on the bottom of the speaker and shift the plate as needed. 3) Re-tighten the screws and repeat steps #5 and #6.

8) Select the firewall plate previously removed. Noting the color dot position, thread the wire groups through the rubber grommet in the firewall plate. Carefully set the firewall plate in place on the base, guiding the wires into the cut-out channel. BE CAREFUL NOT TO PINCH ANY WIRES AS THE FIREWALL PLATE IS SET DOWN. Using the three hex-head screws previously removed, attach the firewall plate to the base and tighten securely.

9) Remove one of the interface units from its box. These units are attached to the speaker base such that the bottom side of the interface faces away from the speaker, with the felted top facing the speaker back. The bottom can be identified by the two threaded holes in the corners of the interface units. Set the interface unit on the floor with the opening facing the rear-center of the base, bottom on the floor. The bottom lip of the interface should be on the base at the outer edge of the firewall plate. This positioning should allow you to connect the interface unit to the three wire groups.

10) Note the three groups of wires coming through the rubber grommet. Visually identify them as: the RED group, with a pin plug on the end; the BLUE group, with a blue-sleeved hook on the end; and, the WHITE group, with a plain hook on the end.

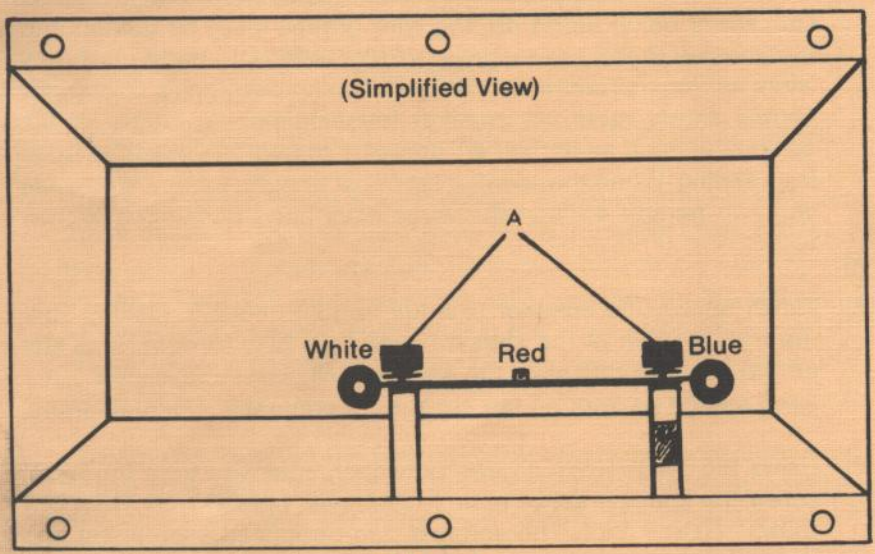


FIGURE 2

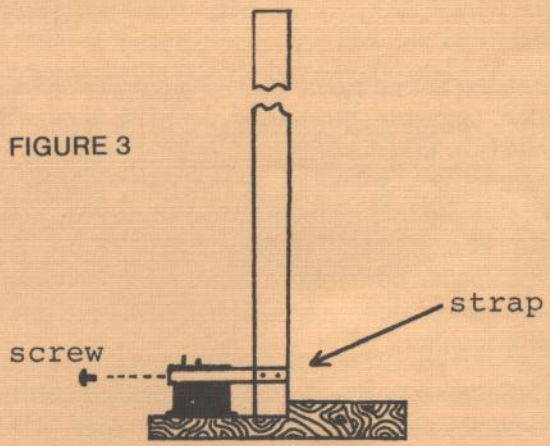
11) Refer to FIGURE 2. Insert the pin plug into the RED socket on the circuit board. The BLUE hook is attached to the board on the right side, identified by the blue tape on the nylon spacer below the

thumb screw (A), and the word "BLUE" on the board at this point. This is accomplished by loosening the thumb screw (A) three turns, placing the hook between the thumb screw and the washer, and then tightening the thumb screw securely. Repeat this procedure on the other hook on the WHITE side of the circuit board.

12) CAREFULLY stand the interface up on the firewall plate, aligning the six holes. Be sure not to pinch any wires as the interface is set on the firewall plate! Using six of the Truss-Head screws removed earlier, attach the interface unit to the base, BUT DO NOT TIGHTEN THESE COMPLETELY YET.

13) Refer to Figure 3. Select one of the four metal straps and three of the Truss-Head screws from the hardware packet. This strap runs across the side of the speaker system and attaches to the bottom (rear) of the interface unit. First attach the straps to the side of the speaker with two of the screws provided, do not tighten yet. Align strap with threaded hole in the bottom (rear) of interface, and attach with the third screw. Do not tighten yet.

FIGURE 3



14) Repeat step #13 for other side-strap.

15) Now that all screws have been installed, tighten all screws securely. This completes the assembly of the speaker system. (If desired, a corner square can be used to insure perpendicular installation of panels before screws are tightened.) Repeat steps #2 through #15 for the other speaker system.

REMOVAL OF INTERFACE UNITS

WARNING: ALWAYS UNPLUG THE LINE CORD AND AUDIO FEED BEFORE REMOVING INTERFACE!

WARNING: High voltages are present in a charged panel. If the interface must be removed from the speaker, the following procedure must be followed to discharge the panels. 1) UN-PLUG the interface from AC outlet and amplifier. 2) Un-bolt the interface from the speaker's base by removing the six Truss-Head screws. 3) Set the interface unit on the floor to the side of the speaker base being careful not to un-plug the three wire groups from the speaker. 4) Remove the center RED pin plug, and touch the tip (while holding the wires, NOT the plug) to either the BLUE or WHITE terminal on the circuit board. 5) Loosen the two thumb screws and remove the two hooks.

Since the Acoustat Model Two + Two is capable of revealing the subtlest detail in music playback, the entire playback system must be of the highest quality to obtain the best performance from the speaker system. Without question, any limitation in the performance of this speaker system can be traced to the limitations of some component in the audio chain. Careful consideration of all aspects of the playback system (preamplifier, amplifier, turntable, tonearm, cartridge and inter-connecting cables) should be considered a must if you wish to get full satisfaction from your new speakers.

The set-up procedure and assembly instructions are the same for all models of Acoustat electrostatic speaker systems. We advise that the following instructions be followed fully to obtain the best performance from your new speakers. Errors in initial set-up can prohibit the system's performance at low frequencies, as well as lower the system's overall efficiency.

Some of the principal considerations which will determine the performance potential of the speaker system as installed are:

1) **The Wall Behind the Speakers** – This wall should be reasonably absorbent, and sufficiently rigid so that it will not rattle.

2) **The Orientation of the Speaker System Within the Room** – (See Fig. 4.) For deepest low bass performance, the speakers should project sound along the longer axis of the room. This is a universal rule of speaker placement, and is in no way peculiar to Acoustat speakers. If this is not possible in your room, the performance of the speaker system will not be significantly compromised other than a slight loss of deep bass performance. In addition, we have found that a rather wide separation of the speakers (up to the point where the two speakers and the listening area form an equal sided triangle) provides a very large "listening window" without loss of center-fill. Therefore, set-up along the long wall has certain virtues as well.

3) **Distance From the Rear Wall** – Since the Acoustat loudspeaker is a dipolar radiator, placing the speaker too close to the rear wall will yield substantially reduced low bass output, due to rear wave cancellations, and a somewhat muffled sound. We recommend for most rooms a MINIMUM rear wall distance of three feet, measured from the back of the panels to the rear wall.

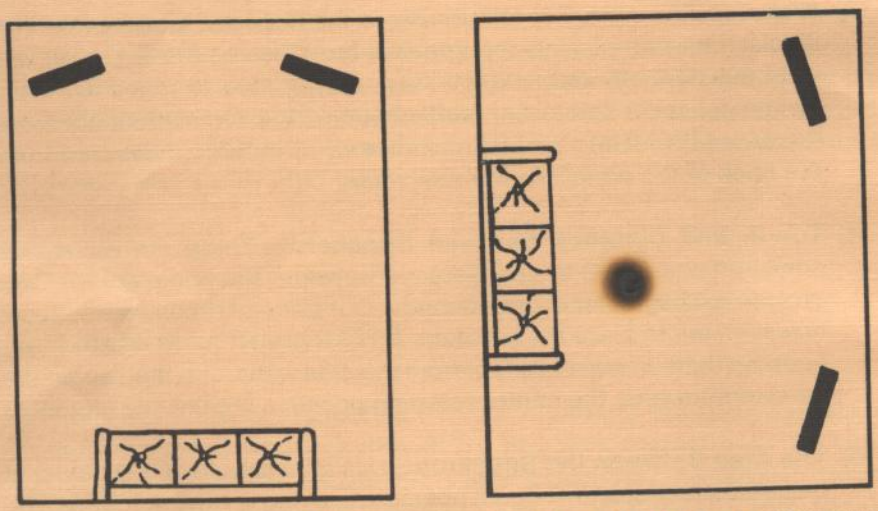
4) **Toe-In and Distance Between Speakers** – There are numerous combinations of toe-in and distance between the speakers that will provide excellent sonic performance. Our general recommendations, however, are to place the speakers AS FAR APART AS POSSIBLE, yet keeping them at least two feet from the side walls, and then angle the speakers towards the center listening position. (Again, see Figure 4.)

5) **The Area Between the Speakers** – This area should be kept clear of major obstructions to airflow if optimum imaging is to be achieved. The size and shape of any objects placed between the speakers will determine the extent of any deleterious effects on the imaging. Objects such as record cabinets that stand fairly tall or equipment racks should be avoided.

6) **Phasing** – Acoustat speakers are designed to preserve the correct absolute phase throughout the system, including the final coupling of the signal to the air. This ensures that vocalists and instruments will sound as natural as possible. Therefore, make sure that connections from the interface are correctly oriented: i.e., red (+) and black (–).

7) **Electric Feedback** – Electrostatic loudspeakers produce a strong electric field which can influence the operation of any low level electronic circuitry in close proximity. This can result in feedback well above the audio spectrum, which has the effect of high power dissipation and decreased headroom in the system. For this reason, the turntable-cartridge leads and the phono inputs of the preamplifier should be kept at least six to eight feet from the nearest speaker to ensure that no feedback can occur.

8) **High-Frequency Control Setting** – The high-frequency balance control affects frequencies primarily above 10k Hz. The recommended setting of this control is at the 3 o'clock position for the most natural high-frequency balance. In many cases, however, room acoustics, cartridge response and other variables may lead to a different setting for proper tonal balance.



BEST LOW BASS RESPONSE

LARGEST LISTENING WINDOW

FIGURE 4 – Room Placement

SPECIFICATIONS

MODEL TWO + TWO

Frequency Response: 28 - 20K + or – 2 dB
Sound Pressure Level: 115 dB @ 20′ in a 16′ x 24′ room
(Program Material Peaks)
Minimum Power Requirement: 50 watts
Nominal Impedance: 4 ohms
Power Consumption: 5 watts (120v, 50/60 Hz)
Control: High Frequency Balance (Controls Frequencies Above 10K Hz)
Dimensions: 7′10″ x 20″ x 3½″

WARRANTY: Lifetime, see warranty statement for details.



ACOUSTAT

Model Two/M
Model Three/M
Model Two/MH
Model Three/MH

ACOUSTAT Modular Hybrid Speaker Systems

OWNER'S MANUAL
AND
ASSEMBLY INSTRUCTION

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INTRODUCTION

Congratulations on your purchase of the worlds finest loudspeaker, the Acoustat Modular Hybrid electrostatic with Magne-Kinetic Interface'. Please review the entlre owner's manual before you begin to assemble your new speakers to assure you of reaching the speaker's full sonic potential. When assembled, placed correctly in the room, and used with the proper electronics, the Acoustat electrostatic loudspeakers will provide you with years of listening enjoyment.

PLEASE NOTE: The speakers require several hours of playing time before their full efficiency can be realized.

REGISTRATION CARDS

Please complete and return the enclosed purchase registration card within ten days of purchase of your new speakers. This card does not determine your eligibility for waranty but will allow Acoustat to inform you of updates and other product news that would be of interest to speaker owners. Any additional information you provide will aid the Acoustat Corporation in continuing to bring music lovers everywhere the finest audio components available today.

PACKAGING

SAVE ALL PACKAGING MATERIALS ! Your Acoustat electrostatic loudspeakers are finely crafted pieces of equipment, and must be properly cartoned whenever shipment is necessary. ONLY the original packaging materials will insure safe transport If lost or damaged, replacement packaging materials may be obtained from the Acoustat Corporation at a nominal charge.

FUSES

Acoustat speakers Models Two/M and Three/M and Models Two/MH and Three/MH utilize slo-blo type fuse(s) in the audio signal path. The Models Tw/M and Three/M with Magne-Kinetic 121 Interface, and Models Tw/MH and Three/MH with MagneKinetic 131 Interface utilize 3 amp slo-blow fuse. When replacing fuse(s) only those of similar value and type can be used or the warranty may become invalid.

ASSEMBLY INSTRUCTIONS

For Models Two/M & Three/M

PLEASE READ COMPLETELY BEFORE YOU BEGIN TO ASSEMBLE YOUR SPEAKER SYSTEM!

1, Lay the speaker face up on the floor. CAREFULLY and SLOWLY! Dropping the speaker could rupture the diaphragm with trapped air.

2. Remove the three screws from the bottom of the speaker system. The screws are 2-1/2" in length, each with a flat washer. Set them aside.

3. Remove one of the bases from the base box. Place the base against the bottom of the speaker. such that the front/top (name plate is on the front-right hand corner of the base) of the base faces up, and the three holes line up with the three holes in the bottom of the speaker. Start all three long screw/washer assemblies (through the base holes) into the speakers frame, DO NOT TIGHTEN

4. Adjust the base so that there ar of the base is flush with the rear of the frame. lighten the three screws securely.

5. CAREFULLY turn the speaker over, so that the back side is facing up. Remove one of the **MK-121** Interface units from its carton and set aside the hardware needed Place the Interface unit on the floor at the base of the speaker. with the opening of the unit facing the back of the speaker.

6. You will notice three groups of wires extending through the rubber grommet on the speaker's firewall plate (lower rear area). VIsually identify the three wire groups as the RED GROUP, with a pin plug on the end; the BLUE GROUP. with a blue sleeved hook on the end; and the WHITE GROUP, with a plain hook on the end.

7. (Refer to Figure 1). Insert the pin plug into the RED socket on the circuit board of the interface unit. Attach the BLUE hook to the board on the right side, identified by the blue tape on the nylon spacer below the thumbscrew. and the word "Blue". Loosen the thumbscrew three turns. Place the hook between the thumbxrew and the washer, and tighten securely. Repeat the same procedure for the WHITE group, at the white side of the circuit board

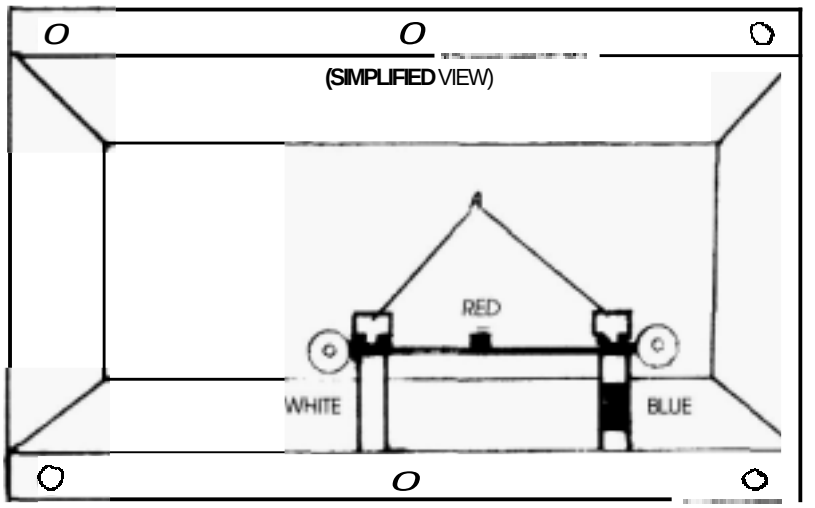


FIGURE 1
PANEL CONNECTIONS AT INTERFACE

8. Push any excess wire into the rubber grommet on the back of the speaker's base.

9. CAREFULLY, place the interface unit on the back of the speaker's base, aligning the six mounting holes. Be careful not to pinch any wires when you set the interface on the metal firewall plate Using the six screws provided in your hardware packet. attach the interface unit to the speaker's back.

10. Install the two casters included with the unit into the bottom rear corners of the unit. (The casters have nuts prethreaded into the stem.) When assembled and standing. the system should be perpendicular to the floor. This perpendicularliy can be determlned by two factors: 1) the type of floor the speaker is standing on; and 2) the amount of caster stem thread showing. If the system *is to* **be** positioned on a hardwood or cement floor, the caster must be screwed in all the way (or almost all the way) into the interface unit. If the system is to be installed on a carpeted surface, the caster will need to be screwed in only partially. The actual setting can be adjusted when the speaker is standing.
NOTE Depending on the particular room set-up, a slight degree of tilt back or tilt forward may be desired. This can be accomplished by caster positioning. and will not cause stability problems with the speaker system.

11. When the correct caster adjustment has been obtained. securely tighten the nut on the caster stem against the interface unit chassis.
WARNING: The caster WILL NOT support the entire weight of the assembled speaker system. When movlng the system, Do NOT tilt the speaker off its base and roll it like o hand truck. To move the system slide the base along the floor with the caster acting as an assist only.

12. Refer to "Recommended Set-Up and Speaker Placement" for room placement suggestions. When you have determined where the speaker will beplaced. plug the interface unit into a live wall outlet. The system should remain plugged in at ALL times for proper performance.
NOTE The current draw of the MK-121 Interfaceunitis very low: about five watts

13. Set the High Frequency balance pot on the interface at approximately the one o'clock position for your initial listeningtests. Thiscontrol effectsthefrequencies primarily in the last octave(10-20KHz) of the musicalspectrum.The proper setting Will be that which yields the correct degree of "sparkle" or "airiness" of the sound.

14. Repeat the above procedure for the other speaker.

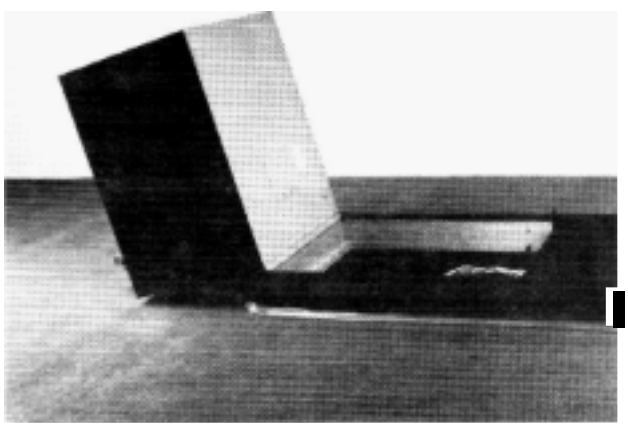
ASSEMBLY INSTRUCTIONS

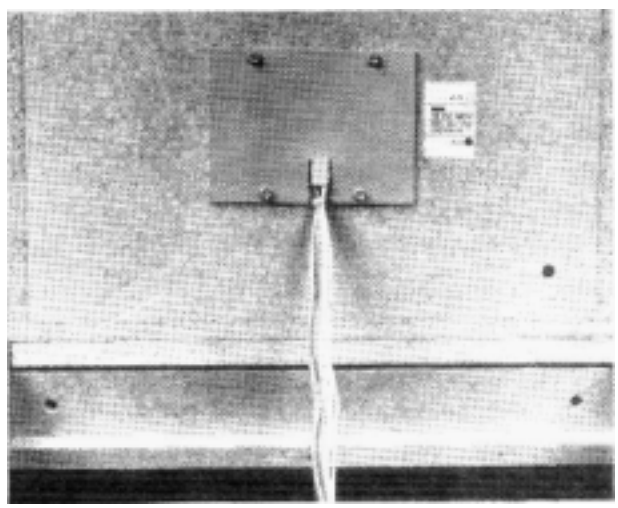
For Models Two/MH & Three/MH

PLEASE READ COMPLETELY BEFORE YOU BEGIN TO ASSEMBLE YOUR SPEAKER SYSTEM!

1. To assemble the speaker system, you will need to be allowed enough floor space for the bottom of speaker panel to be parallel to, and five feet from therearwall. In a later step you will be required to lean the system against this rear wall. Remove one speaker panel unlt from box. Remove plastic bag (HINT spread bag **on** floor before laying down speaker to protect grille cloth.)CAREFULLY lay speaker down in position described above. DO NOT ALLOW THE SPEAKER TO DROP TO THE FLOOR!!!

2. Remove one woofer assembly from its box. Be careful not to put pressure on binding posts, high frequency control knob or woofer. Set hardware kit aside. Set woofer assemblys front/bottom edge on the lower rear edge of the speaker's frame, It will balance. Using a flat blade screwdriver or 5/16" net driver, remove the plastic Insulator cover from the front (unfinished side) of the woofer box as follows 1) Loosen top two screws three turns 2) Remove lower two screws: *3)* Slide plate down and off of woofer **box.**





3. Note the three wire groups originating from the speaker system. Visually identify them as: the RCD GROUP, with a pin plug on the end: the BLUE GROUP, with a BLUE-sleeved hook on the end Insertthe RED GROUPs pin plug into the RED jack on theconnector plate. entering from the LOWER sidcotthe jack. Place the BLUE hook UNDER the lower thumbscrew securely. (NOTE Warning label identifies which thumbscrew is for the WHITE GROUPS hook to other(UPPER) thumbscrew in a similar fashion as the blue group. The three wire groups should then be positioned to exit at the bottom/center Of connector plate.

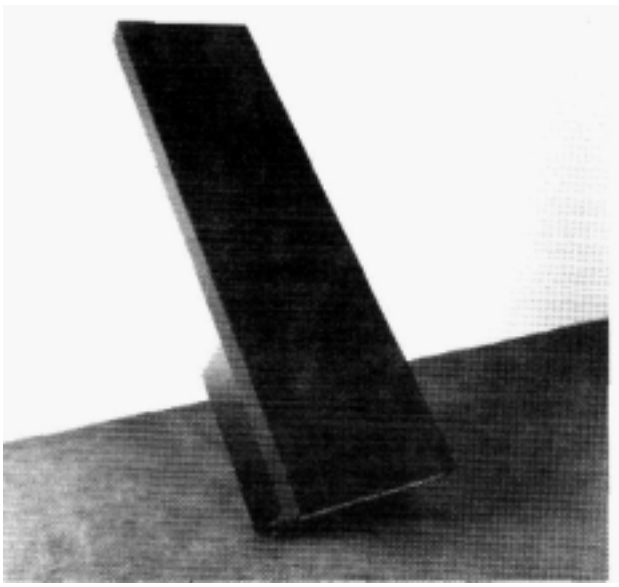
4. Reinstallthe platic insulator plate as follows: 1) Slide the plate under the two upper screws that had been loosened in STEP 2.2) Position the three wire groups such that they fit under the U shaped flap at the lower/center of the insulator plate. 3) Install the two lower screws and tighten securely, being sure

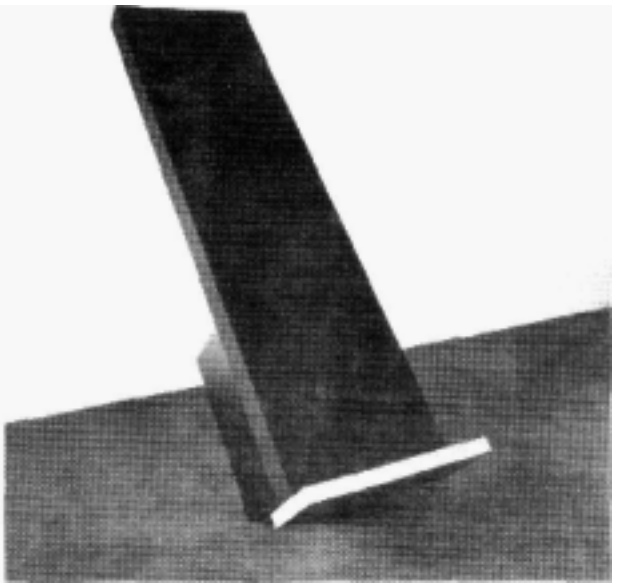
not to pinch any of the wires under the plastic. When properly assembled. the wire groups should ALL fit under the U-shaped flap on the insulator plate.

5. Now the woofer box is to **be** placed into the opening on the back of the speaker. (The box is rather heavy and you may wish to have an assistant help you lift the assembly into place.) Carefully lift the box up off the frame and place it squarely into the opening at the bottom of the speakers frame. Be sure not to pinch any wires from the three wire groups as the box is set into place. (Be careful Where you grasp the box when lifting it. i.e. don't put your hand through the woofer on the *bottom* of the box!!)

6. Select the two short (1/2") screws from the hardware kit. Using a flat blade screwdriver, install these two screws through the two metal straps at the top of the box and into the two threaded holes on the top of the box.
   NOTE: If the holes do not line up, the metal strap can be easily moved to align with the hole. Simply tap the strap with the screwdriver in the direction necessary to align with woofer box hole. Tighten screws securely.

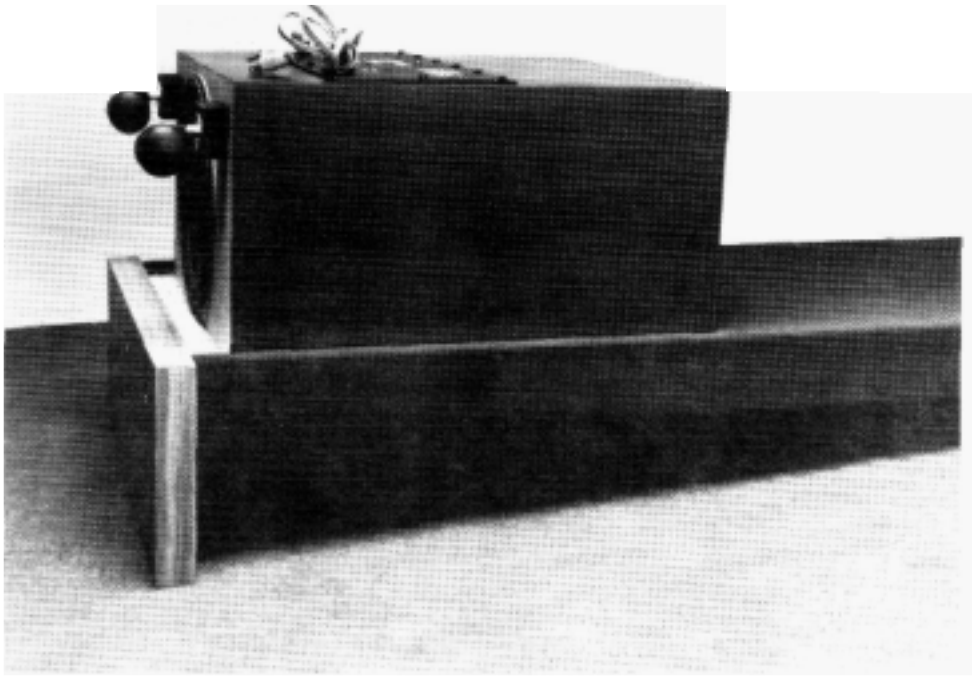
7. Carefully grasp the top of the system and stand the entire assembly upright. **At** this point, the system Will stand, leaning on the lower/back edge of the woofer box. Now, CAREFULLY lean entire assembly back until the top of the speaker rests on the rear wall and the back/bottom edge of the woofer box rests on the floor. This will expose the three holes on the bottom of the speaker frame. where the base is to **be** installed. Select the three long *(2 1/2')* screws and three small washers from the hardware kit. Select one of the bases from the base box.





8. Install a small flat washer on each long screw. Insert one of these assemblies through the bottom right hole on the base (the hole on the side of the base with the Acoustat nameplate), Align this screw with the right-most hole on the bottom of the speaker's frame. Using a flat blade screwdriver, screw LOOSELY into frame. Select another screw/washer assembly and lift left side of base until hole in base aligns with **left** hole in the speakers frame, insert screw/washer assembly and screw LOOSELY into frame. Select last screw/washer assembly and install in center base/frame holes as before Once the three screw/washer assemblies have been screwed loosely into the frame. align the rear edge of the base with the rear edge of the speakers bottom and tighten all three screws VERY SECURELY.
   WARNING The caster will not support the entire weight of the finished speaker system. The casters are not designed to **be** used like a "dolly" for moving the assembled system but rather are intended to guide the assembled speaker as it is "shuffled" across the floor.

9. Now, CAREFULLV stand the speaker back to an upright position, and then, lean the system forward until the top edge of speaker rests once again on the floor. Select the two casters and two large flat washers from the hardware kit. Note that each caster has a nut on its threaded stem. Install the flat washer over the caster's stem and screw the caster/washer assembly into the wood block on the bottom of the woofer **box Do** not yet tighten the lock-nut to secure caster. Repeat for other caster/washer assembly.



10. The exact positioning of the caster, in terms of how much of the stem is screwed into the wood block, will determine whether the finished speaker will stand upstraight. The type of floor the system sits on will ultimately determine how far the casters should be threaded in. On a hardwood, tile or cement floor. the casters Will need to be threaded in all the way. On a carpeted floor, ¼" to 1/2" of thread may need to be left showing. depending on the carpet pile. Once the proper adjustments have been made, the stopnut should be securely tightened against the flat washer. Most likely some adjustment will be necessary after the system has been stood up. At which time the height can be adjusted and the stopnut secured, once the correct setting is achieved. The correct setting is thot which leaves the system perpendicular to the floor. Once achieved, use a 7/16 wrench or pliers to tighten the stopnut against the flat washer.
    WARNING: The caster will not support the entire weight of the finished speaker system. The casters are not designed to be used like a "dolly" for moving the assembled system. but rather are intended to guide the assembled speaker as it is "shuffled" across the floor.
11, Position the assembled speaker system in the room, such that it is approximately three feet from the back wail and a minimum of two feet from the side wall, angled towards the center listening position. Plug the line cord into an always live outlet. Set the high frequency balance control to the "0' position for your initial setting Connect speaker terminals to amplifier, making sure to maintain proper "phase". i.e. plus(+) terminal of amplifier wired to plus(+) terminal of the speaker and. minus (–) to minus(–).
12. Repeat the above procedure for the other speaker system.

NOTE Due to the break-in requirement of the electrostatic portion of the speaker system, the first few days of playing time will produce sonic improvement and an increase in efficiency.

RECOMMENDED SET-UP AND SPEAKER PLACEMENT

DISTANCE FROM WALL

Leave at least three feet from the speakers to the rear wall. To determine this distance. measure from the center of the back of the speaker to the rear walll, This measurement should be taken on a perpendicular to the speaker. Allow at least *two* feet from the side of the speakers to the side walls.

PLACEMENT WITHIN THE ROOM

By placing the speakers far aport against a long wall, you will obtain the largest "listening window" without loss of center fill. Place the speakers *so* that they form an equilateral triangle with the listening position at the apex (Refer to Figure **2A).**

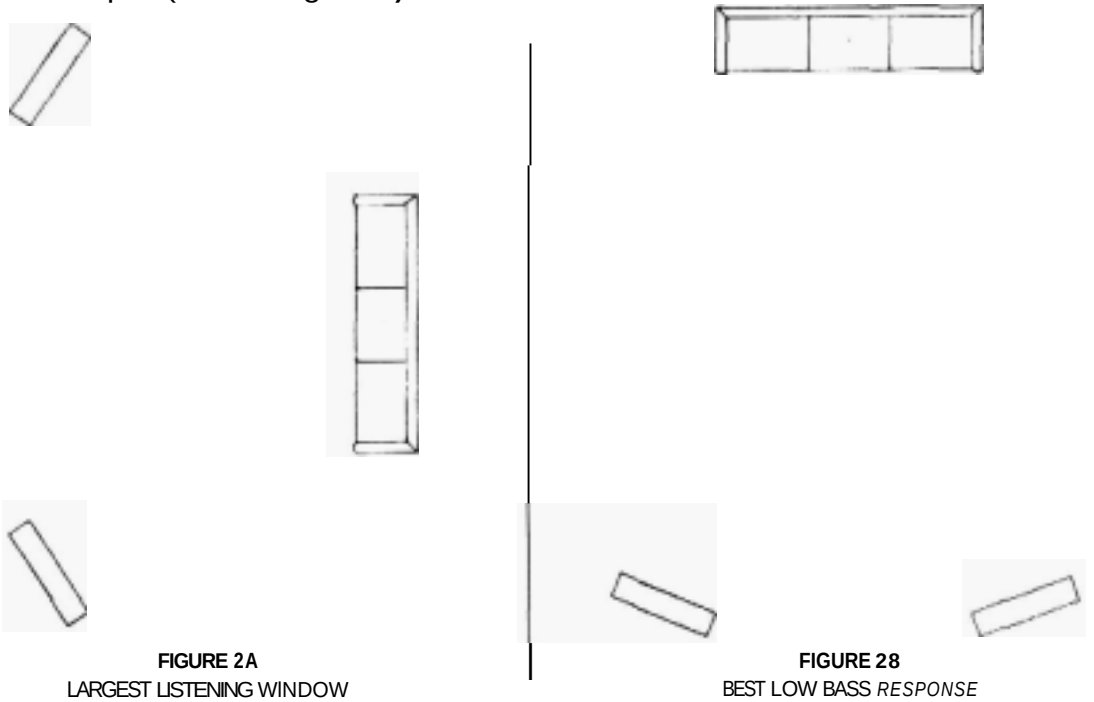


FIGURE 2A
LARGEST LISTENING WINDOW

FIGURE 28
BEST LOW BASS *RESPONSE*

By placing the speakers against the short wall of the room, with the rear of the speakers projecting into the corners. the deepst possible bass will be obtained. It may be impossible to retain the two feet suggested distance from the side of the speaker to the wall in a narrow room In this case, it is preferable to use the available space to separate the two speakers, and locate them closer to the side walls. (refer to figure 2B)

ANGLING

Angle the speakers with the panels directed toward the listening position. There are two general methods for angling or toein (Refer to figure 3 on following page). 1) Angle the speakers so that the "apex" is slightly in front of the listener. (*See* Position A). This arrangement offers the widest listening window, enabling you to move your llstening position with a minimum of tonal change; OR 2) Angle the speakers so that the **"aped"** is slightly behind the listener. **(See** Position B) This arrangement reduces the "Listening window", but provides a more focused sound. It requires less angling, therefore, the speakers are angled outward slightly to achieve this "apex" position.

NOTE Neither position is in all cases superior to the other, Personal taste and room placement will determine which is the best for you. Experiment!

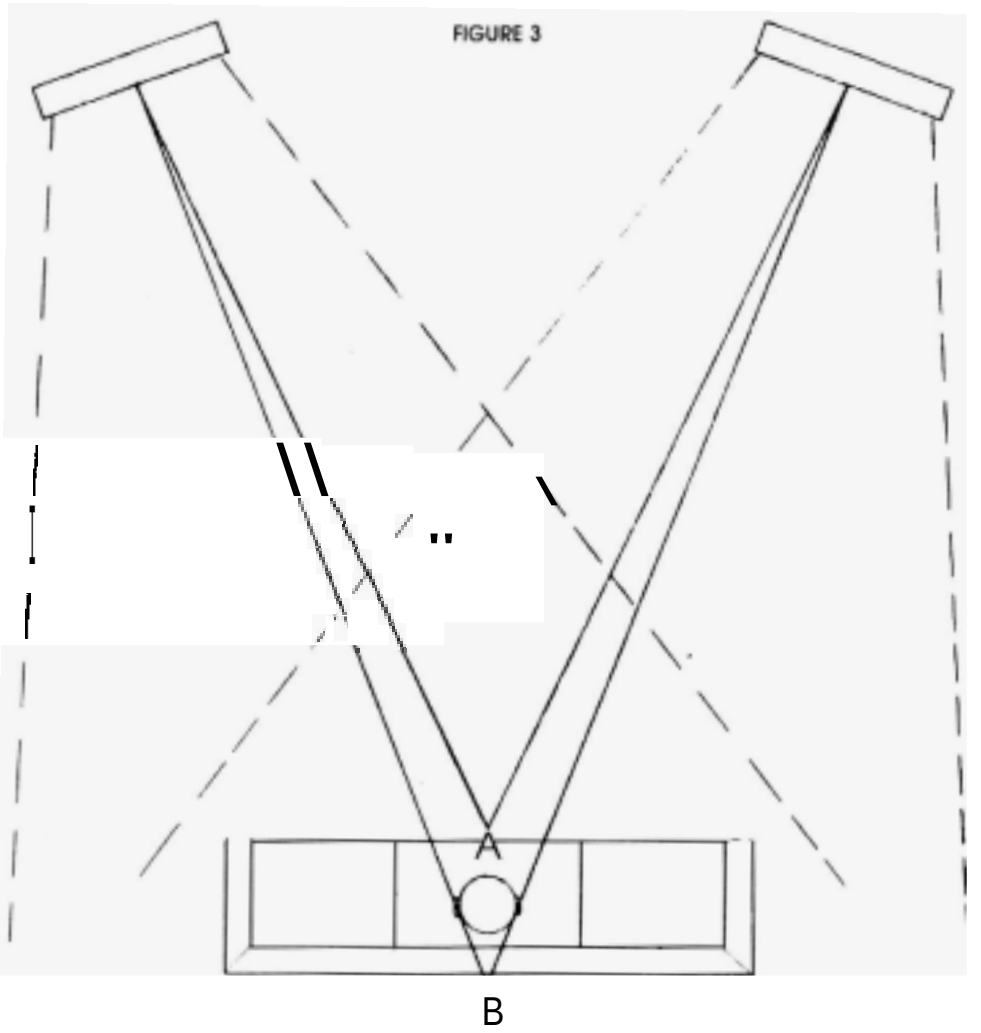
ACOUSTICAL PROPERTIES **OF** THE WALLS

A live end-dead end set-up in the listening room can sometimes improve the sonic characteristics ot a speaker system. This can be accomplished by using materials behind the speakers such as Sonex fiberglass panels, carpet, tapestry, etc. Treating the walls can yield more precise imaging and superior focus from your speakers. Perform a listening test before you treat the walls permanently. using a heavy blanket suspended temporarily Wile you listen.

THE SOLID LINES ARE SHOWN TO FACILITATE ANGLING ONLY. WHEN THE PANELS ARE PERPENDICULAR TO THE RESPECTIVE SOLID LINE THAT APEX IS ACHIVED

THE DASHED LINES REPRESENT THE SONIC RADIATION OF THE SPEAKERS.

FIGURE 3



NOTE: SPEAKERS SHOWN ARE DRAWN WITH THE FROM PLANE **OF** THE SPEAKER PERPENDICULAR TO THE LISTENER. IN A ROOM THIS SEI-UP WOULD YIELD THE APEX IN THE B POSITION TO ACHIEVE ME *APEX* IN POSITION A THE SPEAKERS WOULD HAM TO BE ANGLED IN SLIGHTLY.

PHASING

Acoustat speakers are designed to preserve the correct absolute phase throughout the system, including the final coupling of the signal to the air. This ensures that both vocalists and instruments will sound as natural as possible. Phasing depends on the correct connections from the interface. Be sure these connections are correctly oriented, I.e. red (+) to red, and black (–) to black.

ELECTRIC FEEDBACK

Electrostatic speakers produce a strong electric field which can influence the operation of any low level electronic circuitry in close proximity This can result in feedback well above the audio spectrum, which has the effect of power dissipation and decreased headroom in the system. For this reason the turntable/cartridge leads and the phono Inputs of the preampilfier should **be** kept at least six to eight feet from the nearest speaker to ensure that no feedback can occur.

WARNING! DO NOT apply audio signal to the interface wlth the AC Power removed, hence no panel bias! Connection to switched outlets is not recommended. DO NOT exceed fuse ratings or bypass fuse receptabie. Either of the above conditions will result in damage to the low frequency transformer if the interface Is overdriven. requiring an expensive repair not covered by, the warranty.

CLEANING

Speaker cloth may be cleaned with **any commercial cleaning fluid,** or any cleaner designed to be used with polyester knit fabrics. Use a cleaner such as K2R for small concentrated spots.

REMOVAL OF INTERFACE FOR MODELS TWO/M & THREE/M

WARNING ALWAYS UNPLUG THE LINE CORD BEFORE REMOVING THE INTERFACE!
If the interface must be removed from the speaker, the following procedure is necessary to discharge the panels

1, UNPLUG the interface from the AC outlet and dlsconnect the speaker leads from the amplifier.

2. CAREFULLY, lay the speaker on the floor. DROPPING IT CAN RESULT IN DAMAGE!

3. Unbolt the interface.

4. Set the interface on the floor behind the speaker, k i n g careful not to unplug the three wire groups from the speaker

5. Remove the center RED pin plug. Hold the wire an Inch behind the pin and GENTLY pull. DO NOT GRAB THE PLUG! Touch the RED tlp to either the BLUE or the WHITE terminal on the circuit board

6. Loosen the two thumbscrews and remove the hooks

WARNING: High static voltages are present in the charged panel. Failure to follow these procedures will result in an annoying, but harmless electrical shock.

REMOVAL OF HYBRID MODULE FOR MODELS TWO/MH & THREE/MH

WARNING ALWAYS UNPLUG THE LINE CORD BEFORE REMOVING THE HYBRID MODULE!
If the Hybrid Module must be removed from the speaker, the following procedure is necessary to discharge the panels

1, UNPLUG the Hybrid Module from the AC outlet and disconnect the speaker leads from the amplifier.

2. CARERILLY, lay the speaker on the floor DROPPING CAN RESULT IN DAMAGE!

3. Unbolt the Hybrid Module, both the two screws on the top of the module, and the three screws on the bottom of the speaker frame.

4. Set the module on the floor behind the speaker, being careful not to unplug the three wire groups from the speaker.

5. Remove the plastic insulator cover from the Hybrid Module.

6. Remove the center RED pin plug. Hold the wire an inch behind the pln and GENTLY pull. ***DO*** NOT GRAB THE PLUG! Touch the RED t i p to either the BLUE or the WHITE terminal on the circuit **board**

7. Loosen the two thumbscrews and remove the hooks.

8. Replace the plastic insulator cover

WARNING High static voltages are present in a charged panel. Failure to follow these procedures will result in **an** annoylng. but harmless shock.

LIMITED WARRANTY

Amustat Corporation warrants to the owner that the Amustat loudspeaker system excluding the Dynamic Woofer.will perform as specified and that it will be free of defects in materials and workmanship for a period of FIVE YEARS from the date *of* origlnal manufacture.

In addition, the Acoustat Corporation will continue to warrant the product at our option as long as it is In service, subject to the conditions below. Acoustat Corporation warrants to the owner that the Dynamlc Woofer employed in the 2mH and 3mH will perform as specified and that it will be free of defects in materials and workmanship for a period of (2) two years from the original date of manufacture.

Acoustat Corporation will repair defective units without charge for labor or parts subject to the following conditions

a) The unit must not have been altered or damaged through misuse. abuse, negligence, accident. or improper operation

b) All repairs must be undertaken at the factory or other service center designated by Acoustat Corporation. Units submitted for warranty repairs must be shipped in the factory packing carton to Acoustat Corporation or its designated owner, and will be returned to the owner freight and insurance prepaid by Acoustat Corporatlon.

c) Normal wear and maintenance am not covered by this warranty

d) Fuses have not been bypassed and only fuses of the proper value have been used.

ACOUSTAT CORFORATION SHALL NOT BE RESPONSBLE IN ANV WAY FOR CONSEQUENTIAL OR INDIRECT DAMAGES OR LIABLITIES RESULTING FROM THE USE AND OPERATION OF THE PRODUCT COVERED HEREIN OR RESULTING FROM ANY BREACH OF THIS WARRANTY OR ANY IMPLIED WARRANTY RELATING TO THE SAID PRODUCT.

Some states do not allow exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you.

Thls warranty give you specific legal rights and you *may* have other rights which vary from state to state.

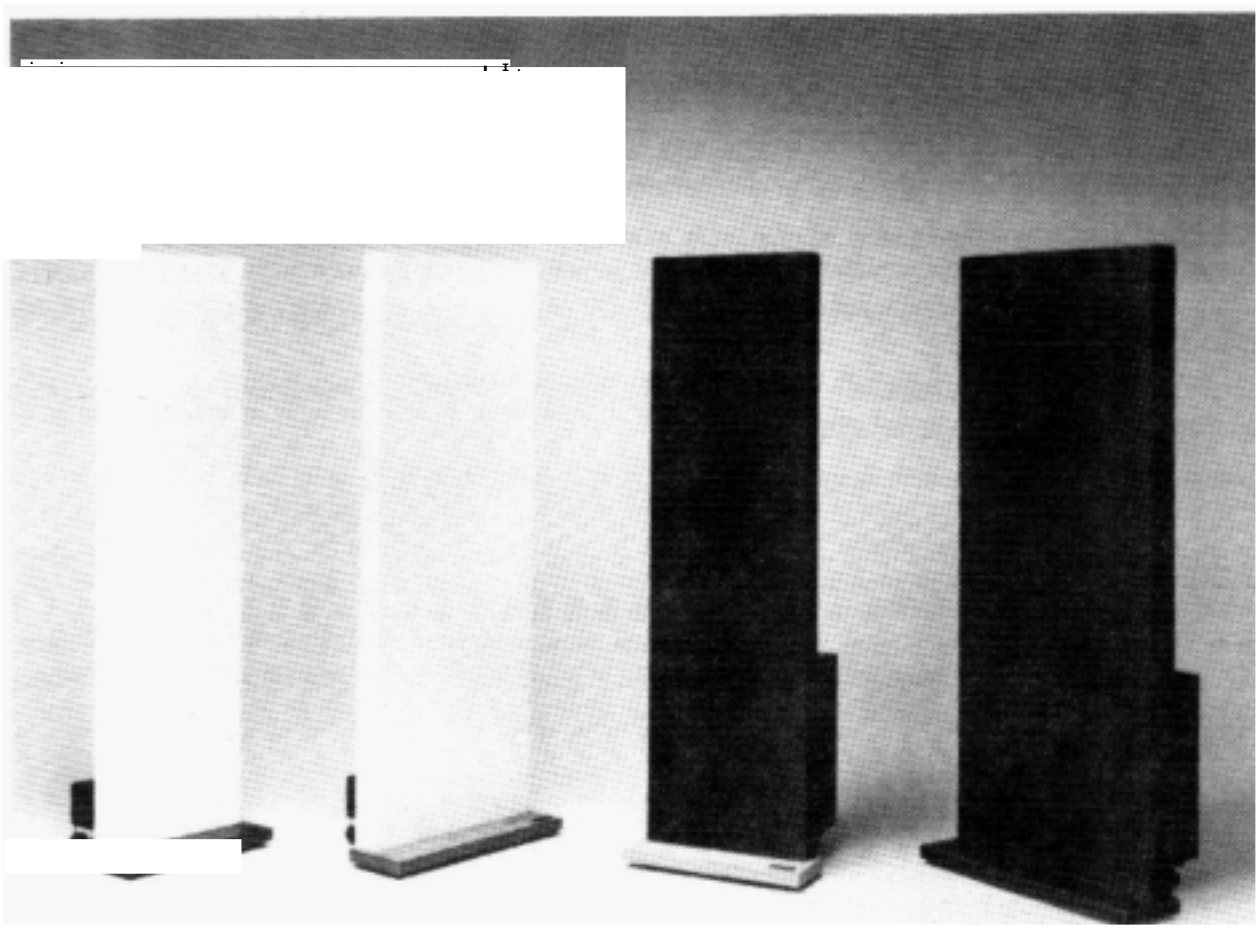
SPECIFICATIONS

MODEL TWO/M-Frequency Response: 35-20 KHz +/- 2 dB; Sound Pressure Level: 108 dB 18' in a 14x22" room. (Program Material Peaks); Minimum Power Requirements 100 Watts Per Channel; Nomlnal Impedance: 4 Ohms Power Consumption: 5 Watts (120v. 50/60 Hz); Control: High Frequency Balance (Controls frequencies above 10 K Hz); Dimenslons 7 2 x 20" x 31/2"; Weight 81 lbs. (Net weight for one speaker with Interface)

MODEL THREE/M-Frequency Response: 30-20 KHz +/- 3dB Sound Pressure Level: 110 dB 18' in a 14'x22' room. (Program Material Peaks); Minimum Power Requirements: 70 Watts Per Channel; Nominal impedance: 4 Ohms Power Consumption 5 Watts (120v. 50/60 Hz); Control: High Frequency Balance (Controls frequencies above 10K Hz); Dimenslons 7 2 x 2 8 x 31/2"; Weight 98 lbs. (Net weight for one speoker with interface)

MODEL TWO/MH-Frequency Response: 30-20 KHz +/- 3dB; Sound Pressure Level: 110 dB@ 18 in a 14'x22' room. (Program Material Peaks); Minimum Power Requirements: 40 Watts Per Channel; Nominal Impedance: 4 Ohms Power Consumption: 5 Watts (120~50/60 Hz); Control: High Frequency Balance (Controls frequencles above 10K Hz); Dimensions 7 2 x 20" x 31/2"; Woofer enclosure: 21" x 18" x 13'; Weight 110 lbs. (Net weight for one speaker with interface)

MODEL THREE/MH-Frequency Response: 30-2OKHz +/-3dB; Sound Pressure Level: 112 dB @ 18' in a l4'x22' room. (Program Material Peaks): Minimum Power Requirements: 40 Watts Per Channel; Nominal impedance: 4 Ohms Power Consumption: 5 Watts (120~50/60 Hz); Control: High Frequency Balance (Controls frequencies above 10K Hz); Dimensions 72' x 28" x 31/2"; Woofer enclosure: 21" x 1 8 x 13; Weight 127 lbs. (Net weight for one speaker with Interface)



Acoustat

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Acoustat
corporation

**********PRELIMINARY ASSEMBLY INSTRUCTIONS**********

MODEL TWO/M and THREE/M

THE COMPLETE OWNER'S MANUAL FOR THE NEW ACOUSTAT MODEL TWO/M AND THREE/M WILL BE AVAILABLE SHORTLY. PLEASE READ THROUGH THE COMPLETE OWNER'S MANUAL ENCLOSED, REPLACING THE ASSEMBLY INSTRUCTIONS (on Page 2) WITH THESE PRELIMINARY INSTRUCTIONS.

1) Lay the speaker face-up on the carpet, CAREFULLY! DO NOT allow the speaker to fall to the floor. SLOWLY lay it down. Dropping the speaker face down may rupture the diaphragm with trapped air.

2) Remove the three (3) screws from the bottom of the speaker system. (They are 2" long with a flat washer on each screw.) Set aside the screw/washer combination.

3) Remove one of the bases from the base box. Place the base against the bottom of the speaker, such that the front/top (nameplate is on the front-right hand corner of the base) of the base faces up, and the three holes line up with the three holes in the bottom of the speaker. Start all three long screw/washer assemblies (through the base holes) into the speakers frame.

4) Adjust base such that the rear of the base is flush with the rear of the frame. Tighten the three screws securely.

5) Carefully turn the speaker over, so that the back side is facing up. Set the MK-121 Interface unit on the floor at the base of the speaker, with the opening of the MK unit facing toward the speaker.

6) Note the three (3) groups of wires coming through the rubber grommet on the speaker's firewall plate (lower-rear of speaker). Visually identify them as: the RED group, with a pin plug on the end; the BLUE group, with a blue-sleeved hook on the end; and, the WHITE group, with a plain hook on the end.

7) Refer to Figure 1. in the owner's manual. Follow the procedures outlined in Steps 5, 6, and 7 in the owner's manual, for connection and mounting of the Interface unit.

8) Select the two (2) casters included with the Interface unit. These casters are installed in the bottom-rear corners of the Interface. When assembled and standing, the system should be perpendicular to the floor. This perpendicularity will be determined by two factors:

3101 Southwest First Terrace, Fort Lauderdale. Florida 33315, Phone: 305/462-6700

PRELIMINARY INSTRUCTIONS CONTINUED.....

1) The type of floor the speaker is standing on. 2) The amount of caster stern thread showing.

If the system is to be positioned on a hardwood floor, or on a cement floor, the caster must be screwed in all (or almost all) the way into the Interface unit. If installed on a carpeted surface, the caster will need to be screwed in only partially. The actual setting will probably require some adjustment after the speaker has been stood up. (NOTE: Depending on the particular room set-up, a slight degree of tilt-back or tilt-forward may be desired. This can be accomplished also by caster positioning, and will not cause any problems structurally with the speaker system.)

9) Once the correct caster adjustment has been obtained, the nut on the caster stern should then be securely tightened against the Interface chassis.

WARNING: The caster will not support the entire weight of the assembled speaker system. When moving the system, DO NOT tilt the speaker off its base and roll like a hand-truck! To move the system, slide the base along the floor with the caster acting as an assist only.

10) Refer to "Recommended Set-Up Procedure" in the owner's manual for room placement suggestions.

11) Plug the Interface unit into a live wall outlet. The system should remain plugged-in AT ALL TIMES for proper performance. (Please Note: The current draw of the MK-121 Interface unit is VERY low -- about 5 watts --.)

12) Set the High-Frequency balance pot on the Interface unit at approximately the two o'clock position for your initial listening tests. --This control effects frequencies primarily in the last octave (10-20K Hz) of the musical spectrum-- and the proper setting will be that which yields the correct degree of "sparkle" or "airiness" to the sound. .

13) Repeat the above procedures on the other speaker system.

FUSES: The MK Interface unit employs one 3-amp slo-blo type fuse in the audio signal path. This fuse should be replaced with similar value and type ONLY.

Acoustat
corporation



Acoustat's Model Two/MH Speaker

Exceptional Performance. Affordably Priced. Revolutionary by Design.

A NEW CONCEPT

Acoustat's new Model Two/MH speaker marks the first successful marriage of cone and electrostatic speaker technology.

Made possible by the unique combination of Acoustat's full-range electrostatic panels and the patented MK-131 interface transformer, this hybrid design yields an extremely low crossover point (100 cycles).

Because of this, the mid-range coloration and sonic degradation that are normally inherent in typical two-way speaker systems are totally eliminated.

The Model Two/MH offers greatly increased efficiency while maintaining the bass and dynamic capabilities of Acoustat's larger, full-range electrostatic speakers.

WOOFER AUGMENTATION

Frequencies below 100 Hz are effectively handled by a 10" woofer, sealed in a floor-firing configuration behind the speaker's full range electrostatic panels.

Made of a stiff polycone material, the woofer delivers far less break-up than conventional cone drivers and provides excellent dynamic range.

AFFORDABILITY

The new Acoustat Model Two/MH offers exceptional performance and value. Priced at a modest $1195. per pair, these six-foot-high speakers offer a quality unheard of in speakers at far greater price.

COMPATIBILITY

The Model Two/MH speakers are compatible with a wide variety of mid-priced high fidelity equipment. Because of their higher efficiency they can be comfortably driven by many moderately powered amplifiers and receivers.

HEAR FOR YOURSELF

Listen to the new Model Two/MH speakers. You'll be amazed at their superb clarity, imaging and depth. And remember, all Acoustat electrostatic speakers are backed by a lifetime warranty and Acoustat's reputation as one of the top ten speaker manufacturers in the world.

SEE FOR YOURSELF

Six feet high, twenty inches wide. Your choice of grill cloth and wood type base construction. Your Model Two/MH speakers will become a welcomed part of your decor and enhance your life with sight and sound.

SPECIFICATIONS

MODEL TWO/MH

FREQUENCY RESPONSE: 28-20 K Hz ± 3dB

SOUND PRESSURE LEVEL: 110dB @ 18' in a 14' x 22' room. (Program Material Peaks)

MINIMUM POWER REQUIREMENTS: 60 Watts

POWER CONSUMPTION: 5 Watts (120v, 50/60 Hz)

CONTROL: High Frequency Balance (Controls frequencies above 10 K Hz)

DIMENSIONS: 60" x 20" x 3½" (Woofer enclosure: 21" x 18" x 13")

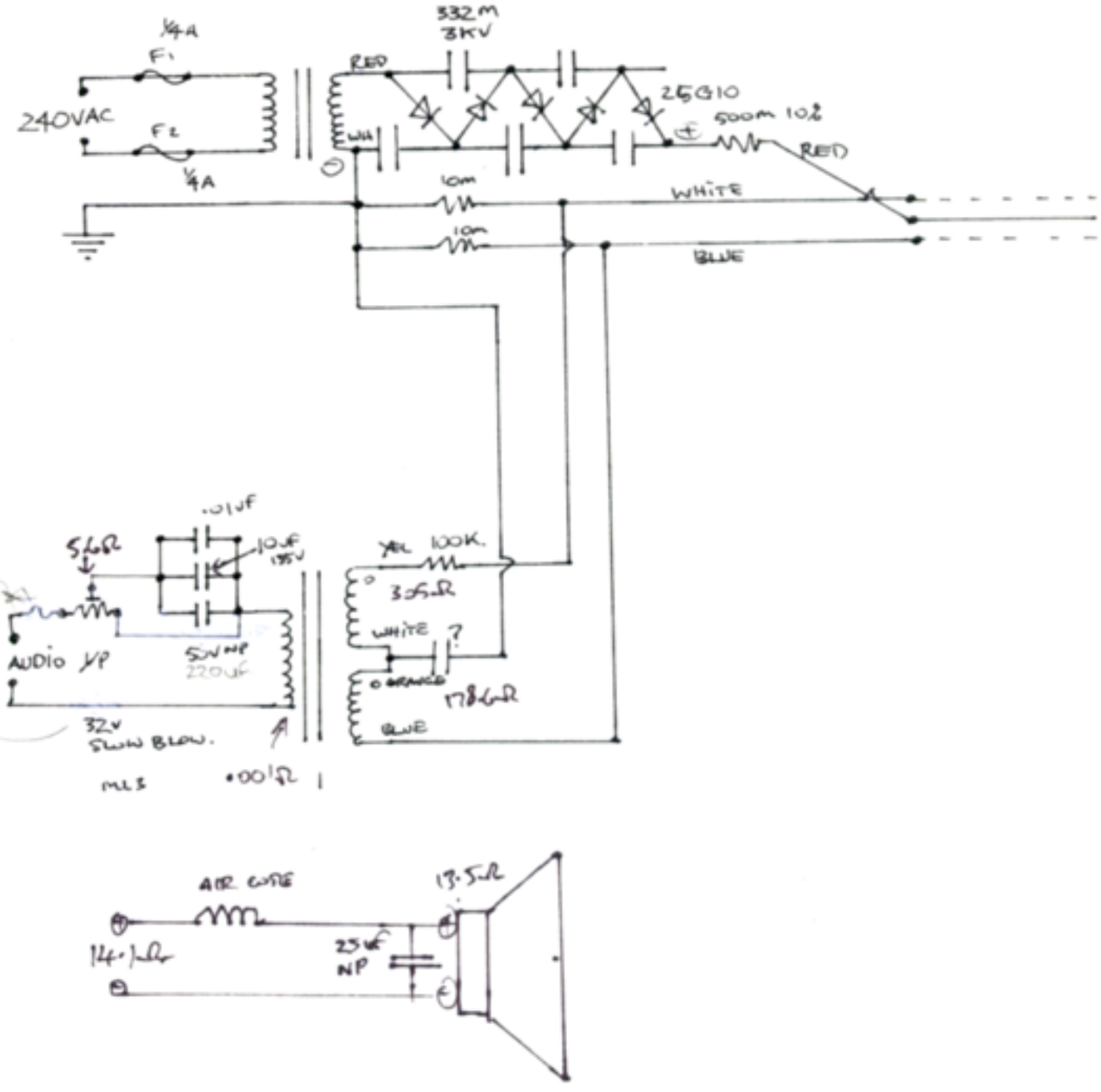
WEIGHT: 85 lbs. each (assembled unit)

ACOUSTAT

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the absolute Sound.

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The Acoustat: Models Three & Four

Let me begin this review with the statement that I intend to get a pair of Acoustats for my own reference system. I haven't yet decided whether they will be the Three's or the Four's because of room size problems. However, after long listening and many trials and tribulations—two manufacturer modifications and shipping damage difficulties—I have come to the conclusion that these are the best single unit speakers I have ever heard. As such, I believe that they offer the best compromise around between size, dynamic range, frequency response, imaging, depth; coherence, and listening flexibility. I also believe that they offer a degree of transparency and speed that is unequalled in any system I hqve heard other than the highly complex reference systems *Sea* Cliff.

Lest I sound bowled away, let me also hasten to add some reservations. The Acoustat Three's, and to a lesser degree the Acoustat Four's, do not provide subwoofer depth in the bass and do not appear to be quite as tight in the bass as the very best cone woofers. The highs seem very slightly rolled in the upper two octaves and this can cause a slight apparent loss of air and imaging precision on material with heavy upper treble content. While each individual panel is full range and coherent, they are multi panel speakers. As such, they are not an exact point source and this shows up in their imaging. They are somewhat difficult to place, conspicuous, and have a somewhat norrow listening window, although much less so than the Acoustat Two's and no more so (in practical terms) than other speakers with excellent imaging like the KEF-105-II's and **B & W** 801's. They are power hungry, and cannot provide top performance with some otherwise excellent amplifiers. They require top grade speaker cables to give maximum performance, and are mercilessly accurate rather than musical or euphonic.

Modifications *Post-Sea* Cliff

I should note immediately that the Acoustat Three's and Four's that I listened to have had two major modifications in the MK-121 drive system that powers the Two, Three and Four. These have substantially cleaned up and improved the sound of all ree models since the Two's were reported on in Issues 20 and 21/22. The modifications were only fully completed once the Four's left Sea Cliff, and only one of the two will be available to most dealers before August. Be advised that if you listened to the Acoustats early on, you did not hear the speakers I am reviewing, and that you should check with your dealer to make sure that both modifications have been made when you audit a pair in a showroom.

The first of these modifications has been made in all production units since mid-June and consists of two large and highly visible 10 microfarad polypropylene capacitors shunting the large electrolytics in the MK-121 drive box. These greatly improve the highs. The second modification consists of a pair of .01 microfarad, black, six kilovolt polypropylenes to replace the mylars (a vendor substituted without telling Acoustat). These will be installed in all units produced after late July, and further improve the treble and upper midrange. Both conversions will be available from dealers at nominal cost by the time you read this, and require only minimal soldering.

The frame of the speakers has also been strengthened (to use casters) since the earliest production runs, and the drive units have slightly improved mountings for the circuit boards. If Acoustat takes my recommendation, they will also be introducing an improved mounting for the bias transformer to reduce the low level mechanical hum it produces, and a plate to convert units for those who find even nearly sub-audible noise objectionable. Check your unit and discuss the status of this with your dealer.

The Nature of the Breed

Given this background, let me begin my detailed comments with a description of how the Three's and Four's differ from the Two's reviewed at length in the back issues. Acoustat specifies that the Acoustat Three's extend the low frequency response (at plus or minus 2 dB) from 35 Hz in the case of the Two's to 30 **Hz;** the Four's extend it to 28 Hz. The Two's have a dynamic range (peak SPL) of 105 dB at 15 feet in a 12' x 18 room, the Three's have a range of 110 dB at 18 feet in a 14' x 22' room, and the Four's have a dynamic range of 115 dB at 22 feet in a 16' x 26' room.

In practice, it seems unlikely that most home owners will actually get bass response down to these limits because of room problems, but there is no question that the Three's and Four's provide a far stronger feeling of depth and power in the deep bass than the Two's. The Four's also provide an audible improvement in the deep bass over the Three's that is not reflected in the 2Hz difference specified in the manufacturer's literature. You do get what you pay for in improved bass response with each Acoustat.

As for dynamic range, the Two's are constricted and the Three's and Four's are not. I could not drive my Four's to overload with the 250 watt per channel amplifier I have available, even in a large room, and I was then getting little notes threatening divorce. (My wife's screams were, happily, inaudible!) I had the same result auditing the Three's at a friend's. His turntable succumbed to acoustic feedback from the speakers long before they showed signs of strain.

I quote the above room dimensions for each model because they give a good practical picture of the ideal room size for a given model. I could not, in fact, find a room big enough to convince myself that I was getting ultimate performance out of the Four's. While I went so far as to move them to a room that was 33 by 28 feet, I had the impression that they were so accurate that I was still getting some slight room reflection and boundary problems, and unable to get the deepest bass the speakers were capable of. (This is the only pair of speakers I have ever cared enough about to move to a friend's house—and they were a real headache to move.) At the same time, I would strongly recommend that you choose the Three over the Two if at all possible, and with a little help from the folks at Acoustat, I have gotten a pair of Four's to work well in my 16 x 18 foot main listening room.

My reason for strongly advising that you pick the Three or Four over the Two lies in the acoustic effect of their different size and dispersion patterns. The model Two is *58* x 20 x 3% inches, and weighs 64 lbs. The model Three is 59 x 28 x 31/2 inches, and weighs 75 lbs. The Four is 59 x 36 x 4, and weighs 86 lbs. Obtrusiveness and difficulty of placement away from room boundaries obviously increases with size. These differences are even more important, however, in terms of what they do to depth and imaging. The two 9" panels in the Two are angled at 13 degrees and create problems with interference between the lobes of sound radiating from each panel, notch cancellation between them, and wrap-around cancellation between the front and back radiations. The two 9" panels and one 8"

panel in the Three are angled at 9 degrees each and the reduction in angle and increase in size reduce these effects significantly. The two 9" and two 8" panels in the four are angled at only 6 degrees each and do the best job of all. The total apparent "arc" in the Two's is 13 degrees and is apparent to the ear. The "arc" in the Three's is 18 degrees and panel separation is far less apparent. The "arc" in the Four's is also 18 degrees but the angle of each panel is 50% smaller than in the Three's.

To further explain the importance of all this data, it is my impression that the Two's tend to have slightly too much separation between the radiation lobes coming out of each panel because their 13 degree angle is too sharp. This means that there is difficulty with the different apparent time of arrival to the ear from each panel, and that the Two's create a range of phantom "sweet spots", each of which still leaves the listener slightly uneasy and experiencing image wander if he moves his head. These problems in the Two's, as explained in previous issues, create a further difficulty. Any listening position involves minor trade offs between linear frequency response, treble control adjustment, speaker placement, and apparent imaging, and all combine to lock the listener into something approaching an "iron vise" seating position in order to get the very best out of the Two's. The Two's also seem to have a slight-wrap around cancellation problem at the edges that can cause a suck-out in the upper bass in some rooms (again, see the review of the Acoustat Model Two in the previous issue).

The Three's and Four's progressively remove these effects to the point where they produce a far less demanding set of listener position and adjustment problems, and a far flatter response and more coherent image in most rooms. They do this at the theoretical cost of a slight loss of precision in imaging due to increased time of arrival and reflection problems from the additional panels. However, my tentative conclusion is that these are very slight losses in practice, and that most of the comments I have heard about the Two being more precise than the Three and Four stems from the psych-ological impact of the "iron vise". In short if you listen to a speaker that makes every head movement just slightly unsettling, you may get an impression of precision and exactness, but, in reality, that speaker is less stable in imaging and creates more inherent trade-offs in every listening position. (This is discussed in more detail in my review of the Quads.)

The Acoustat Three's and Four's also have a wider listening area because of their wider angle of dispersion. There is a fairly simple formula for this and you can use it to calculate the effect on your own listening room. The maximum listening area for the Two's will be equal to the width of the speaker plus only 0.21 feet per foot of distance from the panels. It will be equal to panel width plus 0.31 feet per foot of distance from the panels for the Three's and Four's. Room boundary effects will probably collapse this area by half, however, even if you can get three feet of distance from the back walls and 18 to 24 inches from the side walls.

Vertical dispersion is narrow and the listening area will be limited to the seated position for all models. They are much freer than most speakers, however, of sensitivity to rugs and low furniture like coffee tables, problems that can make the Quad ESL-63's and DCM Time Windows hell to place in some rooms.

All three models appear to have slowing dropping highs above about 14,000 Hz, but the highs are still there. The Three's and Four's are much easier to live with in the highs because the more acute angle between the panels of the Two "spotlights" the highs, and the interactions between the two lobes of radiating high frequencies from each panel produce audible shifts in apparent response with each head movement. Leaving the treble control at about 2 o'clock on the Three's and Four's produces a nice sound balance with a slight taper in the upper two octaves. There is no ideal treble setting for the Two since it is dependent on the particular angle you choose in aiming the panel at the listening position.

As I have already mentioned, all three speakers use the same drive unit. However, each uses very different amounts of power. The Two's need a truly excellent amplifier with more than 100 RMS watts per channel, the Three's need 70 watts, and the Four's little more than 50 watts. They present a largely resistive four ohm load and do not have the mixture of drive phase and inductive and reactive problems that drove amplifiers insane with the Stax. older Quads, and Dayton-Wrights. However, they benefit from being driven by tube units or transistor amplifiers without bridging or heavy current/voltage limiting protection circuitry. I found the Berning EA-230s worked superbly with the Acoustat Four in the bridged mode, as well as the Amber. I have heard good reports about the Leach, PS Audio, Kenwood Purist, Levinson, and Audio Research amplifiers, and I found the Apt to work surprisingly well, although subject *to* some warmth and a tendency to hang on to bass notes.

This is significant, however, because a 3 dB technical increase in efficiency from the Two to Three to Four (and an apparent difference well in excess of 4 dB means you may be able to pay for the larger speaker with a saving in amplifier cost. The Two's cost $1200, the Three's cost $1600, and the Four's cost $2000. Since these are reference quality speakers, and show every trace of veiling, grain, transistor hardness, etc. etc., and it is far easier to come by decent amps with powers below 100 watts per channel than above them, the Three's may actually be cheaper for most users than the Two's when their price is considered as part of the cost of a proper system.

The Listening

The general sound of these speakers has been described in the reviews of the Two, and the major sonic differences between each model have already been described in talking about the technical differences between each model. However, the key to my favorable evaluation of the Three's and Four's is their transparency, speed, and coherence. While using the Four's as reference, they provided all the necessary for the Fox organ records, the opening notes of ***Also Sprach Zarathustra,*** and superb performance on The Sheffield Drum ***Record.*** More importantly, however, the Four's provided a clarity on ordinary chamber music and jazz that made the kind of music that could credibly fit in a home sized room sound more natural and realistic than I have ever heard before. They overwhelmingly outperformed the KEF-105-II's in this regard in every respect, and significantly outperformed my sample of the Quad ESL-63's.

I won't give you a record by record description, but I ran through my Sarastros, Phillips, EMI's etc. for several weeks, and I found the Four's drew more out of my recordings than any previous speaker. More importantly, they did so without any *of* the imaging problems and discontinuities of all the complex systems I have listened to, with the exception of HPs. The problems usually created by crossover failings and different driver locations and speeds, are totally avoided in these speakers. The same is true of the Acoustat Three's, with the loss of some deep bass, and slightly more critical and contradictory imaging. Equally importantly, the Acoustat Three and Four are the first full range electrostatics that I have heard which both sound accurate and minimize the tendency to produce imac wander or constrict dynamic range because of lobe interference. They have a detailed sound state with exceptional stability at a wide range of volumes within their listening area. This is not true of the Two's, and annoyingly missing in the Sound-Labs.

I should also point out, however, that I place great stress on reproducing music and musicians who are, in soundstage and image size, believable in a normal listening room. The Acoustats are less suited for the "big sound" orchestral music buff or rock addict that demands sustained ultra-low bass. The MK-121 drive units will saturate at low frequencies with records like the Telarcs, the bass will loosen and so will definition. Once again, the Acoustats are never quite as tight on music below 40-50Hz as the very best subwoofers. The Acoustats are not all things to all men.

Living With the Three's and Four's

Okay, so what about living with them? Well, any former dipole speaker owner will already know the Acoustats are "difficult" to place in an ordinary listening room. They are actually far freer of many room boundary interaction problems than most cone speakers, but they need space. Real people living in normal rooms may find it difficult to give it to them. At the same time, however, if you can put up with their size they will often sound better in a home even when they are badly placed than most moderately well placed cone units. They will not produce th-kind of boomy upper bass that is all the common in cone systems and are far to vulnerable to lower midrange problems.

They benefit strikingly from being placed as far apart on the long wall as possible, while keeping the listening position at the

Apex of an eauilateral trianale drawn from speakers. They sound best with a slightd wall behind them. Unlike most kers, this does not create a hole in the middle. Instead, it widens the listening area and the precision and spread of the imaging. The Acoustatsalso benefit from careful angling of the panels so that the beams cross either slightly in front or in back of the listener. This minimizes the vestigal spotlighting problems that still occur in the Three's and Four's.

Some other tips: Obey the instruction manual on tilting the speakers, and consider buying the casters for the units ($60 a set). You will find yourself moving them to make minor adjustments and the casters allow them to be rolled out of the way when you are not listening (this is how I talked my wife into letting them into the living room along with accepting the white grill cloth that she prefers to basic black). Adjust your balance control to obtain the best image with each different record; regard it as your imaging control! Accept the fact that the Acoustats are **limited** in verticl dispersion and must be listened to sitting down. Use a stylus cleaner like the Audio-Technica (or Signet) to get your stylus absolutely clean (the Discwasher is simply not as good), clean your records well, use a fast cartridge like the Dynavector or Koetsu (the Grace F-9E is just a little too slow for these speakers), and use a cable like the Powerline or Fulton Gold. Above all. be willto go through several days of getting **s** just right.

This last point is important because I am willing to bet you will never hear these speakers at their best at a dealer's. They are too critical in placement and ultimately, the exact adjustment for the best imaging is a matter of personal choice. It also takes time to get used to dipoles and their different radiating patterns.

If you do take the time, however, I suspect you will find that the Acoustats are a little more restrictive in placement and listening position than most cone units designed for accurate imaging. The KEF-105 **II,** for example, achieves optimal imaging only within a 10 degree vertical arc and about 40-50 degrees horizontally. In practical terms, they **all** tie you down to one two seat couch.

Summing Up

A major design success. A long way from perfect, but *so* is all the competition. If you want detail, coherence, and accuracy — and can give up a little on the deepest bass and upper highs — the Acoustat Three's and Four's arecertainly two of the best speakers available at any price and are cheap compared to the nearest competition.

-AHC

Manufacturer: Acoustat Corporation, 3101 Southwest First Terrace, Fort Lauderdale, Florida33315. (305-462-6700). Source: Manufacturer loan and privately owned. Arial Numbers: 105181/2 for Acoustat ee's and 101193/94 for Acoustat Four's. ice: $1670 per pair for Acoustat Three's. $2070 for Acoustat Four's.

Manufacturer's Comment:

We wish to thank AHC for hisdetailed and accurateassessment of the Acoustat Model Three and Model Four, and we have just a few comments on his observations.

First, in regard to bass depth and tightness:

We realize that some of the best subwoofers yield responsedown to the low 20s and that this is beyond our present electrostatic technology. The Model Three's and Four's do however give honest response down to 30 Hz (given adequate room size and placement) and have three significant advantages over a cone woofer: (1) No crossover phase distortion, (2) No jarring discontinuity in driver speed (ultrafast electrostatic and ultra-slow large cones will never mate well together), and **(3)** the subtle harmonics of low bass transients (i.e., the taut skin sound of a large bass drum) are not lost. A bass drum really can sound like a bass drum (on an electrostatic), rather than sounding like a sofa struck with a salami (like many cones)!

Regarding the slight nign-end roll-off.

Acoustat speakers will measure flat with the high frequency balance control full clockwise, but will sound unnaturally and unbearably bright. That musical sounding speakers possess some high-frequency taper or roll-off is not a new observation. In addition, the polypropylene capacitor mods (two of them) provide a significant improvement in the upper midrange and highs.

Regarding vertical dispersion:

All Acoustat Models have a wide rangeof vertical azimuth adjustment. The recommended tiltback is about three degrees, which is fine for seated and standing listening at a distance of about fifteen feet from the speakers. If ones cares to listen while standing closer distances, the speakerscan be tilted back further.

We especially appreciate AHC's emphasis that the speakers sound best with wide separation, with the distance between the speakers approaching **or** equaling the distance from the speakers if possible. This type of set-up would cause a severe hole in the middle, or **loss** of center-fill, with any dynamic system, but with the Acoustat's and their remarkable phase coherency, the result is an enormous listening window with superb imaging precision.

Again, our thanks to AHC and TAS for the comprehensive and thorough review.

Bob Rieman
Acoustat Corporation





ACOUSTAT
SPEAKERS ▫ ELECTRONICS

MODEL THREE

NO OTHER LOUDSPEAKERS OFFER THESE INNOVATIONS:

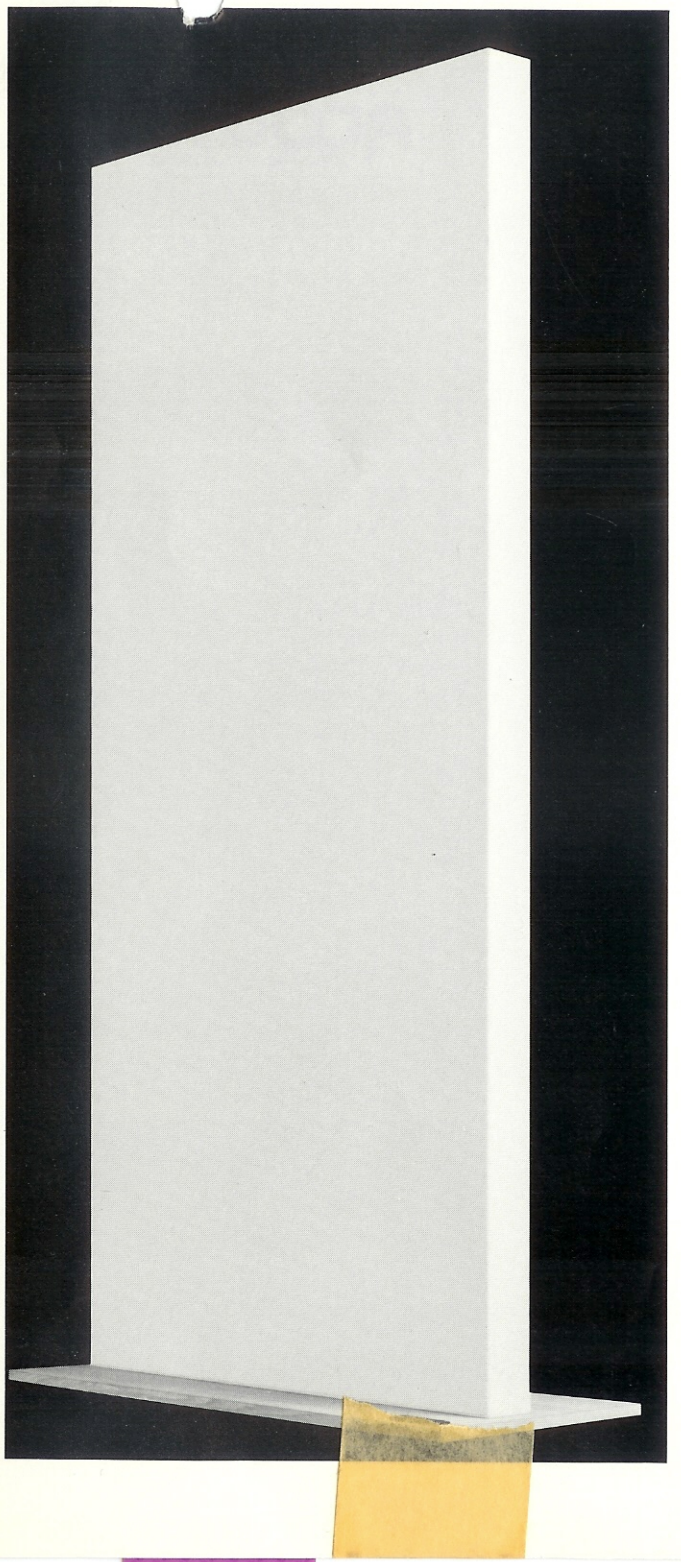
FULL RANGE OPERATION
No crossovers or dissimilar drivers to cause colorations or phase shifts—music emerges with all the sonic detail of the original performance.

ELECTROSTATIC DRIVE TECHNOLOGY
Ultra-low mass diaphram driven over the entire surface by a uniform electric field, resulting in accurate tracing of music's fine detail.

CURVED ARRAY DESIGN
Broad, uniform dispersion with no "box-like" sound or cabinet diffractions yields unexcelled performance in a wide variety of listening environments.

ELEGANT, CONTEMPORARY STYLING
Slim-line design makes an attractive room divider or screen, and several fabric/finish combinations complement any home decor.

Bringing Music to Life



MODEL THREE

Finally, an electrostatic loudspeaker system that is truly practical and functional.

The Acoustat model THREE culminates eight years of experience in design and construction of state-of-the art electrostatic speaker technology. Due to the Model THREE's unique "curved array" panel design, optimal frequency and phase response is maintained across a broad listener arc. Utilizing full-range electrostatic driver elements, the output of the Model THREE precisely and accurately mirrors the input signal, without crossover phase shift or typical cone driver degradation.

The Acoustat model THREE combines the quickness, coherency and low distortion of the electrostatic design with deep bass, wide dynamics and reliability previously thought unattainable in any loudspeaker system regardless of price.

We invite you to audition the Acoustat Model THREE on your most exacting recordings and discover for the first time the music that has gone unheard. Acoustat—We brought the price of high technology down to earth!

Warranty: Limited Lifetime Warranty.
See warranty statement for details.

A comprehensive technical paper is available upon request. Contact Acoustat Corportation.

SPECIFICATIONS:

Frequency Response:
30-20KHz ± 2dB

Sound Pressure Level:
110 dB @ 18′ in a 14′ x 22′ room.
(Program Material Peaks)

Minimum Power Requirements:
70 Watts Per Channel

Nominal Impedance: 4 Ohms

Power Consumption:
5 Watts (120v, 50/60Hz)

Dimensions:
72″ x 28″ x 3-1/2″

Weight:
98 lbs. (net weight for one speaker with interface)

ACOUSTAT
SPEAKERS ▫ ELECTRONICS

Bringing Music to Life

3101 Southwest First Terrace
Fort Lauderdale, Florida 33315

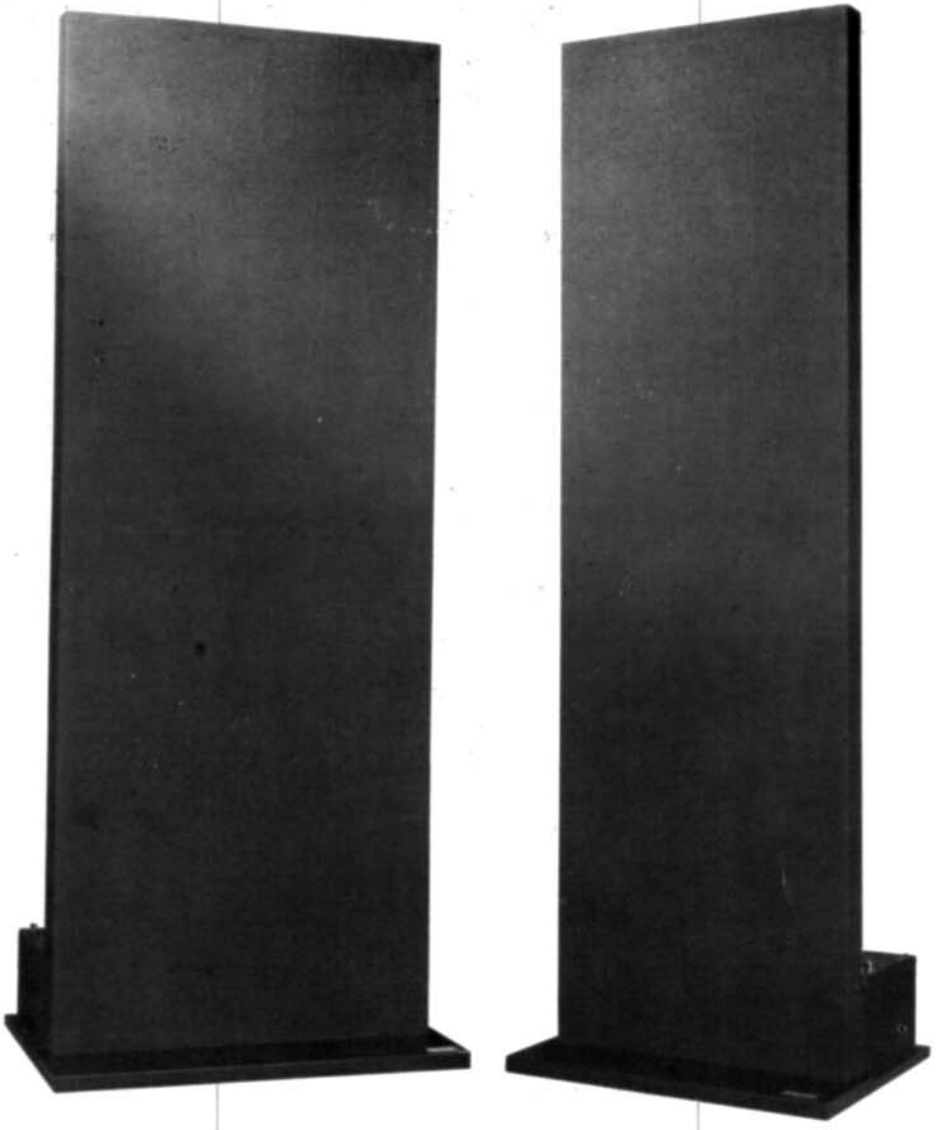
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ACOUSTAT

A UNIQUE FULFILLMENT OF MUSICAL ACCURACY



THE MODEL EIGHT—THE MODEL SIX

Acoustat Corporation, pioneers in electrostatic technology, announces a new dimension in full-range single-element loudspeaker systems—the Model Six and Model Eight.

They are the result of over 20 years of research and development with the assumption that an electrostatic speaker could be built without compromise to accurate fidelity; which could produce a convincing recreation of the original musical performance.

Now there is a speaker system available that is capable of reproducing the most demanding material, with a level of performance heretofore unavailable to the serious music listener.

Advantages of the Acoustat Electrostatic Design

EXCEEDINGLY FLAT FREQUENCY RESPONSE

Because the Acoustat speakers do not rely on multiple drivers and cross-overs to reproduce the audible range of frequencies, they are capable of both extremely uniform amplitude throughout that range, as well as freedom from local peaks and valleys in their response. This locally flat nature of the electrostatic transducer cannot be duplicated with any dynamic driver, and results in a total absence of the typical loudspeaker tonal colorations. The speaker disappears, allowing the music to pass through unaltered.

VANISHINGLY LOW DISTORTION

With five to ten times lower distortion across the frequency spectrum than a dynamic (magnetic) type speaker, Acoustat speakers allow the listener to enjoy extended listening sessions without the typical fatigue associated with most audio systems.

INDESTRUCTIBILITY

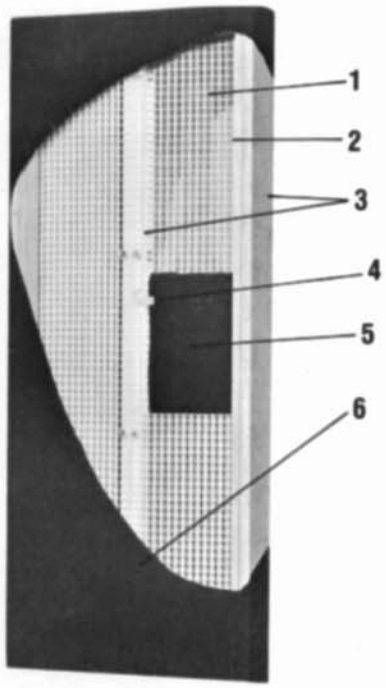
Due to the unique panel construction methods pioneered by Acoustat, the loudspeaker system cannot be damaged by over or under powering. The Acoustat speaker sytems stand alone in this ability to withstand all audio applications without damage or failure.

CONSISTENCY

Acoustat's panels maintain extraordinary unit-to-unit consistency, with no measurable variations between panels. Whereas no two woofers or two tweeters are exactly the same, every Acoustat electrostatic panel is exactly like every other Acoustat panel. This is the reason for the tremendous unit-to-unit consistency of the Acoustat loudspeaker systems.

Warranty: Lifetime. See warranty statement for details.

Inside the Acoustat Speaker



1—Audio-signal-carrying wire grids, positioned on either side of the diaphragm.
2—Mylar diaphragm. Radiates all frequencies. Only .00065 inch thick.
3—Rigid monolithic construction. Using only the finest materials available.
4—Bias feed. Carries the static charging voltage to the diaphragm.
5—Conductive coating on diaphragm. Holds static charge.
6—Special acoustically transparent grille cloth.

The Acoustat Model Six and Model Eight

STATE OF THE ART

Acoustat ushers in a new dimension in quality speaker systems with the Model Six and Model Eight. Their size and proportion make them capable of reproducing the most demanding material in a large-area home environment.

The vertical array design of these speaker systems, with over 18 square feet of radiating area for the Model Six (and over 23 square feet for the Model Eight) results in a superbly convincing recreation of the original musical event. Realistic sound pressure levels and dynamic range are preserved, with the capability of tremendous low-frequency impact.

These new models represent the current state of the art in loudspeaker technology, yielding a level of performance heretofore unavailable to the serious music listener.

SPECIFICATIONS

Model Six

FREQUENCY RESPONSE: 26-20k Hz + or − 2db
SOUND PRESSURE LEVEL: 120db @ 20' in a 16' x 24' room (Program Material Peaks)
MINIMUM POWER REQUIREMENT: 100 watts x 2/50 watts x 4
NOMINAL IMPEDANCE: 6 ohms/3 ohms (parallel configuration)
POWER CONSUMPTION: 10 watts (120v, 50/60 Hz)
CONTROL: High Frequency Balance (Controls Frequencies Above 10K Hz)
DIMENSIONS: 7'10" x 28" x 3-1/2"
WEIGHT: 170 lbs. (Net weight for one speaker with interfaces.)

Model Eight

FREQUENCY RESPONSE: 24-20k Hz + or − 2db
SOUND PRESSURE LEVEL: 125db @ 25' in a 20' x 30' room (Program Material Peaks)
MINIMUM POWER REQUIREMENT: 70 watts x 2/35 watts x 4
NOMINAL IMPEDANCE: 6 ohms/3 ohms (parallel configuration)
POWER CONSUMPTION: 10 watts (120v, 50/60 Hz)
CONTROL: High Frequency Balance (Controls Frequencies Above 10K Hz)
DIMENSIONS: 7'10" x 36" x 4"
WEIGHT: 220 lbs. (Net weight for one speaker with interfaces.)

stereophile

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Volume 9, Number 7

THE ACOUSTAT SIX SPEAKER SYSTEM

Full-range, six-element electrostatic speaker system. Frequency response: 26 to 20,000 kHz, ±2 dB. Maximum SPL on program peaks: 120 dB@ 20′ in a 16′ by 24′ room. Nominal impedance: 6 ohms. Dimensions: 7′ by 28″ by 3½″. Weight: 170 lbs each (with interface). Price: $3950/pair (East Coast), $4050/pair (West Coast). MANUFACTURER: Acoustat Corporation, 3101 Southwest First Terrace, Fort Lauderdale, FL 33315.

For many audiophiles owning electrostatics is like having a mistress: exciting and highly desirable, but of doubtful propriety! I've always been attracted to electrostatics, but had stubbornly resisted buying them, despite their almost irresistible attractions—to wit, clarity, detail, and an overall naturalness that dynamic speakers have striven hard to approach but have never equalled.

Acoustat's first speaker, the Model X, was the first successful attempt to drive an electrostatic directly from a high-voltage vacuum-tube amplifier. It was a pretty good system; it could play fairly loud without stress, and had few of the defects (limited output and susceptibility to breakdowns) that had marred previous electrostatic designs. On the other hand, you were irreversibly mated to that integral power amp, whose sound was not as transparent as a lot of perfectionists would have liked. Acoustat soon realized that if they were ever to expand their market, they had to get rid of the integral amp. That meant using a stepup transformer.

To do this, the speaker's efficiency had to be increased to the point where no more than 100 watts per channel would be needed to drive it to high volume levels. At the same time, the transformer had to present a reasonably "comfortable" load so that most amplifiers could drive the thing. (The older Dayton-Wright XG electrostatics, for example, had such a weird impedance curve---from over 100 ohms at low frequencies to less than 2 in the upper midrange, and highly reactive as well—that only Crown industrial amplifiers could drive them properly!)

But designing a proper stepup transformer was no easy task. To get good bass response, the inductance of the primary must be very high, which means lots of iron (in the core) and many turns of wire. Then, since we need a large step-up ratio to get the high audio voltage to drive the speaker, a correspondingly enormous number of turns are needed in the secondary. This produces such high inductance and so much stray capacitance that high frequency losses become a serious problem. Those have tried to build such a transformer have concluded that it is almost impossible to do it.

Acoustat's solution was so simple it

almost seemed absurd. Taking their cue from multi-way loudspeaker design, where a big speaker handles lows and a small one the highs, Acoustat created their "biformer." This is actually two separate stepup transformers, one optimized for bass, the other optimized for treble. The transformer outputs are combined through a simple, first-order crossover network and fed to the single wide-range electrostatic element. Although this approach still does not yield a speaker system that just any old amplifier can drive, the ability to tailor each transformer to a specific frequency range dramatically reduces the compromises in each.

Earlier Acoustats were only one panel high, which produced a mid-range/treble beam that caused the upper-range response to vary markedly as one stood up or sat down. This effect is wavelength-dependent. If a radiating surface is much smaller than the wavelengths it is reproducing, then the waves propagate like concentric spheres, expanding evenly in all directions from the source. If the surface is much larger than the wavelengths radiated, they also propagate evenly, but as a flat, planar wavefront. Frequencies with in-between wavelengths show various degrees of beaming and uneven distribution.

The introduction of two-panel-high Acoustats (first the Six and Eight, now the 2+2 and the 1+1) eliminated this treble beaming. Part of the effect was due simply to the doubling of height, which raised by one octave the frequency at which beaming began. But this alone is not sufficient to explain the almost total elimination of the effect.

To understand what's going on here, think of the floor and ceiling of the room as mirrors. With the speaker standing up in between, we would see a tower that appears to be three speakers high, with the real one in the middle and its images above and below it. Although room surfaces do not reflect sound as well as a mirror reflects light, their effect on the sound here is essentially the same: acoustically, the speaker becomes about 24 feet high! Vertically, all frequencies are radiated as a series of straight, vertical wavefronts. This prevents the kind of off-axis interference that occurs with spherical radiation, and treble beaming virtually disappears. (Although it still exists in the horizontal plane.)

This would seem paradoxical. We have traditionally wanted the speaker to interact as *little* as possible with the room, yet here is a case where interaction is useful. In fact, to derive the maximum benefits from it, the ceiling and the floor in front of (not behind) the speaker need to be as rigid and as reflective as possible. This too is contrary to common sense, since we usually want the floor to be absorptive, to kill reflections that create dips in midbass response.

Setup of the Sixes was almost easy. Acoustat recommends an absorptive wall or drapes behind the speakers. One really can't have too much sound-absorbing material behind *any* speaker, so I put up 32 square feet of half-inch Owens-Corning Fiberglas behind each one. Getting good imaging was not play a mono recording. Adjust their angling and separation to obtain the narrowest center image, with as little wander as possible when moving your head from side to side. When you play stereo recordings, the setup may be refined further. The bottom of the base has a fairly large, flat area, so despite each speaker's formidable 170-lb weight, its no trouble to slide them around on the floor.

The only problem I had in setting up was the one Jim Strickland (the Acoustats' designer) predicted I would have. He insisted that the Sixes were too big for my room, and that I would have too much midbass. Well, I *did* have too much midbass; it was corrected with a special equalizer designed to handle just that problem.

Sonically, the Acoustat Six is one of

the few speakers I have heard that stands up to comparison with live sound. With the best program material (which for me means my own recordings, Bob Sellman's digital tapes, and a handful of commercial discs and tapes), the sound has a nearly palpable quality; one could almost reach out and touch it. (I recently recorded *The Swan of Tuonela*; the solo English horn was almost perfectly reproduced.)

The Sixes have no perceptible "vowel" colorations of any kind; there is no emphasis of one part of the spectrum over another, either in level or quality; the sound is incredibly smooth and clean; and while there is detail in abundance, it does not draw attention to itself as if to say "hear how hi-fi I am!" Bass goes very deep, and is tightly controlled and free of garbage. I do *not* hear the slight bass muddiness others claim to hear in the Acoustats.

Then there's the matter of integration or coherence. One of the biggest design problems with dynamic systems is in getting multiple drivers to blend, so that the listener seems to hear a single driver. This may relate to the physical displacement of the drivers, to crossover discontinuities, or to the simple fact that radiators of different sizes and materials have varying sonic "signatures," but for whatever reason, I have heard only a few dynamic systems where really good integration has been achieved. Compared to the Six, such systems still sound somewhat disembodied. The Six, of course, has no integration problem to begin with; there is no crossover,[1] and all frequencies are produced by the same diaphragm.

The illusion of hearing "the real thing" is almost perfect, but not quite; there are flaws. The Six's sound is slightly darker, more liquid, and somewhat romantically richer than the real thing. It lacks the ultimate delineation of detail and laser-sharp rendition of transients that would make it sound "real."

Imaging is good but not great. There isn't the pinpoint localization one hears from point-source radiators, and there are still lateral shifts as one moves from side to side through the listening area. But there are compensations. Ambience is well reproduced, with the air and space around instruments beautifully rendered. (If I had to choose, I'd say that accurate rendition of ambience contributes more to the overall illusion of reality than does ultra-precise imaging. The two qualities are not antithetical, but there is no guarantee both will be obtained from the same speaker.)

Perhaps the most significant failing of the Six is mediocre dynamics. I'm not talking about dynamic *range*; the Six can play at high levels without distortion, and low-level reproduction is clear and detailed. Rather, I'm referring to what some people call "dynamic contrast." It is as if the small changes in loudness within a piece are restrained. Sudden orchestral outbursts, though not audibly compressed, nevertheless lack the impact they have when heard live. Both the Fried Q/3 and the Pyramid MET 11 (no longer produced due to bankruptcy), far less expensive speakers, give a more realistic accounting of musical dynamics.

So ends the review proper; it is as objective as I can make it. My emotional reaction to a product should play a minor part (if any) in a review, since I don't feel musical pleasure or emotional gratification are something by which one judges sound reproduction.[2] Such things are left to the performer and the listener; it is enough that the equipment accurately translates the wiggles on the record into air motion. My reaction to the Six, however, is so strong that some subjective comment is necessary. It should not be taken "seriously"—i.e., don't make it your basis for purchasing the loud-

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1 There *is* a crossover, but it integrates two low-distortion transformers, not two highly resonant mechanical devices. JGH

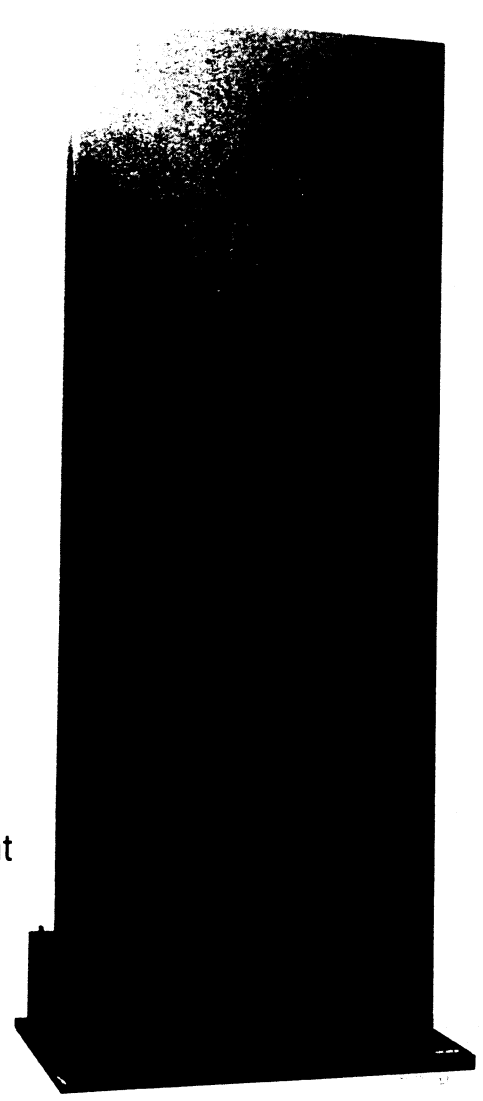
speaker. Rather, take it as the very personal reaction of one music lover to a particular piece of equipment.

The Six has certain qualities which would normally seem contradictory, that here comfortably co-exist. The most amazing of these is the way it can sound both clinically analytical and seductively romantic at the same time. It manages to be both an audiophile's and a music lover's speaker. With exciting program material, it is stupendously spectacular, yet it is so relaxed, unforced, and natural (especially on voice and small instrumental groups) that the music lover can forget the equipment and enjoy the music.

Quite frankly, I have never enjoyed listening to music on any speaker as much as I have with the Six. I would often put on one of my favorite recordings as background music. On more than one occasion, the Six forced me to put aside whatever else I was doing, regardless of how important it was, and listen to the music. This has never happened with any other speaker, and I am at a loss to explain it. In a world where expensive speakers often fail to live up to the expectations created by their high price, the Six is something of a check-rated "best buy." **BS**

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2 I think Bill is correct in trying to separate his emotional response from his review of the product's performance, but not for the reason given. In fact, I think that "musical pleasure" and "emotional gratification" are precisely how one judges the experience of sound reproduction; the problem is that the *reviewer*'s emotional gratification may not be reproduced in any particular purchaser, and is therefore not a *reliable* basis for recommending a product. It does make a large difference in the outcome of a review, however.**LA**



Model Eight



Model Six

the absolute sound®

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Volume 7, Number 27

The Acoustat Model Eight Electrostatic

Consider, if you will, the following two apparently contradictory findings. First, the Acoustat electrostatic loudspeaker systems have been reviewed by nearly every august periodical in the normally hyper-critical alternative audio press, and have emerged virtually unscathed by criticism. Second, many serious listeners contend that loudspeakers exhibit significantly more "character" (read "coloration") than any other link in the audio reproduction chain. My listening experience supports this contention in that I have yet to encounter a loudspeaker system that does not display a rather primitive, pervasive level of aural personality. Speakers, as a wise sage once put it, seem akin to covered wagons in an interplanetary age when on juxtaposes their fundamental colorations against the comparative neutrality of the rest of today's state-of-the-art system.

In light of the Acoustats' unabashed membership in the loudspeaker family, the universal praise they have garnered seems most intriguing. My findings in this The Curious Case of the Great Loudspeaker comprise the bulk of this review.

For those familiar with the older models in the Acoustat line, the Acoustat Model Eight speaker is essentially a vertically stacked pair of Model Fours, housed in a single external enclosure (hence the obvious designation of the system as the Model Eight from two Model Fours, two times four equals eight, no?).* In other words, the Acoustat Model Eight is a full-range dipolar electrostatic loudspeaker system consisting of two vertically stacked, four-element electrostatic arrays per side. The height of the speaker is a towering seven feet ten inches, while the width is three feet, and the depth a scant four inches. Decorator colors available for the grilles and speaker bases are black and white. Although the grille material is similar to that found on other speakers, the base of the Model Eight is unique in my experience. It is a block of highly polished acrylic material that is quite modernistic in appearance (the Eight also comes in walnut, oak, teak and rosewood laminate). Each speaker requires two transformers (or "interfaces" as Acoustat calles them), one for each four-panel electrostatic element. The user may either bi-amplify the system (with a resultant nominal impedance of six ohms) or use a single amp, which needs to be very stable because a three ohm load is presented by the paralleled transformers. The only user-adjustable control on the system is a high frequency balance potentiometer on each transformer. Once assembled, the Acoustat Model Eight system weighs in at a hefty 220 pounds per speaker (try pushing *that* around your listening room for months without losing some midruff bulge). The overall appearance of the system is, to say the least, imposing. Even in my large listening quarters, the all-black Acoustats loom ominously, like gargantuan, other-worldly monoliths from Kubrick's *2001*. It is safe to say that the sales of this system to the "house beautiful" set will be rather sluggish.

The assembly and installation of the Acoustat Model Eight loudspeakers in my listening room was a study in frustration. The mechanical bolting of the transformers and speakers to the bases proved simple enough. Real problems started, however, when I attempted to stand the speakers up in the room. After the speakers were mounted on the bases, the assembled system literally scraped the ceiling at several points. Fortunately the ceiling height at the key listening positions in the room was a full eight feet. Future users of the system will be spared this experience of unexpected plaster showers because Acoustat has reduced the overall height of the assembled system in its production version of the Model Eight.

It has been noted before in these pages that attaining optimum placement of dipolar speakers in a given room can be an exhaustive, lengthy process. It is often impossible to optimize all salient aspects of speaker performance (*e.g.*, bass uniformity and amplitude, frequency balance, soundstage width, imaging specificity, etc.) because one parameter is adversely affected by the optimization of another. In the case of the Acoustat electrostatics, this normally problematic procedure is further exacerbated by the narrow horizontal directionality (*i.e.*, beaming) that the speakers exhibit. It took weeks of painstaking placement and repositioning before I began to experience the level of fidelity these speakers are capable of. Even after one has located the best general area of placement for the Acoustats, moving the speakers by mere inches can dramaticaly affect numerous aspects of their sound. Even at the present time I harbor the fear that there may yet be an unexplored square foot in my room that, if tried, would catapult me into audio ecstasy.

A more detailed explanation of my positioning experiments might prove useful to those who purchase this system. It should also strike a responsive chord in those who have wrestled with the often-frustrating, occasionally rewarding problem of dipolar loudspeaker placement. I must stress, however, that the placement problems posed by each room are unique. The positioning approach that works wonders in one room often leads to dismal failure in another.

As is evident in the crude diagrams above, I tried three primary placement strategies in attempting to tame the Acoustat Model Eights. Diagram 1 represents the positioning that has led to satisfactory results with most other dipole speakers I have employed in this room. The Acoustat Model Eights performed quite poorly when positioned in this manner. The sound was bass-heavy, dark, lifeless, and ill-focused.

The placement sketched in diagram 2 resulted from a visit to my home by Bob Rieman and Jim Strickland, the principals of Acoustat. They concurred that the sound quality I was obtaining with the speaker placement outlined in diagram 1 was unacceptable. They then (with my somewhat reluctant assistance) rearranged my entire listening room so that the speakers could be positioned along the long axis of the room, firing down the short axis. this particular placement scheme did solve the problem of dark, bass-heavy sound. Unfortunately it made the speakers sound like a gigantic pair of headphones (a tendency they have anyway), with virtually no center-fill. these problems persisted, regardless of the degree of speaker toe-in employed. Quickly tiring of the world's largest pair of Koss headphones, I elected to try yet another placement approach. According to Rieman and Strickland, the problem with the positioning sketched in diagram 1 was that it was impossible to obtain enough distance between the speakers relative to their distance from the listener. In attempting to combine the best attributes of positions 1 and 2 above, I decided to once again aim the speakers down the long wall of the room, but to move them significantly farther out into the listening area. This should have had the effect of reducing some of the bass heaviness while simultaneously bringing the speaker/listener intersection closer to the ideal equilateral triangle. In order to more closely approximate this latter goal, I also moved the listening couch up substantially farther into the room. This approach yielded immediately improved sound, and it was time for the seemingly eternal process of fine-tuning to begin.

When I stated previously that the movement of a single Acoustat by inches often significantly alters its sound, I was not indulging in literary hyperbole. I experienced substantial shifts in focus, soundstage height, stage width, frequency balance, and depth of field from miniscule changes in the speakers' position. In general I have

found that Acoustat speakers sound the best when the center of the speaker is aimed either directly at, or crossing slightly in front of, the listener. Once this rough step has been taken, the best method I found for intermediate tuning of the speakers was to play a wide range monophonic musical signal through one speaker at a time, subtly shifting its position to yield optimum focus and frequency balance. After both speakers have passed this test individually, the real fun begins. Using the speakers in the conventional stereophonic mode, one must play a wide range of material, slightly moving the speakers (both singly and jointly) until the best sonic compromise is achieved.

One real problem is that the speakers are so revealing of phase-related information that the ideal placement will actually vary from record to record. The same finding holds true when one changes amplifiers or preamplifiers. The placement which is ideal for one amplifier in terms of imaging precision often compromises the imaging capability of another amplifier. This unusual phenomenon could easily lead one to prefer the original amplifier over the newcomer, regardless of which is actually better, unless the speakers have later been optimized for the new amplifier.

Another problem is that the Acoustats are very critical of the reverberant environment surrounding them. The acoustical nature of the walls behind and to the side of them can substantially affect their sound. Even the live, reflective quality of the ceiling is noticeable on some source material.

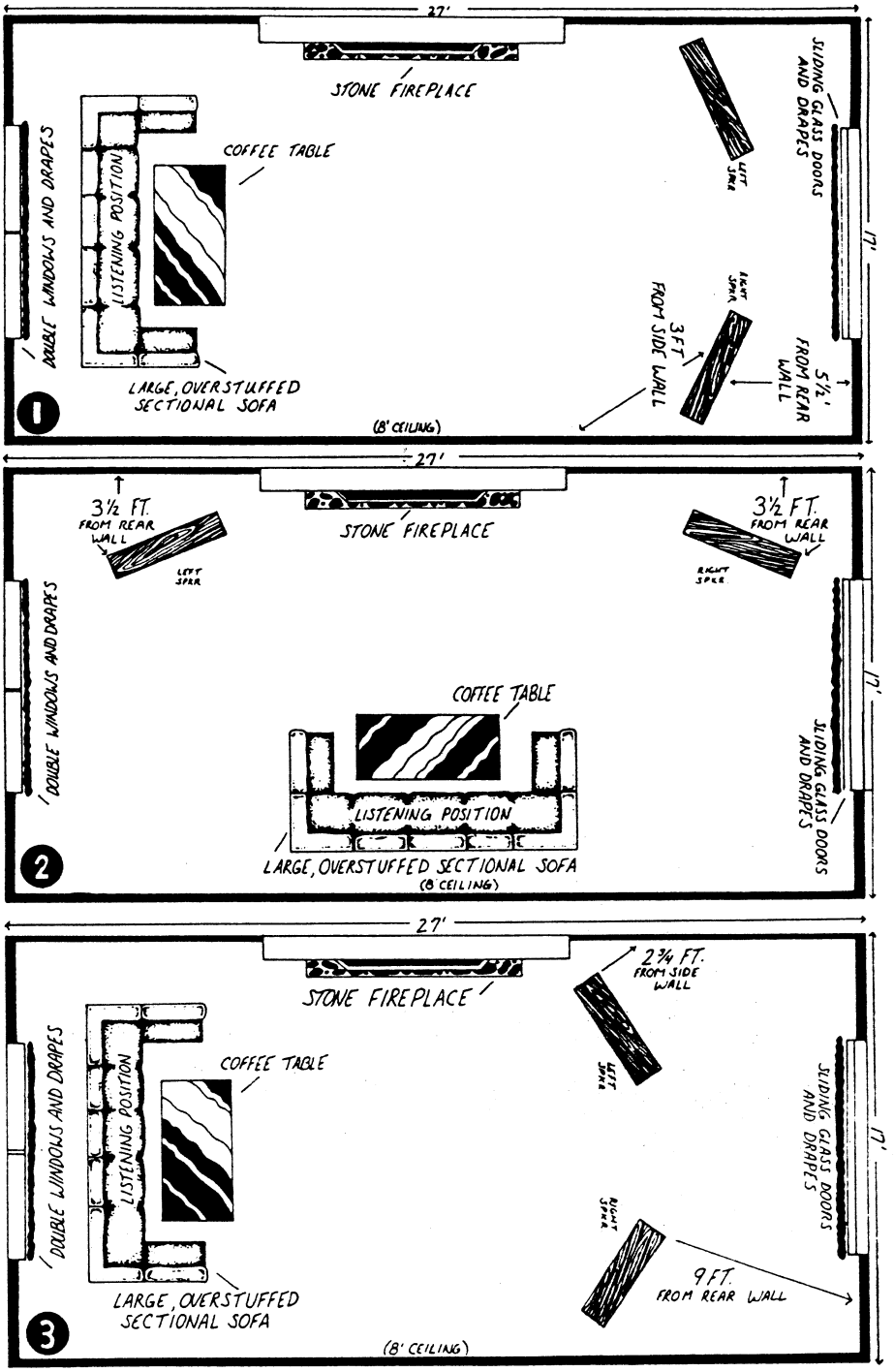
The moral of this tortuous historical tale is this: If you are a listener who prefers to perfunctorily plunk down your loudspeakers and bask in the resultant sonic splendor, you will probably find the Acoustat speakers to be one of the most aggravating experiences of your life. On the other hand, if you are an inveterate tinkerer who derives satisfaction from wringing that last nuance of sonic excellence from a speaker, the Acoustats will afford you a worthy challenge. Remember during your initial set-up, though, that the Acoustats require a lengthy break-in period before their virtues become apparent. In addition, they are very revealing of flaws in the associated equipment and will hide themselves, chameleon-like, behind these flaws at every opportunity.

Assuming that one has managed to properly position the Acoustats, the obvious question that arises is, just how good are these persnickety beasts? In attempting to formulate a clear response to this complex question, I have elected to divide my assessment of the Acoustats' sound into three sections. The first section describes the speakers assets. The second section discusses the areas in which I feel the speakers achieve mixed success. The third section lists the problem areas that I perceive with these speakers.

The Acoustat Model Eight loudspeakers perform exceptionally well in a number of areas:

(1)Top-to-bottom consistency, continuity, and coherency. By virtue of their full-range nature, the Acoustats avoid the serious problems apparently engendered by complex, multi-way crossovers and the use of markedly different drivers to reproduce different frequency ranges. There is a seamless consistency to these speakers that is addictive. Once one has grown accustomed to the absence of driver discontinuity, its re-introduction (via a conventional pair of speakers) is immediately, and painfully, evident. The parallel Acoustat has drawn in their advertisements between the childhood fable of Humpty Dumpty and the similar problems encountered in trying to split a whole musical signal up into multiple subsections is quite apt. All the king's loudspeaker engineers cannot fully re-create a seamless musical whole from these composite pieces. Multiple driver systems inevitably have some degree of discontinuity. In the better systems, to be sure, the canny conjuring trick of reassembling the musical whole at the listener's ear is remarkably well carried off. Nevertheless, the advantages of a well-executed full range design are quite evident in comparative listening tests, particularly on instruments spanning a wide frequency range. This is one aspect of the Acoustats' design that has been very well realized.

(2)Definition and preservation of musical detail. This is another area in which the Acoustats do an outstanding job. On complex, densely instrumented passages, the Acoustats clearly delineate the musical path of each individual instrument. This is probably the most "thrilling" aspect of listening to familiar discs on the Acoustats for the first time. They often uncover the presence of entire instruments which had heretofore passed unnoticed. This ability is especially striking on multi-track popular recordings where individual instruments are often densely stacked. Curiously, the Acoustats (like headphones) do much better at this sort of unraveling at the *sides* of the soundstage than they do in the center. Most of the rediscovered "missing" instruments I noticed were positioned right on the speaker panels themselves. Also curious is the fact that the Acoustats do such an amazing job of separating musical details, yet they are rather dull and



somewhat opaque themselves (certainly not the qualities one usually encounters in a "high definition" component).

(3) A very low (perceived sense of) distortion. Quite simply, the Acoustats sound lower in distortion than nearly all other speakers in my auditioning experience. This conclusion is consistent with the general measured finding that electrostatic systems are, generically, lower in distortion than dynamic systems. This comparative freedom from distortion is refreshing and brings the listener closer to the real musical experience.

(4) Immense sound pressure level capability. Given adequate amplifier horsepower, the Acoustat Model Eights will play at incredibly loud levels. Gratifyingly, they do not break-up or distort the way most dynamic systems do when they are pushed hard. Veteran listeners seem to grow accustomed to wincing during the reproduction of very loud *crescendos* on an audio system. This habituated, almost subliminal response rarely occurs with the Acoustat Model Eights. As in the case of the reduced distortion discussed above, the removal of this common problem makes the listening experience easier in subtle ways that defy enumeration. When a speaker system will play so loudly, in such a clean manner, there is a real tendency to increase the playback amplitude to potentially ear-damaging levels. In the case of the Acoustat Eight, the speaker's inability to sound truly dynamic, its cloudy opacity, and its transient homogenization make this course all the more tempting. The only other speaker system I have encountered whose effortless, low distortion output seemed limited only by the available amplifier power is the hybrid Infinity/Magnepan QRS-1D. Not surprisingly, the QRS-1D, like the Acoustat Model Eight, is a speaker with a very large surface area for sound radiation.

(5) Linear frequency balance. Be warned that this virtue is difficult to obtain. With careful positioning in the proper listening environment, the Acoustat Model Eight is capable of satisfyingly uniform frequency reproduction. Although the frequency extremes are down, the vast majority of musical frequencies are reproduced in proper relationship to one another. With the exceptions noted later in this review, the Acoustat Model Eight is refreshingly free of the anomalous bulges and thin spots that often pockmark speaker sound.

(6) Relative neutrality. When viewed comparatively against other loudspeakers, the Acoustat Model Eight does achieve a high level of neutrality. As speakers go, it is a relatively colorless device. When viewed against the backdrop of live music, needless to say, the system does exhibit some marked departures from accuracy, which I will discuss later. Nevertheless, in the present real world of admittedly imperfect transducers, the Acoustats are admirably free of idiosyncratic aural character.

There are three areas in which the Acoustat Model Eight system achieves mixed success. Two of them overlap somewhat. The two related areas are imaging properties (side-to-side, front-to-back, and vertical height) and soundstage presentation. To minimize the very distracting visual cues provided by these monstrously large speakers, I conducted many of my listening tests in the dark. (The interference of strong visual cues in ascertaining a speaker's imaing and soundfield characteristics should not be underestimated.)

(1)Imaging characteristics. To put it bluntly, obtaining the level of imaging accuracy that these speakers are capable of is a tedious, time-consuming venture. As I have previously stated, slight positional shifts, either on the part of the listener or in the location of one or both speakers, markedly alters the imaging of these speakers. I found the "mono," single-speaker tuning method described earlier to be a useful starting point. The sensitivity of these speakers to phase-related information makes it difficult to obtain optimum imaging for all source material. Curiously, one can play a number of records which sound relatively vague and ill-focused, and then, most unexpectedly, a single instrument will stand forth, precisely suspended in space, with all the imaging specificity one could hope for. In a related vein, the Acoustat Model Eight system makes all too clear the appalling number of instruments that are recorded out-of-phase on many rock music albums.

- Lateral imaging characteristics. After much placement experimentation, I was able to achieve side-to-side imaging focus and continuity that was surprisingly good (surprising considering how poorly the system sounded in this respect when first set up).

It is much easier to obtain credible lateral imaging at the sides of the soundstage (*i.e.*, on the speaker panels themselves) than it is in the center. Even after adequate center-fill has been attained, there are often residual problems with the areas in between the panels and the center. Prior to final tuning (unless you get lucky), the system tends to focus correctly at only three points across the lateral continuum (left, center, and right). Images appearing at left-center or right-center tend to be vaguer in point of origin. Further positioning experimentation can minimize these aberrations, and a continuous, coherent lateral wall of well-focused images can be gleaned. The soundfield width will, on occasion, extend past the physical sides of the speakers. The Acoustat Eight is no QRS-1D in this regard, however, since the preponderance of the far left/right image placement is on the speaker panels themselves.

With judicious placement, then, the overall lateral imaging characteristics of the Acoustat Eight can be quite excellent. Their major limitation in this area is that only one person at a time can enjoy this imaging prowess, and even that individual must sit very still.

- Depth of field. The Acoustat Model Eight system does a realistic job of capturing front-to-back depth under optimal conditions. As in the case of lateral imaging, the speakers' capabilities in this area are highly contingent upon correct placement and the proper listening environment. Obtaining correct depth of field is also highly amplifier dependent. If one employs an amp that is essentially two-dimensional (like all the samples of the Acoustat Trans Nova I auditioned), the Model Eight system will sound almost totally flat in perspective. Switching to an amplifier with good depth retrieval ability (*e.g.*, an Audio Research D-79B) clearly indicates that the speakers do have capability in this area. Although the depth afforded by the Model Eights is not as exactly focused as the very best systems (once again I have been spoiled by the QRS-1D), it does do very well in this department. In addition, the depth of field is even and consistent across the entire soundstage, with the level of depth at the sides roughly equaling that at the center.

I encountered a rather puzzling phenomenon when attempting to optimally place the Model Eights for depth retrieval. When the panels are aimed in certain positions, the front-to-back size of musical instruments becomes strangely enlarged, as though one had taken the instruments and stretched them, like taffy, from the speaker panels out to the listener. The effect at its most extreme can suggest a four-channel audio system, replete with rear speakers. This quality is akin to a mechanical version of Carver holography. Again the parallel of headphones comes to mind in that they too can place instrumental images inside and behind the listener's head.

Interestingly, I have encountered this phenomenon in another pair of speakers recently. Polk Audio was displaying prototypes of a new top-of-the-line system dubbed the Stereo Dimensional Array at the June CES in Chicago. Engineer Matthew Polk has apparently been investigating the phase relationships involved in the loudspeaker listening experience. Like the Acoustat Model Eight in certain placement configurations, the Polk Stereo Dimensional Array conveyed an uncanny sense of music coming from behind the listener, although only two speakers were playing. What particularly caught my eye in the suite was the wall poster Polk was displaying touting the Stereo Dimensional Array. The poster depicted a three-dimensional grid stretching from far back in space out to the listener. This sketch afforded a surprisingly accurate visual analogue to the unusual depth-related sonic quality shared by the Polks and the Acoustats. It is a phenomenon I suspect we will be hearing more about in the future as a proposed panacea for the relative two-dimensionality of conventional stereo loudspeakers.

Moving on to the related area of ambience retrieval, the Acoustat Model Eight system does very well in its retention of ambience details. The reverberant character of the recording environment present on the source material is clearly evident when reproduced on these speakers. One can easily detect the small, artificially deadened acoustic space of the recording studio (as well as the post-recording injection of electronic reverberation). On the other side of the coin, "real" recording environments, from the live acoustics of a small church to the expansiveness of a large concert hall, are clearly delineated. Subtle ambience details (such as the rear wall of the recording site) are also preserved by the Model Eights. Again I must stress, however, that unless proper associated equipment is employed, and the speakers are correctly positioned in a reasonable listening room, these beneficial qualities will remain stubbornly hidden.

- Image height. Given their immense size, I correctly anticipated that the Acoustat Model Eight system would sound "larger-than-life" on certain recordings. One does indeed experience acoustic guitars and human voices that are eight feet in height with this speaker. In fairness to the Acoustats, this occurence may partially be a function of the fact that my 17 X 27 foot room is actually undersized for these speakers in certain respects. Also, this problem of Paul Bunyan image height seems largely restricted to certain popular

recordings where the microphone technique utilized was, shall we say, close. Perhaps the Acoustats are simply revealing these recordings for what they truly are. I did not encounter the problem on more naturally recorded material. The large vertical image size projected by the Acoustats can be thrillingly beneficial on large scale orchestral works. Nevertheless, I often found myself looking up at instruments and voices, even when listening in the dark. Some images actually sounded like they were emanating from the ceiling. In addition, the image height shifts when the listener's moves his head.

(2)Soundfield. I have already described many of the attributes of the Acoustat's soundfield in the preceding section. The Model Eight is reasonably open and spacious, although a sizeable segment of the music tends to stick on the panels. The sheer size of the speakers almost mandates a seemingly open and spacious sonic presentation. It would be difficult for a dipole radiator of this size to sound boxlike (*i.e.*, shrunken and constricted) in the conventional sense of the term.

Overall, then, the Acoustat Model Eights project a large, spacious, highly-defined, well-focused soundfield when properly set

(3)Bass reproduction. The bottom end of the Acoustat Model Eight is generally quite good. Although it does not extend into the subterranean region of the true subwoofer, it does descend low enough for the vast majority of recordings, and is therefore satisfactory to me in this regard. Again the issue of variation between listening rooms must be taken into account. PHD has informed me that he was unable to obtain satisfactory deep bass response from the Acoustat Model Six in his room, which has dimensions nearly identical to mine.

Apart from issues of bass quantity, one must consider bass quality. Although the Acoustat Eight is free from the boxy, discontinuous bottom end of many cone systems, it does present some problems of its own. The plastic-like resonant flavor that mars the tonal neutrality of the Acoustats (discussed later) is quite evident in the speaker's bass reproduction. In addition, the bottom end is slightly sluggish and a bit flabby compared with today's very best bass reproducers. Of course the omnipresent challenge of proper placement greatly affects the uniformity and evenness of the Acoustat's bass response.

It is now time to address the apparent paradox cited at the beginning of this review. After extensively auditioning the Acoustats, I must conclude that they do indeed have a character of their own and do exhibit several shortcomings:

(1)Sound radiation pattern. To put it simply, the Acoustats are severely directional speakers. They provide a textbook example of what is meant by the term "Venetian blind effect." This can be most dramatically demonstrated by standing in front of the speakers to one side, then moving slowly across the front of the speaker to the other side. Like rays of sunlight through Venetian blinds, the listener experiences an alternating series of hot spots (where high frequencies are audible) and cold spots (where the sound is decidedly dull). The either/or dichotomy of this effect is reduced in severity as the listener gains distance from the loudspeakers. Nonetheless, there is no distance great enough to substantially vitiate the problem. At normal listening distances, the listener must remain positioned in a very narrow "sweet" zone. Subtle positional movement on the part of the listener causes virtually everything to shift, from the localization of instruments to the frequency balance. A common defense of this "listening prison" that often accompanies electrostatic speakers is that "serious" listeners remain in a single listening position. This righteous view apparently relegates those of us who do not like beaming to the realm of the frivolous. I, for one, certainly have no desire to perform cartwheels or run a fifty yard dash while listening to music. Nor, on the other hand, do I wish to be cemented in place, unable to move, like a department store mannequin. I have noticed an interesting phenomenon while watching some critical listeners auditioning the Acoustats. While the music is playing, they continually shift their body and head positions until that elusive sweet spot is found. They will then remain frozen in whatever grotesque position may be required. Sometimes they will tire of this aural lockjaw and will briefly reposition themselves. Inevitably they bow to the dictates of narrow dispersion and re-assume their original position. When another piece of music commences, the process begins anew.

I realize that the tone of my comments on the directionality of the Acoustats sounds rather harsh. It is true that there are many individuals who are not fazed by the system's beaming. It is also true that there is a wider listening area available for those who are willing to settle for acceptable sonic results, as opposed to excellent ones. In short, although the narrow directionality of the Acoustats is an objective reality, the degree to which a given listener will be offended by this property is subjective and arbitrary. I feel that it constitutes one of the major potential drawbacks of the Acoustats for many people, and that it needs to be emphasized in a complete review of the speaker. In my case, I can reluctantly live with such narrow directionality, but it constantly reminds me that I am listening to a speaker system and not real music. In live concerts one certainly does not experience narrow rays of sound, aimed in laser-like fashion, that shift in tonal balance with each minute moment. Unfortunately, the same cannot be said of the Acoustat loudspeakers. Such directionality is unquestionably unnatural.

(2)Plastic-like resonant coloration. There is a distinctive "plastic" tonal flavor to the Acoustats which is present throughout the frequency spectrum. This coloration is most noticeable in the midrange (the upper midrange in particular), but it is clearly audible at all frequency points. It is the presence of this plastic sound (some—namely, HP—have dubbed it credit-card like) that constitutes the Acoustat's most serious departure from sonic neutrality. The sound of virtually every instrument emerging from the Acoustats is stamped with this flavor. One can roughly approximate this distinctive plastic sound by lightly drumming on the speaker panels themselves. As is true to a greater or lesser extent with all speakers, the material out of which the drive elements are fashioned has an inherent resonant sound of its own. This resonance flavors the sound of the signal passing through the transducer, superimposing its own spurious character on the music. Since the electrostatic panels employed in the Acoustats are fashioned out of a Mylar substance, the finding that they lend a plastic sound to music should not be surprising. This unusual aural signature is audible on everything from brass to bass, from the sharp transient of a snare drum to the steady rush of pink noise. Musical instruments reproduced through the Acoustats tend to sound like they are made of plastic rather than wood, brass or whatever their actual composition might be. This plastic sound interferes with the true tonal flavor of musical instruments and voices, and represents the Acoustats most pervasive coloration.

(3)A modicum of cloudy, gauze-like veiling. The Model Eights exhibit a somewhat veiled sound, as though a sheet of cotton gauze had been draped over the music, interceding between the listener and the musical signal. Musicians and vocalists sound like they are performing behind a curtain. This effect noticeably reduces the sense of pellucid clarity one perceives at live performances. One experiences a certain level of recessed opacity when listening to the Acoustats. Although the Acoustats do offer greater clarity than the majority of competing speakers, they lack the tangible, palpable immediacy that is obtainable from the best of their contemporaries. Unless one is accustomed to the "reach-out-and-touch-it" clarity provided by these other systems, the Acoustats will prove more than satisfactory in this respect.

(4)Transient homogenization. The Acoustats tend to homogenize the distinctive leading edge of instrumental attack. This is not to say that transient reproduction is not clean, because it is cleaner than that of most dynamic systems. Rather, the initial instrumental attack that helps differentiate a plucked harp from a struck wood block has a certain indistinguishable uniformity to it. Percussion lacks its razor sharp snap. The unique hard/soft sound of the classical guitar (based on the sharp plucking of soft nylon strings) is fused into an amorphous whole. There is a certain irony in this shortcoming of the Acoustats. They are, after all, electrostatic loudspeakers, and lightning-fast transient reproduction is one of the legendary fortes of such devices.

Please bear in mind that I am not primarily referring to sluggishness of transient response (although the Acoustats do blunt the edge of very hard transients). What I am describing is a homogenization, a uniformity of instrumental attacks that should in fact be well differentiated.

(5)Limited dynamic impact. Although the Acoustat Model Eights will play at excruciatingly loud levels, they lack a true sense of dynamic "aliveness." Music with wide dynamic range sounds mildly compressed or rounded off. One of the key elements of live music is its effortless, instantaneous acceleration from silence to vibrant life. The Acoustats are not very convincing in this regard, and consequently sound somewhat lifelss. They sound mechanically overdamped. Because the system is so low in distortion and is capable of extremely high sound pressure levels, there is a tendency on the part of the listener to attempt to compensate for this lack of "aliveness" by turning up the volume. Increasede amplitude does not make a satisfactory substitute for dynamic aliveness.

(6)Additional midrange coloration. Although the middle range reproduction of the Acoustat Eight is vastly better than that of most speakers, there are some additional aberrations to be reckoned with. The Acoustats' midrange bears just a trace of

nasality, along with a slightly hollow quality. The system also sounds mildly tunnel-like at times, which is probably more a function of dispersion characteristics than anything else. In addition to the foregoing properties which inhabit the entire midrange area, the upper midrange is beset by traces of a smearish glare which continue, albeit in abated fashion, into the treble region. The severity of this problem is highly amplifier dependent. With many amplifiers the upper midrange of the Acoustat Eight is virtually unlistenable, which is a real tribute to the speaker's analytical prowess. The composite result of these flaws is that the midrange of the Model Eight sounds somewhat mechanical (as opposed to life-like), which is a failing it shares, to a greater or lesser extent, with every loudspeaker I have auditioned.

(7)Limitations in high frequency reproduction. The top end of this system is slightly dull. Increasing the high frequency control serves primarily to aggravate the speaker's latent tendency toward an aggressive, smeared high end. Tambourines, for example, sound slightly raspy and smeared. Personally, I would happily choose a somewhat reticent high end over an edgy, downright nasty one, even if the latter did measure flat in an anechoic chamber. To some degree, one is forced to make just such a choice with the Acoustat Model Eight. Even optimally balanced, however, the treble reproduction of this speaker falls short of state-of-the-art performance in several ways. Highs are slightly dry and muted, and lack the airy, extended, crystalline, delicacy of the real thing. Other high frequency reproducers more accurately capture this aspect of live music (*e.g.*, the best ribbon tweeters, the latest incarnation of the Infinity EMIT, etc.). On the other hand I must stress that the high end of the Acoustat speakers is very revealing. More often than not, the high frequency flaws that one might initially attribute to the speaker actually belong to another component farther back in the chain. This finding pays tribute to the Acoustats' relative neutrality and analytical nature. Although the speakers do possess the aforementioned weaknesses, relative to other loudspeakers their high frequency reproduction is quite good.

Nowhere is the marvelous definitional and detailing ability of the Acoustats more evident than in the high end.

This completes the main body of my appraisal of the Acoustat Model Eight. At this juncture, it might prove instructive to briefly compare the Model Eight with some of the other speakers in the Acoustat line. I have had extensive listening experience with the Model Three and Model Four systems. Accordingly the following comparative comments are restricted to those two models.

On an overall basis, the Model Eight is clearly the best sounding Acoustat I have encountered. It offers numerous advantages over its smaller brothers. First, it eliminates the severe vertical dispersion problem plaguing the shorter systems (except for types like 007's Jaws or Larry Bird). The smaller Acoustats exhibit virtually no high frequencies when one is standing up.

Second, the Model Eight is much more effortless in its sound (due, no doubt, to its larger surface area). The benefits of this range from a subtle sense of ease in reproducing demanding works to a clearly discernible reduction in rawness and glare, particularly in the upper midrange.

Third, the Model Eight is capable of significantly deeper and more powerful bass. Again this would appear to be a direct function of its greater radiating area. Unless a serious interface problem exists with a given listening room, I cannot imagine anyone describing the Acoustat Model Eight as bass-shy. This criticism can be justifiably applied to the smaller systems in many rooms.

Fourth, the Model Eight can generate substantially higher sound pressure levels. For certain applications (*e.g.*, a very large listening room, monitoring work in a recording studio), this increased SPL capability could prove very important. In the average domestic installation it is probably not a factor. A system, like the Model Eight, that can provide such engulfing waves of sound can furnish an interesting perceptual experience, however.

Fifth, the Model Eight can provide a soundfield that is truly immense in size. As I mentioned earlier, this affords a most realistic rendition of large scale musical works.

Sixth, when using the Model Eight, I detect less of the tunnel-like quality of sound that seems indigenous to the Acoustats. The difference is subtle, but clearly evident.

On the other side of the ledger, the smaller Acoustats offer some advantages of their own. They offer a better sense of focus, particularly in the center "channel." The Model Eight often sounds somewhat vague and diffuse in this area, while the small Acoustats sound more precisely focused. The smaller Acoustats are also a little less reticent sounding. They are somewhat more forward in their presentation of musical material.

And then there is the matter of price. The Model Eight, at nearly $4800, is certainly not the bargain of the line. It does sound better than the smaller models (especially in its comparative freedom from strain and glare), but this level of improvement comes at a steep financial cost. The current version of the Model Three, at $1595, is one of audio's true bargains. (Owners of older Model Two, Three or Four systems would be well advised to spend the $100 for the MK-121 modification kit. This simple transformer upgrade kit substantially improves the sound of these speakers in a variety of ways, including less upper midrange glare and cloudiness, vastly improved bass response, more extended highs, etc.) The new model Two + Two, which Acoustat has promised to me for review, also appears to constitue an appealing value (the Two + Two is a vertically stacked pair of Model Twos, or, alternatively, a pair of half-width Model Eights). Kudos are due to Acoustat for providing full-range electrostatic loudspeaker systems at affordable prices that rival the sound of the best speakers in the history of audio (many of which were plagued with reliability problems and cost two to three times what the Acoustat does in today's dollars).

With the exception of the above areas, the various models in the Acoustat line unquestionably share a family sound. As such, the majority of the remarks (both good and bad) that I made about the Model Eight can also be applied to the other speakers in the line.

In closing, I wish to note that I have been of two minds about the Acoustat Model Eight while writing this protracted review. On one hand, they do fall short of the ideal of the absolute sound (*i.e.*, live music) in the ways I have outlined. If the tone of this review has been somewhat critical at times, it is because I felt the need to address the Acoustat's weaknesses. Its not inconsiderable virtues have been lavishly described elsewhere. On the other hand, when viewed as a real entity in the admittedly imperfect world of loudspeakers, it is an exceptional effort. It demands (and deserves) the very best in associated equipment. It is, without question, one of the three or four best speaker systems I have auditioned. Although some of these other systems clearly outpoint the Acoustat in the ways mentioned in the review, on balance, the Model Eight may be the best of the bunch. I do feel that some of its more vexing limitations (*e.g.*, its overdamped, lifeless quality, the degree of plasticity in its sound) could be cured, and I would hate to see its very talented designer rest on his already-accrued laurels. Although I was always aware that I was listening to a speaker system with its own sonic identity when I auditioned the Acoustat Eight, I nonetheless consider it to be one of the premier examples of loudspeaker technology.

—John Nork

Manufacturer: Acoustat Corporation, 3103 S.W. First Terrace, Fort Lauderdale, Florida 33315. **Source:** Manufacturer's Loan. **Serial Numbers:** 202803; 202806. **Price:** $4750/pair.

PHD Comments:

I'm in complete agreement with JN's review.

Nork talked about a problem in assembling the speaker where they hit the ceiling. This can be avoided if the speakers are assembled in an upright position.

These speakers may have very low distortion as JN indicates but the plastic, ringing quality in the midrange would frequently leave me with a moderate case of listening fatigue.

Manufacturer's Comment:

When John Nork requested the Model Eights for evaluation, and we realized the size of his listening room, we were reluctant. But John (perhaps feeling that bigger must be better) was insistent so the speakers were sent with misgivings, and Jim Strickland and I decided to visit him to help with the problems we anticipated.

The Model Eights are *large* and would be more at home in a room twice the size of his or in a small auditorium. The Model Six and Eight were named the Professional Series because we saw their application in large rooms for music or sound reinforcement and recording studio use more than in most home environments. Our experience to date with installation in recording studios has been interesting; most control rooms are far too small to achieve decent imaging, but the SPL produced has been sufficient to satisfy the bleeding eardrum requirements of most recording engineers.

We sympathize with JN's frustrations in trying to deal with and optimize room boundary effects. A pair of Model Eights has nearly 50 square feet of frontal radiating area, and in a room of JN's size there is virtually no way to get the speakers far enough apart and at the same time have enough listening distance for ideal imaging and breadth of listening area. Also, all of JN's walls are pretty reflective. One way

to make a room acoustically bigger than it really is utilizes damping material (drapes, Sonex, acoustic wall board) on the wall behind the speakers or behind the listener (we prefer the former).

Since our driver panels are not in an enclosure, per se, the room becomes the enclosure, and proper matching of speaker radiating area to room volume is very important in all of our models.

Beaming and directionality.

True or False: In a concert or performance the instruments or performers are radiating sound omnidirectionally, so the ideal loudspeaker should be omnidirectional too. "The speaker that diffuses sound everywhere is accurate nowhere." (Peter Moncrieff)

Many instruments radiate omnidirectionally, but the important first arrival sound is very directional relative to the perspective of the microphone which is our "window" on the event. The vectors from the instruments to the microphone are a beam in reverse. The indirect or ambient portion of the sound will approach the microphone from other directions and because of time and phase differences will be perceived as ambience. The ear or our psychoacoustic mechanism has a remarkable ability to differentiate first arrival from ambient information, and it is this perception of first arrival sound and the intricate phase relationship between instruments in different locations and at different distances that gives us our perception of image, both left-right and front-back.

Image is not such a strange word to describe properties of sound. The analogy of motion picture photography for audio reproduction is really quite apt. The camera equivalent to the microphone, very weak waveforms captured on film or tape, enhancement of the signal millions of time by the projector or amplification. In the movie theatre we see on the screen a continuous moving image of the original scene. Next time you visit a theatre look behind you and observe the *beam* that is creating the image on the screen. It is important to remember that the speaker can reproduce only what the microphone "saw" at its particular vantage point, that the first arrival sounds from the instruments are a beam in reverse, and that the function of the speakers is to reverse the process of the microphones. If this is done with proper attention to maintaining phase accuracy, then the sonic image will be preserved.

We conclude that directionality or beaming is not only good, it's damn well essential. The omnidirectional or over-dispersed speaker can no more produce a coherent sonic image than a naked light bulb can produce a visual one. Acoustat speakers by virtue of their size and mild interpanel angles provide a beam width at the listening area approximately equal to the extended distance between the speakers unless a small room dictates listening too close in which case the optimum listening area will be restricted.

Plastic (credit card) coloration.

When HP first mentioned this new and heretofore undiscovered coloration an issue or two ago, we were puzzled. We listened and listened some more and still we couldn't hear it—of course none of us were totally sure what it was we were trying to hear. (Picture the management of Acoustat holding their American Express cards close to their ears and flicking it with a fingernail.) The topic became the subject of a few converstaions with others in the industry including another equipment reviewer, and they couldn't hear or identify it either. Further discussions ensued with two *TAS* reviewers—one of whom was John Nork at the time of our visit to Indianapolis said John, "Yes, I can hear what Harry's talking about, but it's a minor aberration which doesn't bother me, and I doubt it would bother other audiophiles." And Tony Cordesman voiced to us essentially the same sentiments several months later.

Perhaps speaker manufacturers have an adaptive deafness for the colorations of their own products. We can certainly hear the colorations of cones and even the slight metallic tinge of electromagnetic ribbon drivers, and we realize that any speaker including ours has some colorations. But plastic? The fault, assuming it exists, is presumably subtle. There has been no change in panel fabrication methods or materials for nearly seven years, and a fault that takes that long to discover surely can't be too bad.

Transient homogenization.

Well, this one has us scratching our heads also. We see the root of this complaint in a letter to the editor in which a *TAS* subscriber described his feeling that perhaps transients of different instruments sounded too much alike, and HP commented, "Hm, you might have something there" or words to that effect. On this point we vigorously disagree. Play the Opus 3 recording *Gitarr Kvart etten Transkriptioner* on any of our speaker systems (guitar plus soprano, alto and bass guitars) to see how well the leading edge transients of four different though very similar instruments can be differentiated. Another example, Dave Grusin's *Discovered Again* ("Keep your Eye on the Sparrow") in which the individual transient identity of several instruments spanning the mid bass to treble range is clearly identifiable.

The picking of nits aside, we do appreciate JN's comprehensive analysis of the Model Eight and the many kind things he said about it. We would perhaps argue with his contention that the Eight is our best speaker—it certainly wasn't the best for his room. Jim and I both felt after our efforts at helping in set up that the 2 + 2s would have been a much better match for his room, would have given him far fewer headaches in set up and adjustment and would have provided (for his listening distance) better imaging.

And finally, Jim Strickland has indicated that he has no intention of "resting on his already-accrued laurels." The evolutionary history of our product improvement over the past seven years should lend credence to that declaration.

Bob Rieman
Acoustat Corporation
Fort Lauderdale

ANALOGUE ASSOCIATES, LLC

Acoustat X Servo Amplifier Specialists

August, 2006

Analogue Associates, LLC is dedicated to the maintaining and upgrading Acoustat Direct Drive Servoamplifiers, the best design for driving electrostatic speakers ever conceived. Our greatest respect goes to James Strickland, the original designer of these amplifiers.

We have been involved with Acoustat Servoamplifiers since 1977. All part changes have taken into consideration the function and operating conditions of each part in the circuit design. Everything discussed here has been done because we personally want the best sounding amplifiers and speakers in the world. We hope you share that desire. Also we would like to thank the many owners and others who continue to contribute information and ideas for upgrades.

These amps make Acoustat electrostatic speakers sound much better than any combination of conventional amplifier(s) with interfaces, no comparison. A frequent problem with these speakers is that often people don't like what they hear because Acoustat ESL's are extremely revealing. They tend to blame the speaker. The problems generally heard are with the front end. It sounds self-serving but experience has shown this to be true 90+% of the time. That is not to say the amplifiers don't have their sonic problems, but that is what we are addressing here.

You or a technician can do some of these modifications. We suggest that the more elaborate ones by done by us primarily because our experience has taught us quite a bit about how to deal with the high voltages involved. That experience with this uniquely designed amplifier, along with having custom proper equipment required, makes maximizing performance and troubleshooting problems easier. Finally, the delicate traces on these amplifiers tend to break and pull off the board. This amplifier is not a common garden-variety device.

Recent experience has taught us a lesson. Because these amplifiers are mono and are EXTREMELY sensitive to a/c mains cables ALWAYS be sure that you use the exact same type a/c cord on both amps. If you are using the original cable captured in chassis cover this is not an issue. We have had good results with the Audience PowerCords. The Audience PowerCords do not seem to emphasis any particular area, but do reduce grunge and lower the noise floor when used with the Servoamplifiers. In order to use them you will have to drill out the rivets that hold the factory cable cover in place and replace the factory cable with your own **DO NOT OPERATE THESE AMPLIFIERS WITH THE CHASSIS CAGE OFF!** There are voltages in there that can bring a swift end to your listening career. Mr. Strickland's safety cage works beautifully--don't try to defeat it.

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THE BASIC UPGRADES

Do your Servoamplifiers have tube standoffs? These are essential for circuit board life. At this time the most expensive repair is for severely burned circuit boards due to lack of tube standoffs. The early X's did not have them, but many owners had them retrofitted. They run $4 each, plus labor of $90 to install all 8. With tube standoffs in place, the other components in close vicinity of the tubes survive much better. This also reduces arcing both on top of and underneath the circuit board due to carbonizing of the epoxy from overheating. The circuit board is always be examined for carbonizing and scrapped clean as necessary. It is not a bad idea to replace even the 20+ year old original stock parts if the amplifiers have had a lot of use. Sometimes the sockets will develop carbon "threads" between the plate and other lower voltage pins. This problem will cause the tube to go into thermal runaway.

We have sourced a new quad IC for these amps, which has proven to be the best sounding one yet. This is obviously something you can install yourself. They run $20.00 per matched pair. You will need to allow them to break in for about 3 weeks and after that you should reset the clipping symmetry. We would also suggest replacing the IC socket at the same time as this often resolves a myriad of mysterious problems. Cleaning the old one is just not enough. We can supply one with solid milled and gold plated pin sockets, which effectively eliminates the need to ever replace them again. The parts are $30, IC's and sockets, and $60 for installation for the pair. Included in this and all of the upgrades listed is adjusting the clipping symmetry of each amplifier.

REVISED The next step is to improve the power supplies for the 150vt and 17vt sections. We replace the 4-22mf capacitors with matched 47uf 500vt parts and replace all 12 of the zener diodes with Fairchild HEXFREDs. This results a more stable power supply and has sonic benefits as well. We also replace the 3-10mf capacitors with higher rated parts as well. Finally, we replace all of the capacitors in the 17vt power supply with newer, better sounding parts. This improves the reliability of the Servo's under stress and the revisions to this upgrade have resulted in significant improvements to imaging. The capacitors and diodes run about $183.00 and the labor to install all of them is $150 per pair of amplifiers.

Our experience indicates that the above modifications make these amplifiers quieter and rock solid. To date we have not had a single failure of a modified amplifier that was not related to tube failure. The most critical aspect of the performance and reliability of the amplifier at that point becomes the tubes themselves. While we have had a tubes go for over three years in a pair of amplifiers that was used hard and still test well and sound good, it is critical that the tubes be tested periodically because tube failure becomes the single aspect the modifications cannot protect the amplifiers from. If you do not have access to a tube tester that can provide an emissions life test, we can check them for you at $1 each plus shipping and return them to you. This can extend the useful life of the tube without sacrificing reliability or sonics. Depending upon availability we sell NOS 6HB5's at $22.50 each, tested and matched in quad sets as to tube style.

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THE MAJOR UPGRADES

Two significant modifications are bypassing the gain and hf balance pots. The gain bypass is fairly simple and results in quite a change in the sound of the amp. We bypass the rotary gain control with the highest quality fixed resistor for each amp. This matches the gain between the amps. We have found over time that using a single 10k resistor produces the best results and we provide a Naked Vishay for that purpose. The resistors run about $16 each. The installation labor is $30 for the pair. The sound is quieter, yes truly quieter, and there is an obvious reduction in distortion.

We can also replace the high frequency carbon pots with a 12 position fixed resistor switch. It is nearly impossible to match each channel with the original carbon pots. This modification will allow you to change the hf balance readily and in predictable steps. This also results in a marked decrease in noise (distortion), increased high frequency purity and better image stability. We fabricate a stepped resistor switch with 12 values to allow steps of ~.2db at 10khz with a maximum variance of ~2.5db. The values we chose fall into the range of ~9 o'clock to 12 o'clock on the stock rheostats, the most commonly used positions. We have found that with discrete resistors these lower values are typically desired due to the improvement in the high frequency signal. If you require a higher value we can provide a resistor that will allow you to do that without sacrificing the tight adjustment allowed by .2db steps. The cost to replace with a fixed resistor switch is $90 for a pair of custom 12-position switches, including the price of the resistors. The labor to install them is $20 per pair.

More complex but sonically very important is bypassing the automatic turn-on circuit. We put a manual turn-on switch in place of the auto-on circuit and remove the unnecessary components. This reduces the noise level and improves the sound of the amplifier throughout its frequency range. The change costs $150 per pair of amplifiers and it is one of the single most impressive sonic changes that we make to these amps. In the original design, the turn-on circuit drives one quadrant of the IC into saturation the entire time the amplifier is playing music at a moderate level. This quadrant is not used for audio purposes but the sound of the IC nevertheless is significantly impacted. This does mean that you will have to turn the amplifiers on and off manually with a switch that replaces the gain control knob when the gain control is removed. Additionally, we are now using the manual switch to provide power to the high voltage transformer, thus allowing us to remove the SCR, a rather noisy electronic switch, utilized in the original automatic turn-on design.

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There is a secondary but very important reason for this modification. The most common failure in our experience with these amplifiers is thermal runaway of weak tubes. In the original configuration, a significant line voltage surge would trip the turn-on circuit turning the amp on. If there are extended or multiple surges and there is a weak tube, the tube can begin to overheat. If the condition goes unnoticed, it will cause the tube to fail, which will overheat other related parts and cause the amp to fail. The manual switch eliminates this problem because the amp cannot turn on by itself. If you are listening to music when this situation occurs you would hear this kind of problem as one channel begins to get distorted and drop out as the tube overheats. You then have around 10-15 seconds to turn the amp off manually, which will abate the problem. You should then examine the tubes and perhaps replace them before turning the amp back on. As long as the 5amp fuse hasn't blown, most likely no damage has occurred.

It is NOT RECOMMENDED that you turn the amps on manually and allow them to be left on unattended for long periods of time, such as several hours or overnight, etc., because you have created the same scenario.

To facilitate moving the amplifiers away from the speakers, we can provide custom lengths of high voltage wire to allow the placement of the direct drive servoamplifiers closer to the preamplifier. The wire runs $.44 a foot per lead with 3 leads per channel. This translates into a cost of $1.32 per channel per foot. We use red, white and black. This allows you to use short, high quality interconnects between your preamplifier and the Servoamplifier. The secondary benefit of moving the Servoamps away from the panels, preferably into another room, is that the amps are subject to less microphonic stress and will sound noticeable cleaner. Just tap on the circuit board, while unplugged, if you want to see how much vibration is transmitted to all of the components. We recommend that you use a clear vinyl high voltage shield for each of the six high voltage leads to reduce the likelihood of the wire being punctured by spikes or teeth. It also has a sonic benefit that Acoustat recognized late in their production runs. You must realize that the voltage in the wire is as high as 2.5kv and while generally coming into contact with it is not lethal for adult humans, it will knock you off your feet and stun you. I speak from experience. It can be lethal to small animals. This is not recommended in an environment where the traffic is young children.

The last component in the Major Upgrade section is a set of replacement transistors for the stock Motorola PNP and NPN transistors supplied by Acoustat. These new transistors are high-speed, high-resolution transistors which improve the sound significantly, especially the bass response, which now has more apparent deep bass, with improved low bass impact and definition. The level of noise and grit is also diminished. We remove the transistor sockets along with the transistors originally used by Acoustat and the new ones are soldered directly to the board. This change also improves the imaging with the traditional laid-back image of these speakers being brought to a point between the listener and the panels without impairing the overall sense of front to back imaging. It is like trading your tickets in row 20 for those in the middle of the row 8. The parts run $40 and the labor to install them is $35 per pair (when done with any other upgrade) of amplifiers. One of the most cost effective updates to date.

We are now building a replacement for the quad IC opamp used in these amplifiers. These consist of two superb single opamps and the related circuitry being mounted onto a 14-pin adapter that allows it to be a direct plug in replacement for the existing quad IC. Note that these can only be used where the turn-on circuit has been modified by us as discussed above since there is no provision for the two remaining quadrants in this circuit and two of the pin positions are used by the new opamp circuitry. The sonic affect of these parts is pervasive in all aspects of the sound of the amps. While hard to describe, it is impossible to overlook. This circuit is a quantum leap in resolution and distortion reduction over the quad IC, even ours. The resulting music from this update defines **Palpable**. It isn't inexpensive at $300 for a pair of these assemblies, but it is worth it. See further notes on this below.

THE ULTIMATE UPGRADES

THE ULTIMATE UPGRADES-AUDIO SECTION

NEW It has been apparent from the beginning that one place to make improvements was in the capacitors used in the low voltage signal path. The stock amplifiers came with a variety of types of capacitors, including the dreaded ceramics, about the worst sounding capacitor for audio. So we asked our cap builders to build new caps to replace all of the low voltage capacitors. When the stock capacitors are replaced with these the bass becomes huge, deeeeep and thunderous. Voices became clear, no straining to understand lyrics, and liquid. We are offering a complete set of custom capacitors to replace all of the capacitors in the low voltage audio circuit. Not all can be supplied by our dutiful cap builder, Auricap, but the one that cannot are be is the best we can find for the job. The cost is not too bad, $240 for the 32 capacitors. The labor is $112 if we are doing any of the other upgrades at the same time, or $157 if not, to install them in a pair of amplifiers.

We can replace the high voltage resistors, the 500meg 4w, 6.8 Meg 5w, 680k 4w, 10K 15w and 10k 5w, using Caddock Ms and Mg series non-inductive resistors. The total cost for all 22 of the resistors is $337 with an additional $90 in labor to replace them. This seems like a lot, but when I replaced the 12 basic high voltage parts (6.8meg 4w, 10K 5w and 10K 15w only) and bought them from Acoustat in 1989, they charged me $212. The sonic effect of replacing these resistors is impossible to overlook. The transparency of the audio signal is vastly improved, the soundstage is significantly enlarged and the music becomes separated from the panel. It begins to approach live music.

Now available are replacements for critical output coupling capacitors custom made for us by Auricap, one of the premier audio capacitor manufacturers. These are a major improvement over all of the caps supplied by Acoustat (and there were at least 4 different versions from them before they quit selling them) including the Fdyne polypropylene caps they made available for a short time. These new caps flesh out voices, particularly female voices take some hardness out of the upper frequencies and result a more "relaxed" and less strained sound. The image is now extended further into the room, moving the listener up from row 8 to row 3. In combination with the high voltage resistor updates, these allow the amplifiers/speakers to play significantly louder before breaking up. We had special leads

made for these that allow for the bypassing of three additional solder joints and the leads from the pcb to the output socket. These are large (2"x2") and have to be placed in a slightly different location to allow the chassis cage to function as normal. At $39.50@, for a total of $158 per pair, we are able to provide these at a price cheaper than Acoustat sold theirs for in 1990. If they are installed along the high voltage resistor upgrade the installation labor is $35, otherwise the installation labor is $70.

NEW Along with the new output coupling capacitors we can provide the same quality parts to replace the 10uf 250vt caps in the output section of the amplifier. These are of the same as the output coupling capacitors and since two of them are in the signal path, they have a significant impact on the sound of the amps. The first thing noticed is that the sound field is blacker, that is, quieter. Because of the stock location of these capacitors on the board, we build a stand to mount them and move these underneath the board. This takes them away from the heat of the tubes. The capacitors are $36@, with 6 required per pair of amplifiers. Installation labor is $90 if done with other modifications, or $125 if done by itself. The labor charge includes the parts required to build the stand to mount the capacitors underneath the circuit board and additional insulation for the capacitors in the form of 7500vt rated Kapton tape wrap for each capacitor.

Over the last few years the audio world has become more aware of the value of using good resistors in audio circuits. To that end we replace all critical low voltage resistors with Caddock TF020s and MK-132s. We can currently provide these resistors at a very competitive price, approximately $4 for the TF020'S. The total cost for all 66 of the resistors is $257. We tried Holco's but they will not stand up to the voltages and do not sound as good. The cost of installation is high as well, but you are talking about taking out and replacing nearly every resistor in the amps. We charge $110 per amp for the labor, totaling about $477 for the pair. It is hard to express the difference this change makes but the purity of the signal takes a quantum leap. With the advent of the new Discrete Opamps and transistors this upgrade becomes paramount. The difference in the improvement the TF020s make with the Discrete Opamp and upgraded transistors vs. the stock resistors is astounding. While each of these can be done on their own, it has become apparent that the component changes that represent our “Ultimate Upgrades” are best appreciated when done together.

THE ULTIMATE UPGRADES-HIGH VOLTAGE POWER SUPPLY

NEW Until recently the high voltage power supply has seemed to be the one area that we could not do much with, but that has now changed. We asked Audience to build a part for us that had not been done before, a 1uv 3000vt polypropylene capacitor. The first prototypes took eight weeks to get and were an immediate success. These capacitors impart what I like to refer to as “scare factor”; that is, when there is a very dynamic high volume attack required in the music it seems to come out of the black, blindsiding the listener, much like a scary movie. The transient quality of the music, most obvious in the bass but evident throughout the frequency range and is, well, scary. I would never have thought of the transient response of this amplifier and speaker as being slow, but there was obviously room for improvement. Again, blacker background, better articulation, etc, are all evident and it makes sense that this would happen with better capacitors in the area. This also proved to be

timely; as we have begun to experience failures due to age in the stock oil filled capacitors provided with these amplifiers. When the stock capacitors fail, they short out and the amplifier will just blow the 5amp fuse. These new capacitors are very large and best mounted inside the chassis below where the original stock capacitors are located. This allows for the chassis safety cage to remain in place. Additionally because the capacitors have lots of voltage and will be mounted together, we wrap the capacitors with Kapton tape that has a rated insulation value of 7,500vdc. This protects the capacitors from arcing between each other and the chassis. These capacitors are not cheap at $45.00@ (well actually they are a fantastic value) and you will need to replace all four in a pair of amps. We also are installing a .01uf 3kv bypass capacitor for each of the 1uf capacitor. The impact of this bypass capacitor is to further expand the soundstage and more clearly delineate the acoustic space for each instrument. The bypass capacitors are $12@ and four are required per pair of amplifiers. This brings the total for the parts to $228 and the labor for installation is $90 per pair (when done with any other upgrade, otherwise the labor is $125) so the total installed cost for these is $318, a veritable bargain

NEW The diodes that are part of the voltage doubler in the HV power supply have proven to be weak over time and subject to failure when there is a voltage spike in the AC line. We have found a new soft recovery controlled avalanche (less spikes during transients) rectifier that has a significantly higher voltage, 7.5kv, and current limits, up to 20amps for spikes and 5amps for repetitive peaks. Compare those specs to the 7kv 350 milliamps for the stock parts and you see the increased margin of safety. There are sonic benefits, quieter and smoother sound, but the point here is to increase reliability. Most people have suggested just using diodes intended for kitchen microwave ovens, but they are noisy and at least as expensive. We suggest these (2 per amplifier, for a total of 4) be replaced as preventive maintenance, but feel that they are much more critical when doing the high voltage capacitor upgrade. The parts cost $75 for all four rectifiers, and there is no labor charge for installation when done with any upgrade.

NEW The last component in the HV power supply, and arguably the most important component in the amplifier, is the HV transformer itself. The factory part has really proven to be a pretty reliable given what it has to do, but it is prone to failure and is noisy. We have commissioned a larger version to be built that allows for more plates, thicker copper wire and more insulation. Additionally the entire design was re-examined, some changes made in the construction and the materials brought up to contemporary standards. Finally the new transformer has higher output voltage than the original part which results in another 500vt available to the tubes. The sonic result is again a reduction of apparent background noise, improved dynamics, bass control and overall detail. The difference is not subtle. The new transformer will, with minor modifications to the mounting tabs, fit within the original footprint and still allow the original chassis cover to be used. It is quieter and more reliable than the stock version. This upgrade can be installed by itself at any time and any level of upgrade with the same benefit. We do require that this be installed with the new HV diodes above. Each Transformer is $215, so the total with the diodes is $505 plus the installation labor of $90.

THE GOD MODS

As much as I would love to take credit for this fundamental change in the HV circuit design, it came about as the result of input from Ton Melein, a friend and fellow Servo-Amplifier nut, Michael Elliott (Alta Vista Audio, LLC) and George Kaye (Moscode, Inc.). I include these names not to name drop, but to give credit to the people who brought about what has to be the most fundamental change to the sound of these amplifiers. This modification involves installing a second High Voltage transformer and a Full Wave Rectifier circuit to bring them together. I could try to tell you the difference in the sound of the Servo-Amplifier but I have run out of superlatives. You will notice that you thought you had bass before; but you really didn't until now. You thought you had imagining before, but you didn't. You thought you had quiet before, but you didn't. You thought you had music before, but you do now. The change in the sound of the amplifier that this modification imparts is like nothing I had heard before. Listening to the first pair built, they sounded so different I thought something was wrong with them. Think Control over all the aspects of the sound in a fashion unlike they had ever been before. Even if you install a tube front end (keep watching this space) in these amplifiers, without this upgrade they CANNOT sound this good. Is it the Holy Grail for these amps, you will have decide, but I couldn't listen to a pair these amps again without it. If we could provide no other upgrade, this upgrade alone would be enough to justify our existence from inception to date. Others have done modifications to these amps, but no one has done this before, no one. The down side, the amplifiers weigh an additional 10 lbs and all of the weight goes to one end, i.e., they get even more awkward to move and expensive to ship.

Assuming you start with a stock HV power supply, this modification REQUIRES 4 of the new 1uf 3kv Auricaps, 8 of the new HV diodes and at least two new HV transformers per pair as well some metal work. It ain't cheap, but we are doing our best to make it available at a reasonable price. Note that the GOD MODS include all of the parts in the Ultimate Upgrade-High Voltage Power Supply, you get both in one price so it is not as bad as it seems. See the Upgrade Summary for total cost when either of these two is done.

GOD MOD (1)

We provide 4 new Upgraded high voltage transformers with 1963vt output vs. the original stock 1820vt, 8 new HV diodes, 4-1.0uf 3kv Auricap capacitors with .01 bypass capacitors and install them in a neat package on the amplifiers. Cost with installation labor, $1,465 with any other upgrade category, $1,615 if not. We will help with the cost by allowing you $60@ for each working original 380c transformer on the amps. So if you have 2 good ones, subtract $120. This offer will hold as long as we have need for the transformers to allow us to do GOD MOD (2) upgrades below. The agreement to buy them back will be made at the time the upgrade is ordered and is subject to Analogue Associates, LLC requirements at that time.

GOD MOD (2)

Assuming you have two good stock 380c transformers and we have sufficient supply of 380c transformers from GOD MOD (1) upgrades, we can provide you two USED stock HV transformers instead of 4 new Upgraded HV Transformers, and the rest of the upgrade remains the same. This would be a very cost efficient way to do this upgrade, but understand that the transformers will be pulls and USED. They will be tested to be sure they are fully functional before and after they are installed, and will have a 90 day replacement guarantee from delivery date. We require that your transformers be 380c's as we have to match the transformers (voltage) for this purpose and the 380c were the last, best and most common of the original stock Acoustat HV transformers. The cost of GOD MOD (2) will be $900 with any other upgrade category, and $1,050 if not. GOD MOD (2) has to be approved at the time of payment on the upgrade to insure that there are available transformers and they are set aside for you.

In summary (yes this will actually come to an end) we are always working on and developing new revisions for these amplifiers, but will not perform any of them for others until they have stood the test of time in our own environment. As your read this it would appear that some of the same improvements are indicated for each modification and that if all were done at the same time it would unbelievably better. That is correct. We have had the benefit of doing each of these one at a time to our own units and being surprised by the outcome of each, particularly when comparing them to a stock pair as a baseline. It is shocking to hear the difference between a fully modified pair and a stock pair. We have always believed a stock pair of Servo's driving Monitor 4's will produce a musical image that is still nearly state of the art, so we feel that a fully modified pair is, well...and we can produce the glowing reviews by customers to prove it.

THE CAVEATS

All of the above parts and labor prices are subject to change without notice. The cost of the updates along with return shipping must be paid in advance of the work being performed. Please see the Servoamp Upgrade Summary for the most current pricing, but any inconsistencies between two prices will be settled at our discretion. We are not doing this to get rich, merely to make it worth the significant amount of time it takes to do these modifications and do them correctly. We are not professional technicians and do not perform the work as a sideline just for profit. We want you to love these amplifiers as much as we do. A lot of time has gone into the development of these modifications and we are justifiably proud of the results. We typically do only one modification at a time and then listen to the results in a complete system using either Monitor 3's, Monitor 4's, converted Model 66's or a pair of custom Double Monitor 4's. This way if a problem arises it is easier to track down the culprit. If it doesn't sound like it should, it doesn't leave. Therefore this is not done in a hurry. Expect a turnaround of from 1 week for a minor modification and six to eight weeks plus for complete overhaul. We will not be rushed. All modifications are done on a 100 % money back guarantee basis with the amplifiers being returned to you in their original status, but you would be responsible for all shipping costs. Since we can't afford to restore the amps back to their original state frequently, these upgrades are done with great care.

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We are always interested in the reactions to the changes made, even if they are negative and are open to suggestions for other improvements. Our only goal is to build the best sounding Servoamplifiers we can for ourselves and any others who share our love affair with these amplifiers. In order to continue to develop these modifications, we need to make sure that they are accepted in the field and address any problems that may arise.

If you should decide in the future that you are interested in selling your speakers, let us know and we will help you find a buyer. We like to keep track of these for our own selfish reasons as we now have over 60 amplifiers under our wing locally, nationally and internationally.

Happy Listening,
Michael Savuto and Paul Lambert
Analogue Associates, LLC

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ANALOGUE ASSOCIATES, LLC
SUMMARY OF UPGRADES AVAILABLE FOR ACOUSTAT SERVOAMPLIFERS
AS OF AUGUST 1, 2006

Description of Parts and Service	Reason for upgrade and improvement imparted	Cost Per Pair of Amplifiers* Parts	Labor	Total
	THE BASIC SERVOAMPLIFIER UPGRADES			
Installation of tube standoffs (only if not in amplifier currently)	Allows better cooling of the circuit board and longer life of components in area around tube. Plus now we are able to get the red ones instead of the old brown, tan or black ones, so they look cool! When these are replaced we always scrap all the carbonization around the sockets to reduce any chances of arcing between the pins.	$32.00	$90.00	$122.00
REVISED Upgrade of 150vt and 17vt power supply parts. Replace all zeners with HEXFREDS, the 22uf, 10uf in the 150vt side. For the Opamp's 17vt power supply we replace the and 1000uf capacitors. Results in much improved sonics for the opamp.	Stabilize the 150vt PS, and 17vt PS, a weak area in the original design. Upgrade capacitors in area of the tubes to higher ratings and move them for better cooling. Results in quieter and more stable amplifiers. The original parts deteriorate over time and are often a source of false turn-ons. Replacing the 1000uf and the 47uf capacitors in the 17vt power supply results in better sonics from the opamp. We are now replacing the 1n4004/6 with Fairchild HEXFREDs which are quieter and faster than the original zeners	$181.00	$150.00	$331.00
Install new IC and replace IC socket with gold plated, solid milled pin sockets. These are not required if you decide to go to the Discrete Opamp below.	The new IC is more linear, lower distortion, with a wider and deeper soundstage. Original IC pin sockets corrode over time and are another source of often mysterious problems and degrading sonics. Solid milled gold plated pins in new IC socket eliminate the corrosion common on the old stamped aluminum pin sockets.	$30.00	$60.00	$90.00
	The above items make up a Basic Upgrade for Stability and Sonics.	**$243.00**	**$300.00**	**$543.00**

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SUMMARY OF UPGRADES AVAILABLE FOR ACOUSTAT SERVOAMPLIFERS
AS OF AUGUST 1, 2006

Description of Parts and Service	Reason for upgrade and improvement imparted	Cost Per Pair of Amplifiers* Parts	Labor	Total
	THE MAJOR SERVOAMPLIFIER UPGRADES			
Replacement of Gain Control with Fixed Resistor.	Eliminates a nasty source of noise and distortion and provides for exact matching of gain between the amps. Very significant reduction in distortion, grain and noise in audio signal. Smoothes out all frequencies. More musical, less hi-fi.	$40.00	$30.00	$70.00
Replacement of HF Control with custom 12 position Fixed Resistor Step switch.	This, like the replacement of the volume pot above, eliminates yet another nasty source of noise and distortion and provides for exact matching of frequency response between the amps. Very significant reduction in distortion, grain and noise in audio signal. Smoothes out high frequencies and while it does not extend the high frequency response, which is current limited, it does give the sonic impression of doing that. We can replace the pot with a fixed resistor like the gain control, but don't recommend it as the speaker can benefit from flexibility in this area.	$90.00	$20.00	$110.00
REVISED Bypass auto turn-on circuit, install manual turn-on switches.	This is the motherlode. The original auto-turn on design required quite a few parts and one quadrant of the IC driven into saturation to keep HV powered up. This was done for user convienence, but had a significant negative audio impact. We install a switch which also allows us to remove the SCR which is used to power up the HV supply and bypasses the need for the opamp to be involved, dedicating it to audio only. Additionally the 17vt power supply now serves only half the original load. Sonic background now goes black, vs. dark gray, distortion drops another level of magnitude, dynamic range increases, speakers have better bass and play louder. No other change has as dramatic an effect unless this upgrade is performed and every other change benefits from it. Somewhat inconvenient since the amplifier must be manually turned on and off, but can be offset with longer runs of HV wire to panels which allows amps to be placed closer to other electronics. This cannot be done without the HF and Gain Control replacement above because we need to have a hole for the switch and we don't want to drill any holes unless necessary.	$30.00	$150.00	$180.00
Replace the stock transistors with new High Speed, High Resolution Transistors	The sonic improvements are obvious. One area in particular that benefits is bass performance with an increase in low bass impact and detail. The overall level of grit is again reduced with improvements most noticeable in female vocals. These take about two weeks to fully break in, just the amp plugged into the wall is enough, but after the first day of breaking in they begin to show their true colors. Clipping symmetry should be adjusted after these are installed. If you have felt that the image from your Acoustats was too laid back in the past, these solve that as well. They extend the soundstage to a point between the listener and the panels.	$40.00	$45.00	$85.00
REVISED Replace Quad IC with completely new custom hand built Discrete Opamp Circuit. These can only be used if the turn-on circuit bypass above is in place. This opamp replacement consists of two ultra high resolution single opamps, with related circuitry, built onto a 14 pin socket adaptor. This assembly will plug directly into the upgraded IC socket. We are now using a different coupling capacitor than the original version which results in improved bass performance.	The quality of quad opamps has always been a limitation until now. With this update the barrier is broken. The sonic impact of this upgrade is hard to describe, but easy to hear. Everything is better. The parts take about 1 week to fully break in and will require the clipping symmetry be adjusted afterwards, which we do before the amps are shipped. The best analogy I can come up with is that it is comparable to changing from tired tubes to NOS in a preamplifier. Resolution takes another step up. The increase in musical energy is pronounced in micro-dynamics as well as large scale dynamics. Front to back depth with the spacing of instruments and width of image also benefit. The very definition of Palpability. I will tell you that the full benefit of this upgrade, and that of the High Speed, High Resolution Transistors, is limited without upgrading the High and Low Voltage resistors below. There is still a marked improvement in the sound, but the limiting factor becomes the resolution of the resistors. With the new capacitors bass performance is improved as well as the price being reduced.	$300.00		$300.00
	Total cost of Major Upgrade only	**$500.00**	**$245.00**	**$745.00**
	Total of Basic and Major Upgrade of these amplifiers	**$743.00**	**$545.00**	**$1,288.00**

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SUMMARY OF UPGRADES AVAILABLE FOR ACOUSTAT SERVOAMPLIFERS
AS OF AUGUST 1, 2006

Description of Parts and Service	Reason for upgrade and improvement imparted	Cost Per Pair of Amplifiers* Parts	Labor	Total
	THE ULTIMATE SERVOAMPLIFIER UPGRADES			
	ULTIMATE SERVOAMPLIFIER UPGRADES-AUDIO SECTION			
Custom built Polypropylene capacitors to replace all the capacitors in the low voltage audio circuit.	In factory stock amplifiers you see nearly every conceivable capacitor type, included the dreaded ceramics, the worst audio capacitors. For example, the very last component in the low voltage signal path before the tubes is most often a 220pf ceramic capacitor. There are five 220pf caps, all ceramic, in the signal path. Replacing these in an otherwise completely upgraded pair of amps results in bass that is huge, deeeeep and thunderous. Voices become clear, no straining to understand lyrics, and liquid. Soundstage takes another step towards you. The closest analogy I can give you is the typical hallmark of a great audio system is that the musicians appear to be in the room with you. Well in this case, you are in the room with them instead, not a subtle difference. We are offering a complete set of custom capacitors to replace all of the capacitors in the low voltage signal path. There are 32 capacitors to be replaced in a pair of amplifiers. This is not a job for the inexperienced or faint hearted, rivaled in difficulty only by the 66 low voltage resistors. These parts will only be sold as a complete kit.	$240.00	$112.00	$352.00
Replacement of all of the critical low voltage resistors (33 per amp) with Ultra High Grade Parts, Caddock TF020's or MK-132's. These are expensive but worth it. The labor involved is daunting and some of the solder work required is challenging to be kind about it, thus the high labor cost to install all 66 of them. If you want to upgrade these amps to sound their best, replacing the original resistors is required.	This is the most expensive, and most overlooked upgrade. All of the resistors supplied with the later amps are 1% radio shack quality metal film resistors. Even so, these were ahead of their time in 1978, no one else used 1% resistors. We have never pushed this upgrade hard because of the cost, but with the two newest upgrades, replacing the original resistors is now critical. These allow for the final pristine detail everyone expects, but rarely achieve, from an electrostatic speaker. It is like looking out of the window into a light mist and then having the sun break through. You know what a summer day is like after a cleansing rain, this is it audio style. Even with the mist the amplifiers are great, with these resistors in place, the mist is gone and the sound is unparalleled. The affect of this is more pronounced than ever with the revisions to the high voltage section. If your amp has the early 5% (gold banded) carbon firm resistors this upgrade is an absolute MUST. These resistors will not be sold individually, only as a complete kit.	$257.00	$220.00	$477.00
Replacement of all of the HV resistors (22 total) with High Precision Caddock 1% High Voltage Resistors.	The effect of this change is to further smooth out all frequencies, results in a marked increase in the transparency of the signal, but most of all they result in a more "off the panel" effect. The image drops away from the panels with a commensurate increase in the soundstage. Turn out the lights and the speakers cease as an apparent source of music. These are expensive but worth it. These will not be sold individually, but only as a complete kit.	$337.00	$90.00	$427.00
Custom built Polypropylene High Voltage output coupling capacitors.	We are having some custom output coupling capacitors made for us by one of the premier audio capacitor manufacturers. They are a major improvement over any of the caps supplied by Acoustat including the polypropylene caps Acoustat made available for a short time. These caps continue to flesh out voices, particularly female voices, and further the improvement in soundstaging brought on by the upgraded high voltage resistors. In combination with the high voltage resistor updates, these allow the amplifiers/speakers to play significantly louder before breaking up. Additionally we having special leads made up for these that will allow for the bypassing of two additional solder joints and the lead from the pcb to the output socket. These are large and have to be placed in a slighly different location for best cooling and to allow the chassis cage to function as normal. At $37.50@ these represent probably the biggest bargin of all of the Ultimate upgrades.	$150.00	$70.00	$220.00

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AS OF AUGUST 1, 2006

Description of Parts and Service	Reason for upgrade and improvement imparted	Cost Per Pair of Amplifiers* Parts	Labor	Total
Polypropylene 10mf capacitors in the output stage.	Along with the new output coupling capacitors we can provide the same quality parts to replace the 10uf 450vt caps in the output section of the amplifier. These are of the same as the output coupling capacitors and since two of them are in the signal path, they have a significant impact on the sound of the amps. Two of these capacitors are in the output signal path and one is related to the 150vt power supply for V2 and V4. Overall the image is improved with shaper delineation of instruments within the sound stage, there is an obvious reduction in the noise floor resulting in yet a "darker" background, and the ability of the amplifier to sound at ease as well resolve instruments and music under demanding conditions is improved.	$216.00	$75.00	$291.00
	Total cost of Ultimate Upgrade-Audio Section	**$1,200.00**	**$567.00**	**$1,767.00**
	Total of Basic, Major and Ultimate Audio Section Upgrades of these amplifiers	**$1,943.00**	**$1,112.00**	**$3,055.00**

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AS OF AUGUST 1, 2006

Description of Parts and Service	Reason for upgrade and improvement imparted	Cost Per Pair of Amplifiers* Parts	Labor	Total
	ULTIMATE SERVOAMPLIFIER UPGRADES-HIGH VOLTAGE POWER SUPPLY			
NEW, Replacement of the 1uf 3kv High Voltage Power Supply capacitors and provide bypass capacitors.	The foundation of these amplifiers is the 5kv high voltage power supply for the tubes and to bias the diaphram. We are beginning to see these capacitors short out due to age which brought us to our next logical step. We asked Audience to build a replacement for the four factory 1uf 3kv can capacitors. This turned out to be the biggest challenge we had presented to them yet. The results were beyond our wildest hopes. These capacitors gave the amplifiers what I call "scare factor" beyond anything I have heard to date. The amplifiers get quieter, with transients that explode out of nowhere. These bring a new definition to bass from an electrostatic speaker which is what you will first notice. Soon it becomes apparent that this same affect is happening across the entire frequency spectrum. We also had them build .01uf 3kv bypass capacitors for these which further expand the soundstage and present the instruments each unto themselves. The ultimate result is the music gets more involving with a sense of pace that I never felt was missing, but it was.	$230.00	$90.00	$320.00
NEW, Replacement of the High Voltage Power Supply Rectifiers.	The high voltage diodes which are part of the power supply have proven to be weak over time and subject to failure when there is a voltage spike in the AC line. We have found a new soft recovery controlled avalanche (less spikes during transients) rectifier that has a significantly higher voltage, 7.5kv, and current limits, up to 20amps for spikes and 5amps repetitive peaks. Compare those specs to the 7kv 350 milliamps for the stock parts and you see the increased margin of safety. There are sonic benefits, but the point here is to increase the reliability of these amps. Most people have suggested just using diodes intended for kitchen microwave ovens, but they are noisy and at least as expensive. We suggest these (2 per amplifier, for a total of 4) be replaced as preventive maintenance, but feel that they are much more critical when doing the high voltage capacitor upgrade. There is no labor charge for installation when done with 1uf 3kv capacitor or the HV Transformer upgrade.	$75.00	$ -	$75.00
REVISED, New 1963vt HV Transformers	The original HV EI transformer was subject to a few problems, most notably hum and eventual failure. This is a function of what they have to do, it is a tough job. It was sized for a specific footprint.We contracted with the manufacturer to build larger versions for us. While only 1/4" wider, it allowed for more steel, heavier gauge copper wire and more insulation. During this changeover it was found that one of the sources of the failure problems that had plagued these transformers was that the original design called for Kraft paper as insulatation. This material harkens back to 1920's technology and serves well but is somewhat fragile. Current technology is to use Nomex, which while more expensive is slightly thinner and has a higher insulation value. At the same time it was decided that the output of the transformer could be safely increased to 1963vt vs the original at 1820v. Not only is the voltage higher, but the transformer can provide more current. By itself or in combination with the new capacitors above, this solidifies the foundation of the sound of these amps. While this upgrade is listed in the Ultimate Upgrade section, it can be done at any time and still get a significant benefit in bass power and speed of dynamics at all frequencies. Installation requires some modification to the mounting ears on the new transformer, but otherwise it is a direct replacement. Installation of these transformers also requires installing the new high voltage diodes above.	$430.00	$ 90.00	$520.00
	The charges for the Ultimate Upgrades-High Voltage Power Supply only.	**$735.00**	**$180.00**	**$915.00**
	Total of Basic, Major and Ultimate Upgrades of these amplifiers	**$2,678.00**	**$1,292.00**	**$3,970.00**

ANALOGUE ASSOCIATES, LLC
SUMMARY OF UPGRADES AVAILABLE FOR ACOUSTAT SERVOAMPLIFERS
AS OF AUGUST 1, 2006

Description of Parts and Service	Reason for upgrade and improvement imparted	Cost Per Pair of Amplifiers* Parts	Labor	Total
	THE GOD MODS			
	Note: Both of these two upgrades include all of the parts in the Ultimate Upgrade-High Voltage Section.			
NEW, DOUBLE HV TRANSFORMERS IN A FULL WAVE RECTIFIER CONFIGURATION- To date we have only done this upgrade on fully modded amps, but I have no doubt that it should be one of the first upgrades anyone who is serious about wanting these amps to sound right should do.	While I doubt this will be the last modification for these amplifiers, it is fundamentally the most important. This modification involves installing a second High Voltage transformer and a Full Wave Rectifier circuit to bring them together. (If you would like an explanation of a Full Wave Rectifier, try http://www.allaboutcircuits.com/vol_3/chpt_3/4.html). I could try to tell you the difference in the sound of the Servo-Amplifier but I run out of superlatives. The first thing you will notice is that you thought you had bass before; but you really didn't until now, not just more but better, more articulate. You thought you had imagining before, but you didn't, think surround sound. You thought you had quiet before, but you didn't. You thought you had music before, but you do now. The change in the sound of the amplifier is like nothing I had heard before.			
NEW, GOD MOD (1), The Best, but Most Expensive	We provide 4 new Upgraded HV transformers 1963vt output, 8 new HV diodes, 4-1.0uf 3kv Auricap capacitors with .01 bypass capacitors and install them in a neat package on the amplifiers. We will help with the cost by allowing you $60@ for each working 380c transformer that are on the amps. So if you have 2 good ones, subtract $120. This offer will hold as long as we have need for the transformers to allow us to do GOD MOD (2) upgrades below. The agreement to buy the functional 380c transformers will be made at the time the upgrade is ordered and is subject to Analogue Associates, LLC requirements at that time. Add $150 if this upgrade is not done with any other category of upgrade.	$1,240.00	$225.00	$1,465.00
	Total of Basic, Major, Ultimate and GOD MOD (1) Upgrades of these amplifiers	**$3,183.00**	**$1,337.00**	**$4,520.00**
NEW, GOD MOD (2), The cost effective way to get there.	If you have 2 functional 380c HV transformers, given availability, we provide 2 used, but tested 380c high voltage transformers, 8 new HV diodes, 4 1.0uf 3kv Auricap capacitors with .01 bypass capacitors and install them in a neat package on the amplifiers. This offer will hold as long as we have the transformers to allow us to do GOD MOD (2). The agreement to do this mod will be made at the time the upgrade is ordered and is dependent upon availability of appropriate transformers. Add $150 if this is not done with any other category of upgrade	$675.00	$225.00	$900.00
	Total of Basic, Major, Ultimate and GOD MOD (2) Upgrades of these amplifiers	**$2,618.00**	**$1,337.00**	**$3,955.00**

NOTE: All of these prices are based upon beginning work on a functioning pair of amplifiers that have not received extensive modifications, are in effect stock with few minor changes, and do not include shipping. We reserve the right to reject any amplifier for upgrade that is so modified that it requires extensive work to restore to original working condition. Any amplifier with prior modifications should be described in as much detail as possible or pictures sent to allow for visual inspection prior to acceptance to avoid being returned at the owners expense. This is to protect both you and us from beginning something that we may not be able to complete to our mutual satisfaction. *All Prices are subject to change without notice.

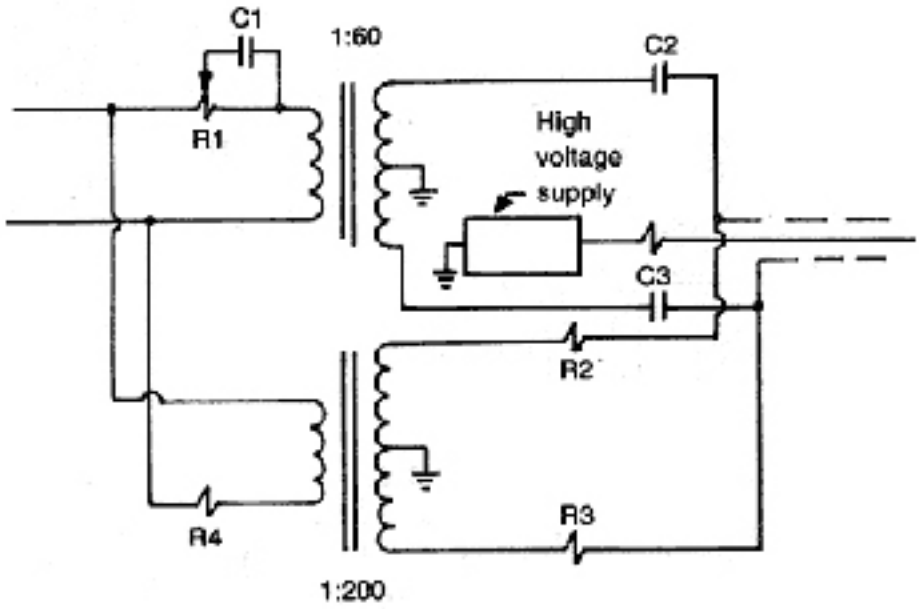
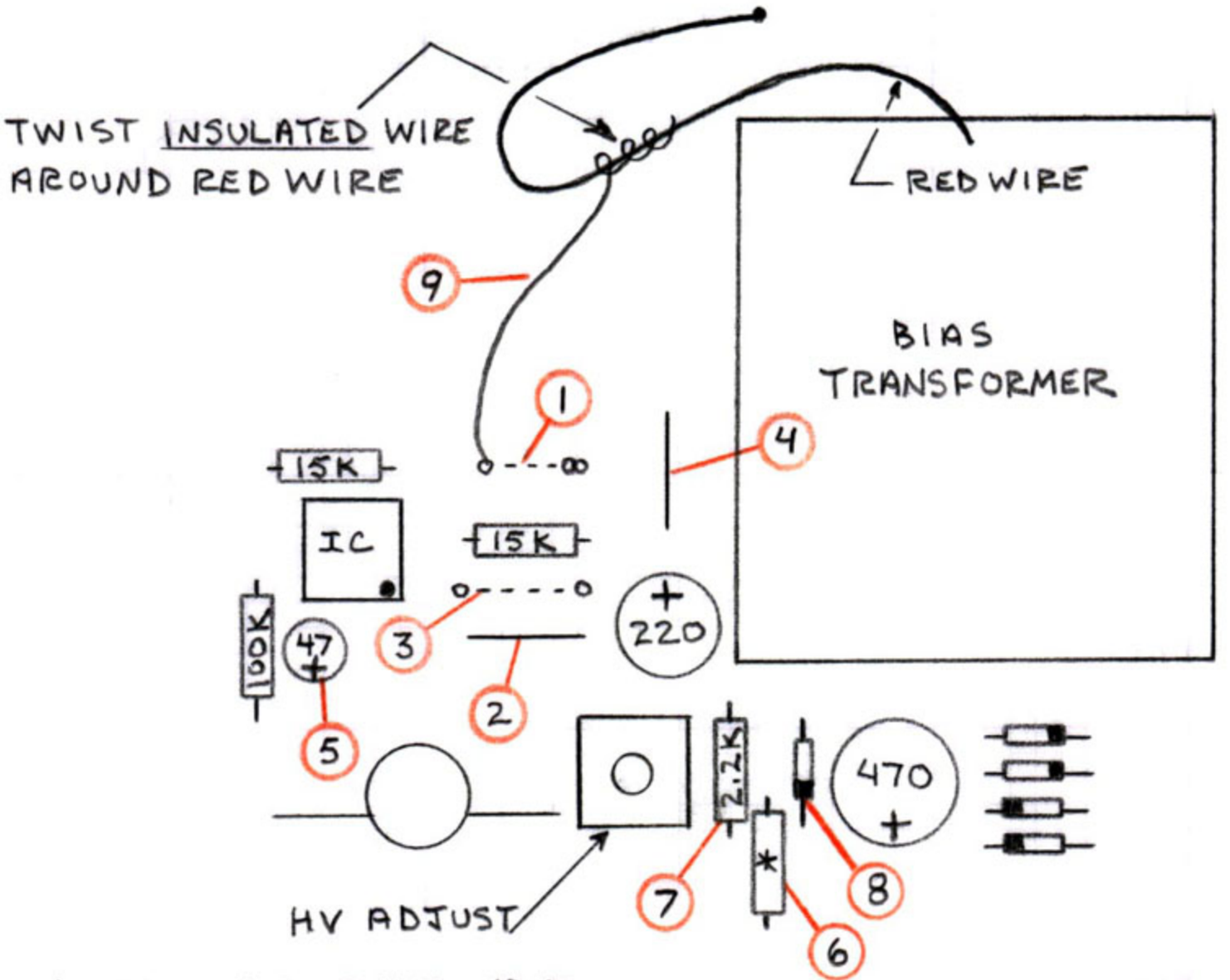


Diagram of the Accoustat frequency selective transformer circuit



* 100Ω FOR 12 VAC INPUT
470Ω FOR 15 VAC INPUT

ACOUSTAT

BIAS SUPPLY MODIFICATION

LAYOUT SHOWN FOR SPECTRA 11 & 1100
OTHER MODELS SIMILAR

AJS JUNE 2003

THE TECHNOLOGY OF FULL-RANGE-ELEMENT ELECTROSTATIC LOUDSPEAKERS

by James C. Strickland, President of ACOUSTAT CORPORATION

The fundamental goal of designing a loudspeaker system must be to reverse the process of the recording microphones as exactly as possible. For more than 25 years, the standard of the recording industry has been the condenser (electrostatic) microphone, which consists of a full-range-element of extremely low mass, intimately driven *acoustically* over the entire surface of the diaphragm. To reverse this exactly, one would need a loudspeaker with a full-range-element, also of extremely low mass, and driven *electrically* over the entire surface of the diaphragm – only then can the original waveform be duplicated. The above is an exact description of the electrostatic type speaker. It is interesting to note that as a mechanism for reversing the role of the microphone, a cone system is inherently wrong, in that: 1) It splits the musical spectrum with crossovers, i.e., it is not capable of full-range-element design, 2) It has high mass (comparatively), and 3) It does not intimately drive the diaphragm surface at all points of radiation.

Although the electrostatic loudspeaker element has long been known as the only transducer capable of maintaining the integrity of the signal generated from the condenser (electrostatic) microphone, the implementation of electrostatic loudspeaker systems has been far slower than that of the condenser microphone. As discussed below, this was due to many design difficulties associated with the much higher power and voltage in a speaker, as compared to those in the electrostatic microphone.

THE ELECTROSTATIC ELEMENTS

The electrostatic panel consists basically of a very thin mylar diaphragm, which is coated with a conductive and sandwiched between two electrodes. These electrodes can be either perforated conductive plates, or wires. (Further discussion of these two types of construction is presented later in this paper.) It is important to note that these electrodes do not physically touch the diaphragm, but are positioned a small distance away on both sides. This is one of the most important differences between the electrostatic and the cone type or planar-magnetic type of loudspeaker elements, and is the reason for much of the electrostatic's superiority. That is, the electrostatic element must move only the thin diaphragm – not the diaphragm plus wires, voice coils, etc.

The audio signal is applied to the electrodes and in turn an electric field is created around the diaphragm. This field acts on the thin (.00065 inches thick) mylar diaphragm with a push-pull force causing the diaphragm to vibrate. As you can see, the electrostatic does not depend on the mechanical motion of voice coils or wires, but instead uses an ultra-low-mass diaphragm set into motion by an instantaneous electric field. Therefore, the *entire* diaphragm is driven by the audio signal, not just one small area of the diaphragm, as is the case with other types of loudspeaker elements. This enables the audio signal applied to the electrostatic element to have several million times more intimate control over the diaphragm (and therefore air motion) than a good cone system, and several hundred thousand times more than the planar-magnetic type element.

It should be obvious that the electrostatic element, due to the physics of its design, can have the best transient response, the lowest distortion, and the widest frequency response of all the types of loudspeaker elements.

A BRIEF HISTORY OF ELECTROSTATIC LOUDSPEAKERS

Because of their low mass and excellent transient behavior, electrostatic loudspeakers first appeared as tweeters. It was assumed initially that their smaller excursion would limit their ability as bass reproducers, yet it turns out that this is not the case. The large radiating area associated with the electrostatic element permits a far better acoustic impedance match than does the much smaller area provided by even a *fifteen* inch woofer. Thus large excursions are not necessary for robust bass if sufficient moving surface is present.

It is also true that early attempts at full-range electrostatic loudspeakers did not utilize full-range-elements. They followed past cone speaker practice and employed separate electrostatic woofers, midranges, and tweeters. These designs revealed some of the merits inherent to electrostatics, but failed to utilize the greatest single advantage of the electrostatic principle – that

the elements can superbly cover the *entire* audio range without crossovers. All Acoustat speakers are, and have always been, crossoverless full-range-element designs.

In terms of construction, most of the early electrostatic loudspeakers used the coated, perforated conductive electrode approach to panel design. This is a logical approach since the use of such plates is in keeping with the wording of all the electrostatic theories. The principle difficulty, however, is that the perforated plates will develop charge concentrations in the most difficult areas to uniformly coat with an insulating material – with the effect of too much insulation where it is least needed and too little insulation where it is most needed, i.e., at the sharp corners of the holes in the perforated conductive plate. The results of this method of construction have been unreliability of the electrostatic element, typically in the form of arcing and actually melting the thin mylar diaphragm.

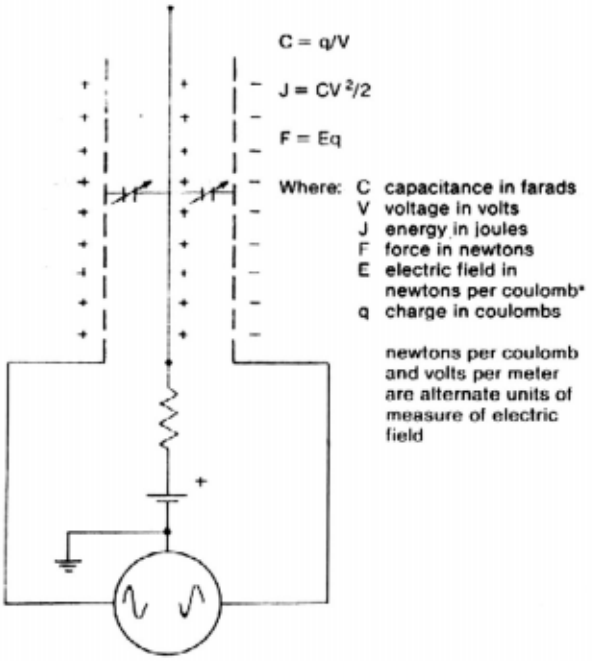
Several methods have been used to provide necessary dielectric integrity. Michael Wright used an insulating gas to prevent electrical breakdown. Harold Beveridge created an epoxy matrix panel design. But, in 1953 the most practical new idea for creating a reliable electrostatic element was patented by Arthur Janszen – The Sheathed Conductor panel design. Although difficult to construct on a large scale, the sheathed conductor panel design opened the door for a new era of dielectric integrity. The sheathed conductor construction was used in several early Janszen designs including the Janszen and RTR tweeters.

About 1963, James Strickland became involved in a project to adapt the Janszen principle to a larger scale, using the cube-louver structure later refined at Acoustat. This pioneering work led to the first truly full-range electrostatic elements, which were not only dependable, but virtually indestructible – The Acoustat full-range electrostatic panels.

HOW IT WORKS, THE CONSTANT-CHARGE CONCEPT

While not nearly as old as the concept of the electrostatic loudspeaker, the idea of a constant-charge electrostat is far from new. Well over twenty years ago, electrostatic loudspeaker theoreticians including Frederick V. Hunt, Arthur Janszen, Peter Walker, Michael Wright, and others, had seen the unique advantages in an electrostatic transducer concept in which a diaphragm is kept at an essentially constant charge and placed within a spatially uniform electric field, varying with the audio, created by opposing plates driven push-pull, as shown in figure 1.

FIGURE 1 Physics of a Constant Charge ESL



It should be noted that constant-charge does not mean constant-voltage. Constant-charge means that the number of excess electrons (or the number of "holes" in the case of a positively biased diaphragm) remains virtually constant despite the changes in the relative potential of the driving plates and in the proximity of the diaphragm relative to the plates. Thus, it is necessary for the voltage of the diaphragm to float according to the audio driving voltages and the position of the diaphragm with respect to the two plates. When the constant-charge principle is applied, the second order (square-law) non-linearities drop out of the force equations. This permits the electrostatic loudspeaker to maintain very low levels of distortion throughout the entire excursion-space of the diaphragm. This advantage is impossible to duplicate in a magnetic driver.

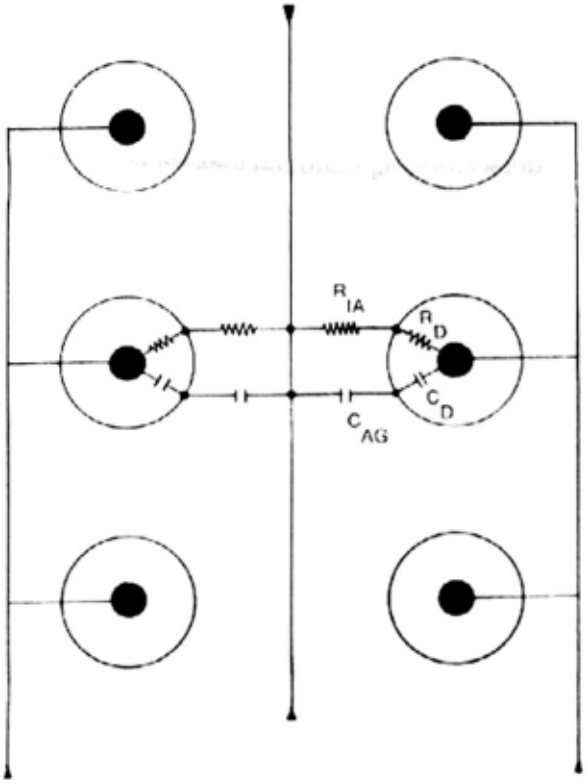
CONSTRUCTING A FULL-RANGE ELECTROSTATIC PANEL WITH REAL WORLD MATERIALS

The electrical characteristics, such as operating voltages and climatic variations, are largely determined by the ionization characteristics of air and by the properties of the insulating material used on the electrostatic plates; whether they are perforated plates or sheathed conductors. Acoustat's early work with sheathed conductor

electrostats was done with polyethelene insulated wire affixed to the cube-louver structure. With a polarizing potential of ten to fifteen thousand volts, these polyethelene insulated panels yielded high sound pressure levels – in the damp south Florida climate. But, the panels were not consistent in all climatic conditions. After further research and experimentation, plus a careful restudy of Arthur Janszen's patent, the problem became obvious. While the use of good insulation, such as polyethelene, had seemed logical, polyethelene was in reality too good an insulator – in fact, about a thousand times too good.

A return to Janszen's prescription of polyvinylchloride (PVC) insulated wire allowed more reasonable voltages and also overcame the climatic variability. The reason for this can be seen in figure 2 – which is a cross sectional view of an operating real world electrostatic panel.

FIGURE 2 A Sheathed Conductor Electrostatic Viewed Into the Axes of the Wires



R_{IA} resistance of ionized air

C_{AG} capacitance of air gap

R_D resistance of dialectric

C_D capacitance of dialectic

Air typically shows low level ionization when exposed to an electrical potential gradient of about one thousand volts per millimeter. Since Acoustat uses a wire-to-diaphragm spacing of about 2.5 millimeters, with a diaphragm bias of about five thousand volts fed through five hundred megohms, it can be seen in the static (no audio) condition, the DC potential drop between the diaphragm and the surface of the sheathed conductors will be approximately twenty-five hundred volts. Thus, nearly all the remaining potential drop will occur in the insulation of the sheathed conductor – which may be viewed as a ballast resistor to bring the air gap between the sheathed conductors and the diaphragm to a proper value for the best operation of the system. Too low an insulation resistance results in noisy operation, while too high an insulation resistance results in reduced operating level.

Probably the greatest advantage of the sheathed conductor technique is the high reliability and dielectric integrity which can be provided by a manufacturer of mil-spec PVC insulated wire. These wire grades have shown virtually unlimited life once they have passed the manufacturer's rigorous voltage breakdown testing.

Thus, while sheathed conductor panels are difficult to build, they are totally reliable, as shown by the tens of thousands put into use by Acoustat over the last six years, without a single known over-driving failure.

INTERFACING, THE RIGHT QUESTION AND THE RIGHT ANSWER

In the spring of 1980, Acoustat perfected the Magne-Kinetic Interface (patent pending), a new approach to matching a crossoverless electrostatic to conventional power amplifiers. This solution is rapidly becoming appreciated as the only truly practical solution to the extremely difficult problem of driving a full-range-element electrostatic loudspeaker with conventional amplifiers.

We have been asked many times since the introduction of the MK-121 Interface, "Why didn't you do this before?" The best answer to this question comes from a realization of just how complex the electrostatic transducer's load characteristics look to the output of the interface.

Two separate characteristic curves present themselves, which define the drive problem. A full-range electrostatic array has an impedance which is almost totally capacitive, and this impedance falls by almost a thousand-to-one ratio over the audio band. Such an array also has an associated

voltage-sensitivity curve which is far less radical, only about a three-to-one (10 dB) total range. Unfortunately for the interface designer, these curves track *somewhat* in the lower half of the spectrum, and are *opposite* in the upper half of the audio spectrum.

From the above it can be concluded that the pursuit of a single "ideal" step-up transformer is an endeavor doomed from the outset. The problem is not just that the answer is impossible, but that the question is wrong! Focusing on this wrong question has no doubt retarded the pace of electrostatic development. The proper question pursues a simultaneous solution to the impedance match and the voltage match problem and leaves the solution open to invention.

Asking the right question made the MK-121 possible. Making it a reality required an intensive study of transformer and electrical network properties. Out of this study came the conclusion that a two-transformer, band-overlap configuration had the theoretical possibility of yielding a simultaneous solution to the problems of impedance and voltage matching. Even the very first prototype units showed us that this was, without question, the right approach.

THE MK-121, HOW IT WORKS

The MK-121 has solved a problem which designers have been grappling with for at least twenty-five years. Two physically and electrically different push-pull transformers and a few passive parts allow the circuit to operate in a quasi-parallel, band-overlapped manner, effectively sharing the drive problems of impedance and voltage matching. The overlap is more than one-third of the audio band, virtually the entire critical midrange region. This overlap has a median frequency of about 1500 Hz, as shown in figure 3.

FIGURE 3 Transformer Overlap of MK-121

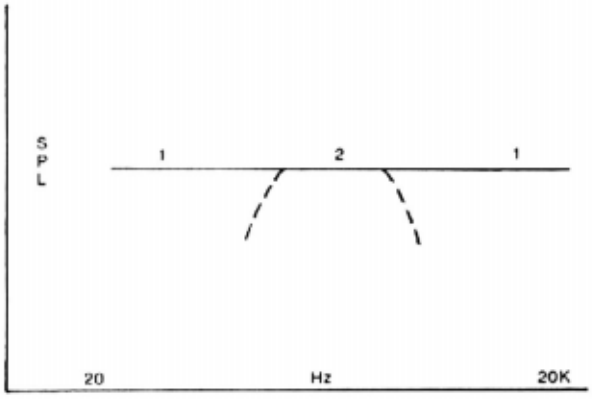


Figure 4 is a simplified schematic of the MK-121 Interface and bias supply. Out of this simple but sophisticated circuit come several essential advantages:

1) The secondary impedance of the smaller (high-frequency dominant) transformer is only about 1½% of the larger unit.
2) Any residual electrical resonance can be pushed to the top extreme of the audio band – just as the mechanical resonance is located in state-of-the-art condenser (electrostatic) microphones. Gone is the plague of mid-band resonance found in single transformer designs.
3) The passive components which connect the signal to the elements have a serendipidous effect not immediately expected. This effect is a magnetic analogy to bi-amping. Difficult low frequency and infrasonic signals do not get a chance to intermodulate the purity of upper-band pass-through. The net result is startlingly useful – the MK-121 will drive the elements with far less distortion on difficult dynamic material than could any collection of transformers alone, or even a direct-drive amplifier!
4) The efficiency is much better than any single transformer design could yield, making the drive situation quite reasonable for quality amplifiers.
5) The vastly improved impedance match allows sonic superiority beyond that previously achieved by Acoustat, or others.

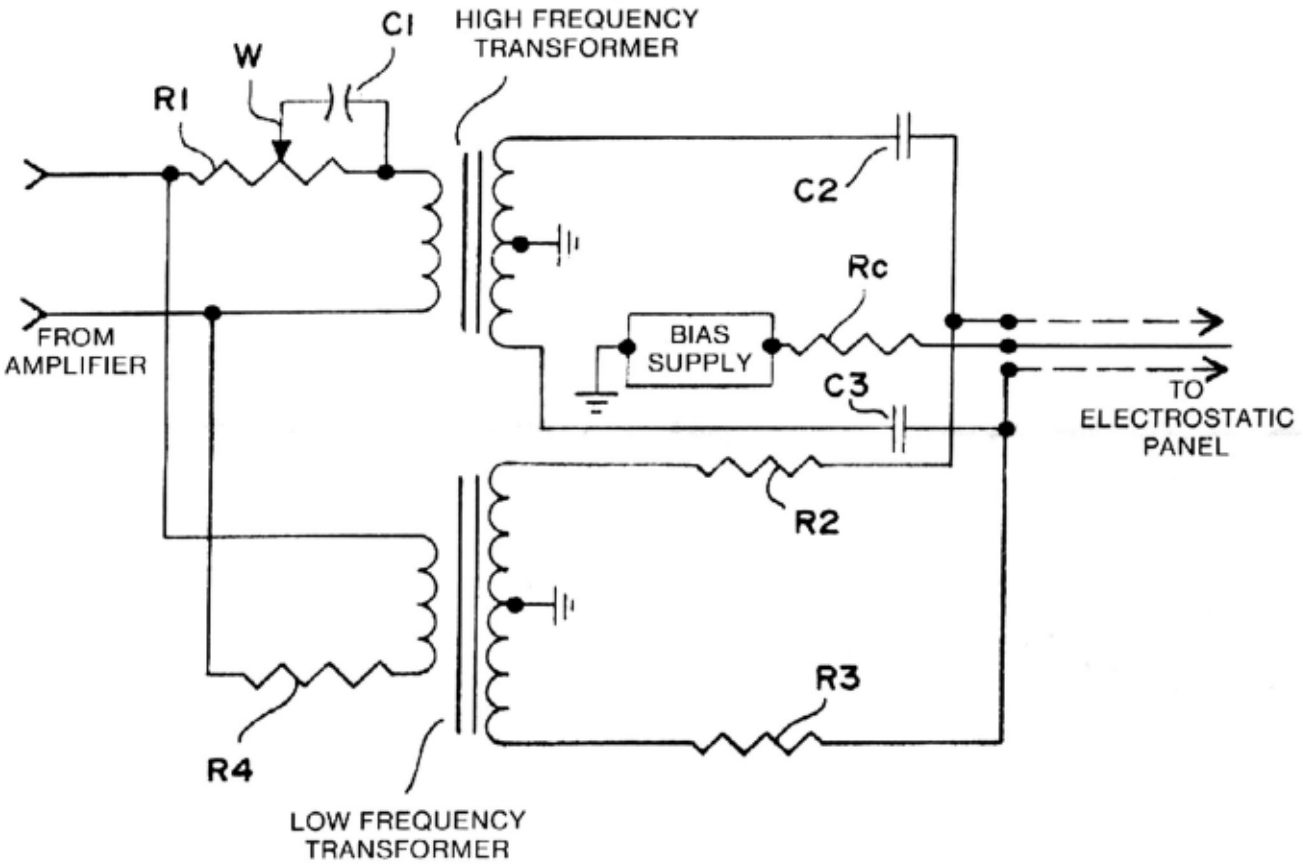
POWER AMPLIFIER REQUIREMENTS

As sophisticated and efficient as the coupling is by this method, an Acoustat loudspeaker still demands a quality amplifier, preferably in the one hundred watt per-channel range minimum for the two panel model, and scaling down to fifty watts per-channel minimum for the larger and hence more efficient four panel speakers. This power level requirement is a reflection of the fact that to have the unique merits of direct electrical action in an electric field, we must charge and discharge the capacitance which must come with that electric field. Thus, higher power levels than might be expected from the high acoustic efficiency of the transducer are needed for proper charge/discharge rate and control. It is also not unusual for the amplifier to run warmer into an electrostatic load. This is because there are few losses in the interface and elements, hence the amplifier actually re-absorbs much of the power it generated one-quarter cycle earlier. Electrostatic elements actually run ice-cold.

CONCLUSION

Asking the right question and inventing the right answer has opened a whole new era for the crossoverless full-range electrostatic loudspeaker. Acoustat's speaker systems are now even more outstanding in performance, cost less, and can be offered in a smaller, more manageable size.

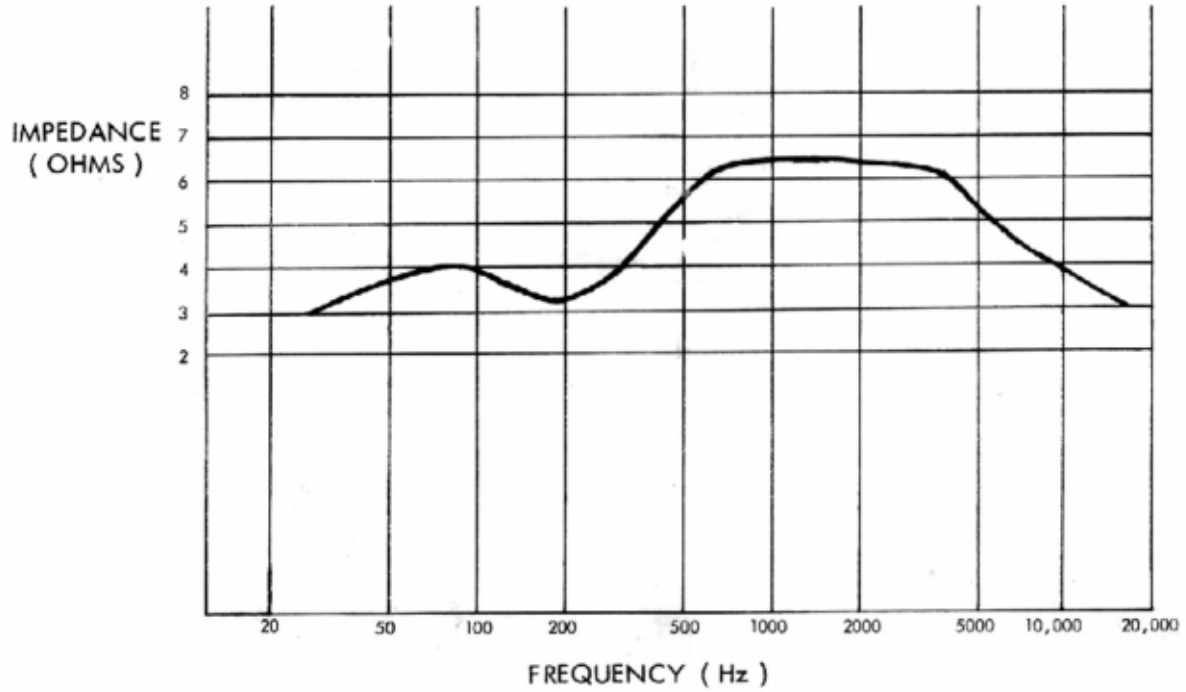
FIGURE 4 Simplified Schematic of Magne-Kinetic Interface and Bias Supply.**



**PATENT PENDING

The band-overlap operation of the MK-121 can be understood from an inspection of its schematic. The low-frequency transformer is optimized from the bottom of the spectrum, working as full range toward the top as possible, whereas the high-frequency transformer is optimized for the top of the spectrum going as full range as possible toward the lower end. Two resistors, R1 and R2, and two capacitors, C2 and C3, gradually transition the loudspeaker load from one drive impedance level to the other. It is this technique that makes the excellent impedance and power match possible between the widely varying speaker impedance and a conventional amplifier. R1 and C1 control the source impedance feeding the high-frequency transformer, and act as a high-frequency balance control. R4 is a saturation limit for the low-frequency transformer so that high infrasonic currents will not generate destructive potentials.

FIGURE 5 IMPEDANCE CURVE OF ACOUSTAT MK-121 LOUDSPEAKER SYSTEMS
(MEASUREMENTS MADE ON ACOUSTAT VECTOR-IMPEDANCE METER)

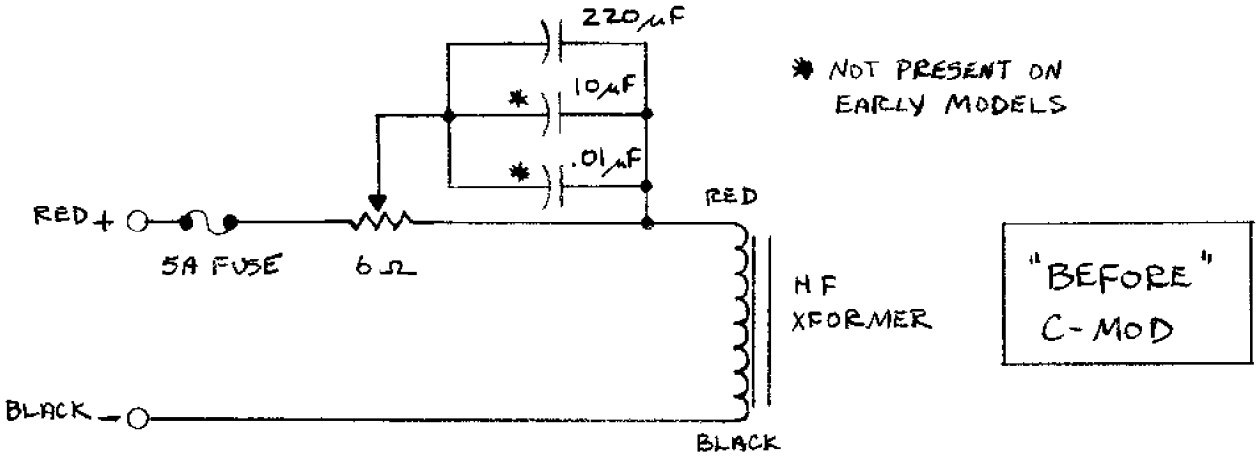


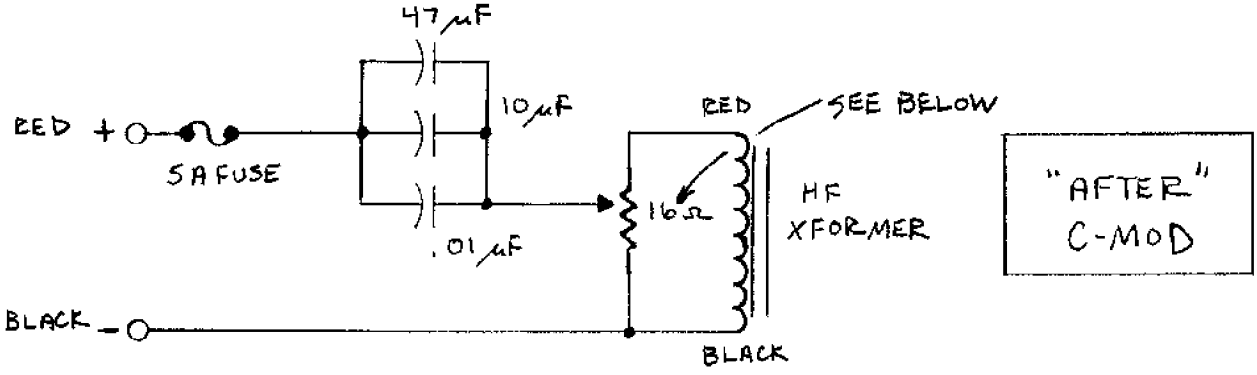
High-Frequency Control at Two o'clock Position
Maximum Phase Angle : ± 30 degrees

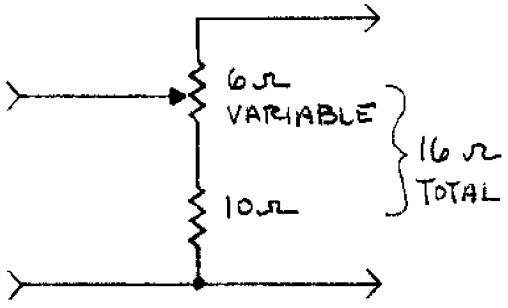
ACOUSTAT
corporation

3101 Southwest First Terrace, Fort Lauderdale, Florida 33315

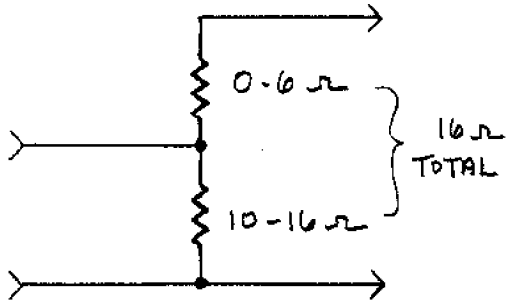
Phone: 305/462-6700



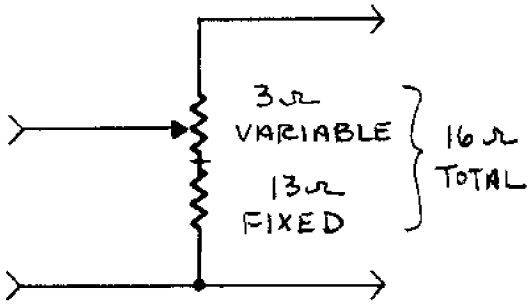




USING ORIGINAL 6Ω VARIABLE



USING FIXED RESISTORS



FACTORY MODIFIED

AJS 6-03-2003

Dear Acoustat Owner:

Thank you for participating in The Medallion Series Transformer Modification Program. We have received your questionnaire and have reserved technician time for converting your interfaces.

WHEN TO SEND: scheduled time for modifying your interfaces is during the week of … Please allow enough shipping time so that your interfaces arrive promptly. Units returned late may "lose their place" in time.

HOW TO SEND: Your interfaces should be packed in their original shipping carton(s) if possible. We strongly recarmend that you pack them with the side panels, in order to minimize the possibility of damage during shipping. If you do not have the original shipping carton (s) '. you can go to your local office supply store and purchase a suitable carton for shipping. Please refer to the enclosed illustration, which describes a means of bolting your interfaces together to minimize the risk of damage if you will not be using the original packing material. We have provided four nuts to use in this application. When you have finished packing your interfaces, please attach the enclosed return authorization labels to the outside of the box(s) and ship your interfaces UPS insured ($850. for MK-121's, $650. for MK-131"s) .to the factory.

MEI'HOD OF PAYMENT: Please include with your interfaces, a cashier's check or money order for the following amount:

$300. for MK-121's (full range speakers)
$225 for MK-131's (woofered speakers)

Personal checks will be accepted, however, we must wait for them to clear before we can return your interfaces, and will therefore delay the modification process.

REI'URN SHIPMENTS: Modified interfaces will be returned freight collect to you in the week following the modification. Modified units can be identified by a small placard on the back of each interface, which says "Acoustat Medallion Transformers" .

We appreciate your careful attention to the above instructions. This will assure you of prompt turn around of your interfaces and a minimum of hassles. Thank you for your cooperation.

Acoustat
a DIV of **the davld hafter company**

8/19/85

ACOUSTAT

div. of the david hafler company

A MESSAGE FOR ACOUSTAT OWNERS:

THE ACOUSTAT MEDALLION TRANSFORMER MODIFICATION PROGRAM

Acoustat proudly announces a major breakthrough in the sonic performance of its Magne-Kinetic drive electrostatic speakers. The modification involves the replacement of the audio transformers in the Magne-Kinetic (MK) interfaces—two transformers in each full range (MK-121) interface, and one in each woofered speaker (MK-131) interface (MH&S versions). The new transformers are of a strikingly different and innovative design and accomplish the following desirable sonic results:

- Increased dynamic range without "strain"
- Midrange now has marvelously natural warmth, smoothness, liquidity, and lack of "graininess"
- Low bass is more extended and bass transients much tighter and more controlled
- Highs are far more extended with improved transient response
- Greatly improved imaging and depth retrieval

We have offered relatively few modifications for our speakers over the years, however all who have heard the new transformers agree that this is the most significant improvement in the company's eight year history. (Most estimate the improvement to be five to ten times that of any prior modification or change). The response of the critics has been extremely enthusiastic.

The incorporation of the new, improved transformer technology into current speaker production will coincide with this announcement.

PRICE: $300.00 per pair of MK-121 dual audio transformer full range interfaces.
$225.00 per pair of MK-131 single audio transformer woofered system interfaces. (Roughly the cost of a moderately priced moving coil cartridge.) Plus UPS shipping both ways.

The modification program will only be done at the Acoustat plant facility (MK Mod Center) — (no kits or field conversions) and will include full testing, check out, and replacement of any marginal components at no extra charge.

Converted interfaces will be identified by a small placard on the back of the interface. Because of the large number of potential conversions, (six to seven thousand pair), we anticipate the program will take six to twelve months. The modification will be done on a "first come, first served" basis.

STEP 1) Get your name on the waiting list by filling out the enclosed questionaire and promptly returning it to the MK Mod Center.

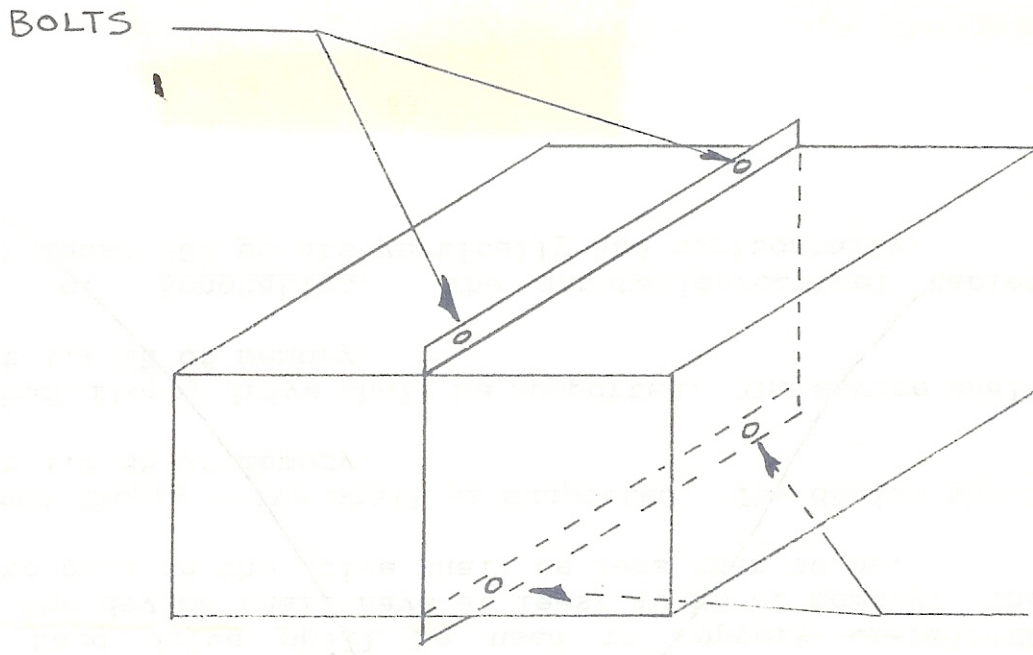
STEP 2) We will notify you approximately one week before the conversion of your MK units is scheduled, and will provide you with address labels with a return authorization code and suggestions for alternative packing methods if you no longer have the original packing materials.

STEP 3) Return your units to us via UPS with payment enclosed. Units not returned during the week scheduled may "lose their place" in the waiting list line.

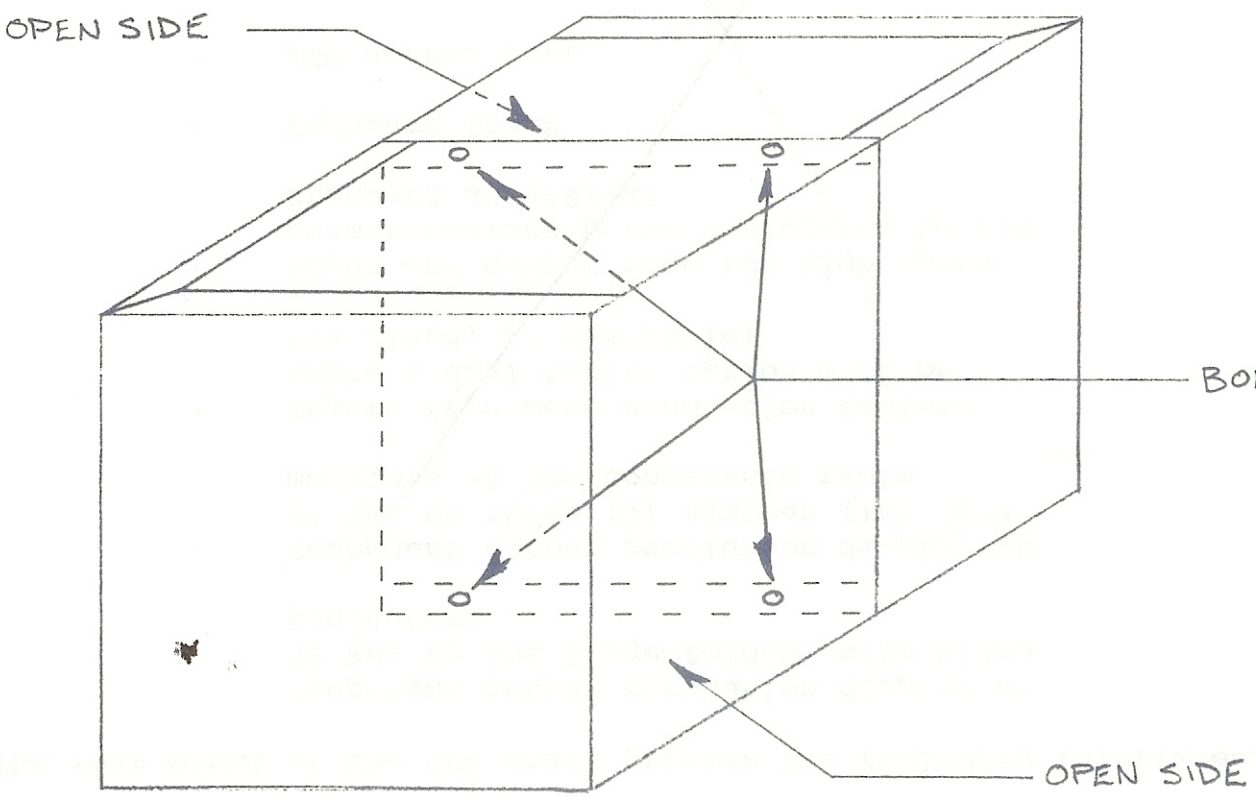
STEP 4) We will complete the conversion and return the units to you UPS (freight collect) in the week following the modification. (Allow 2-3 weeks plus shipping time for the conversion.)

The new transformers are really quite marvelous — so marvelous that we are offering the modification program with a money back guarantee as detailed on the enclosed form.

3101 Southwest First Terrace, Fort Lauderdale, Florida 33315, Phone: 305/462-6700



MK-121
MK-121-2(A)



MK-121-B
MK-131

ACOUSTAT
a div. of the david hafler company

WHAT THE REVIEWERS ARE SAYING
ABOUT THE NEW ACOUSTAT MEDALLION TRANSFORMERS:

Exerpted from Stereophile (vol. 7, no. 7, 1984) :

"Acoustat has come up with a new transformer design for their interface, which radically improves the sound of all their speakers. I had the opportunity to perform before-and-after comparisons using both new and old interfaces on my pair of 1 + 1s. I heard a major improvement in detailing and transparency in the new improved version. They also had far better imaging, at least a doubling of depth information, and a feeling of transient speed that the Acoustats never had before. Add to this a greatly improved ability to reproduce low level dynamics (they no longer have to attain at least moderate volume before sounding neutral), and increased speed in handling high level passages that resulted in an apparent increase of dynamic range. Most of these improvements occur over the entire frequency range. Instead of being a minor refinement, they are a major step forward bringing the Acoustats far closer to the more expensive Stax and Quads in an area where the Acoustats have tended to lag. If you have Acoustats, you need this modification. If you have rejected the sound of the Acoustats in the past, you should listen to them with the new transformers."

"The 1 + 1s are electrostatics with real dynamic life. As good as the Stax and Quads are in other respects, they are not power speakers. Anyone who likes rock, large jazz groups, organ, large-scale orchestra, or opera at live-performance listening levels is going to opt for the Acoustats. The improved interface makes them simply one of the most dynamic speakers around. If you like power with your music and big hall sound, the Acoustats should be just the thing for you."

"The 1 + 1s also have a natural feeling of bass power that usually comes from subwoofers or the best dynamic speakers. Plus, the bass is now faster and tighter than before."

"The Acoustats are strikingly improved in the midrange. They are much more transparent, faster, and cleaner. This seems to be solely the result of the new transformers, and can thus be retrofitted to any existing Acoustat."

"In summary, the net result is a major step forward in the sound quality of the whole Acoustat line, and a truly excellent value."

Exerpted from International Audio Review:

"Of course this breakthrough step up transformer technology is applicable to all Acoustat models, not just the new Model One, and is said to make an even more spectacular sonic improvement in the larger models than we heard in the smallest Model One. Now that Acoustat is rolling again, on better financial footing than ever, they also have a dramatically improved product that sounds much better than ever. These sonic improvements also affect precisely the areas in which Acoustats have been slightly weak. The old midrange was somewhat remote instead of immediate; the new clearer midrange helps this enormously. The old treble extended to the upper treble but then died steeply, giving less speed and airiness than one would hope for from an electrostatic; the new treble is a spectacular improvement in speed and airiness. We've just started to work in our lab with the new interfaces featuring the new technology transformers, so we'll have more comments to add in the future. As with most Acoustat upgrades, the new transformers are retrofittable to your interfaces, thereby protecting your original investment in Acoustats. The factory upgrade is very modest, considering that it includes labor and new transformers, the most expensive part of the interface. $225 per pair for the single transformer subwoofer model interface, and $300 per pair for the dual transformer full range model interface. Be sure to ship only the interfaces, not the whole speaker, to Acoustat (you're paying for the shipping)."

ACOUSTAT

a div. of the david hafler company

the absolute sound.

Volume 10 **Number 37** **Spring 1985**

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The New Acoustat Medallion Modification

So you thought you could just buy a good electrostatic speaker system, and that would be that, right? You thought that you could always improve the sound with a new amp here, or a bit of new cable there — but that with a decent electrostatic, once the basic panel design was up and running, you were absolved of having to think about speaker-tweeking — right?

Wrong. Manufacturers of electrostatics are more aware of their designs' deficiencies than even the reviewer! The wiring, the passive parts, the basic layout, (especially) the transformers themselves can and do cause certain sonic aberrations. To conquer such short-comings is another matter; that takes time, and as far as sales are concerned, time can't stand still. To wit: No one can afford to wait for perfection before selling an otherwise worthy product.

Acoustat has always had an enviable reputation for customer service and for refusing to rest on its laurels — a reputation gained at much expense, with said expense arguable contributing to the irm's financial collapse. (The loss of Acoustat could in fact have been a tragedy for the High End, since Acoustat is among the very few offering a reasonably priced alternative that is truly in the upper echelons of performance; indeed, you have to spend more than $5000 to substantially surpass the Acoustat 1+1, which sells for about $1500.)

That Acoustat is again producing and shipping speakers is already common knowledge, and the full story of the company's rise and fall and rise has been covered elsewhere in this issue. But it's interesting to note that Acoustat has put into effect an improvement for its entire line of speakers — the Medallion Transformer Modification — just before the firm closed its doors last year. In other words, Acoustat embarked upon a relatively major product-improvement effort while, one assumes, knowing full well what troubles lay in store. Talk about dedication!

So now. with David Hafler at the helm and Jim Strickland back to the designer's table, the Medallion transformer is making big news both as a part of the current product line and as a modification being offered to current owners of Acoustat speakers. I must say, however, that recent talk of "incredible" sonic improvements in the latest Acoustats is somewhat overstated. As usual. Nonetheless, the speaker has been improved to a notable degree.

Electrostatic loudspeakers perform their best with transformer-coupled tube amplifiers. Using the correct output taps of a good tube amp insures proper impedance matching of the amplifier-speaker interface, also providing a truly balanced path for the positive and negative signal voltages. (The behavior of output transformer-less designs, such as the Futterman, is different, since the output tubes are operated in a non-push-pull manner: one tube with a floating regulator, the other with its regulator grounded. While the circuit, so it can be argued, is push-pull the actual operation is unbalanced. Moreover, this of configuration requires high amounts of feedback, in contrast to the transformer-coupled tube amp which often uses ten to fifteen decibels of feedback!)

Since the transformer-coupled tube amp can be made more linear, the only non-linearities to be dealt with are residuals: interactive leakage-inductance and capacitive-shunting effects between the windings of the transformer A good low-loss transformer minimizes these effects.

As such, this electrical behavior should not only be attributable to the power amp, but is in fact also a factor in the performance of the transformers in the electrostatic speaker's power supply module. And despite assertions that good transformer design died with the Marantz 9 and the Dynas, the reader can rest assured that, for from being dead, this black art is just now beginning to be understood. There is, after all, a method to the madness.

That Strickland has managed to extract levels of greater performance from the Medallion, using essentially the same circuit, demonstrates again the viability for the resurgence of his speakers, and the inherent superiority of the ESL principle over the dynamic loudspeaker. Remember, electrostatics have existed almost as many decades as the moving coil speakers!

On my own pair of *2+2s*, I've found that the new transformers result in greater resolution and clarity, and an increased sense of focus throughout the frequency range. While the top is indeed cleaner, the extension is not of the order reported in Stereophile (Vol. 7, No. 7); however, the listener may be conned into thinkng it is. This "presence", heretofore lacking in the sound, is thankfully restored. The speaker now reproduces brass and string timbres accurately, with their rasps and edges intact, without rounding off transients as before. Ambient clues are then extracted with superior specifity; the shape of the soundstage and its reflections are decoded, as are the positions of images therein.

Most of all, as with the new breed of amplifiers reviewed in recent issues, the sound-stage is rendered with an illuminated transparency. No distractions or blurring are evident (as we hear with the Stax, where the sides of soundstage defocus — although the sideways extension is stunning).

The bass clarity is further increased, due, I believe, to lower losses and less saturation in the transformer. While the general sound of ths speaker is, in this frequency section, reminiscent of the earlier model, I find a greater coherence has been wrought with the Medallion mod. Cellos and basses are better defined in mass ensembles, the voices of male chorals are leaner and meaner in their delivery, and there is less overall coloration and muddling.

"All right," you ask, "Is it worth it?"

Absolutely.

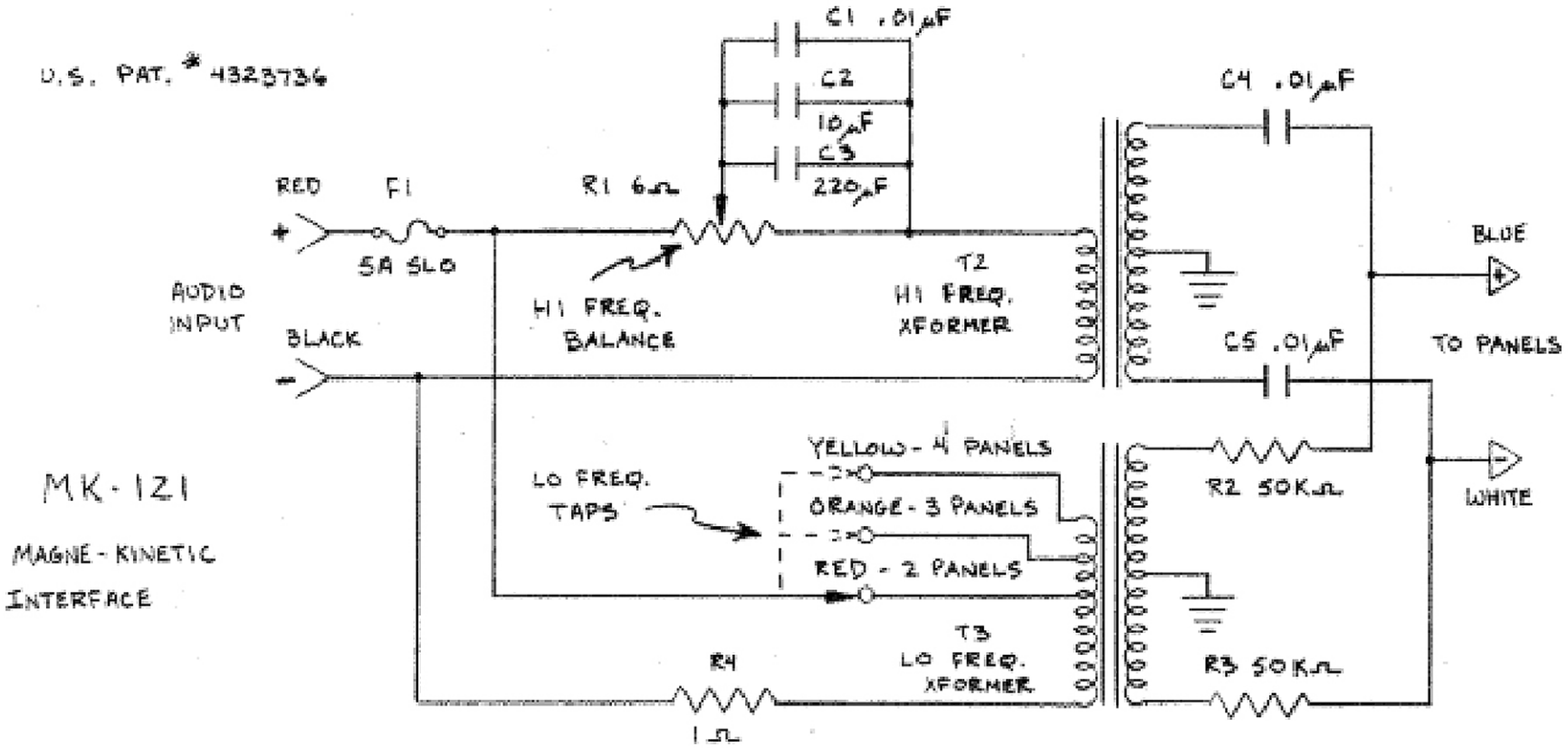
This *$225* to $300 investment (depending on which interface is used — the one- or the two-transformer version) is like adding a much better amplifier to your system. The improvements are not overwhelming, yet all in all, they bring you closer to the music.

The new range of Medallion-interfaced Acoustats are, in fact, new speakers, and doubters should evaluate them again. They may just find the Acoustats irresistible. Remarkable these improvements are not; commendable and significant, they are.

A G B

Manufacturer; Acoustat, 31*01* Southwest First Terrace, Fort Lauderdale, Florida 33315. **(305)** ***462-6700. Designer:*** Jim Strickland. for the single transformer unit. $300 for the dual transformer unit. Source; Reviewer's Purchase. Serial Nos.: 108191. 122383.

U.S. PAT. # 4323736



MK-121

MAGNE-KINETIC INTERFACE

MK-121-2(A) MEDALLION "C" MODIFICATION

The MK-121-2 and MK-121-2A interface is an intermediate enclosure style in the MK-121 series. This interface, a 55 cm x 14 cm x 12.5 cm box, was manufactured for many years, and therefore the user should expect some variations in internal details.

The following modification instructions assume that the user is able to identify electrical components and is fairly competent with a soldering iron. Read through the entire instructions before beginning. Modify only one interface at a time so that the other interface may be used as a reference. Refer to Figure One to help identify parts and wire locations.

1. De-solder all the wires connected to the printed circuit board. Clean up excess solder. Remove the hex-head screw and two thumbscrews and lift out the printed circuit board.

2. Look at the components on the printed circuit board. If there are five high-voltage diodes (small black oblong), no modification to the bias supply is necessary. If there are only two high-voltage diodes, then the bias supply must also be modified. Some interfaces may already have the bias supply modification. These may be identified by a miniature printed circuit board (with five high-voltage diodes) soldered to the main board. NOTE: If the interface needs bias supply modification, perform steps #A-L after performing step #21.

3. De-solder the remaining wire connections (4 places) on the low frequency transformer. This is the largest of the three transformers. Remove the transformer (six screws).

4. Transfer to the new low frequency transformer the four metal mounting clips on the feet and the two threaded metal stand-offs. Make sure to install the hardware in the same

orientation as the original transformer by noting the relative locations of the colored wires.

5. De-solder the remaining wire connections (2 places) on the high frequency transformer. This is the second largest of the three transformers. Remove the transformer (4 screws).

6. Transfer to the new high frequency transformer the four metal mounting clips on the feet.

7. Locate the capacitor(s) associated with the High Frequency Balance control. These capacitor(s) may be mounted directly on the control, or mounted on an adjacent terminal strip. In any case, de-solder and remove the capacitor(s), including the terminal strip, if present.

8. De-solder and remove both ends of the heavy buss wire attached to the end terminal of the audio fuseholder and to terminal #1 of the High Frequency Balance control.

9. De-solder the remaining wire attached to terminal #1 of the High Frequency Balance control. In some later units this wire may be a very heavy Monster Cable.

10. If the capacitors removed in step #7 were mounted on a terminal strip, proceed to step #12. Otherwise, drill two 4 mm holes, as shown in Figure Two, from the outside of the chassis.

11. Mount the new resistor/capacitor assembly to the chassis, using 6-32 hardware in the newly drilled holes. Note that this horizontal mounting is different than the vertical mounting shown in Figure One, but the wiring is the same. Proceed to step #13.

12. Mount the new resistor/capacitor assembly to the screw studs, in the same position as the original terminal strip. See Figure One.

13. Solder one of the black wires from the resistor/capacitor assembly to terminal #3 of the High Frequency Balance control.

14. Attach, but do not solder, the other black wire from the resistor/capacitor assembly to the black binding post.

15. Solder one of the red wires from the resistor/capacitor assembly to terminal #2 of the High Frequency Balance control.

16. Attach, but do not solder, the other red wire from the resistor/capacitor assembly to the end terminal of the audio fuseholder.

17. Locate the wire that was removed in step #9. This wire should be attached at one end to the Low Frequency Tap. Solder the free end to the end terminal of the audio fuseholder. If this wire is Monster Cable, it may help to wrap some 22 gauge buss wire around the connection before soldering.

18. Install the high frequency transformer (4 screws) and the low frequency transformer (6 screws) in the same manner as the original parts. Install all the screws before tightening to insure proper alignment.

19. Solder the red wire from the high frequency transformer to terminal #1 of the High Frequency Balance control.

20. Solder the black wire from the high frequency transformer to the black binding post.

21. Solder the four low frequency transformer primary wires (yellow, orange, red, and brown) to the lower small holes on the low frequency tap terminal strip. See the inset in Figure One for the exact locations marked with an "X". *NOTE: For Models 6 and 8, the low frequency primary wires have different colors as follows:

NORMAL		"6 & 8"
Red	-	Green
Orange	-	Blue
Yellow	-	Gray
Brown	-	Brown

NOTE: If performing the bias supply modification, stop here and refer to the separate instructions. Otherwise, proceed to step #22.

22. De-solder and remove the two large .01 uF/6KV capacitors on the printed circuit board.

23. Install and solder the two new .01uF capacitors in the same position as the original parts.

24. Place the printed circuit board in its original position on top of the stand-offs. Replace the hex-head screw with lockwasher at the rear of the board and replace the two thumbscrews with lockwashers at the front of the board.

25. The primary wiring is now complete. Check all solder connections and route the wires close to the chassis. Make sure that no wires are touching the body of the High Frequency Balance control, the resistor on the resistor/capacitor assembly, or the resistor attached to the back of the Low Frequency terminal strip. (These parts get hot!) Also make sure that the capacitor leads on the terminal strip are not touching adjacent terminals.

26. Solder the secondary wires from the low frequency transformer to the printed circuit board as follows:

    a. Yellow wire to pad "LF Y"
    b. Blue wire to pad "LF B"
    c. White wire to the rear center ground pad. (Next to hex-head screw.)

27. Solder the secondary wires from the high frequency transformer to the printed circuit board as follows:

    a. Yellow wire to pad "HF Y"
    b. Blue wire to pad "HF B"
    c. White wire to the rear center ground pad.

28. Solder the secondary wires from the bias transformer (the smallest of the three transformers) to the printed circuit board as follows:

    a. Red wire to pad "R"
    b. White wire to the rear center ground pad.

    NOTE: If there is no white wire, solder a length to the frame of the transformer. Scrape the enamel coating on the metal to insure a good solder connection.

29. Locate the green ground wire from the AC line cord and solder to the rear center ground pad of the printed circuit board.

30. Replace any wire ties removed during modification.

31. Attach the Medallion Transformer label to the rear outside surface of the chassis in the lower right hand corner.

32. Repeat steps #1-31 for the other interface.

NOTE: For proper bass response, the Low Frequency Tap must be set according to the number of electrostatic panels in the speaker:

2 Panels	-	Red Tap	
3 Panels	-	Orange Tap	
4 Panels	-	Yellow Tap	
6 Panels	-	Blue Tap	Models 6 & 8 Only
8 Panels	-	Gray Tap	

PARTS INCLUDED

(For a pair of interfaces)

QTY	PART NUMBER	DESCRIPTION
2	XH121	High Frequency Transformer
2	XL121	Low Frequency Transformer (or XL128 for Models 6 & 8)
2		Resistor/Capacitor Assembly
2	DL018	Medallion Transformer Label (Red)
12"	WB004	22 Gauge Buss Wire
24"	WB008	18 Gauge White Wire
4	HB064	6-32 x ½" Allen Button Head Screw
4	HN061	6-32 Keps Nut
4	CP001	.01uF/6KV Capacitor

*Models 6 & 8 have two pairs of interfaces, therefore two modification kits are required.

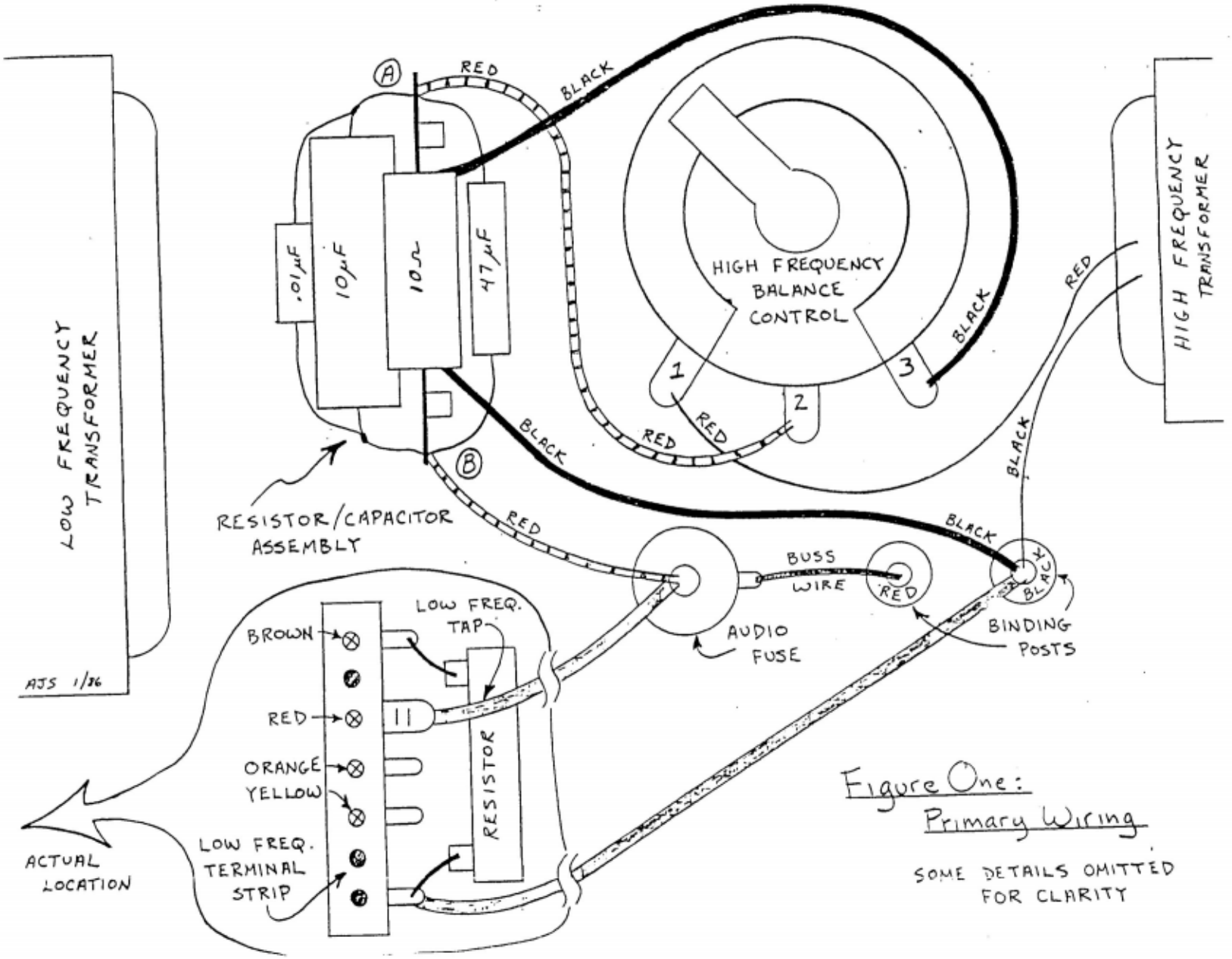


Figure One:
Primary Wiring

SOME DETAILS OMITTED FOR CLARITY

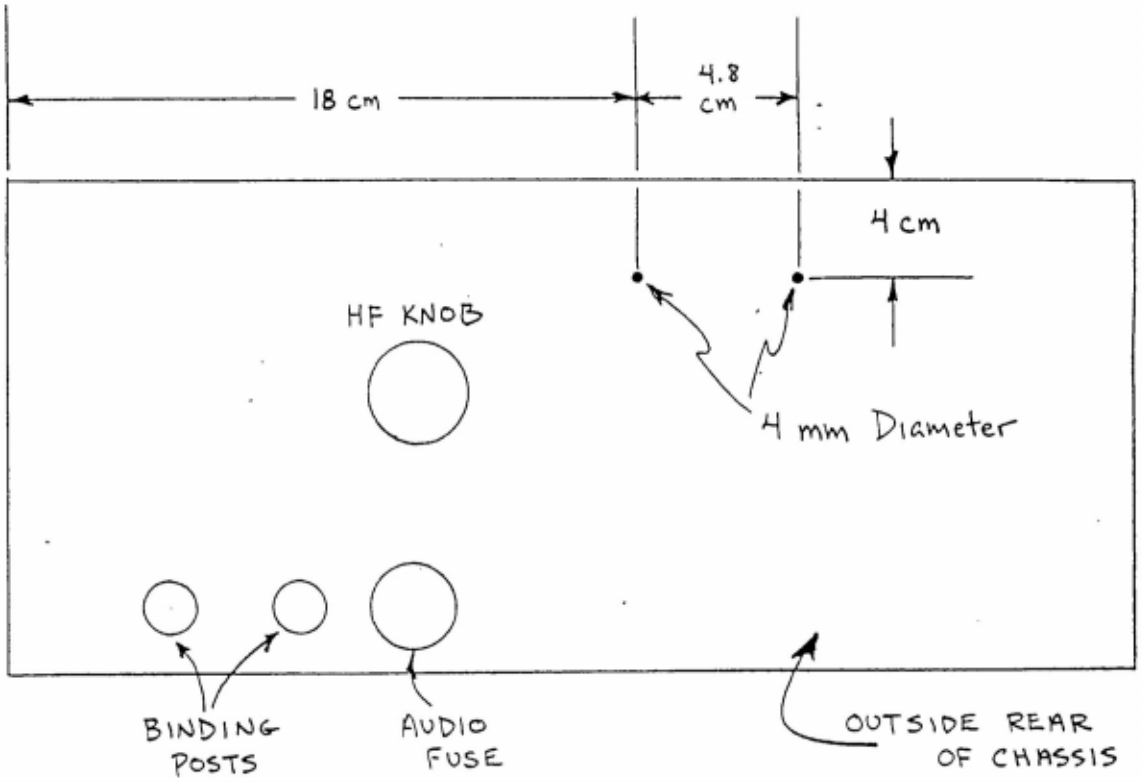
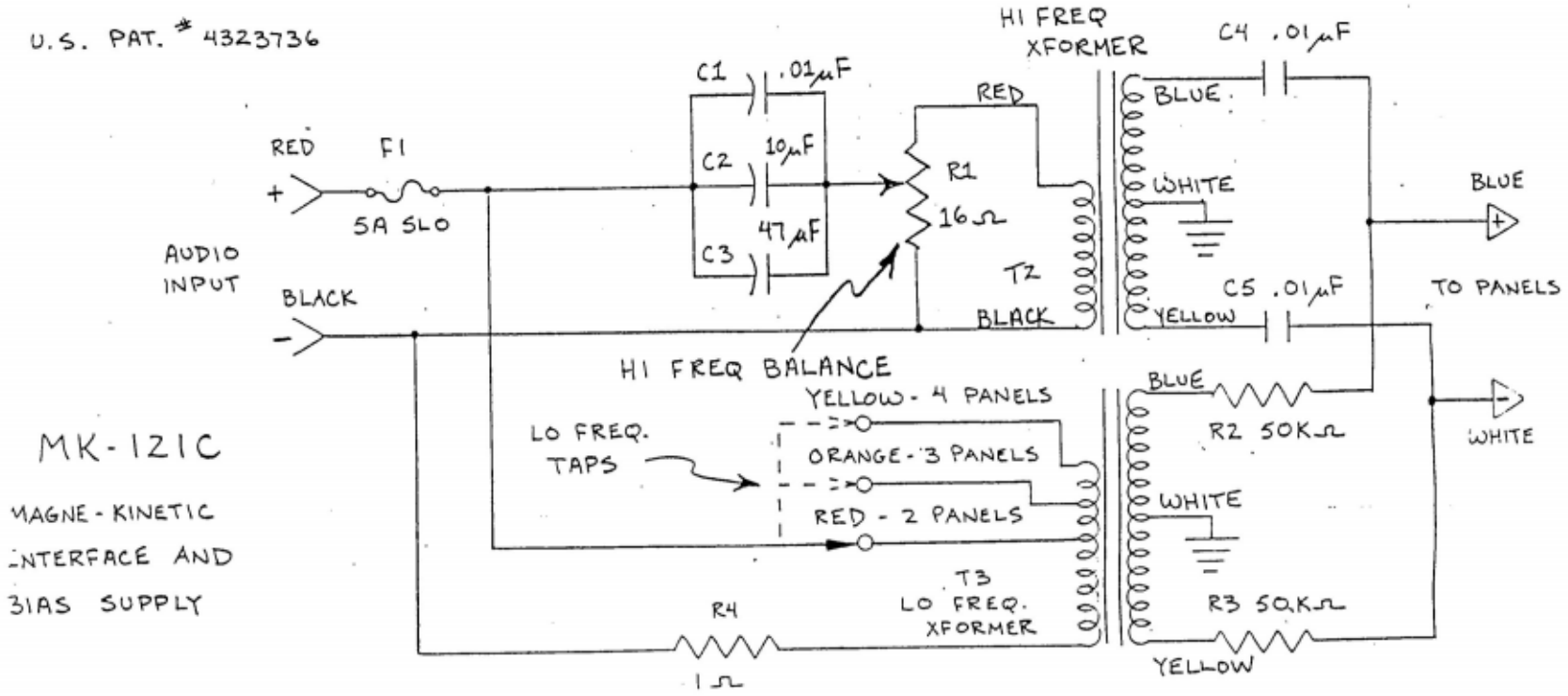


Figure Two: Location Of Holes For Step #10

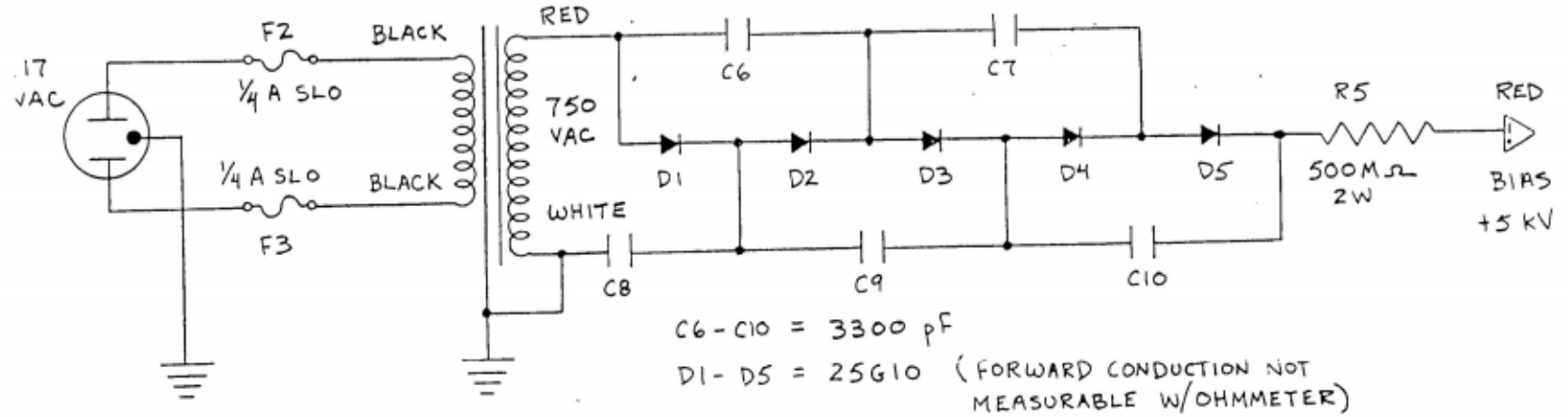
- NOT TO SCALE -

U.S. PAT. # 4323736



MK-121C

MAGNE-KINETIC INTERFACE AND BIAS SUPPLY



C6 - C10 = 3300 pF

D1 - D5 = 25G10 (FORWARD CONDUCTION NOT MEASURABLE W/OHMMETER)

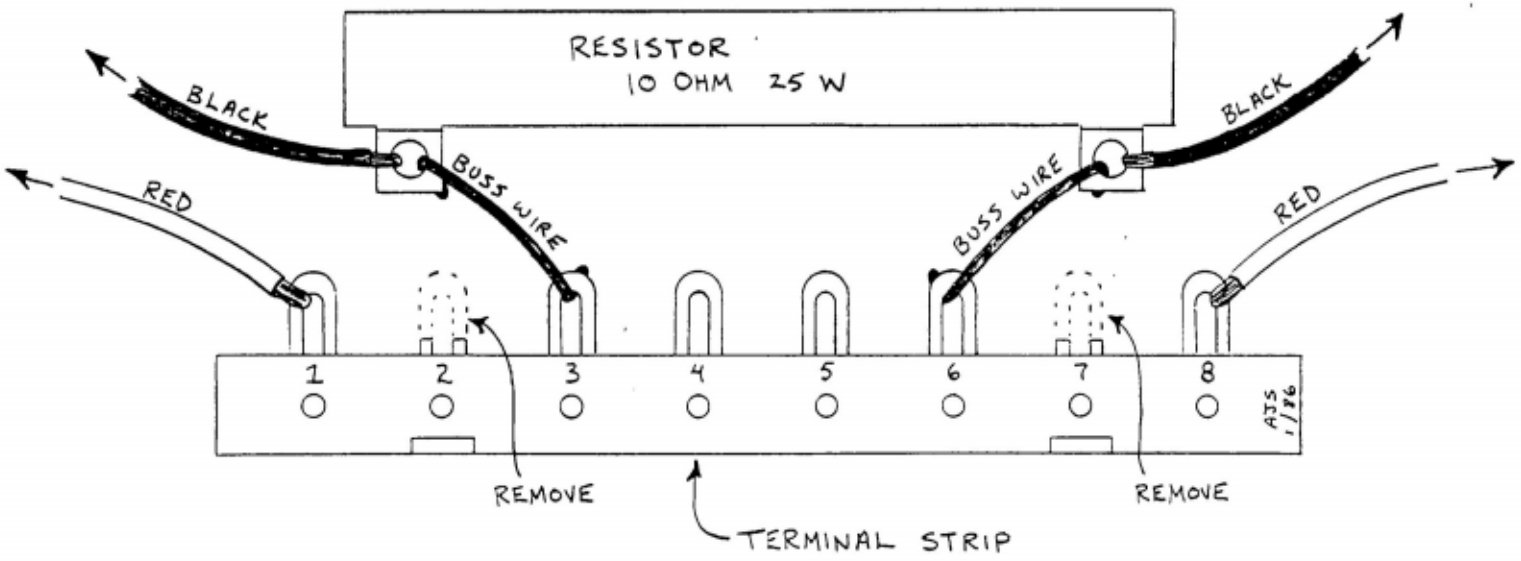
AS-OF-DATE: 06/23/89 COMPONENT SELECTION OPTIONS: OWNER ( ) STOCK ( )
PRINT OPTIONS: COMMENTS?(Y) REF-DESIG?(N) EFFECTIVITY?(N) COST?(N) LEAD-TIME?(N)

ASSY. PART NO.	REV	DESCRIPTION	QUANTITY	UM	M/B	DRAWING NO.	ECN	USER
FG-21MK		MK121-2A MODIFICATION KT	1.00	EA	M			LAST C

LEVEL	COMPONENT NO.	QUANTITY	UM	DESCRIPTION	COMP REV	OPER	W/C	DWG SEQ NO	M/B	ECN	SCRA
.01	CCA-114	2.000	EA	8 LUG 2 & 7 GROUND K-STN		000			B		.000
		QTY EXT: Y									
.01	CE-476B	2.000	EA	47 UF 50 V AXIAL		000			B		.000
		QTY EXT: Y									
.01	CPA-001	4.000	EA	.01 UF 6000 V		000			B		.000
		QTY EXT: Y									
.01	CPA-002	2.000	EA	10 UF 100V		000			B		.000
		QTY EXT: Y									
.01	CSA-008	2.000	EA	.01 UF 160V 20%		000			B		.000
		QTY EXT: Y									
.01	HWA-064	4.000	EA	6-32 X 1/2 ALLEN BUTTON		000			B		.000
		QTY EXT: Y									
.01	HWA-N061	4.000	EA	6-32 KEPS NUT		000			B		.000
		QTY EXT: Y									
.01	PMA-L-018	2.000	EA	MEDALLION LABEL RED		000			B		.000
		QTY EXT: Y									
.01	PMA-P-001	2.000	EA	5" X 7" PARTS BAG		000			B		.000
		QTY EXT: Y									
.01	~~RM35-100~~ RM20-100	2.000	EA	10 OHM 25 WATT		000			B		.000
		QTY EXT: Y									
.01	TT-121H	2.000	EA	MK121 HIGH TRANSFORMER		000			B		.000
		QTY EXT: Y									
.01	TT-121L	2.000	EA	MK121 LOW TRANSFORMER		000			B		.000
		QTY EXT: Y									
.01	WWA-014BL	3.500	FT	14 GA STRANDED BLACK		000			B		.000
		QTY EXT: Y									
.01	WWA-014R	3.500	EA	14 GA STRANDED RED		000			B		.000
		QTY EXT: Y									

FIGURE TWO - MOUNTING RESISTOR ON TERMINAL STRIP

NOTE: CAPACITORS (MOUNTED TO TERMINALS 1 & 8)
ARE NOT SHOWN FOR CLARITY
SEE FIGURE ONE FOR TOP VIEW



INSTRUCTIONS FOR FIELD UPDATE KIT
MKl2l—B TO "C" VERSION

These instructions apply only to Acoustat Magne—Kinetic interfaces that have been previously modified, or originally manufactured, with Medallion Audio Transformers.

Whereas no technical knowledge is required for this modification, the user should be reasonably competent with a soldering iron and simple hand tools. Read through the entire instructions before beginning. Modify only one interface at a time so that the other may be used as a reference. Refer to Figure One to help identify wire and parts locations.

1. Disconnect all audio feeds and AC power from the interface. Remove the interface, and discharge the electrostatic panel by pulling out the red bias lead, (grab it by the insulated wires!), and touching it to either of the thumbscrews. Then disconnect the white and blue wires.

2. Position the interface as shown in Figure One. Remove the two hex—head screws securing the printed circuit board and move the board off its posts so that the chassis mounted parts behind it are accessible.

3. Desolder and detach the two medium gauge white wires on the capacitor terminal strip.

4. Desolder and remove the 22OuF electrolytic capacitor on the capacitor terminal strip.

5. Mount and solder the new 47uF electrolytic capacitor in the same position on the terminal strip as the old capacitor. Make sure that the PVC tubing is covering the capacitor leads.

6. Desolder and detach the heavy gauge red wire on the side terminal of the audio fuse.

7. Desolder and detach the small gauge black wire on the black binding post.

8. Desolder and detach all the wire connections on the High Frequency Balance resistor. The resistor has three terminals with five wires attached.

9. Remove the High Frequency Balance resistor. The two medium gauge white wires and the heavy gauge red wire from the audio fuse should now be free and should be discarded.

10. Mount the new High Frequency Balance resistor in the same position as the old resistor with the variable slider section closest to the chassis edge. Bend the mounting clips for a snug fit into the end of the resistor.

11. Solder a length of 16 gauge buss wire to the side terminal of the audio fuse. Attach, but do not solder yet, the other end to terminal A of the capacitor terminal strip.

12. Re—route the heavy gauge red wire (coming from the Low Frequency Tap) and solder to terminal A of the capacitor terminal strip.If this wire is too short, splice it with an additional length of heavy gauge red wire and cover the splice with the large diameter PVC tubing.

13. Solder a length of heavy gauge red wire to terminal B of the capacitor terminal strip. Solder the other end to terminal 2 of the High Frequency Balance resistor.

14. Splice a length of 18 gauge red wire to the small gauge red wire coming from the high frequency transformer. Cover the splice with the small diameter PVC tubing. Solder this wire to terminal 3 of the High Frequency Balance resistor.

15. Attach, but do not solder yet, the small gauge black wire coming from the high frequency transformer to terminal 1 of the High Frequency Balance resistor.

16. Solder a length of heavy gauge black wire to the black binding post. Solder the other end to terminal 1 of the High Frequency Balance resistor.

17. The wiring is now complete. Check over all solder connections and route all wires close to the chassis. Make sure that no wires touch the body of the High Frequency Balance resistor, as this part can get hot.

18. Remove the protective paper from the slider of the High Frequency Balance resistor and position the slider in the center of the adjustable region. Carefully tighten the set-screw.

19. Scrape off the old HF calibration label and apply the new label such that the “0 dB” line is centered over the resistor’s slider.

20. Reinstall the printed circuit board. Be careful to route its connecting wires underneath, but not touching, the circuit board.

21. Peel off the old Blue Medallion label on the rear outside of the interface and apply the new Red Medallion label in its place.

22. Repeat steps 1—21 for the other interface.

PARTS INCLUDED (FOR A PAIR OF INTERFACES)

2	47uF ELECTROLYTIC CAPACITOR (W/PVC TUBING ON LEADS)
2	16 OHM SLIDER RESISTOR
12″	18 GAUGE RED WIRE
30″	14 GAUGE RED WIRE
10″	14 GAUGE BLACK WIRE
2	HF CALIBRATION LABEL
2	RED MEDALLION LABEL
2	SMALL PVC TUBING #9 x 1 1/2″
2	LARGE PVC TUBING #2 x 2″
6″	16 GAUGE BUSS WIRE

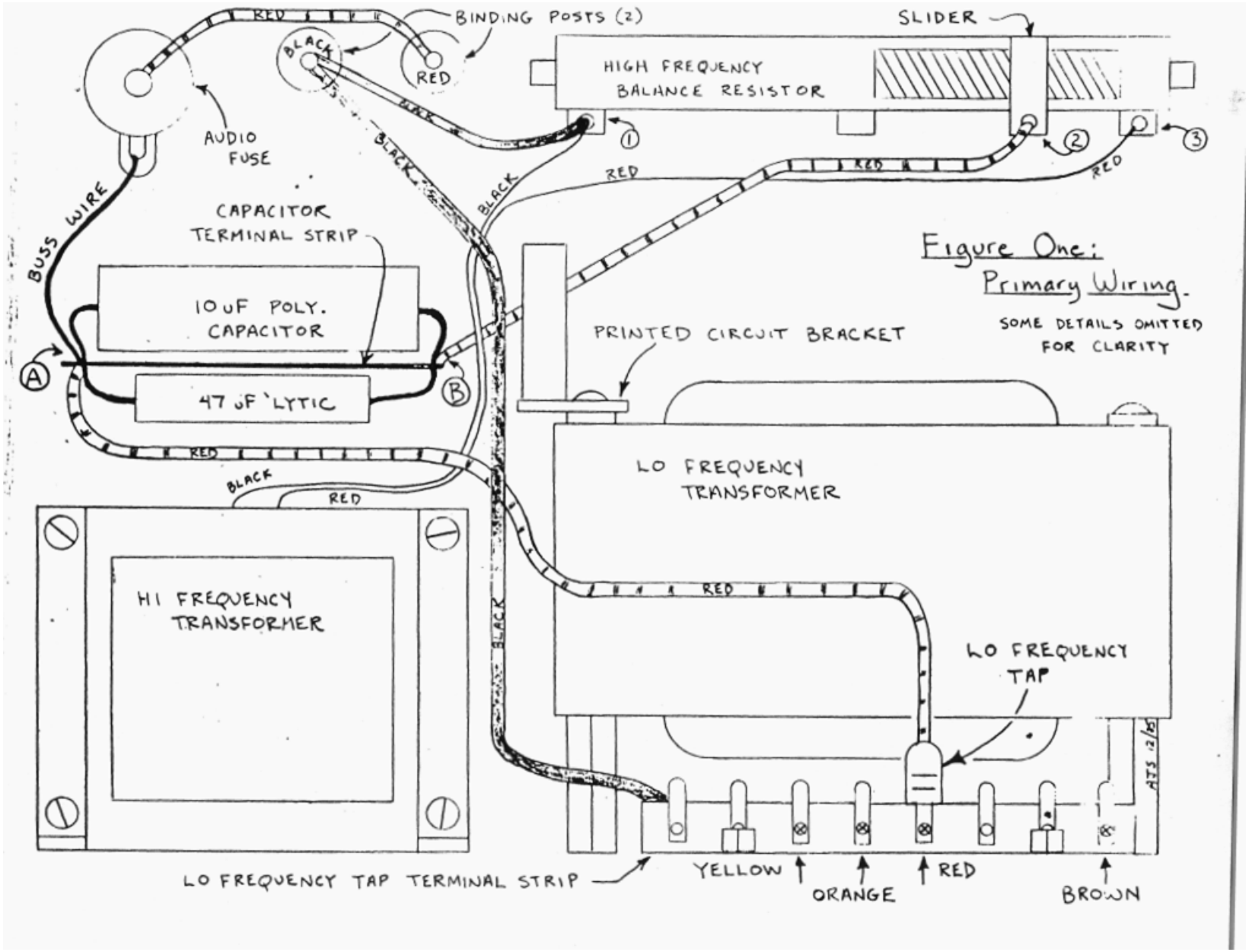
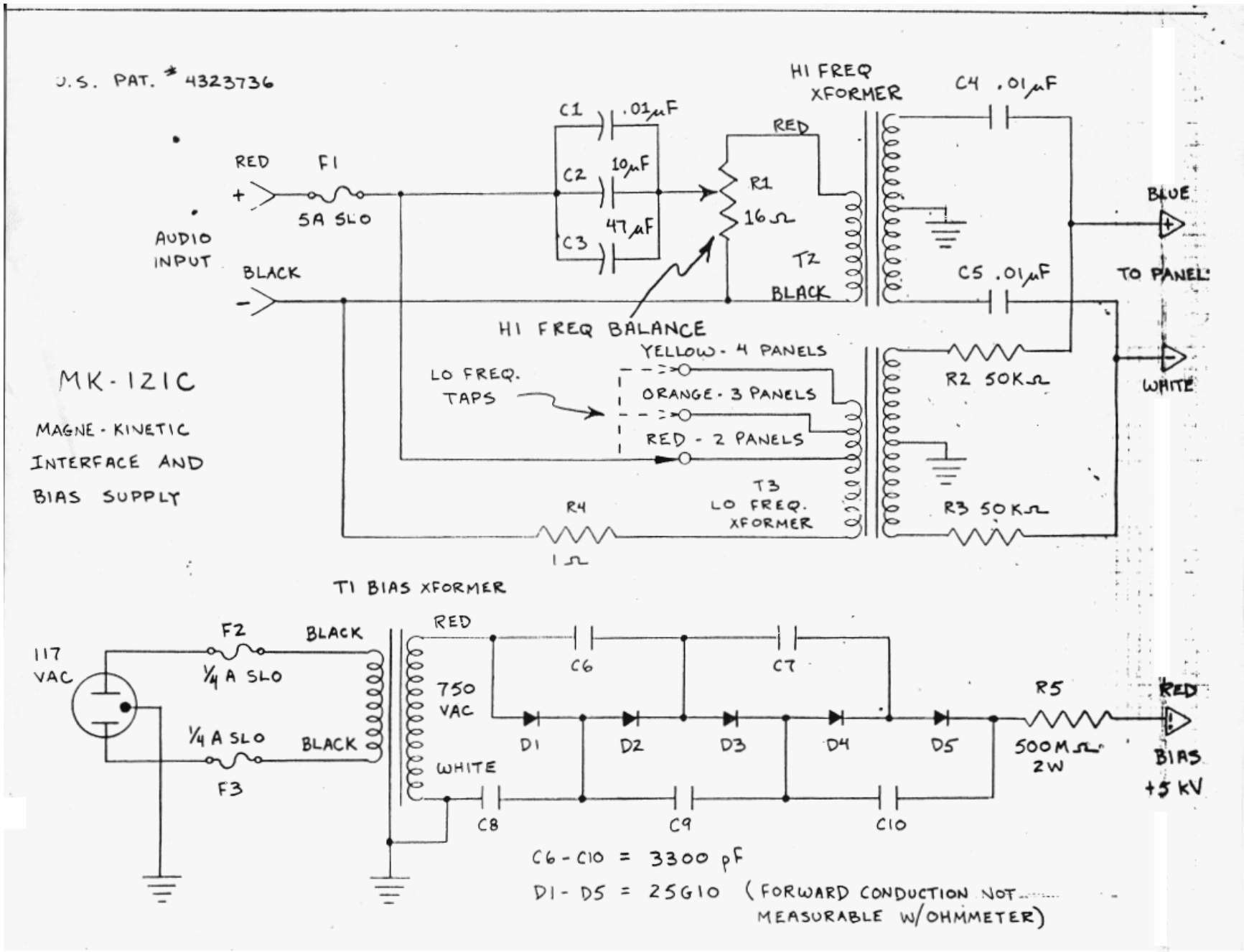


Figure One:
Primary Wiring.

SOME DETAILS OMITTED FOR CLARITY


U.S. PAT. # 4323736
MK-121C
MAGNE-KINETIC
INTERFACE AND
BIAS SUPPLY
AUDIO INPUT
RED
BLACK
F1
5A SLO
C1 .01μF
C2 10μF
C3 47μF
R1
16Ω
HI FREQ BALANCE
HI FREQ XFORMER
T2
RED
BLACK
C4 .01μF
C5 .01μF
BLUE
TO PANEL
WHITE
R2 50KΩ
R3 50KΩ
LO FREQ. TAPS
YELLOW - 4 PANELS
ORANGE - 3 PANELS
RED - 2 PANELS
T3
LO FREQ. XFORMER
R4
1Ω
T1 BIAS XFORMER
117 VAC
F2
1/4 A SLO
F3
1/4 A SLO
BLACK
BLACK
RED
WHITE
750 VAC
C6
C7
C8
C9
C10
D1
D2
D3
D4
D5
R5
500MΩ 2W
RED
BIAS +5 kV
C6 - C10 = 3300 pF
D1 - D5 = 25G10 (FORWARD CONDUCTION NOT MEASURABLE W/OHMMETER)

ACOUSTAT
corporation

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Phone: 305/462-6700

The ACOUSTAT SERVO-CHARGE AMPLIFIER

Service and Owner's Manual

Remove 5, 6, 8, 9 pins

~~[illegible]~~

new 6.8M (outer)

new 10K s/o (if old part is blue)

Remove .01μF C22 & C29

Sky Pilot ™

Title: Acoustat, Monitor 3 and Monitor 4, Electrostatic Loudspeaker system, and Model X Servo-charge Amplifier Service Manual.

This document is a recreation of the original xerographically copied manual which was obtained from the engineering department of the company which was the last known owner of the Acoustat line (early 1999). It has been modified from it's original form in the following ways:

- Due to the condition of the original schematic diagram the one herein was recreated in an Accel CAD database. It is electrically identical, but graphically different from the original.
- Note 1 on the schematic was deleted and the information referencing diode types was included at the components mentioned in the note.
- Previouly omitted filament circuitry was drawn into schematic to match the layout drawing.
- Two capacitors on the schematic diagram, erroneously sharing the same reference designation of C26 were corrected.
    - The 220 pF on the printed circuit board was changed to C39.
    - The parts list was corrected to include the previously missing C39 (C26).
    - The layout drawing was corrected from C26 to C39.
- A zener diode, hand drawn on the schematic at V1 and V3, connected Cathodes to Cathodes, Anodes to control grids was omitted since no other information was available about the mod.
- The formatting within pages was modified as a result of the OCR scanning process and available typeface.
- Spelling errors were corrected as a result of the OCR scanning process.
- Page numbering was added to pages and table of contents for improved organization.
- Table of contents was reformatted and corrected to include all figures and drawings.
- Images were cleaned and straightened.

Note: The handwritten notes on the cover page of the manual were added by the original owner of the manual. They have been preserved for historical accuracy. The meaning, technical significance and validity of those notes are unknown.

ACOUSTAT
SERVO-CHARGE AMPLIFIER
SERVICE MANUAL

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INTRODUCTION

The Servo-Charge Amplifier Service and Owner's Manual has been written as part of an effort to minimize the service problems encountered by our dealers and customers. We have found that many of these problems are the result of a failure to understand the principles of operation of the circuitry of the Servo-Charge amplifier and that this situation has been complicated by a lack of documentation of the physical layout of the printed circuit board.

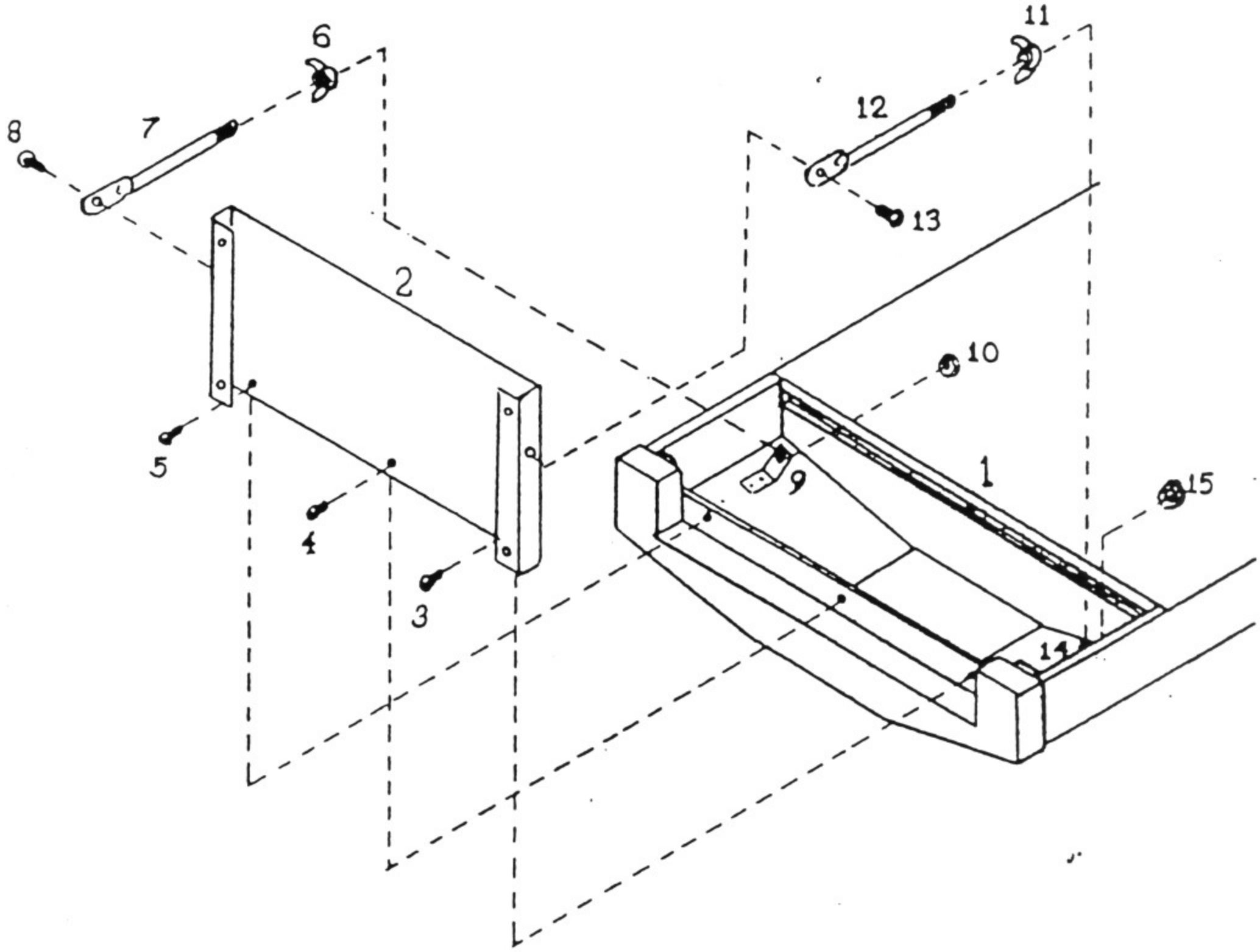
We have also determined that many systems fail to function at their full potential because of deficiencies in the initial set-up. Therefore, a section has been included outlining the preferred procedure for the placement and connection of a newly installed system.

The acoustics of the room will play a major role in the ultimate performance of the speaker system and we have found that it is far more rewarding, in terms of the quality of results obtained, to tune the speakers to the room than to add line equalization. A solid, reflective, and unobstructed wall should be directly behind the speakers and any-required tuning of the room can normally be accomplished with slight changes in the placement of drapes or other wall hangings.

Final Assembly
ACOUSTAT MONITOR THREE AND MONITOR FOUR
Monitor Three shown in the following drawings:

The following instructions are for the final assembly of one Monitor Three or Monitor Four speaker; repeat these instructions for the final assembly of the other speaker.

In the interest of clarity, the screw-in feet and the high voltage harness have been omitted from the exploded view immediately below.



1. Lay the speaker face down on a carpet for final assembly.

   Lay the speaker on the plastic bag it came in to keep carpet fuzz off the grill cloth.

2. Install the screw-in feet in the base-plate as follows:

Thread the rear (plain edge of base-plate) feet fully in.

Thread the front (three holes in edge of base-plate) either fully in or left out up to 5/8" depending on whether the speaker is to be placed on a hard floor or a soft rug respectively. This is for appearance so that the amplifier will appear level when the speaker is upright.

Adjust the feet so that the base-plate will not rock on a hard floor.

3. Install the base-plate (2) on the speaker (1) using silver finish machine screws (3) (4), and (5) and tighten so that the felt dampers are compressed to about one half of their original thickness or about 1/8".

4. Remove the hex nuts (10) and (15) from the threaded rods (7) and (12) respectively. Leave the wing nuts on the rods as factory supplied.

5. Insert the threaded ends of rods (7) and (12) through the holes in mounting brackets (9) and (14) respectively.

6. Thread hex nuts (10) and (15) onto threaded rods (7) and (12), just a turn or so.

7. Note that your hardware package contains four short black screws and eight longer ones.

8. Using two of the shorter screws, fasten threaded support rods (7) and (12) to the sides of the base-plate (2) keeping the flattened "offset" toward the base-plate.

9. While the speaker is still lying down, screw the two hex nuts (10) and (15) back down the threaded rods (7) and (12) until they contact brackets (9) and (14). Then run the wing nuts (6) and (11) up finger-tight against the brackets.

10. Prepare a Servo-Charge amplifier for installation:

    Remove the top cover, install the four tubes provided, and replace the cover.

11. Stand the speaker upright in the approximate location where it will be used.

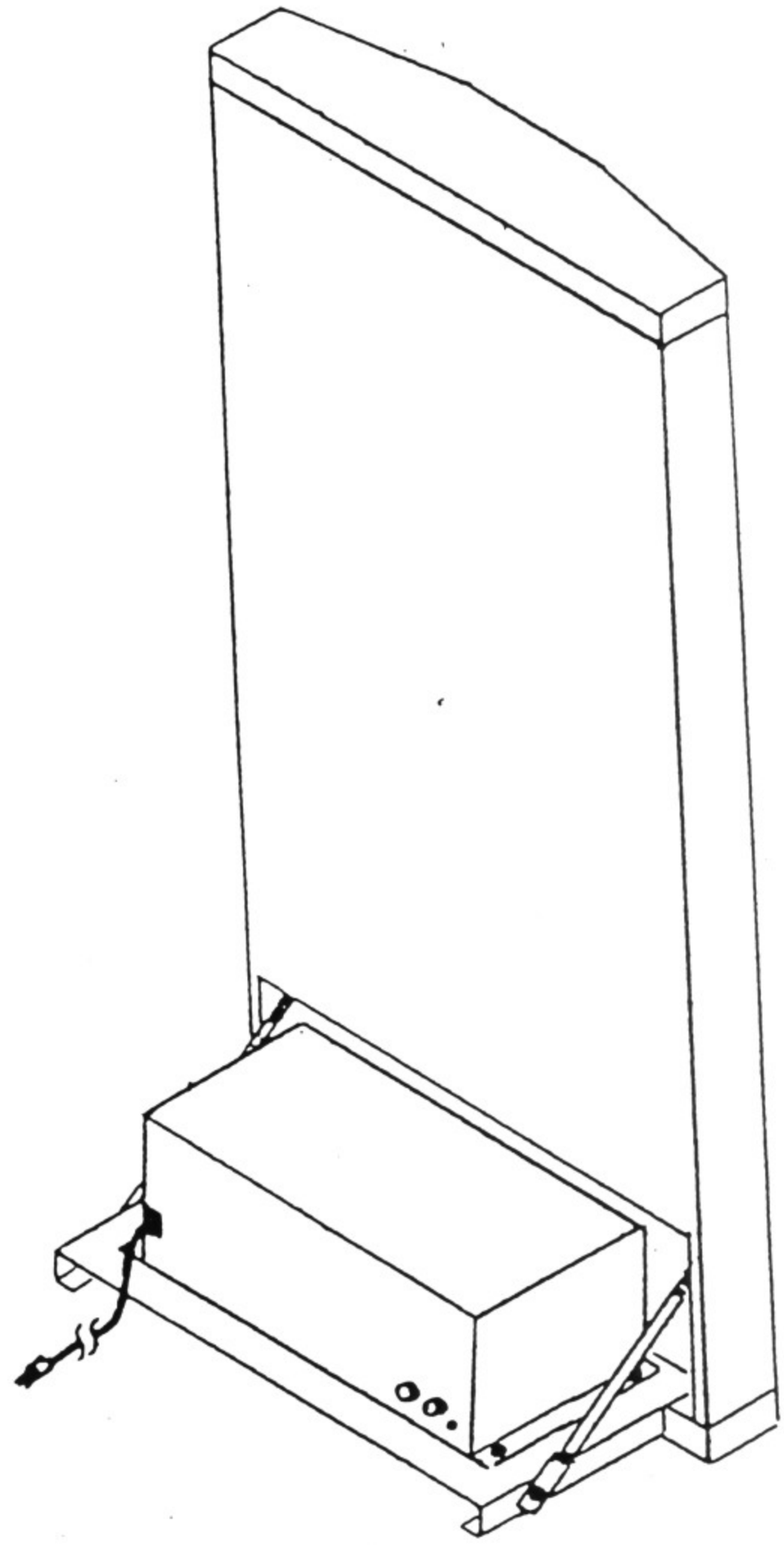
    Caution: Under certain conditions, the speaker could easily be pushed over forward until the final azimuth adjustment has been made or the amplifier mass added.

12. Before plugging the amplifier into the wall, connect the speaker by plugging in the high voltage harness to the amplifier. Make sure that the color code (and therefore the electrical phasing) of the harness matches that of the receptacle on the amplifier. This will occur when the wires enter the three prong plug from the top.

13. Position the Servo-Charge amplifier on the base-plate so that the mounting holes align.

14. Bolt the Servo-Charge amplifier to the base-plate using four of the longer black screws. Tighten only until the grommet just begins to compress.

    THIS WILL PREVENT ACCESS TO THE HIGH VOLTAGE CONNECTOR WHILE THE SPEAKER IS OPERATING



15. Make an initial setting of the vertical azimuth of the speaker using the wing nuts (6) and (11) and the hex nuts (10) and (15). The hex and wing nuts should turn freely with the fingers; if not, exert slight fore or aft pressure on the array. Do not tighten so that one rod "fights" the other. A good initial setting Is to tilt the speaker so that the top of the speaker is two to three inches behind the bottom of the speaker. This can be easily judged by dangling a broomstick behind the speaker.

16. Set the gain pot to approximately the nine o'clock position and the high frequency balance pot to approximately the eleven o'clock position for your initial listening tests. You are now ready to connect the input and AC power.

SET-UP INSTRUCTIONS FOR ACOUSTAT ELECTROSTATIC SPEAKER SYSTEMS

The set-up procedure, exclusive of assembly, is the same for all Acoustat electrostatic speaker systems. We have been able to make the Monitor series speaker systems more tolerant than the Acoustat X systems for small aberrations in the set-up and room tuning; but we still advise that the preferred procedure should be followed fully to obtain the best possible performance from the system.

Some of the principal considerations which will determine the performance potential of the speaker system as installed are:

The Wall Behind the Speakers:

This wall should be hard, reflective, and sufficiently rigid that it will not rattle--sliding glass doors are a "No-No".

The Orientation of the Speaker System Within the Room:

Unless there is an overriding consideration to the contrary, the speakers should project sound along the longer axis of the room. This can be considered a universal rule of stereo speaker systems and is in no way peculiar to Acoustat products.

The Grounding of the System:

It is essential that the power supply ground be connected to prevent any buildup of charges in the Servo-Charge amplifier power supplies. THE THIRD WIRE GROUND MUST BE CONNECTED.

While the system may function reasonably well with only the power supply ground, this leaves the main signal ground floating. THERE MUST BE ONLY ONE SIGNAL GROUND IN THE SYSTEM and this should normally be provided at the input of the preamplifier.

Electric Feedback:

Electrostatic loudspeakers produce a strong electric field which can influence the operation of any low level electronic circuitry in close proximity and can result in feedback at frequencies well above the audio spectrum---this has the effect of high power dissipation and decreased headroom in the system. The tone arm of the turntable and the input of the preamplifier should be kept at least six to eight feet from the nearest speaker to ensure that no feedback can occur.

Phasing:

Acoustat speaker systems are designed to preserve correct absolute phase throughout the system including the final coupling of the signal to the air. This ensures that vocalists and instruments will sound as natural as possible. Therefore, make sure that the connections from the speakers to the amplifiers are correctly oriented: the wires should enter the three prong Pomona plug from above.

The Area Between the Speakers:

This area should be kept clear of major obstructions to airflow if optimum imaging is to be achieved. The size and shape of objects placed between the speakers will determine the extent of any deleterious effect on the imaging---objects such as record cabinets or equipment racks between the speakers should be avoided.

Tiltback:

The tiltback of the speakers has the combined effect of improving the vertical dispersion of the system and of breaking up standing waves in the room. Two or three degrees of tilt is typical and is a good initial setting—this corresponds to about three inches of rearward displacement of the top of the speaker.

Toe-in:

This setting is possibly the least critical. However, if the speakers are toed in too much, a soloist will appear to be singing from a position somewhere beyond the rear wall.

Distance from the Wall:

If the speakers are placed too close to the rear wall of the room, o soloist will tend to sound "muffled", and if the speakers are placed too far from the wall, a soloist will sound "hollow".

For purposes of setting up the system, we recommend that the speakers be auditioned using a solo female vocalist of reference quality. We have found that the human ear more sensitive to anomalies in the human voice than in instrumental music and, since "imaging" is most discernible in the mid-range, we recommend that a female vocalist be selected.

Once the system has been assembled and connected, the orientation within the room determined, the initial settings of tiltback and toe-in made, and the amplifier controls set (nine o'clock for the gain controls and twelve o'clock for the HF Balance control of the Monitor---eleven o'clock for the Acoustat X and Monitor Three would be typical); the audition may begin with the speakers placed too close to the wall. At this point, the speakers should sound muffled. By moving the speakers out from the wall a little at a time, a point should be reached at which "you could reach out and touch the soloist." When this has been accomplished, the tiltback, toe-in, HF Balance, and gain balance to center the preamplifier control can be fine-tuned by experimentation.

SHIELDING AND GROUNDING OF AUDIO SYSTEMS

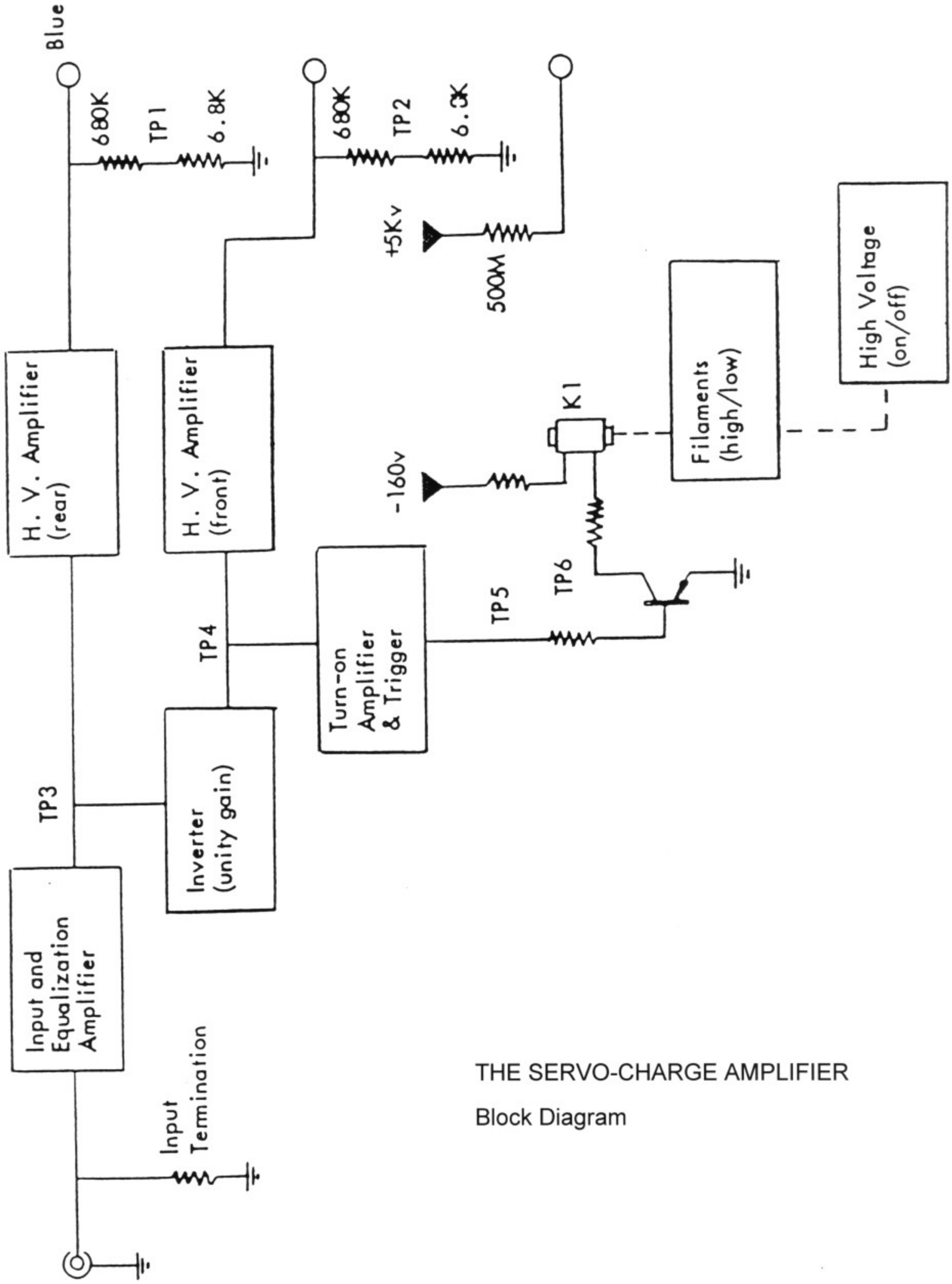
The purpose of this section is not to make the reader an expert on the subject of shielding and grounding; but, rather, to provide simple guidelines for the reduction of environmental noise in the signal paths typically used In high fidelity audio systems. In this application, the use of single conductor coaxial cables between single ended outputs and Inputs is nearly universal and the RCA "phono plug" is the most common connector in use. Therefore, we will confine our discussion to this type of feed.
While It should be obvious that proper grounding Is always important, it is all the more important with this type of feed where extraneous shield currents are so easily injected into the audio. Thus, it is quite important that a single grounding point for the system be selected so that the ground and "neutral" currents of the power wiring in the building in which the system is installed will not be conducted through the shields of the connecting cables. The degree to which a single well chosen grounding point can be selected and the degree to which ground "loops" can be eliminated will be the principal determinant of the degree to which inductively coupled and resistively coupled environmental noise can be isolated from the system. Thus, for example, the two cables of a stereo feed from a stereo preamplifier to a stereo power amplifier should be of equal length and use adjacent routing. Deviation from this principal can result in the cable shields acting as a loop antenna.
It should be pointed out that power line noise can never be totally eliminated as some noise will be fed in through the power supplies of the equipment involved in addition to the internal noise generated within the high fidelity audio equipment. While it is certainly true that the internal noise situation is improved with each advance of the "state of the art", the problem can never be completely eliminated!

Normally, the system grounding point chosen will be the lowest level signal input of the system and when a tuner is not in use, this will usually be the phono preamp input. If a tuner is present, it is often preferable to use the low side of the antenna input as the system ground,

Shielded cable should always be used from any source to the input of an amplifier and the connections, especially of the shields, must be excellent so that the resistance of the connection will be trivial.
Thus, the connectors must be clean and must mate securely and the attachment of the connectors to the cables must be properly executed.

DESCRIPTION

The Acoustat Servo-Charge amplifier is a hybrid solid state and vacuum tube device specifically designed to drive the electrostatic transducer panels of the Acoustat X and Acoustat Monitor loudspeaker systems.
In order to eliminate the requirement for power amplifier switching cables from the preamplifier, the Servo-Charge amplifier is designed to turn itself on at the first presence of an input signal and to turn itself off after, the signal has been absent for a period of approximately five minutes.
To accomplish these goals, the solid state portion of the circuitry operates at all times. When the amplifier is in its "off" state, the high voltage supply for the output vacuum tubes is inoperative and the vacuum tube filament supplies are reduced to one half of their operating voltage.
The input section of the amplifier is based on a premium quality quad integrated circuit operational amplifier used for signal amplification, active equalization, phase inversion, and control of the automatic turn-on/turn-off functions.
The output sections of the amplifier are two hybrid discrete operational amplifiers which drive the "plates" of the electrostatic transducer panels in a push-pull format.
The output vacuum tubes operate at the working voltage of the electrostatic panels so that transformer "matching" is not used.

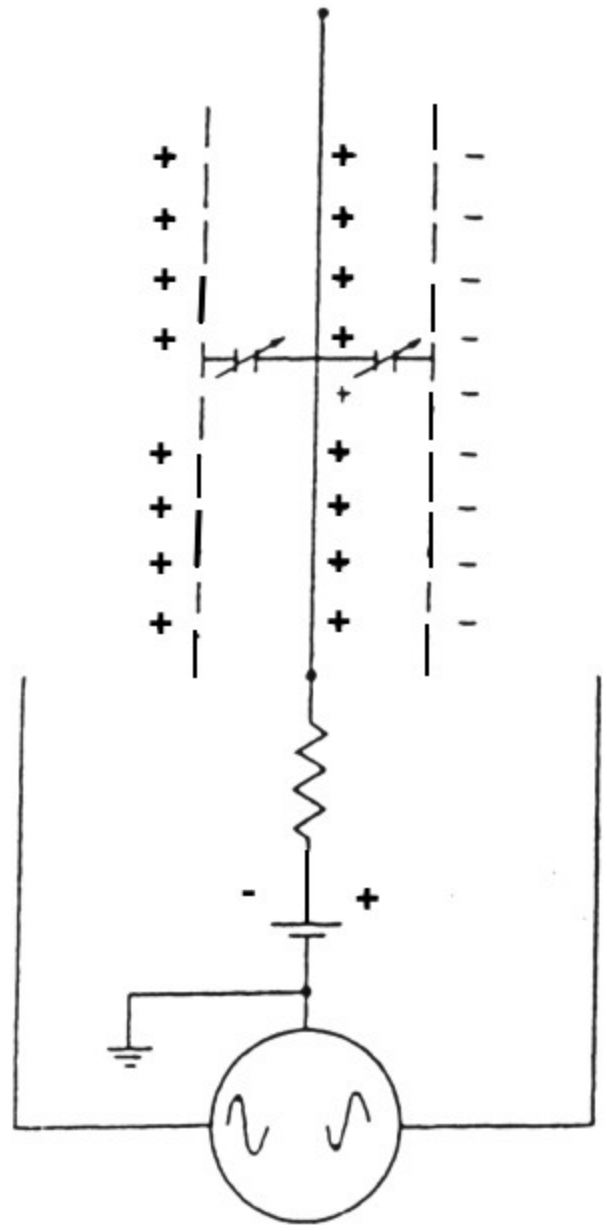


THE SERVO-CHARGE AMPLIFIER

Block Diagram

THEORY OF OPERATION

In order to understand the operation of the Servo-Charge amplifier, it is very useful! to have at least a rudimentary understanding of the load which it was designed to drive.
Acoustat uses what are referred to as constant charge electrostatic transducer panels in which the electrostatic "plates" are driven in a push-pull format and the driven diaphragm is biased in such a manner that its electrostatic charge remains constant despite the application of high voltage audio signals to the electrostatic plates.



$C = q/V$

$J = CV^2/2$

$F = Eq$

Where: C capacitance in farads

V voltage in volts

J energy in joules

F force in Newtons

E electric field In Newtons per coulomb *

q charge in coulombs

*Newtons per coulomb and volts per meter are alternate units of measure of electric field

While we admit that the physics is not "obvious at a glance" we will, for the purposes of this amplifier service manual, simply state the electrical requirements to drive the electrostatic loudspeaker panels that we use at Acoustat Corporation and not dwell on the physics of electrostatic loudspeaker design.

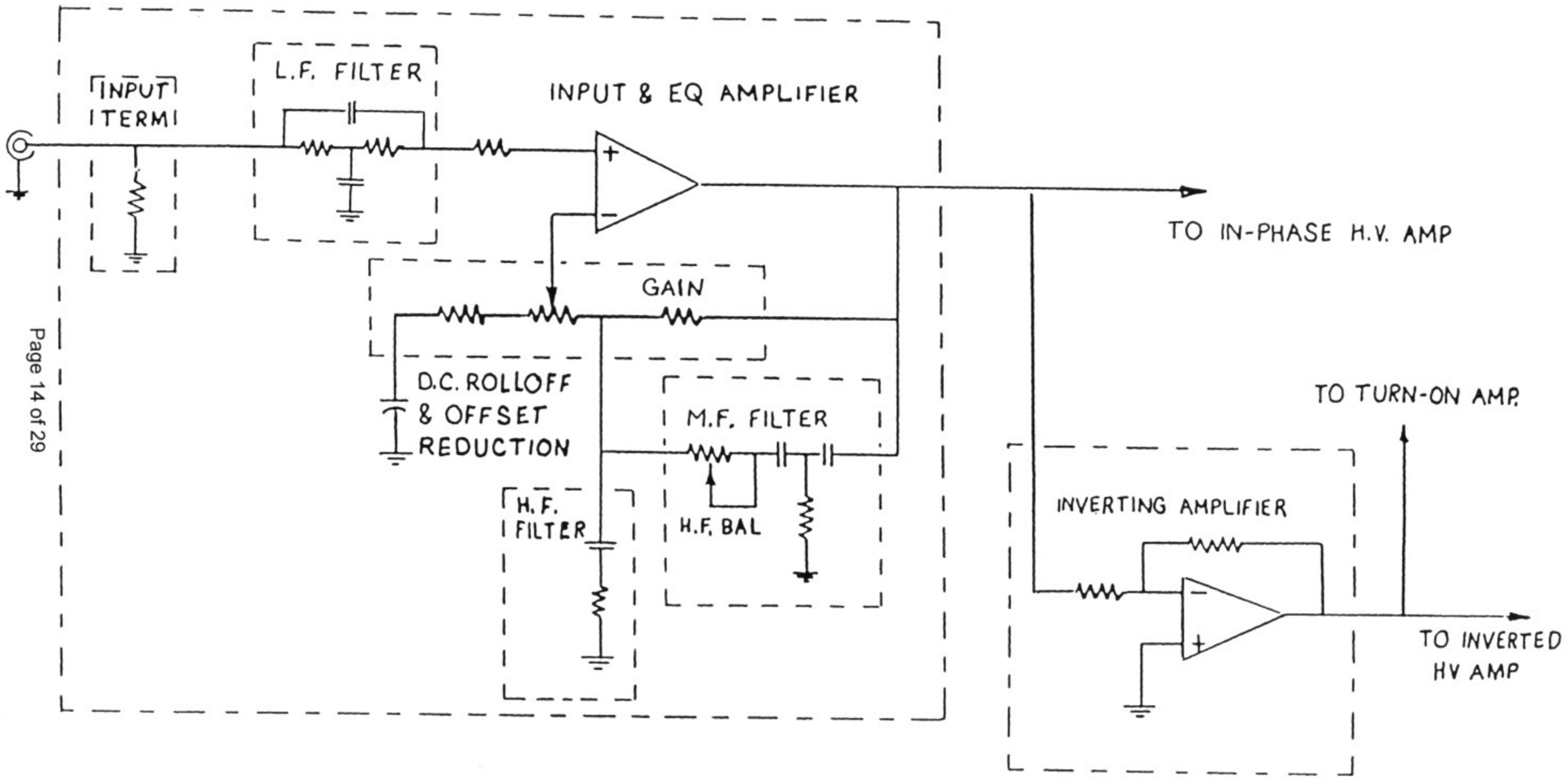
In order for the charge on the driven diaphragm to remain constant despite its own physical excursions (it is the moving element used to excite the air and is analogous to the cone in a conventional speaker) and the electrical excursions of the electrostatic "plates" (we use insulated wire bonded to a plastic grid rather than perforated and insulated sheet metal for reasons of reliability and acoustic openness) it must be biased through a sufficiently high resistance that its charging time constant will be long compared to the period of the lowest audio frequency used and the DC offset of both plates must be nearly the same and sufficiently removed from the potential of the diaphragm for proper biasing of the system to exist.

Within the Servo-Charge amplifier, we bias the diaphragm through a 500 megohm resister to provide the proper time constant and capacitively couple the drive to the electrostatic plates so that their DC offset can be controlled to near ground potential by the use of a resistor which is tapped to also act as a low voltage measuring point for testing purposes.

The above biasing situation results in a DC voltage differential of 4000 to 4500 volts between the diaphragm and the plates. The plates are in turn driven with a maximum AC signal amplitude of 4000 to 4500 volts peak to peak. The front and rear plates, being operated in a push-pull format, are driven with equal amplitude but 180 degrees out of phase.

The use of constant charge transducer panels eliminates the second order (or square law) functions from the force equations so that the waveform used to drive the electrostatic plates is nearly identical to the waveform at the output of the first stages of the amplifier except for amplitude and is also nearly identical to the waveform at the Input of the amplifier (from the preamplifier or tuner) except for amplitude and the equalization necessary for flat acoustic frequency response. The panels are also equipped with felt dampers on their rear sides to broaden and reduce the amplitude of the diaphragm resonant peak so that it can be used in a controlled manner to improve the bass frequency response of the system.

The theory of operation of each specific portion of the Servo-Charge amplifier is as follows:


INPUT TERMI
L.F. FILTER
INPUT & EQ AMPLIFIER
TO IN-PHASE H.V. AMP
GAIN
D.C. ROLLOFF & OFFSET REDUCTION
M.F. FILTER
H.F. FILTER
H.F. BAL
TO TURN-ON AMP.
INVERTING AMPLIFIER
TO INVERTED HV AMP

INPUT AND EQUALIZATION AMPLIFIER

This is the first stage of the Servo-Charge amplifier and Is in operation in both the operating and standby modes of the amplifier. This stage amplifies and processes the signal from the preamplifier other audio source and drives the phase Inverter and in-phase (rear plates of the speaker) high voltage amplifier. The Input and Equalization Amplifier provides approximately 20 dB of gain at typical settings of the Gain control and includes the equalization networks and the HF Balance control.

R5 acts as the input termination and sets the input Impedance of the amplifier.

R9, R10, C12, and C13 comprise the "wall effect" equalization network to smooth the base response of the dipole output of the speakers in the presence of an acoustically reflective rear wall. If the speakers are to be operated a considerable distance from a wall, or in "free air", ,this network can be effectively bypassed by the addition of 1/2 megohm resistor in parallel with C12.

C18, C19, and R18 comprise the midrange equalization network.

R15 and C17 comprise the high frequency equalization.

R16, R16A, and R17 comprise the High Frequency Balance control network and determine the relative contributions of the midrange and high frequency equalization networks.

R12, R13, and R14 comprise the overall gain control network and C15 acts to limit the DC offset of the stage by reducing the DC gain to unity.

In addition, on amplifiers prior to serial number 1700, a higher level input was provided which was designed to be driven by the speaker outputs of any tuner/amplifier on which a preamplifier was not provided. This provision was seldom utilized and was eliminated in the process of changing the main input provision from a DIN (RCA phono) jack to a 1/4 inch diameter telephone jack. This is a two conductor (mono) jack with only tip and sleeve connections.

If required in individual cases, the "receiver input" provision may be substituted for the preamplifier input on the later amplifiers by moving the tip connector lead from the telephone jack to the printed circuit board so that the input to the amplifier is the Junction of R6, R7, and R8 rather than the junction of R5, R9, and C12—after installing R6, R7, R8, and C11 on the printed

circuit board (R6 is substituted for the factory installed wire jumper in this procedure).

PHASE INVERTER

This stage Is driven by the Input and Equalization Amplifier and is used to drive the Rectifier (or Turn-On) Amplifier and the inverted-phase (front plates of the speaker) high voltage amplifier.

This is a unity gain stage without equalization and should very seldom be the cause of any technical difficulty. The signal at pin 8 of the op-amp should be equal to, but out of phase with, the signal at pin 7 (output of the Input and Equalization Amplifier).

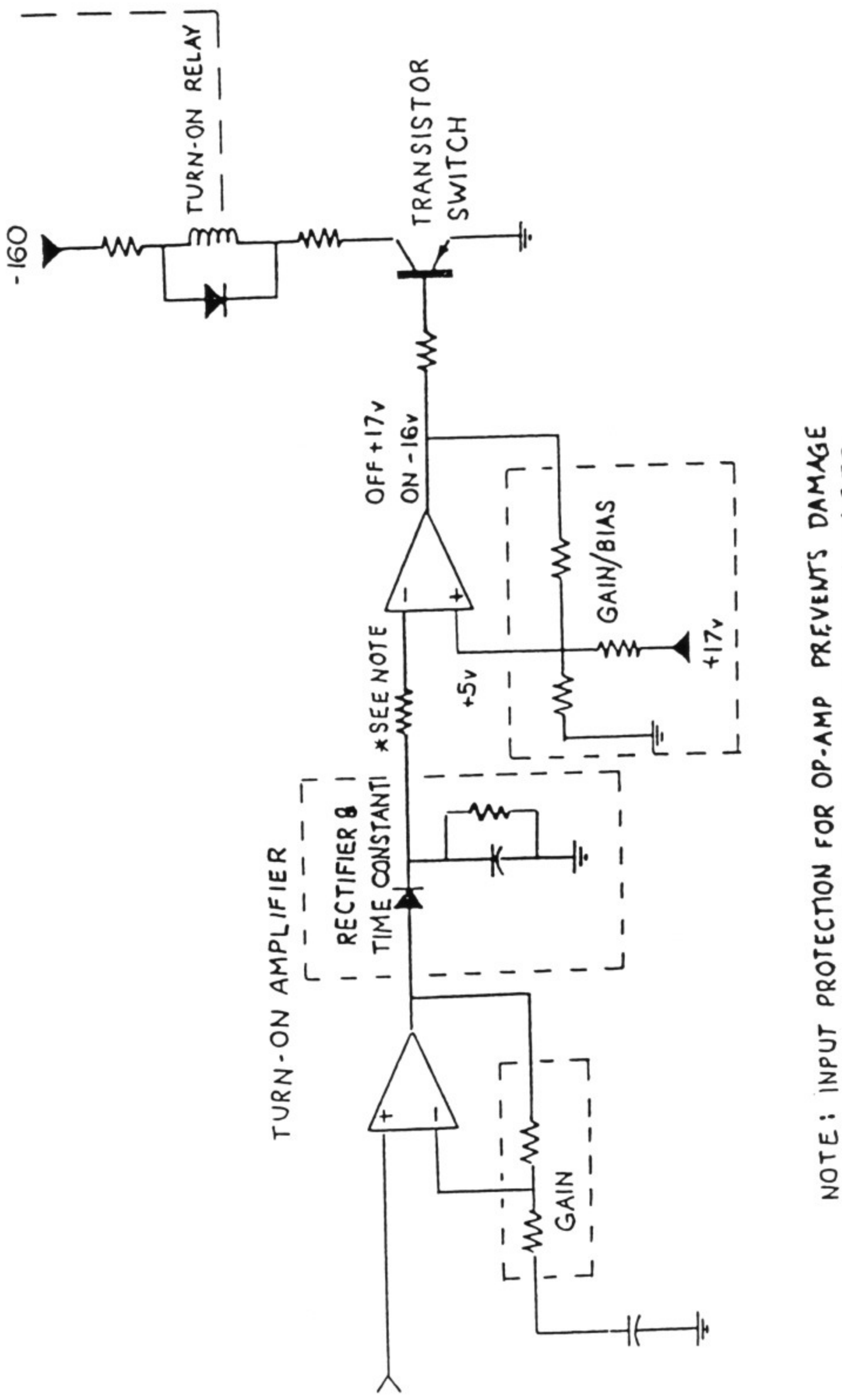
RECTIFIER (TURN-ON) AMPLIFIER

This is the first stage of the automatic "instant-on" circuitry and is driven by the Phase Inverter.

This stage provides up to 40 dB of gain throughout the audio range diminishing sharply to unity gain at DC for offset control. The full gain is available only for low signal levels since the stage is driven to clipping during moderate to loud passages; but the full gain must be available for small signals so that the amplifier will not tend to "turn-off" (or resume its stand-by mode) during quiet passages in musical selections.

Rectifier diode CR14 provides a DC signal to operate the Trigger Amplifier and the signal storage network composed of R26 and C21 provides a sufficiently long time constant to maintain the amplifier in its operating mode for 3 to 6 minutes (averaging about 5 minutes) after the cessation of moderate to high signal levels. After amplifier serial number 1700, R25 is included in the circuit to slow the charging rate of the signal storage network to reduce the probability of "falsing" or turn-on due to a single transient pulse.

While difficulties involving this stage are not common, assembly errors have occurred and a complaint of premature turn-off (or turn-off during quiet passages In music) should lead first to a visual inspection of R23 and R24 for their correct values.



NOTE: INPUT PROTECTION FOR OP-AMP PREVENTS DAMAGE DURING POWER FAILURE OR WHEN UNPLUGGED

TRIGGER AMPLIFIER

This is the switching portion of the automatic turn-on circuitry and is used to operate relay K1. Relay K1 Is part of the power supply and controls the filament supplies and, through one of the filament supplies and a triac, the high voltage supply.

The Trigger Amplifier operates as a voltage comparator and is referenced to the positive low voltage supply rail such as to cause an "off" , or stand-by, state of the Servo-Charge amplifier. The amplitude of the reference bias is such that approximately five volts (positive) is required from the Rectifier Amplifier to force an "on" condition.

The gain of the system is such that approximately -15 dBv at the main input should result in an "on" condition when the Gain control of the Servo-Charge amplifier is at approximately the "nine o'clock" position.

DIAPHRAM BIAS

The diaphragm (or diaphragms) of the Acoustat loudspeaker is biased from the high voltage supply through a 500 megohm resistor. Thus, the speakers are only biased when the Servo-Charge amplifier is "on".

OUTPUT AMPLIFIER

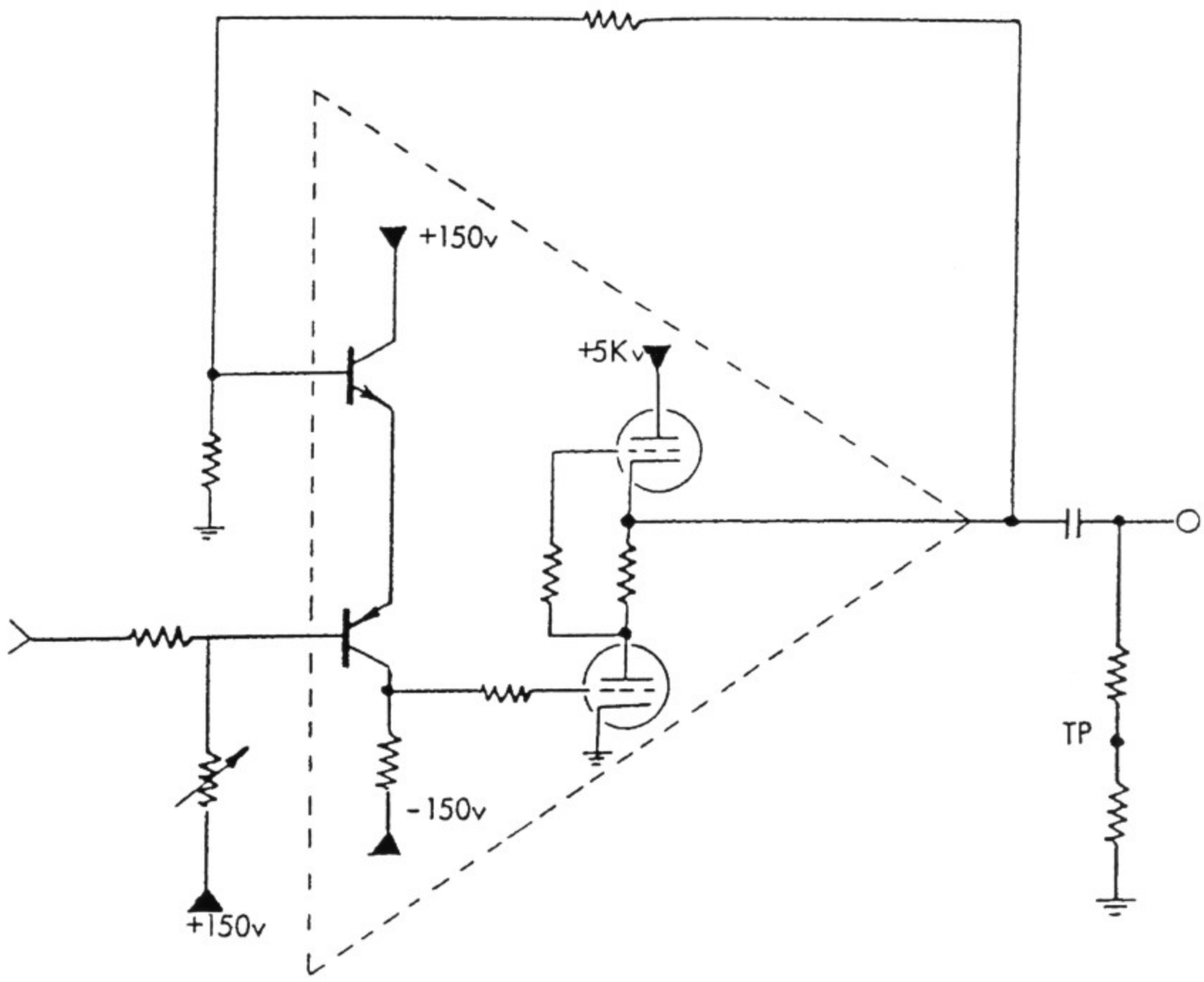
There are two Output Amplifiers which operate 180 out of phase so that the electrostatic plates of the Acoustat speaker are driven "push-pull". Each of the Output Amplifiers is a discrete hybrid op-amp operated with a gain of approximately 45 dB.

With the Gain control set at the "nine o'clock" position, a 7.5v RMS input signal at 1KHz will result in 4500v peak to peak signals at the electrostatic plates of the speaker.

The high voltage portions of the output amplifiers operate only when the Servo-Charge amplifier is in the "on" condition.

SIMPLIFIED SCHEMATIC

Discrete High Voltage Amplifier



POWER SUPPLIES

The power supply of the Servo-Charge amplifier can be thought of as having been divided into two principle parts. The 17 volt supplies and the 150 volt supplies operate at all times. The 5000 volt supply operates only in the "on" condition of the amplifier and the filament supplies are switched between two levels of operation—6 volts in the "on" condition and 3 volts in the "off" or stand-by condition.

The positive and negative 17 volt supplies, the positive and negative 150 volt supplies, and the filament supplies for the two "lower" vacuum tubes are all powered by a single transformer with appropriately tapped secondary windings. The term "lower" vacuum tubes, in this case, means the tubes with grounded cathode connections. The filament portion of this part of the power supply is switched between series and parallel operation for the "off" and "on" conditions of the amplifier, respectively.

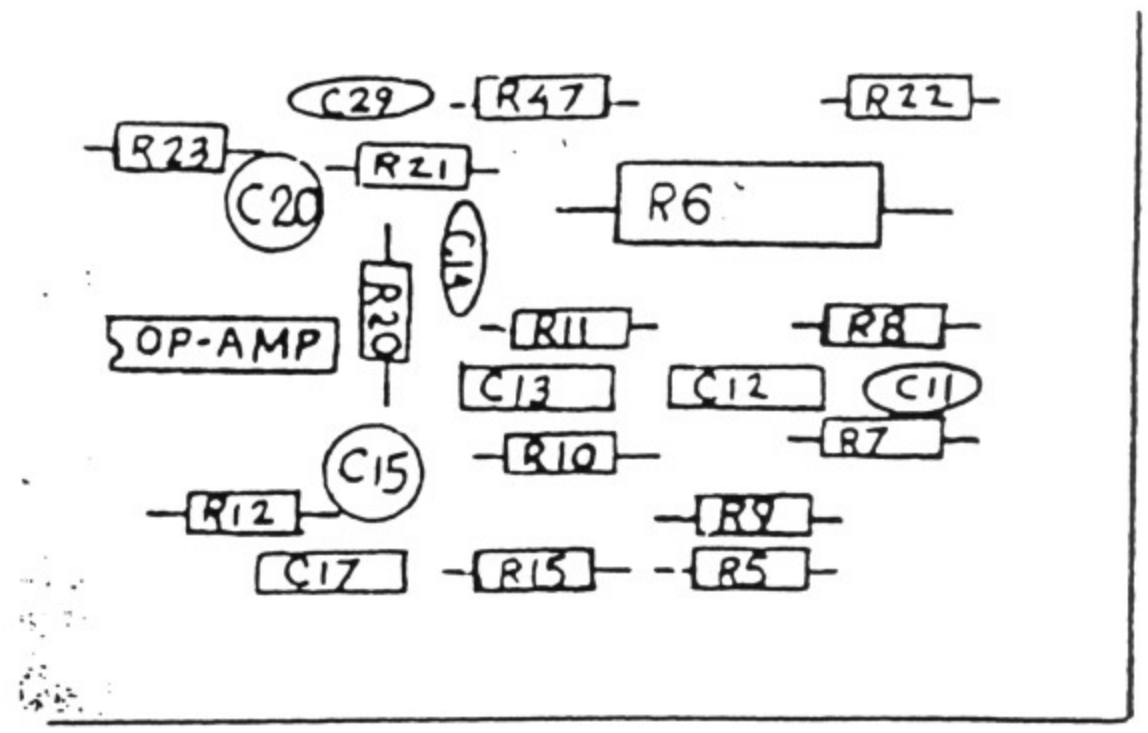
Two separate filament transformers are used to provide the necessary cathode heater isolation for the two "upper" vacuum tubes and the primary windings of these two transformers are switched between series and parallel operation for the "off" and "on" conditions of the amplifier. In the "on" condition, the primary winding of the high voltage transformer is also supplied with power through the triac.

GROUNDING

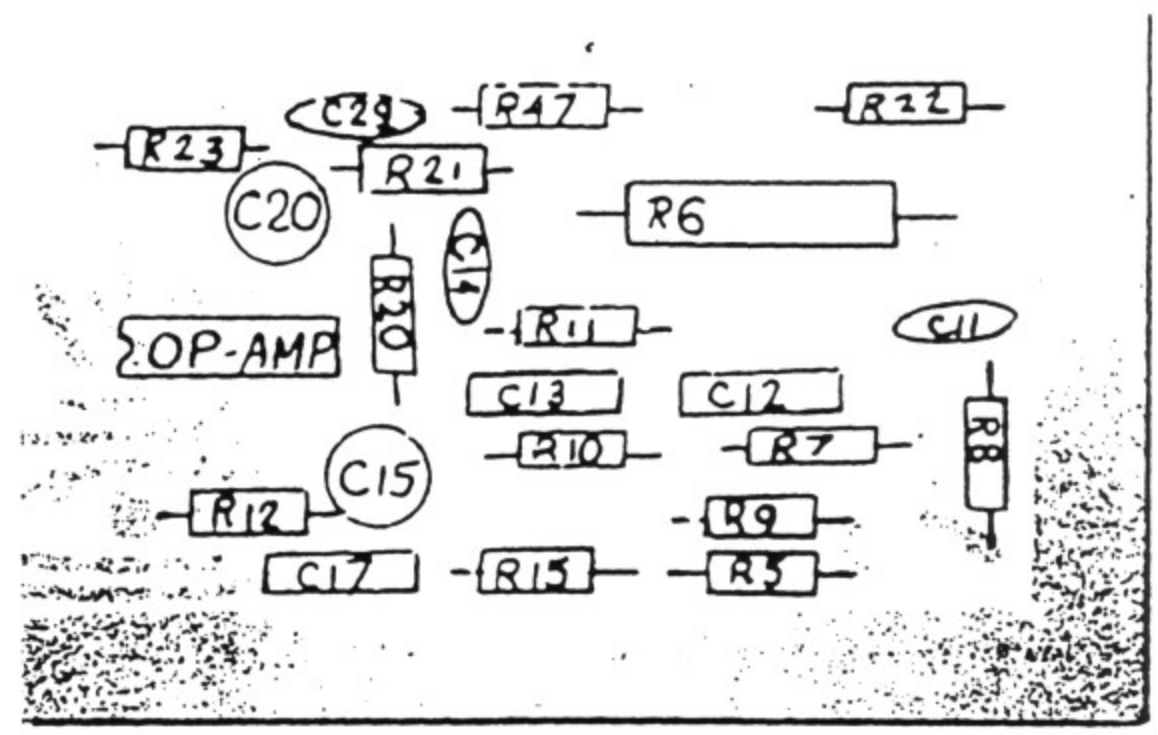
To permit a solid connection between the chassis of the Servo-Charge amplifier and the chassis of the preamplifier or tuner, the Servo-Charge amplifier is "floated" away from power line ground by the use of two silicon diodes. These provide for an isolation of up to six tenths of a volt and preclude the occurrence of the hums and buzzes which result from the slight potential difference between the various power outlets within a room.

It is essential, however, that the power supply ground also be used to prevent any buildup of static charges in the power supplies. Thus, THE THIRD WIRE GROUND MUST BE CONNECTED.

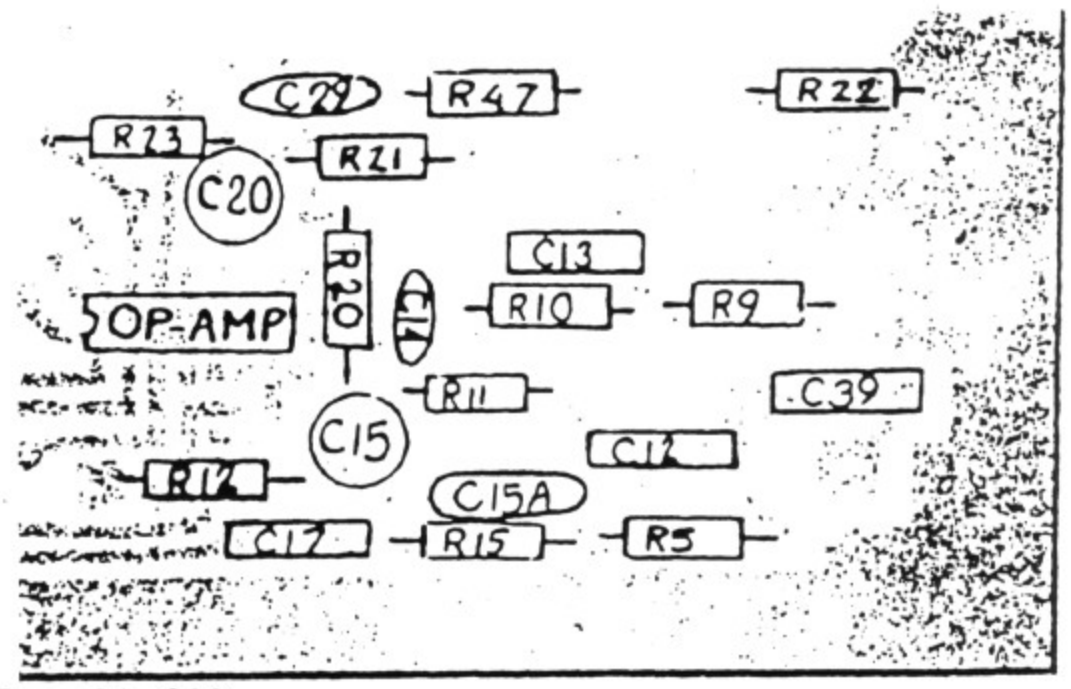
Input area of Printed Circuit
Thru s.n. 1699

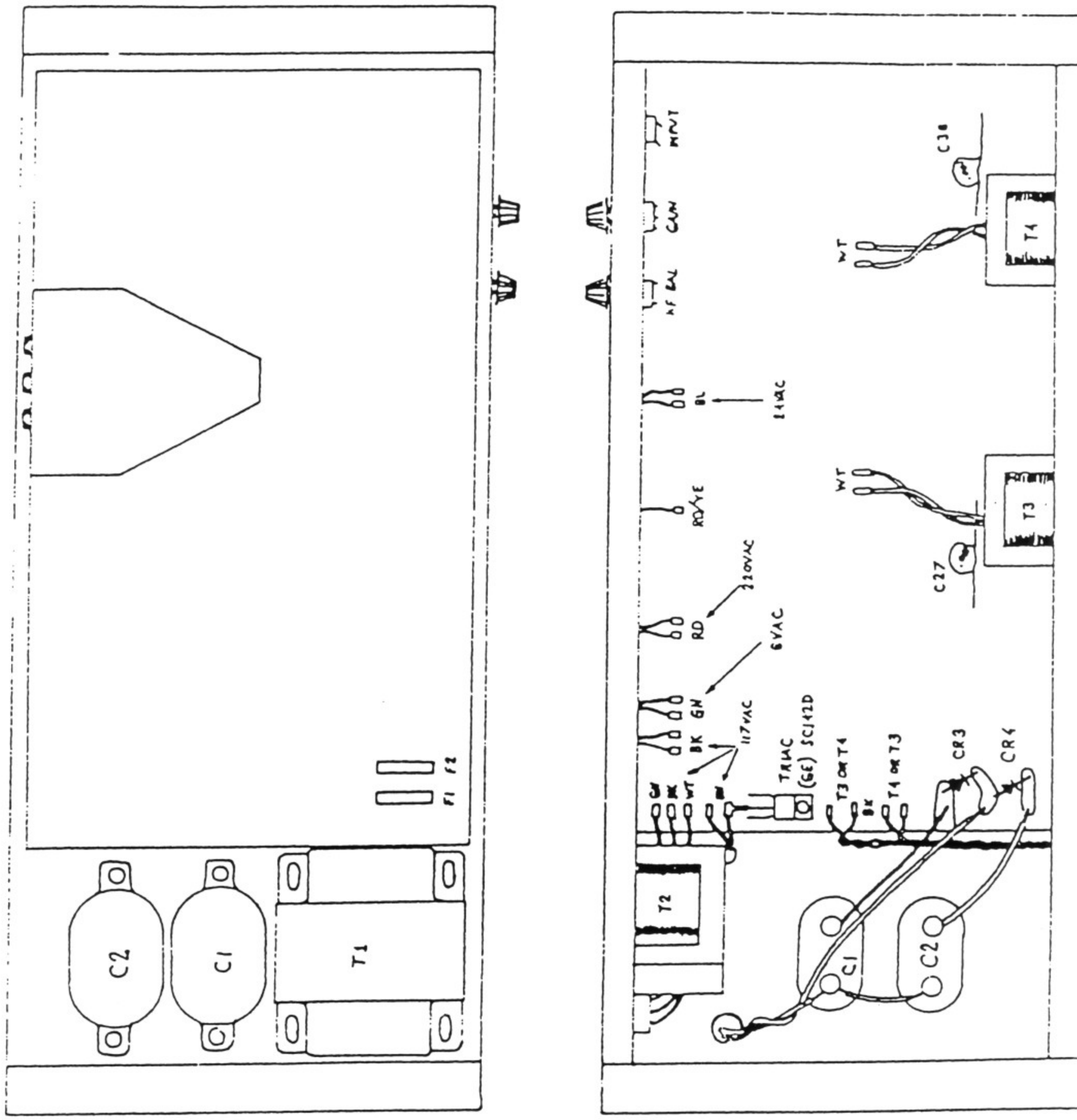


Thru s.n. 1899
R7, R8, C11 omitted
and R6 jumpered as
delivered by factory



From s.n. 1900





CHASSIS ASSEMBLY CA-X3 FEBRUARY 1979

CAPACITORS

C1	1, 3kV, Oil filled
C2	1, 3kV, Oil filled
C3	.01, 3kV, Ceramic
C4	.01, 3kV, Ceramic
C5	1000, 25 v
C6	1000, 25v
C7	22, 250v
C8	22, 250v
C9	22, 250v
C10	22, 250v
C11	470 pF
C12	.0033
C13	.022
C14	220 pF
C15	47, Non-polar formerly 33 or 15 Tantalum
C15A	620 pF, Mica
C16	22 pF
C17	.0022
C18	.01
C19	.0047
C20	47, Non-polar; formerly 15 Tantalum
C21	220, 25v
C22	.01, Ceramic
C23	220 pF
C24	10, 250v
C25	.01, Ceramic
C26	.1, 5 kV
C27	.0001, 6kV
C28	4.7 pF, 6kV
C29	.01, Ceramic
C30	.01, Ceramic
C31	220 pF
C32	10, 250v
C33	.01, Ceramic
C34	220 pF
C35	.1, 5kV
C36	.0001, 6kV
C37	4.7 pF, 6kV
C38	10, 250v
C39	220 pF, 250V

RESISTORS

R1	10K	R45	6.8K
R2	10K	R46	68K
R3	2.7K	R47	750K
R4	2.7K	R48	2M, Pot
R5	68K	R49	100K
R6	100, 5W	R50	10K
R7	680K	R51	10K, 3W
R8	1.5M	R52	10K, 15W
R9	200K	R53	470K
R10	200K	R54	6.8M, 4W
R11	10K	R55	680
R12	4.75K	R56	27K
R13	10K, Pot	R57	6.8M, 4W
R14	470K	R58	680K, 4W
R15	4.02K	R59	6.8K
R16	500K, Pot	R60	100K
R17	10K	R61	500M, 2W
R18	56K		
R19	2.7K		
R20	10K		
R21	10K		
R22	2,7K		
R23	2.2K		
R24	220K		
R25	680		
R26	1M		
R27	10K		
R28	10K		
R29	22K		
R30	1M		
R31	33K		
R32	68K		
R33	750K		
R34	2M, Pot		
R35	100K		
R36	10K		
R37	10K, 3W		
R38	10K, 15W		
R39	470K		
R40	6.8M, 4W		
R41	680		
R42	27K		
R43	6.8M, 4W		
R44	680K, 4W		

COMPONENT CHANGES IN THE SERVO-CHARGE AMPLIFIER

REFERENCE DESIGNATOR	CURRENT	FORMER VALUE	REASON FOR CHANGE
CR9 -CR12	1N4006	1N4004	Mandatory for adequate PIV for all conditions
C22	.01 Ceramic	.01 Mylar	Transient response
C25	.01 Ceramic	.01 Mylar	
C29	.01 Ceramic	.01 Mylar	
C30	.01 Ceramic	.01 Mylar	
C33	.01 Ceramic	.01 Mylar	
C27	.001 6kV	Omitted	
C36	.001 6kV	Omitted	
R25	680 ohms	Omitted	Slower turn-on to reduce falsing
C15	47 Non-polar	15 or 33	Mandatory due to deformation
C15A	620 pF	Omitted	of Tantalum capacitors
C20	47 Non-polar	15	
R18	56K ohms	68K ohms	Increase "warmth"
R15	4.02 K ohms	6.8K or 4.75K	Increase "air"
1C	LF347N or uaF774	OP-11 TL-084 HA-4741-5	

Some or all of the above ore installed on nearly all amplifiers currently in service and all are available for Installation on all amplifiers.

R6	Jumper	100 5W	Receiver input deleted after SN 1700
R7	Deleted	680K	
R8	Deleted	1.5M	
C11	Deleted	470 pF	

From SN 1700 through SN 1895, although an amplifier can not have both standard and receiver inputs, it can be converted to have a high level (receiver) input instead of the standard line level input.

TROUBLESHOOTING

Section I

The Acoustat Servo-Charge Amplifier is designed for years of trouble-free operation. To insure continued reliability the following suggestions are made:

1. Connection or disconnection of audio cables within the system must always be made prior to connection of the amplifiers to the AC outlet. This will prevent possible thermal runaway of the vacuum tubes.

2. Do Not, under any circumstance, exceed the rating of either fuse should replacement become necessary.

3. Do read the section on proper grounding of the audio system.

4. Tubes should be replaced after about one, to one and one half years of average use. Exceeding this life expectancy will most likely result In decreased sonic properties and degradation of high frequency response. A weak tube could fail completely and cause overheating of the grid biasing resistors. The sound will be distorted accompanied by a drop in volume and a tube will usually glow bright red. Zener diode protection has been employed to guard this condition. Should this occur, AC power should be removed as quickly as possible. Refer to Section 2.

Section 2

The purpose of this section is to assist the user/technician in determining the cause of a malfunction and eliminating It. When using the troubleshooting charts, if may be necessary to refer to the schematic and parts layout diagrams. The Acoustat Technical Staff is available to answer questions pertaining to service and to assist in obtaining replacement parts. The AC line cord should be disconnected to prevent dangerous electrical shock, when attempting repairs to the amplifier. All transistors, the integrated circuit device, relay, and 10k 15 watt resistors have been installed In sockets to simplify replacement.

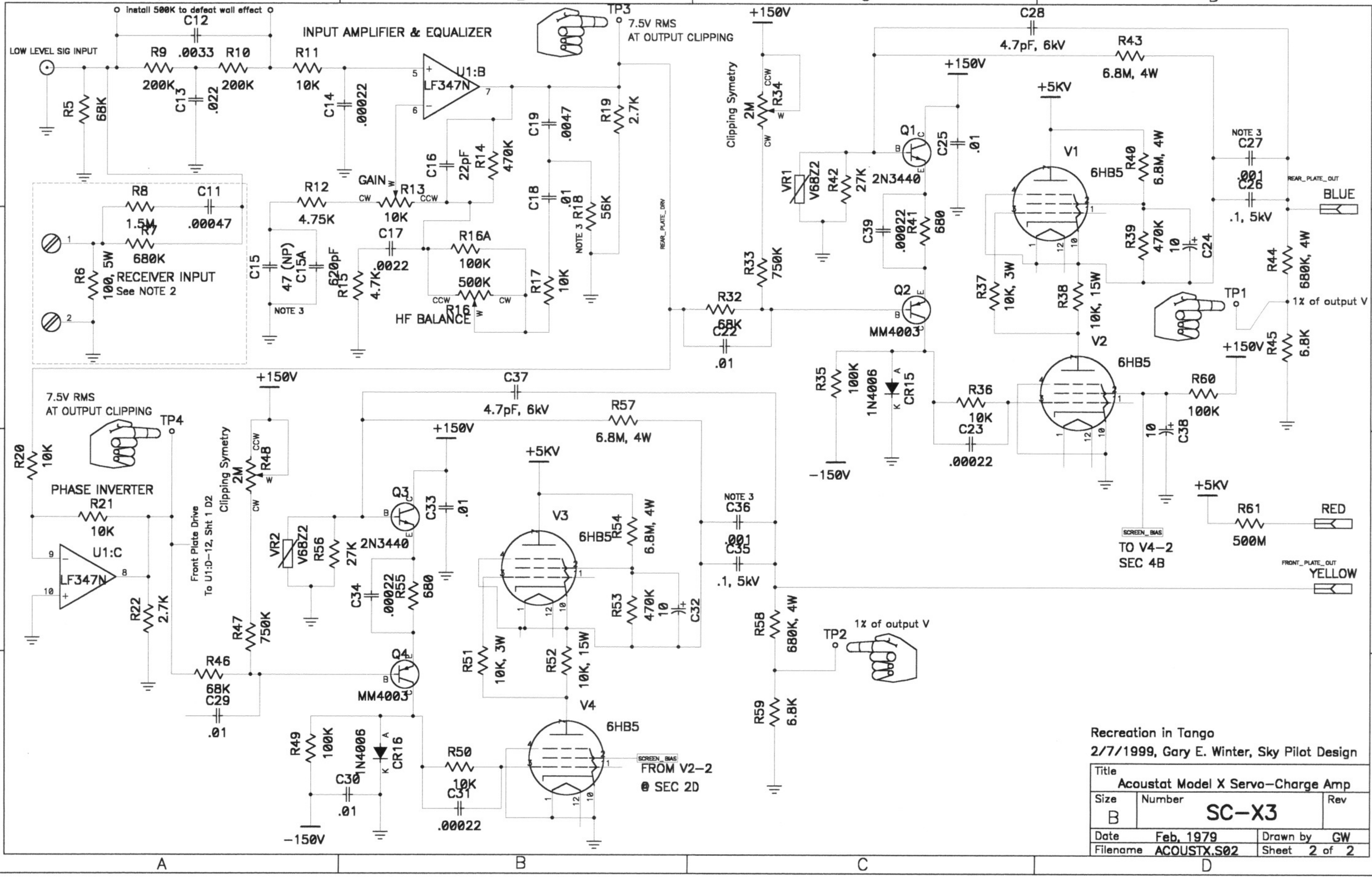
SYMPTOMS	CAUSE	CURE
VI or V3 glows red. Sound is distorted, weakened. or Tube explodes or cracks. also 5 amp fuse may be blown .	A tube has failed, usually V2 or V4, causing the "good" tube in the pair to pull full current and glow red.	Replace both VI and V2 or V3 and V4 Replace the 10k 5w resistor (R37 or R51) and 10k 15w resistor (R38 or R52) closest to the bad tube, or check with an ohmeter. The zener diode, if used, should also be checked/replaced. Check the 5 amp fuse and replace if necessary.
5 amp fuse blows	Shorted high voltage transformer or Shorted high voltage diode	Remove AC power: You are about to operate on the high voltage section ! Determine if the transformer is shorted by disconnecting the red secondary lead from the circuit board. Place a piece of tape over the exposed end of the wire. Install a fresh 5 amp fuse, connect to AC outlet, and apply Input signal for turn on. If fuse blows at this time, replacement of the high voltage transformer is indicated. If the fuse does not blow, check or replace the high voltage diodes (located under the circuit board) observing correct polarity, reinstall a new 5 amp fuse, and reconnect the red wire to the circuit board.

SYMPTOMS	CAUSE	CURE
1/2 amp fuse blows	Shorted diode in 150 volt bridge	Check/Replace CR9,CRIO, CRII,CR12. Replace 1/2 amp fuse—Do not over-fuse, as this will cause the small power transformer to burn up under shorted conditions.
Amp shuts down fro standby mode after 10-15 minutes of play. Input signal is still present.	Defective CR14 Diode opens when heated by nearby tube V4.	Replace CR14 (1N4004 or 1N4006)
Loud intermittent hum	Bad connection at input strip	Check for clean, tight ground connection at input jack of the amplifier and at the output jacks of the preamplifier. A poorly soldered plug on an input cable will also cause this problem.
Constant or Intermittent hum	Check and re-solder bad connection on C5 or C6 1000uf @ 25 v (3300uf on later units)	
Violent purple arcing inside VI or V3	Intermittently shorted filament transformer T3 or T4	Replace the filament transformer associated with the arcing tube.
Waveshapes ok. at test points 1 and 2, When amp is connected to speaker output is very weak.	Open R61 500 megohm resistor	Check or replace R61 500 megohm resistor
Popping Crackling	Arcing tube or Defective R43, R57	Bad tube will usually show visual arc. If popping occurs after considerable on time, replace R43 and R57 6.8 megohm resistors.

SYMPTOMS	CAUSE	CURE
Unit shuts down to standby, but comes back on immediately. or Unit will not shut down to standby mode. or Unit will not turn on from standby.	Defective IC or Arcing tube Defective IC, Q5 Transistor or bad Relay	A defective integrated circuit can cause this problem. The OP-11 device was found to be particularly prone to this rare problem. An arcing tube can also affect proper operation of the turn on circuitry. The offending tube will usually arc at the shutdown to standby point and bring back the amplifier to the full on condition. This tube can sometimes be spotted in a darkened room. The simplest solution is to replace all four tubes.
White noise in background below level of music	Leaky 2N3440 (QI,Q3)	Be sure the noise isn't originating upline in the preamp or elsewhere by removing the input to the servo charge amplifier. If noise persists replace Q1 or Q3.
Amp distorts, weakened output sometimes accompanied by a low level hum.	Defective Q2,Q4, Q1 or Q3 transistor	Check/Replace defective transistor.
Intermittent drop In volume, about 50%, accompanied by low level hum.	Intermittently open junction mm4003 transistor (2N5416 on later units)	Replace Q2 and Q4

SYMPTOMS	CAUSE	CURE
Unit turns on from stand-by due to AC line surges sometimes induced by an air conditioner, fluorescent lights etc.		Earlier production amplifiers are sometimes found to do this. Eliminate the problem by Installing a 680 ohm resistor in series with the cathode (banded end) of CR14. this resistor Is factory installed beginning with s/n 1700.

End


INPUT AMPLIFIER & EQUALIZER
Install 500K to defeat wall effect
LOW LEVEL SIG INPUT
C12
R9 200K
.0033
R10 200K
R11 10K
C14 .00022
R5 68K
C13 .022
U1:B
LF347N
TP3
7.5V RMS
AT OUTPUT CLIPPING
R19 2.7K
C19 .0047
C18 .01
R18 56K
NOTE 3
GAIN
R13 10K
R12 4.75K
C16 22pF
R14 470K
C17 .0022
R16A 100K
R16 500K
HF BALANCE
R17 10K
C15 47 (NP)
C15A 620pF
R15 4.7K
NOTE 3
R8 1.5M
C11 .00047
R7 680K
R6 100, 5W
RECEIVER INPUT
See NOTE 2
REAR_PLATE_DRV
+150V
Clipping Symetry
2M
R34
CCW
CW
VR1
V68Z2
R42 27K
Q1
2N3440
C25 .01
C39 .00022
R41 680
R33 750K
R32 68K
C22 .01
Q2
MM4003
C28
4.7pF, 6kV
R43
6.8M, 4W
+5KV
V1
6HB5
R40 6.8M, 4W
R39 470K
C24 10
R37 10K, 3W
R38 10K, 15W
V2
6HB5
NOTE 3
C27 .001
C26 .1, 5kV
REAR_PLATE_OUT
BLUE
TP1
1% of output V
R44 680K, 4W
R45 6.8K
+150V
R35 100K
1N4006
CR15
R36 10K
C23 .00022
R60 100K
C38 10
-150V
+5KV
R61 500M
RED
SCREEN_BIAS
TO V4-2
SEC 4B
FRONT_PLATE_OUT
YELLOW
7.5V RMS
AT OUTPUT CLIPPING
TP4
R20 10K
PHASE INVERTER
R21 10K
U1:C
LF347N
R22 2.7K
Front Plate Drive
To U1:D-12, Sht 1 D2
Clipping Symetry
2M
R48
CCW
CW
R47 750K
R46 68K
C29 .01
+150V
C37
4.7pF, 6kV
R57
6.8M, 4W
+5KV
Q3
2N3440
VR2
V68Z2
R56 27K
C33 .01
C34 .00022
R55 680
Q4
MM4003
V3
6HB5
R54 6.8M, 4W
R53 470K
C32 10
R51 10K, 3W
R52 10K, 15W
V4
6HB5
NOTE 3
C36 .001
C35 .1, 5kV
R58 680K, 4W
TP2
1% of output V
R59 6.8K
R49 100K
1N4006
CR16
C30 .01
R50 10K
C31 .00022
-150V
SCREEN_BIAS
FROM V2-2
@ SEC 2D
Recreation in Tango
2/7/1999, Gary E. Winter, Sky Pilot Design
Title
Acoustat Model X Servo-Charge Amp
Size
B
Number
SC-X3
Rev
Date
Feb, 1979
Drawn by
GW
Filename
ACOUSTX.S02
Sheet
2 of 2

NOTE 2
Receiver input deleted (sheet 2)
and R25 added, from
S/N 1700 on.

NOTE 3
C15, C15A, C20, C27, C36, R15 & R18
involve changes in production.
The earlier values were:
C15 15uF or 33uF
C20 15uF Tantalum
R15 6.8K
R18 68K
C15A, C27, C36 omitted

NOTE 4
1N4004 acceptable for
CR5–CR8 & CR13–CR16

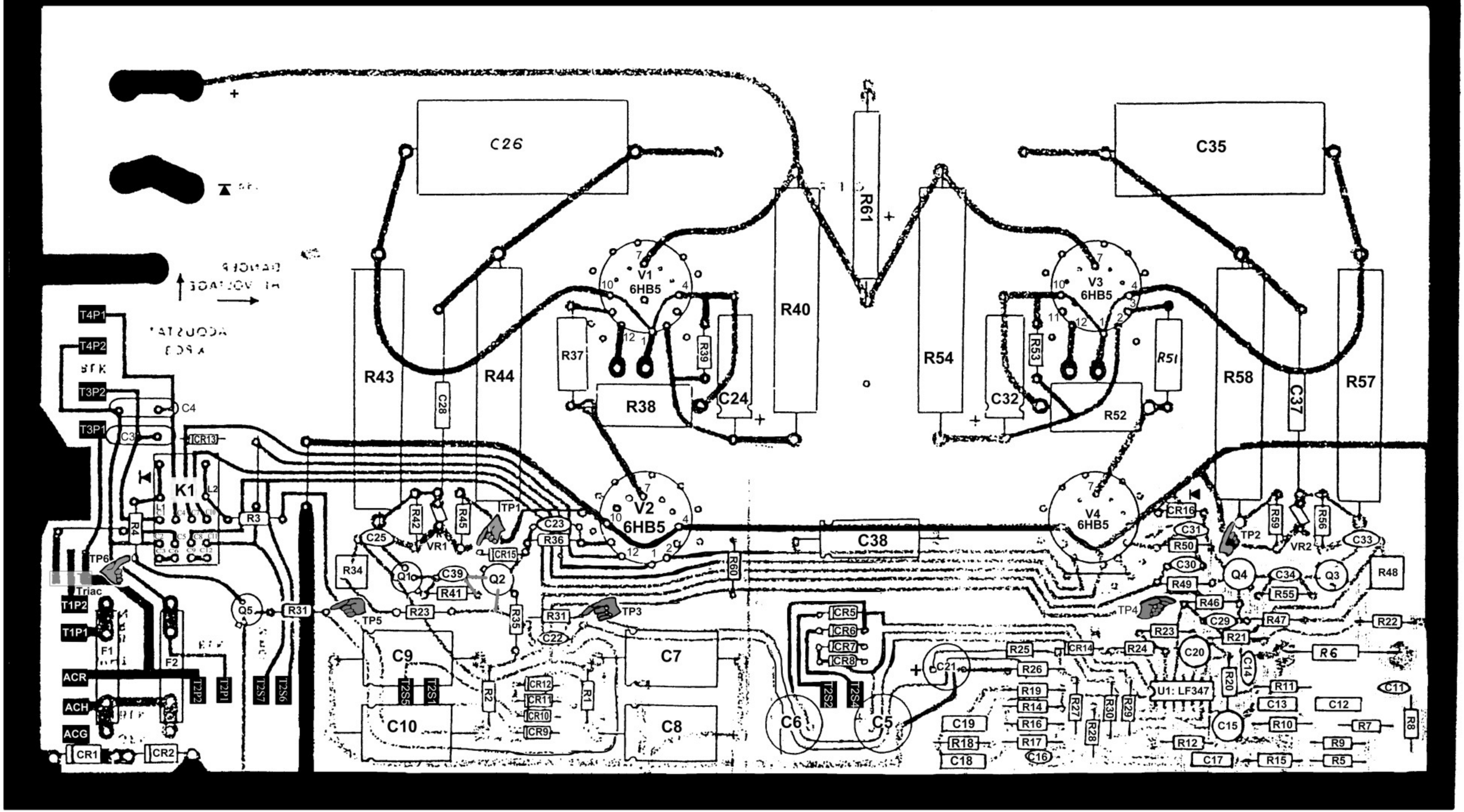
F1
5A (3A Slo-blo)
SC142D
TRIAC1
T1
117 VAC
CR1 1N5400
CR2 1N5400
F2 1/2A (1/4 A Slo-blo)
CR3 S3217
CR4 S3217
+5KV
C1 1uF, 3kV, Oil
C2 1uF, 3kV, Oil
T3
T4
T2
K1:B
K1:C
K1:D
K1:E
K1:A 4PDT
.01, 3kV C3
.01, 3kV C4
FIL1 V1
FIL2 V2
FIL3 V3
FIL4 V4
BLK BLK
+17V
-17V
-160V
+150V
-150V
1000, 25V C5
1000, 25V C6
22, 250V C7
22, 250V C8
22, 250V C9
22, 250V C10
R1 10K
R2 10K
R3 2.7K
R4 2.7K
CR5 CR6 CR7 CR8 CR9 CR10 CR11 CR12 1N4006
CR13 1N4006

TRIGGER AMPLIFIER
+17V
R29 22K
R30 1M
R28 10K
R27 10K
R31 33K
TP5
TP6
U1:A LF347N
Q5 MM4003
-17V
220, 25V C21
1M R26

RECTIFIER (TURN-ON) AMPLIFIER
R25 680 Note 2
CR14 1N4006
U1:D LF347N
R24 220K
2.2K R23
Non-Polar 47 C20 Note 3
Front Plate Drive
From U1:C-8, Sht2 A3

Recreation in Tango
2/7/1999 Gary E. Winter, Sky Pilot Design

Title: Schematic, Acoustat Model X, Power Supply		
Size: B	Number: SC-X3	Rev:
Date: Feb, 1979		Drawn by: GEW
Filename: ACOUSTX.S01		Sheet 1 of 2



PRINTED CIRCUIT ASSEMBLY PC-X3 FEBRUARY 1979

ACOUSTAT
corporation

3101 Southwest First Terrace, Fort Lauderdale, Florida 33315
Phone: 305/462-6700

The ACOUSTAT SERVO-CHARGE AMPLIFIER

Service and Owner's Manual

ACOUSTAT
SERVO-CHARGE AMPLIFIER
SERVICE MANUAL

Contents:

Introduction
System Set-Up Instructions
Shielding and Grounding of Audio Systems
Description of the Servo-Charge Amplifier
Block Diagram
Theory of Operation
    Constant Charge Electrostatic Panels
    Input and Equalization Amplifier
    Phase Inverter
    Rectifier Amplifier
    Trigger Amplifier
    Panel Bias
    Output Amplifier
    Power Supplies
    Internal Grounding
Drawings
    Overall Schematic
    Chassis Assembly
    Input Area Assembly
    Printed Circuit Assembly
Parts List
Component Changes
Troubleshooting

INTRODUCTION

The Servo-Charge Amplifier Service and Owner's Manual has been written as part of an effort to minimize the service problems encountered by our dealers and customers. We have found that many of these problems are the result of a failure to understand the principles of operation of the circuitry of the Servo-Charge amplifier and that this situation has been complicated by a lack of ducumentation of the physical layout of the printed circuit board.

We have also determined that many systems fail to function at their full potential because of deficiencies in the initial set-up. Therefore, a section has been included outlining the preferred procedure for the placement and connection of a newly installed system.

The acoustics of the room will play a major role in the ultimate performance of the speaker system and we have found that it is far more rewarding, in terms of the quality of results obtained, to tune the speakers to the room than to add line equalization. A solid, reflective, and unobstructed wall should be directly behind the speakers and any required tuning of the room can normally be accomplished with slight changes in the placement of drapes or other wall hangings.

SET-UP INSTRUCTIONS FOR ACOUSTAT ELECTROSTATIC SPEAKER SYSTEMS

The set-up procedure, exclusive of assembly, is the same for all Acoustat electrostatic speaker systems. We have been able to make the Monitor series speaker systems more tolerant than the Acoustat X systems for small aberations in the set-up and room tuning; but we still advise that the preferred procedure should be followed fully to obtain the best possible performance from the system.

Some of the principal considerations which will determine the performance potential of the speaker system as installed are:

The Wall Behind the Speakers:

This wall should be hard, reflective, and sufficiently rigid that it will not rattle--sliding glass doors are a "No-No".

The Orientation of the Speaker System Within the Room:

Unless there is an overriding consideration to the contrary, the speakers should project sound along the longer axis of the room. This can be considered a universal rule of stereo speaker systems and is in no way peculiar to Acoustat products.

The Grounding of the System:

It is essential that the power supply ground be connected to prevent any buildup of charges in the Servo-Charge amplifier power supplies. THE THIRD WIRE GROUND MUST BE CONNECTED.

While the system may function reasonably well with only the power supply ground, this leaves the main signal ground floating. THERE MUST BE ONLY ONE SIGNAL GROUND IN THE SYSTEM and this should normally be provided at the input of the preamplifier.

Electric Feedback:

Electrostatic loudspeakers produce a strong electric field which can influence the operation of any low level electronic circuitry in close proximity and can result in feedback at frequencies well above the audio spectrum--this has the effect of high power dissapation and decreased headroom in the system. The tone arm of the turntable and the input of the preamplifier should be kept at least six to eight feet from the nearest speaker to ensure that no feedback can occur.

Phasing:

Acoustat speaker systems are designed to preserve correct absolute phase throughout the system including the final coupling of the signal to the air. This ensures that vocalists and instruments will sound as natural as possible. Therefore, make sure that the connections from the speakers to the amplifiers are correctly oriented: the wires should enter the three prong Pomono plug from above.

The Area Between the Speakers:

This area should be kept clear of major obstructions to airflow if optimum imaging is to be achieved. The size and shape of objects placed between the speakers will determine the extent of any deleterious effect on the imaging--objects such as record cabitets or equipment racks between the speakers should be avoided.

Tiltback:

The tiltback of the speakers has the combined effect of improving the vertical dispersion of the system and of breaking up standing waves in the room. Two or three degrees of tilt is typical and is a good initial setting--this corresponds to about three inches of rearward displacement of the top of the speaker.

Toe-in:

This setting is possibly the least critical. However, if the speakers are toed in too much, a soloist will appear to be singing from a position somewhere beyond the rear wall.

Distance from the Wall:

If the speakers are placed too close to the rear wall of the room, o soloist will tend to sound "muffled", and if the speakers are placed too far from the wall, a soloist will sound "hollow".

For purposes of setting up the system, we recomend that the speakers be auditioned using a solo female vocalist of reference quality. We have found that the human ear more sensitive to anomalies in the human voice than in instrumental music and, since "imaging" is most discernable in the mid-range, we recomend that a female vocalist be selected.

Once the system has been assembled and connected, the orientation within the room determined, the initial settings of tiltback and toe-in made, and the amplifier controls set (nine o'clock for the gain controls and twelve o'clock for the HF Balance control of the Monitor--eleven o'clock for the Acoustat X and Monitor Three would be typical); the audition may begin with the speakers placed too close to the wall. At this point, the speakers should sound muffled. By moving the speakers out from the wall a little at a time, a point should be reached at which "you could reach out and touch the soloist." When this has been accomplished, the tiltback, toe-in, HF Balance, and gain balance to center the preamplifier control can be fine-tuned by experimentation.

SHIELDING AND GROUNDING OF AUDIO SYSTEMS

The purpose of this section is not to make the reader an expert on the subject of shielding and grounding; but, rather, to provide simple guidelines for the reduction of environmental noise in the signal paths typically used in high fidelity audio systems. In this application, the use of single conductor coaxial cables between single ended outputs and inputs is nearly universal and the RCA "phono plug" is the most common connector in use. Therefore, we will confine our discussion to this type of feed.

While it should be obvious that proper grounding is always important, it is all the more important with this type of feed where extraneous shield currents are so easily injected into the audio. Thus, it is quite important that a single grounding point for the system be selected so that the ground and "neutral" currents of the power wiring in the building in which the system is installed will not be conducted through the shields of the connecting cables. The degree to which a single well chosen grounding point can be selected and the degree to which ground "loops" can be eliminated will be the principal determinant of the degree to which inductively coupled and resistively coupled environmental noise can be isolated from the system. Thus, for example, the two cables of a stereo feed from a stereo preamplifier to a stereo power amplifier should be of equal length and use adjacent routing. Deviation from this principal can result in the cable shields acting as a loop antenna.

It should be pointed out that power line noise can never be totally eliminated as some noise will be fed in through the power supplies of the equipment involved in addition to the internal noise generated within the high fidelity audio equipment. While it is certainly true that the internal noise situation is improved with each advance of the "state of the art", the problem can never be completely eliminated!

Normally, the system grounding point chosen will be the lowest level signal input of the system and when a tuner is not in use, this will usually be the phono preamp input. If a tuner is present, it is often preferable to use the low side of the antenna input as the system ground.

Shielded cable should always be used from any source to the input of an amplifier and the connections, especially of the shields, must be excellent so that the resistance of the connection will be trivial. Thus, the connectors must be clean and must mate securely and the atachment of the connectors to the cables must be properly executed.

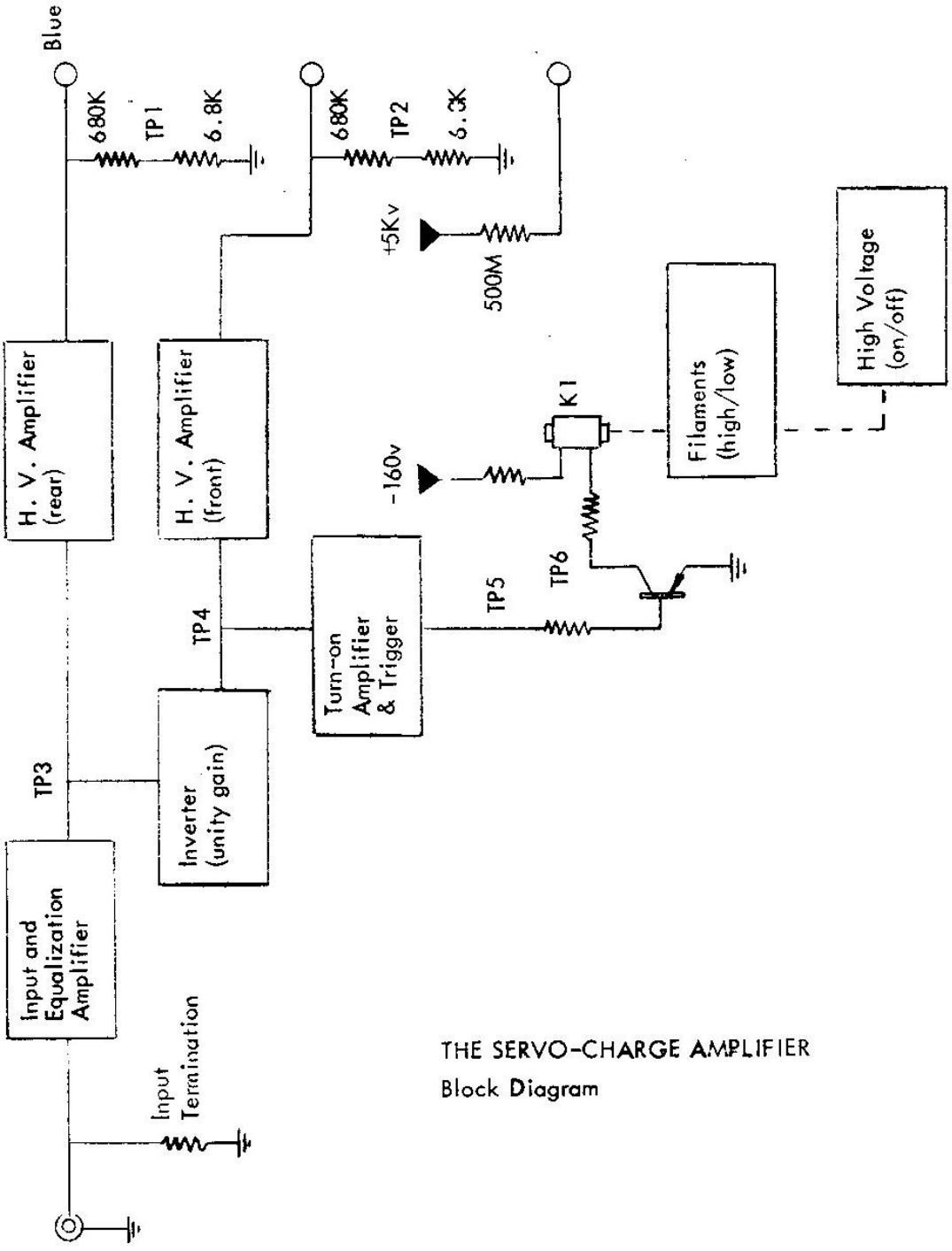
DESCRIPTION

The Acoustat Servo-Charge amplifier is a hybrid solid state and vacuum tube device specifically designed to drive the electrostatic transducer panels of the Acoustat X and Acoustat Monitor loudspeaker systems.

In order to eliminate the requirement for power amplifier switching cables from the preamplifier, the Servo-Charge amplifier is designed to turn itself on at the first presence of an input signal and to turn itself off after the signal has been absent for a period of approximately five minutes. To accomplish these goals, the solid state portion of the circuitry operates at all times. When the amplifier is in its "off" state, the high voltage supply for the output vacuum tubes is inoperative and the vacuum tube filament supplies are reduced to one half of their operating voltage.

The input section of the amplifier is based on a premium quality quad integrated circuit operational amplifier used for signal amplification, active equalization, phase inversion, and control of the automatic turn-on/turn-off functions.

The output sections of the amplifier are two hybrid discrete operational amplifiers which drive the "plates" of the electrostatic transducer panels in a push-pull format. The output vacuum tubes operate at the working voltage of the electrostatic panels so that transformer "matching" is not used.

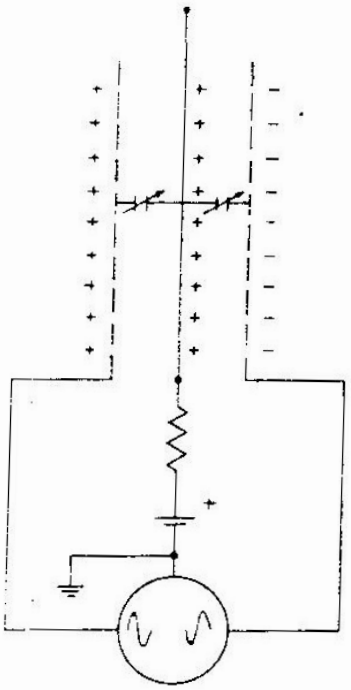


THE SERVO-CHARGE AMPLIFIER
Block Diagram

THEORY OF OPERATION

In order to understand the operation of the Servo-Charge amplifier, it is very usefull to have at least a rudimentary understanding of the load which it was designed to drive.

Acoustat uses what are referred to as constant charge electrostatic transducer panels in which the electrostatic "plates" are driven in a push-pull format and the driven diaphram is biased in such a manner that its electrostatic charge remains constant despite the application of high voltage audio signals to the electrostatic plates.



$C = q/V$

$J = CV^2/2$

$\vec{F} = \vec{E}q$

Where: C capacitance in farads
V voltage in volts
J energy in joules
F force in newtons
E electric field in newtons per coulomb *
q charge in coulombs

* newtons per coulomb and volts per meter are alternate units of measure of electric field

While we admit that the physics is not "obvious at a glance" we will, for the purposes of this amplifier service manual, simply state the electrical requirements to drive the electrostatic loudspeaker panels that we use at Acoustat Corporation and not dwell on the physics of electrostatic loudspeaker design.

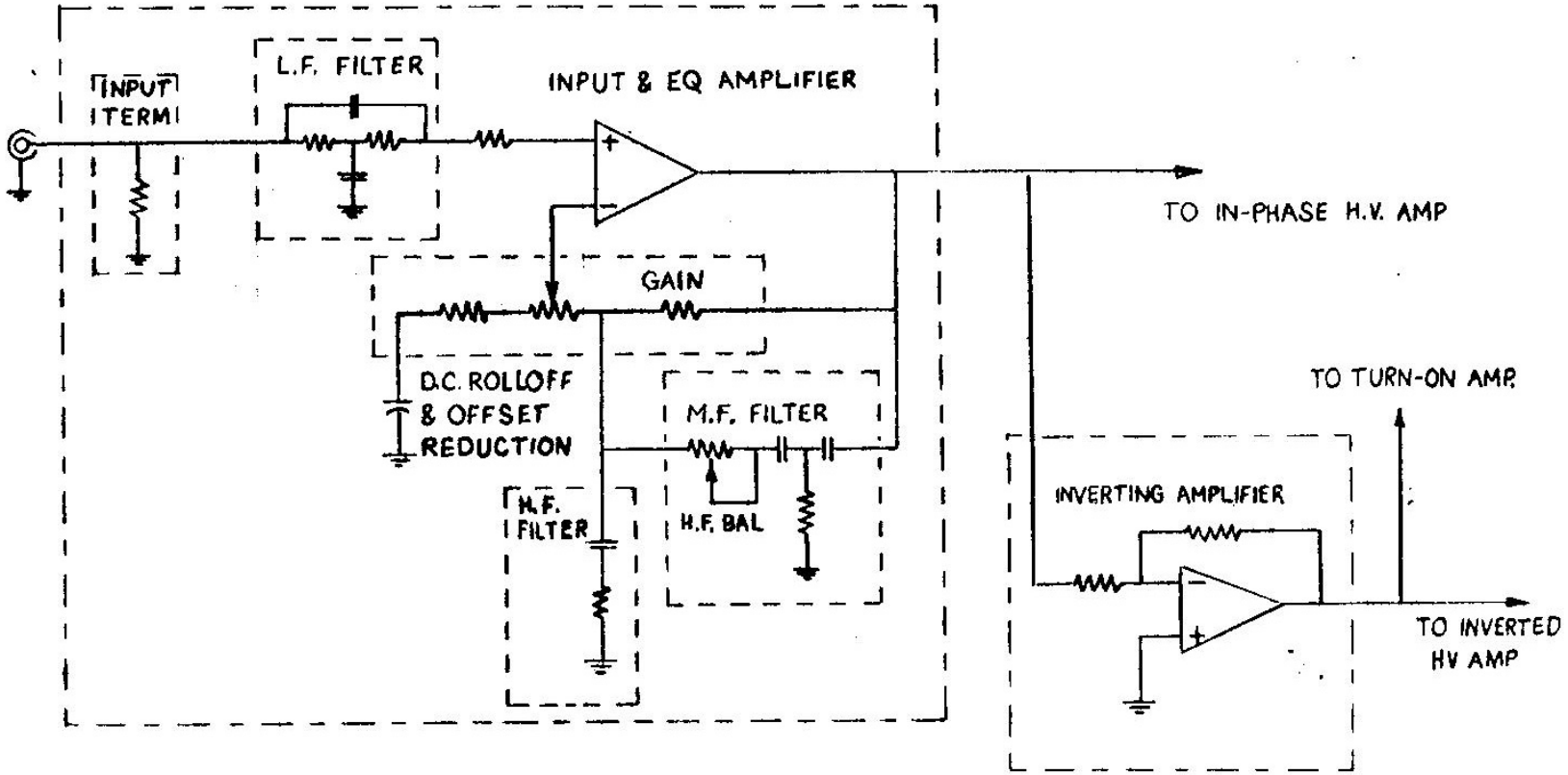
In order for the charge on the driven diaphram to remain constant despite its own physical excursions (it is the moving element used to excite the air and is analogous to the cone in a conventional speaker) and the electrical excursions of the electrostatic "plates" (we use insulated wire bonded to a plastic grid rather than perforated and insulated sheet metal for reasons of reliability and acoustic openness) it must be biased through a sufficiently high resistance that its charging time constant will be long compared to the period of the lowest audio frequency used and the DC offset of both plates must be nearly the same and sufficiently removed from the potential of the diaphram for proper biasing of the system to exist.

Within the Servo-Charge amplifier, we bias the diaphram through a 500 megohm resister to provide the proper time constant and capacitively couple the drive to the electrostatic plates so that their DC offset can be controled to near ground potential by the use of a resistor which is tapped to also act as a low voltage measuring point for testing purposes.

The above biasing situation results in a DC voltage differential of 4000 to 4500 volts between the diaphram and the plates. The plates are in turn driven with a maximum AC signal amplitude of 4000 to 4500 volts peak to peak. The front and rear plates, being operated in a push-pull format, are driven with equal amplitude but 180 degrees out of phase.

The use of constant charge transducer panels eliminates the second order (or square law) functions from the force equations so that the waveform used to drive the electrostatic plates is nearly identical to the waveform at the output of the first stages of the amplifier except for amplitude and is also nearly identical to the waveform at the input of the amplifier (from the preamplifier or tuner) except for amplitude and the equalization necessary for flat acoustic frequency response. The panels are also equipped with felt dampers on their rear sides to broaden and reduce the amplitude of the diaphram resonant peak so that it can be used in a controlled manner to improve the bass frequency response of the system.

The theory of operation of each specific portion of the Servo-Charge amplifier is as follows:


INPUT TERM
L.F. FILTER
INPUT & EQ AMPLIFIER
TO IN-PHASE H.V. AMP
GAIN
D.C. ROLLOFF & OFFSET REDUCTION
M.F. FILTER
TO TURN-ON AMP
H.F. FILTER
H.F. BAL
INVERTING AMPLIFIER
TO INVERTED HV AMP

INPUT AND EQUALIZATION AMPLIFIER

This is the first stage of the Servo-Charge amplifier and is in operation in both the operating and standby modes of the amplifier. This stage amplifies and processes the signal from the preamplifier other audio source and drives the phase inverter and in-phase (rear plates of the speaker) high voltage amplifier.

The Input and Equalization Amplifier provides approximately 20 dB of gain at typical settings of the Gain control and includes the equalization networks and the HF Balance control.

R5 acts as the input termination and sets the input impedance of the amplifier.

R9, R10, C12, and C13 comprise the "wall effect" equalization network to smooth the base response of the dipole output of the speakers in the presence of an acoustically reflective rear wall. If the speakers are to be operated a considerable distance from a wall, or in "free air", this network can be effectively bypassed by the addition of 1/2 megohm resistor in parallel with C12.

C18, C19, and R18 comprise the midrange equalization network.

R15 and C17 comprise the high frequency equalization.

R16, R16A, and R17 comprise the High Frequency Balance control network and determine the relative contributions of the midrange and high frequency equalization networks.

R12, R13, and R14 comprise the overall gain control network and C15 acts to limit the DC offset of the stage by reducing the DC gain to unity.

In addition, on amplifiers prior to serial number 1700, a higher level input was provided which was designed to be driven by the speaker outputs of any tuner/amplifier on which a preamplifier was not provided. This provision was seldom utilized and was eliminated in the process of changing the main input provision from a DIN (RCA phono) jack to a 1/4 inch diameter telephone jack. This is a two conductor (mono) jack with only tip and sleeve connections.

If required in individual cases, the "receiver input" provision may be substituted for the preamplifier input on the later amplifiers by moving the tip connector lead from the telephone jack to the printed circuit board so that the input to the amplifier is the junction of R6, R7, and R8 rather than the junction of R5, R9, and C12--after installing R6, R7, R8, and C11 on the printed circuit board (R6 is substituted for the factory installed wire jumper in this procedure).

PHASE INVERTER

This stage is driven by the Input and Equalization Amplifier and is used to drive the Rectifier (or Turn-On) Amplifier and the inverted-phase (front plates of the speaker) high voltage amplifier.

This is a unity gain stage without equalization and should very seldom be the cause of any technical difficulty. The signal at pin 8 of the op-amp should be equal to, but out of phase with, the signal at pin 7 (output of the Input and Equalization Amplifier).

RECTIFIER (TURN-ON) AMPLIFIER

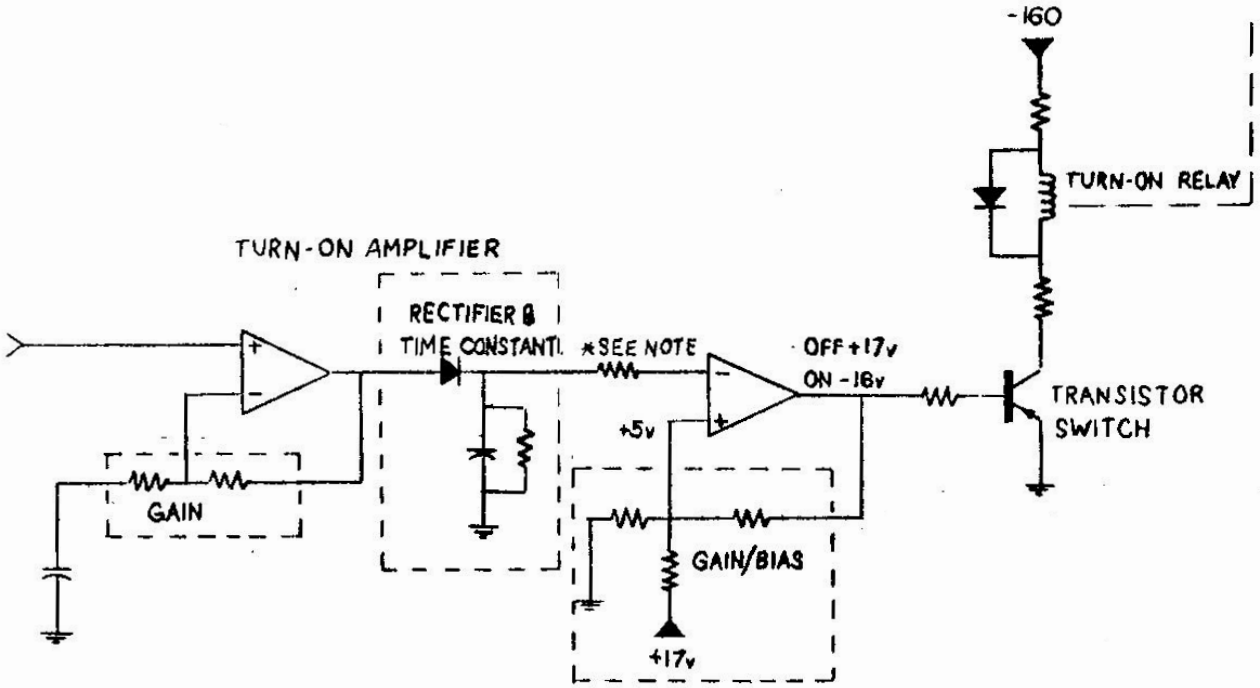
This is the first stage of the automatic "instant-on" circuitry and is driven by the Phase Inverter.

This stage provides up to 40 dB of gain throughout the audio range diminishing sharply to unity gain at DC for offset control. The full gain is available only for low signal levels since the stage is driven to clipping during moderate to loud passages; but the full gain must be available for small signals so that the amplifier will not tend to "turn-off" (or resume its stand-by mode) during quiet passages in musical selections.

Rectifier diode CR14 provides a DC signal to operate the Trigger Amplifier and the signal storage network composed of R26 and C21 provides a sufficiently long time constant to maintain the amplifier in its operating mode for 3 to 6 minutes (averaging about 5 minutes) after the cessation of moderate to high signal levels.

After amplifier serial number 1700, R25 is included in the circuit to slow the charging rate of the signal storage network to reduce the probability of "falsing" or turn-on due to a single transient pulse.

While difficulties involving this stage are not common, assembly errors have occurred and a complaint of premature turn-off (or turn-off during quiet passages in music) should lead first to a visual inspection of R23 and R24 for their correct values.



NOTE: INPUT PROTECTION FOR OP-AMP PREVENTS DAMAGE DURING POWER FAILURE OR WHEN UNPLUGGED

TRIGGER AMPLIFIER

This is the switching portion of the automatic turn-on circuitry and is used to operate relay K1. Relay K1 is part of the power supply and controls the filament supplies and, through one of the filament supplies and a triac, the high voltage supply.

The Trigger Amplifier operates as a voltage comparitor and is referenced to the positive low voltage supply rail such as to cause an "off", or stand-by, state of the Servo-Charge amplifier. The amplitude of the reference bias is such that approximately five volts (positive) is required from the Rectifier Amplifier to force an "on" condition.

The gain of the system is such that approximately -15 dBv at the main input should result in an "on" condition when the Gain control of the Servo-Charge amplifier is at approximately the "nine o'clock" position.

DIAPHRAM BIAS

The diaphram (or diaphrams) of the Acoustat loudspeaker is biased from the high voltage supply through a 500 megohm resistor. Thus, the speakers are only biased when the Servo-Charge amplifier is "on".

OUTPUT AMPLIFIER

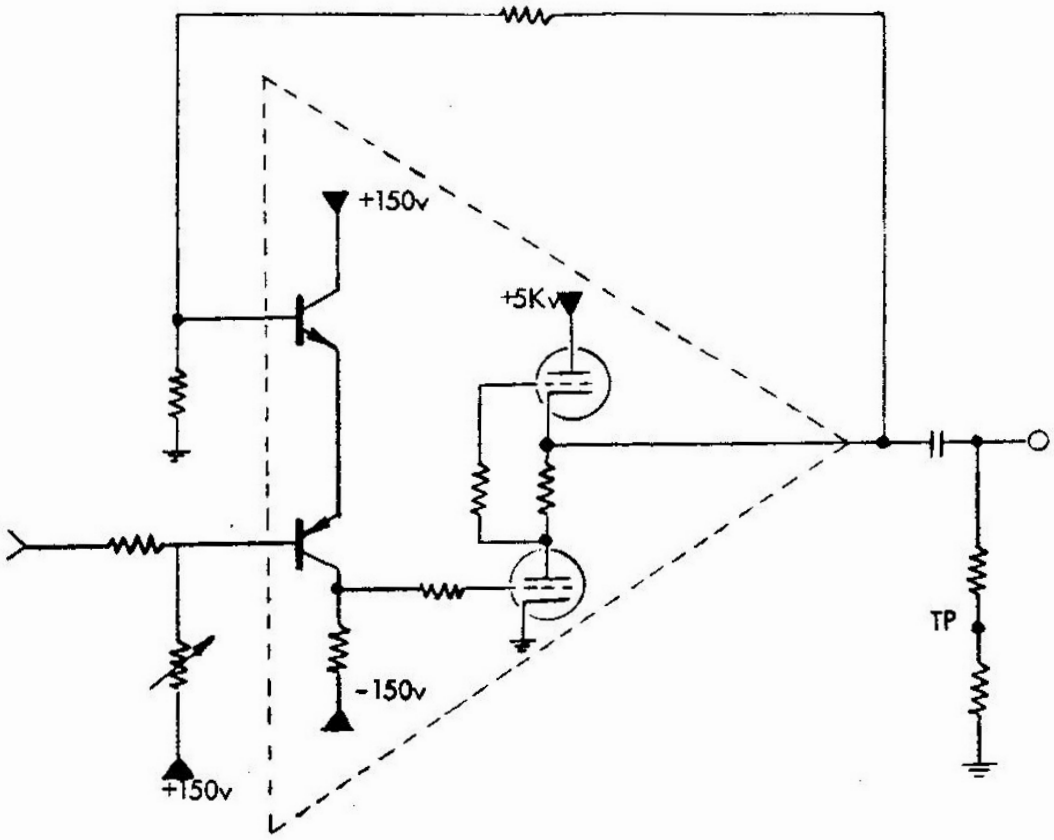
There are two Output Amplifiers which operate 180° out of phase so that the electrostatic plates of the Acoustat speaker are driven "push-pull". Each of the Output Amplifiers is a discrete hybrid op-amp operated with a gain of approximately 45 dB.

With the Gain control set at the "nine o'clock" position, a 7.5v RMS input signal at 1KHz will result in 4500v peak to peak signals at the electrostatic plates of the speaker.

The high voltage portions of the output amplifiers operate only when the Servo-Charge amplifier is in the "on" condition.

SIMPLIFIED SCHEMATIC

Discrete High Voltage Amplifier



POWER SUPPLIES

The power supply of the Servo-Charge amplifier can be thought of as having been divided into two principle parts. The 17 volt supplies and the 150 volt supplies operate at all times. The 5000 volt supply operates only in the "on" condition of the amplifier and the filament supplies are switched between two levels of operation--6 volts in the "on" condition and 3 volts in the "off" or stand-by condition.

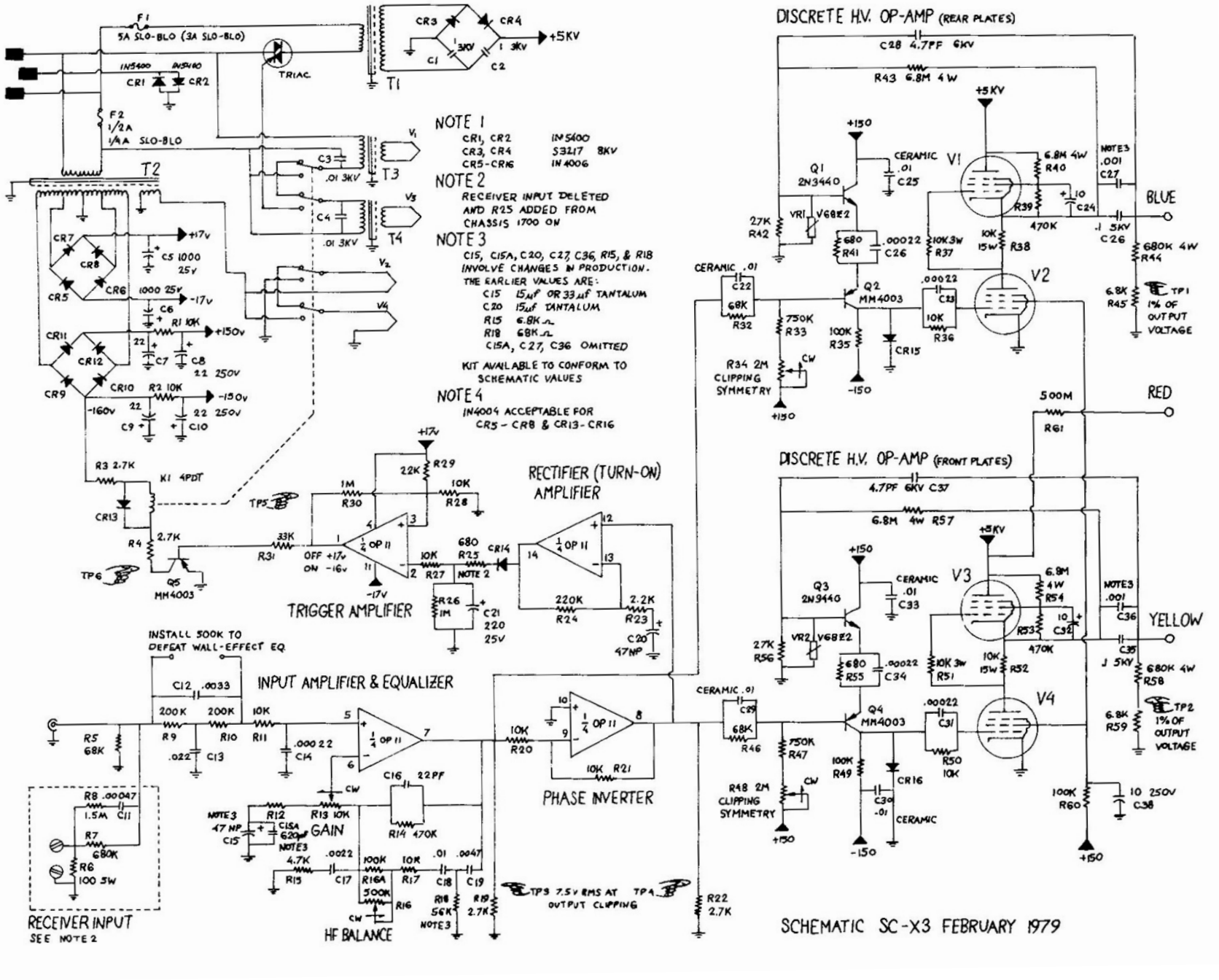
The positive and negative 17 volt supplies, the positive and negative 150 volt supplies, and the filament supplies for the two "lower" vacuum tubes are all powered by a single transformer with appropriately tapped secondary windings. The term "lower" vacuum tubes, in this case, maens the tubes with grounded cathode connections. The filament portion of this part of the power supply is switched between series and parallel operation for the "off" and "on" conditions of the amplifier, respectively.

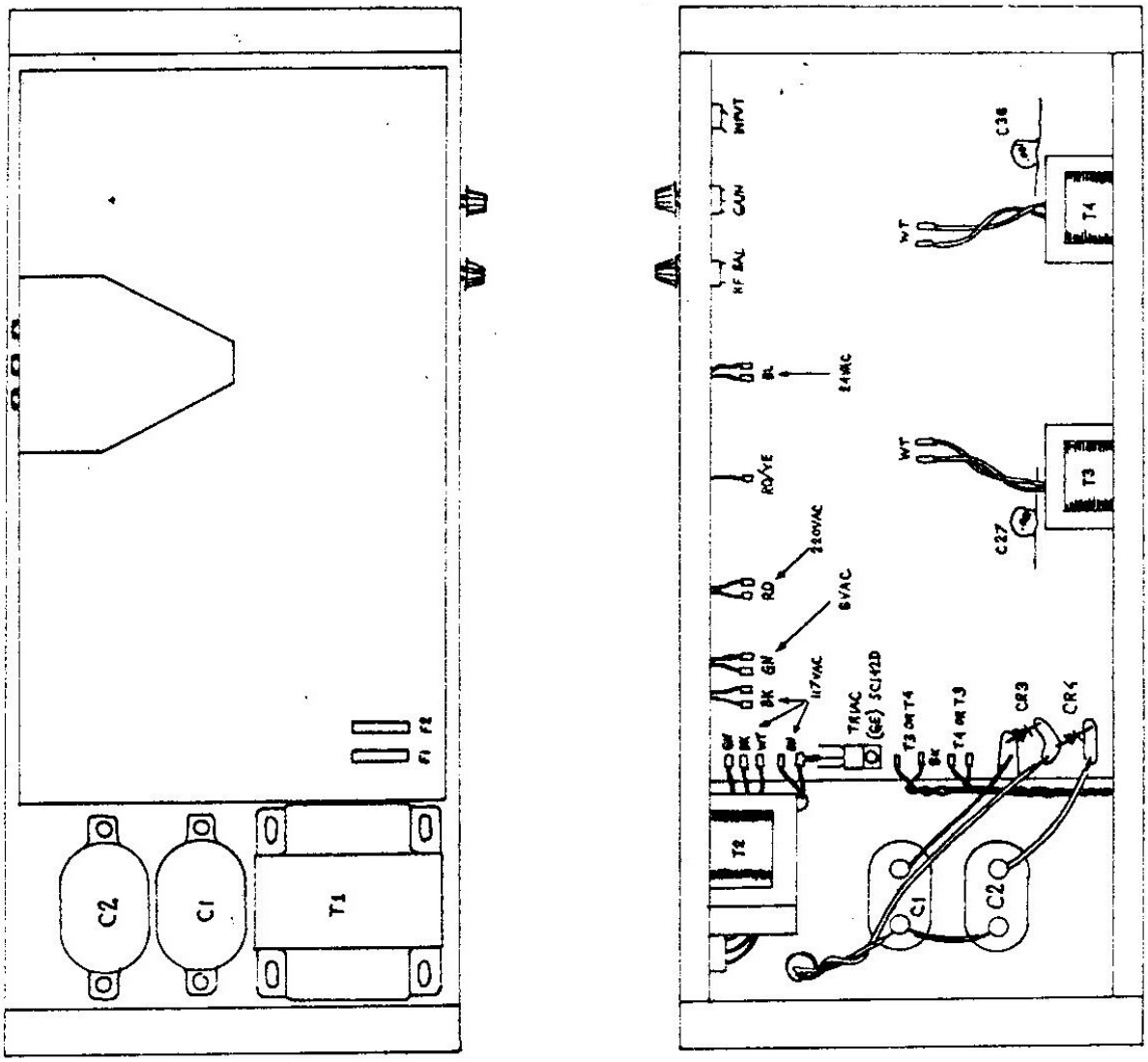
Two separate filament transformers are used to provide the necessary cathode heater isolation for the two "upper" vacuum tubes and the primary windings of these two transformers are switched between series and parallel operation for the "off" and "on" conditions of the amplifier. In the "on" condition, the primary winding of the high voltage transformer is also supplied with power through the triac.

GROUNDING

To permit a solid connection between the chassis of the Servo-Charge amplifier and the chassis of the preamplifier or tuner, the Servo-Charge amplifier is "floated" away from power line ground by the use of two silicon diodes. These provide for an isolation of up to six tenths of a volt and preclude the occurance of the hums and buzzes which result from the slight potential difference between the various power outlets within a room.

It is essential, however, that the power supply ground also be used to prevent any buildup of static charges in the power supplies. Thus, THE THIRD WIRE GROUND MUST BE CONNECTED.

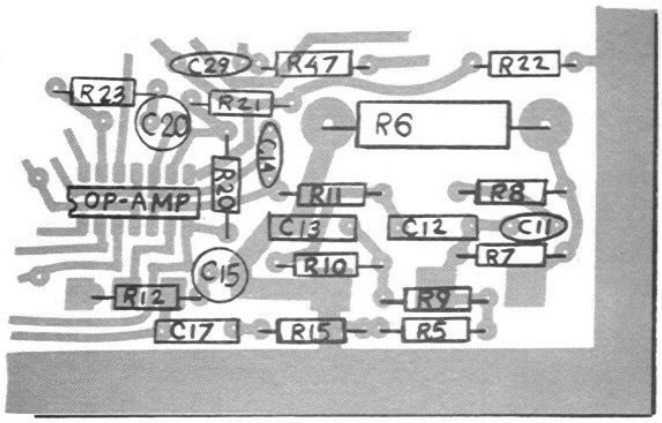

F1
5A SLO-BLO (3A SLO-BLO)
IN5400
CR1
CR2
TRIAC
T1
CR3
CR4
+5KV
C1
C2
F2
1/2A
1/4A SLO-BLO
T2
T3
T4
V1
V2
V3
V4
C3
.01 3KV
C4
.01 3KV
CR7
CR8
CR5
CR6
+17v
C5 1000 25v
1000 25v
-17v
C6
R1 10K
+150v
CR11
CR12
CR9
CR10
R2 10K
-150v
-160v
C7
C8
C9
C10
22 250V
NOTE 1
CR1, CR2 IN5400
CR3, CR4 S3217 8KV
CR5-CR16 IN4006
NOTE 2
RECEIVER INPUT DELETED
AND R25 ADDED FROM
CHASSIS 1700 ON
NOTE 3
C15, C15A, C20, C27, C36, R15, & R18
INVOLVE CHANGES IN PRODUCTION.
THE EARLIER VALUES ARE:
C15 15µf OR 33µf TANTALUM
C20 15µf TANTALUM
R15 6.8K Ω
R18 68K Ω
C15A, C27, C36 OMITTED
KIT AVAILABLE TO CONFORM TO
SCHEMATIC VALUES
NOTE 4
IN4004 ACCEPTABLE FOR
CR5 – CR8 & CR13 – CR16
R3 2.7K
K1 4PDT
CR13
R4 2.7K
Q5
MM4003
TP6
TP5
+17v
R29 22K
1M R30
10K R28
33K R31
OFF +17v
ON -16v
OP 11
-17v
10K R27
680 R25
NOTE 2
CR14
R26 1M
C21 220 25V
RECTIFIER (TURN-ON)
AMPLIFIER
220K R24
2.2K R23
C20 47NP
TRIGGER AMPLIFIER
INSTALL 500K TO
DEFEAT WALL-EFFECT EQ
C12 .0033
200K R9
200K R10
10K R11
.022 C13
.00022 C14
INPUT AMPLIFIER & EQUALIZER
R5 68K
R8 .00047
1.5M C11
R7 680K
R6 100 3W
RECEIVER INPUT
SEE NOTE 2
C16 22PF
R14 470K
CW
NOTE 3
47 NP C15
C15A 620
GAIN
R12
R13 10K
4.7K R15
.0022 C17
100K R16A
500K R16
HF BALANCE
10K R17
.01 C18
.0047 C19
56K R18
NOTE 3
2.7K R19
10K R20
10K R21
PHASE INVERTER
TP3 7.5V RMS AT TP4
OUTPUT CLIPPING
R22 2.7K
DISCRETE H.V. OP-AMP (REAR PLATES)
C28 4.7PF 6KV
R43 6.8M 4W
+5KV
+150
Q1
2N3440
CERAMIC .01 C25
VR1 V68E2
2.7K R42
680 R41
.00022 C26
10K 3W R37
10K 15W R38
6.8M 4W R40
R39 470K
10 C24
NOTE 3
.001 C27
.1 5KV C26
BLUE
680K 4W R44
6.8K R45
TP1
1% OF
OUTPUT
VOLTAGE
CERAMIC .01 C22
68K R32
750K R33
100K R35
CR15
R34 2M
CLIPPING
SYMMETRY
CW
-150
+150
Q2
MM4003
.00022 C23
10K R36
V2
500M R61
RED
DISCRETE H.V. OP-AMP (FRONT PLATES)
4.7PF 6KV C37
6.8M 4W R57
Q3
2N3440
CERAMIC .01 C33
VR2 V68E2
27K R56
680 R55
.00022 C34
10K 3W R51
10K 15W R52
6.8M 4W R54
R53 470K
10 C32
NOTE 3
.001 C36
C35 1 5KV
YELLOW
680K 4W R58
6.8K R59
TP2
1% OF
OUTPUT
VOLTAGE
CERAMIC .01 C29
68K R46
750K R47
100K R49
CR16
R48 2M
CLIPPING
SYMMETRY
CW
C30 .01
CERAMIC
Q4
MM4003
.00022 C31
R50 10K
V3
V4
100K R60
10 250V C38
SCHEMATIC SC-X3 FEBRUARY 1979



CHASSIS ASSEMBLY CA-X3 FEBRUARY 1979

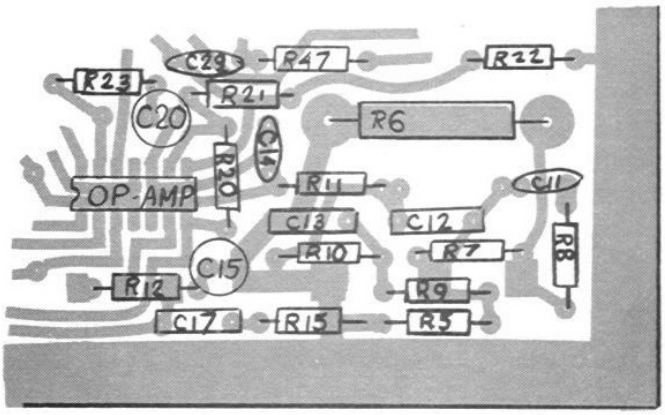
Input area of Printed Circuit

Thru s.n. 1699

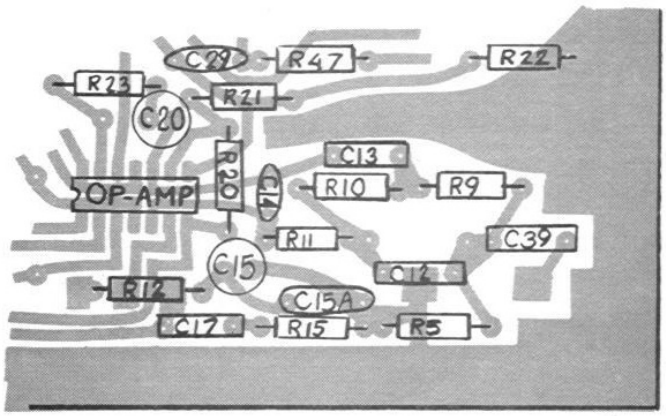


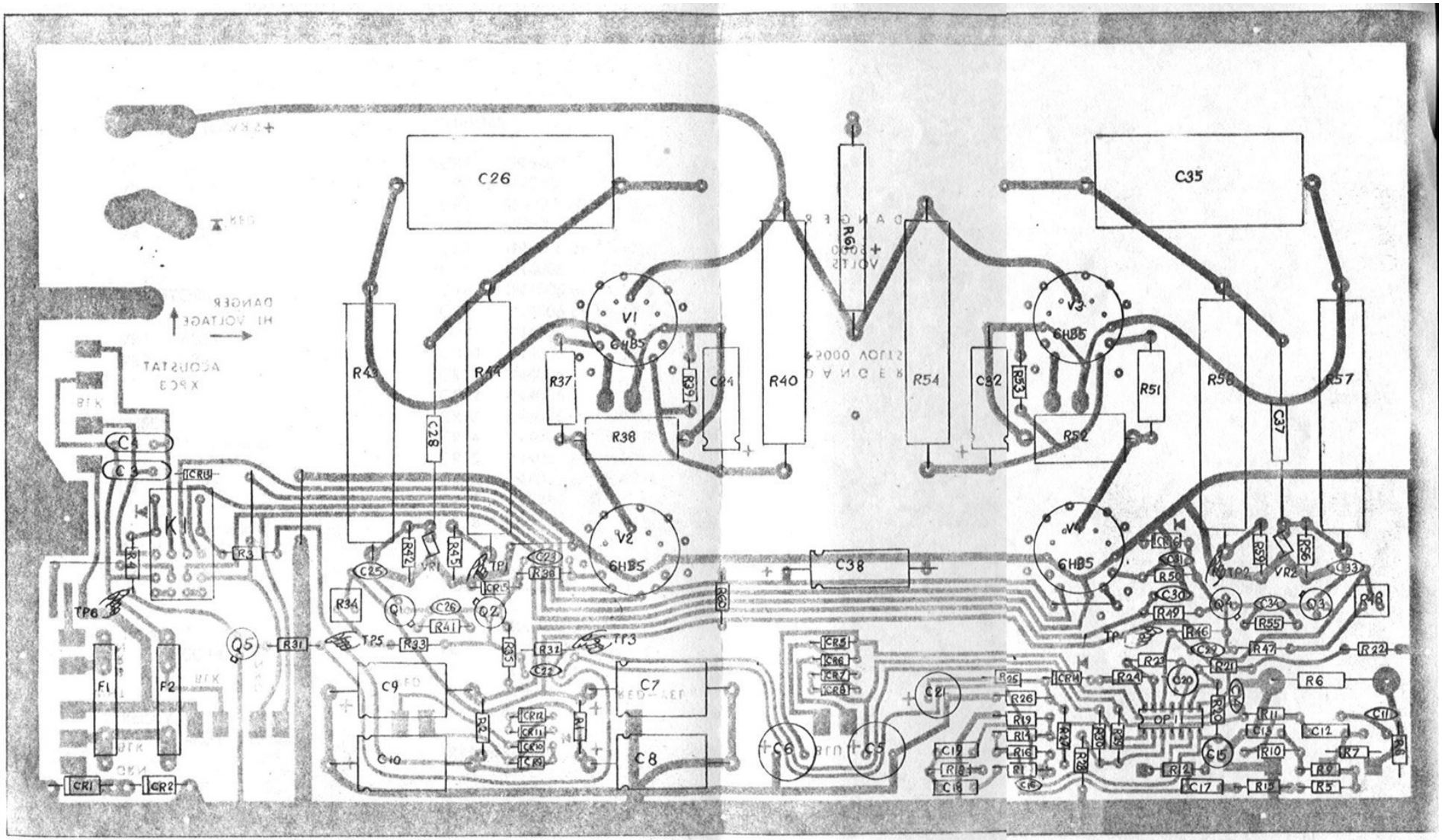
Thru s.n. 1899

R7, R8, C11 omitted and R6 jumpered as delivered by factory



From s.n. 1900





PRINTED CIRCUIT ASSEMBLY PC-X3 FEBRUARY 1979

PARTS LIST

VACUUM TUBES

V1	6HB5
V2	6HB5
V3	6HB5
V4	6HB5

VARISTORS

VR1	68Z2
VR2	68Z2

FUSES

	110v models
F1	5A Slo-Blo
F2	1/2A
	240v models
F1	3A Slo-Blo
F2	1/4A

TRIAC

SC142D

RELAY

K1	4PDT 120vdc

DIODES

CR1	1N5400
CR2	1N5400
CR3	S3217 8Kv/150ma
CR4	S3217
CR5	1N4006 or 1N4004
CR6	1N4006 or 1N4004
CR7	1N4006 or 1N4004
CR8	1N4006 or 1N4004
CR9	1N4006
CR10	1N4006
CR11	1N4006
CR12	1N4006
CR13	1N4006 or 1N4004
CR14	1N4006 or 1N4004
CR15	1N4006 or 1N4004
CR16	1N4006 or 1N4004
CR17	1N5384 150v zener
CR18	1N5384

TRANSFORMERS

T1	2Kv
T2	6.3v, 20v C.T., & 220v C.T.
T3	6.3v
T4	6.3v

TRANSISTORS

Q1	2N3440
Q2	MM4003
Q3	2N3440
Q4	MM4003
Q5	MM4003

CAPACITORS

C1	1 3Kv Oil filled
C2	1 3Kv Oil filled
C3	.01 3Kv Ceramic
C4	.01 3Kv Ceramic
C5	1000 25v
C6	1000 25v
C7	22 250v
C8	22 250v
C9	22 250v
C10	22 250v
C11	470pf
C12	.0033
C13	.022
C14	220pf
C15	47 Non-polar formerly 33 Tantalum, or 15 Tantalum
C15A	620pf Mica
C16	22pf
C17	.0022
C18	.01
C19	.0047
C20	47 Non-polar formerly 15 Tantalum
C21	220 25v
C22	.01 Ceramic
C23	220pf
C24	10 250v
C25	.01 Ceramic
C26	.1 5Kv
C27	.0001 6Kv
C28	4.7pf 6Kv
C29	.01 Ceramic
C30	.01 Ceramic
C31	220pf
C32	10 250v
C33	.01 Ceramic
C34	220pf
C35	.1 5Kv
C36	.0001 6Kv
C37	4.7pf 6Kv
C38	10 250v

RESISTORS

R1	10K
R2	10K
R3	2.7K
R4	2.7K
R5	68K
R6	100 5W
R7	680K
R8	1.5M
R9	200K
R10	200K
R11	10K
R12	4.75K
R13	10K Pot
R14	470K
R15	4.02K
R16	500K Pot
R17	10K
R18	56K
R19	2.7K
R20	10K
R21	10K
R22	2.7K
R23	2.2K
R24	220K
R25	680
R26	1M
R27	10K
R28	10K
R29	22K
R30	1M
R31	33K
R32	68K
R33	750K
R34	2M Pot
R35	100K
R36	10K
R37	10K 3W
R38	10K 15W
R39	470K
R40	6.8M 4W
R41	680
R42	27K
R43	6.8M 4W
R44	680K 4W
R45	6.8K
R46	68K
R47	750K
R48	2M Pot
R49	100K
R50	10K
R51	10K 3W
R52	10K 15W
R53	470K
R54	6.8M 4W
R55	680
R56	27K
R57	6.8M 4W
R58	680K 4W
R59	6.8K
R60	100K
R61	500M 2W

COMPONENT CHANGES IN THE SERVO-CHARGE AMPLIFIER

	CURRENT	FORMERLY	REASON
CR9 - CR12	1N4006	1N4004	Mandatory for adiquate PIV for all conditions
C22	.01 Ceramic	.01 Mylar	Transient response
C25	.01 Ceramic	.01 Mylar	
C29	.01 Ceramic	.01 Mylar	
C30	.01 Ceramic	.01 Mylar	
C33	.01 Ceramic	.01 Mylar	
C27	.001 6Kv	Omitted	
C36	.001 6Kv	Omitted	
R25	680 ohms	Omitted	Slower turn-on to reduce falsing
C15	47 Non-polar	15 or 33	Mandatory due to deformation
C15A	620 pf	Omitted	of Tantalum capacitors
C20	47 Non-polar	15	
R18	56K ohms	68K ohms	Increase "warmth"
R15	402K ohms	6.8K, 4.75K	Increase "air"
IC	LM 774	OP-11 TL-084 HA-4741-5 LF 347	

Some or all of the above are installed on nearly all amplifiers currently in service and all are available for installation on all amplifiers.

R6	Jumper	100 5W	Receiver input deleted
R7	Deleted	680K	after SN 1700
R8	Deleted	1.5M	
C11	Deleted	470 pf	

From SN 1700 through SN 1895, although an amplifier can not have both standard and receiver inputs, in can be converted to have a high level (receiver) input instead of the standard line level input.

TROUBLESHOOTING

Section 1

The Acoustat Servo-Charge Amplifier is designed for years of trouble-free operation. To insure continued reliability the following suggestions are made:

1. Connection or disconnection of audio cables within the system must always be made prior to connection of the amplifiers to the AC outlet. This will prevent possible thermal runaway of the vacuum tubes.
2. Do Not, under any circumstance, exceed the rating of either fuse should replacement become necessary.
3. Do read the section on proper grounding of the audio system.
4. Tubes should be replaced after about one, to one and one half years of average use. Exceeding this life expectancy will most likely result in decreased sonic properties and degradation of high frequency response. A weak tube could fail completely and cause overheating of the grid biasing resistors. The sound will be distorted accompanied by a drop in volume and a tube will usually glow bright red. Zener diode protection has been employed to guard this condition. Should this occur, AC power should be removed as quickly as possible. Refer to Section 2.

Section 2

The purpose of this section is to assist the user/technician in determining the cause of a malfunction and eliminating it. When using the troubleshooting charts, it may be necessary to refer to the schematic and parts layout diagrams. The Acoustat Technical Staff is available to answer questions pertaining to service and to assist in obtaining replacement parts. The AC line cord should be disconnected to prevent dangerous electrical shock, when attempting repairs to the amplifier. All transistors, the integrated circuit device, relay, and 10k 15watt resistors have been installed in sockets to simplify replacement.

SYMPTOMS	CAUSE	CURE
V1 or V3 glows red. Sound is distorted, weakened. or Tube explodes or cracks. also 5 amp fuse may be blown.	A tube has failed, usually V2 or V4, causing the "good" tube in the pair to pull full current and glow red.	Replace both V1 and V2 or V3 and V4 Replace the 10k 5w resistor (R37 or R51) and 10k 15w resistor (R38 or R52) closest to the bad tube, or check with an ohmeter. The zener diode, if used, should also be checked/replaced. Check the 5 amp fuse and replace if necessary.
5 amp fuse blows	Shorted high voltage transformer or Shorted high voltage diode	Remove AC power: You are about to operate on the high voltage section! Determine if the transformer is shorted by disconnecting the red secondary lead from the circuit board. Place a piece of tape over the exposed end of the wire. Install a fresh 5 amp fuse, connect to AC outlet, and apply input signal for turn on. If fuse blows at this time, replacement of the high voltage transformer is indicated. If the fuse does not blow, check or replace the high voltage diodes (located under the circuit board) observing correct polarity, reinstall a new 5 amp fuse, and reconnect the red wire to the circuit board.
1/2 amp fuse blows	Shorted diode in 150 volt bridge	Check/Replace CR9, CR10, CR11, CR12. Replace 1/2 amp fuse--Do not overfuse, as this will cause the small power transformer to burn up under shorted conditions.

SYMPTOMS	CAUSE	CURE
Unit shuts down to standby, but comes back on immediately. or Unit will not shut down to standby mode. or Unit will not turn on from standby.	Defective I.C. or Arcing tube Defective I.C., Q5 Transistor or bad Relay	A defective integrated circuit can cause this problem. The OP-II device was found to be particularly prone to this rare problem. An arcing tube can also affect proper operation of the turn on circuitry. The offending tube will usually arc at the shutdown to standby point and bring back the amplifier to the full on condition. This tube can sometimes be spotted in a darkened room. The simplest solution is to replace all four tubes.
White noise in background below level of music	Leaky 2N3440 (Q1,Q3)	Be sure the noise isn't originating upline in the preamp or elsewhere by removing the input to the servo charge amplifier. If noise persists replace Q1 or Q3.
Amp distorts, weakened output sometimes accompanied by a low level hum.	Defective Q2,Q4, Q1 or Q3 transistor	Check/Replace defective transistor.
Intermittent drop in volume, about 50%, accompanied by low level hum.	Intermittently open junction mm4003 transistor(2N5416 on later units)	Replace Q2 and Q4
Unit turns on from standby due to AC line surges- sometimes induced by an air conditioner, flourescent lights etc.		Earlier production amplifiers are sometimes found to do this. Eliminate the problem by installing a 680 ohm resistor in series with the cathode (banded end) of CR14. This resistor is factory installed beginning with s/n 1700.

SYMPTOMS	CAUSE	CURE
Amp shuts down to standby mode after 10-15 minutes of play. Input signal is still present.	Defective CR14 Diode opens when heated by nearby tube V4.	Replace CR14 (In4004 or In4006)
Loud intermittent hum	Bad connection at input strip	Check for clean, tight ground connection at input jack of the amplifier and at the output jacks of the preamplifier. A poorly soldered plug on an input cable will also cause this problem.
Constant or intermittent hum		Check and resolder bad connection on C5 or C6 1000 uf @ 25 v (3300 uf on later units)
Violent purple arcing inside V1 or V3	Intermittently shorted filament transformer T3 or T4	Replace the filament transformer associated with the arcing tube.
Waveshapes o.k. at test points 1 and 2, When amp is connected to speaker output is very weak.	Open R61 500 megohm resistor	Check or replace R61 500 megohm resistor
Popping Crackling	Arcing tube or Defective R43, R57	Bad tube will usually show visual arc. If popping occurs after considerable on time, replace R43 and R57 6.8 megohm resistors.

ACOUSTAT the monitor



Full Range,
Direct Drive,
Electrostatic
Speaker System

with: Integral
self-contained
Servo-Charge amplifier

the acoustat monitor

A UNIQUE FULFILLMENT OF MUSICAL ACCURACY

From the time the first generation of full-range electrostatic loudspeakers was introduced, about two decades ago, it was apparent that someday this technology could yield a speaker of truly superb performance.

That day has arrived with the presence of the Acoustat Monitor.

If you have heard the Monitor system, there is really very little that we need to say about its sound. However, you would probably like to know some of the reasons that its performance surpasses other speaker types and earlier generation electrostatics.

The Acoustat Monitor had its origin in the early 1960's with a bold assumption that it should be possible to build an electrostatic speaker of no compromise. It would be full range; direct drive; and have high sound pressure levels, no crossovers, and no audio transformers.

It has taken this many years to turn this dream into the Acoustat Monitor—allowing fulfillment of the electrostatic promise.

This promise has long existed because the push-pull, constant charge electrostatic element stands alone in its ability to uniformly and linearly drive large diaphram surfaces of almost negligible mass. Only an incredibly light conductive coating need be applied to very thin mylar diaphrams to distribute charges over the surface.

It is this unique ability that allows a *full-range-element* design with the entire surface radiating all frequencies.

All observers agree that much of the superior performance of electrostatics is due to the highly uniform force field spread over the entire diaphram from which the sound is radiating. The result is very close to converting electricity directly to sound, as if there were no diaphram at all! In the Acoustat Monitor, the driven charges on the diaphram are closer together than a single wavelength of light and the diaphram is only 0.65 thousandths of an inch thick (about one sixth of the thickness of this sheet of paper).

This table illustrates the differences between electrostatics and the two prevalent types of magnetic or dynamic speakers in terms of the two most important parameters for a high performance speaker system.

	Mass of Radiator	Uniformity of Applied Force Over Radiating Area
Dynamic (Cone)	High	Poor
Planar Magnetic	Lower	Better
Electrostatic	Lowest	Best

Compared to a planar magnetic speaker with its wires spaced at intervals and bonded to its diaphram, an electrostatic's "intimacy of drive" is approximately 100,000 times greater. And, compared with a typical cone driver, several million times greater. All the laws of physics confirm that low mass and intimate drive will yield superior transient response, less coloration, and allow definition and detail to be reproduced *even at very low listening levels*.

Controls

1. High frequency balance control which adjusts, over a plus or minus 5 dB range, the response in the upper midrange and high frequency spectrum to compensate for room size, listening distance, and phono cartridge idiosyncrasies.
2. Overall gain control for left-right channel balancing in the event that the preamplifier or other associated equipment does not have this capability.

Safety AC Interconnect on Chassis

Because of the presence of dangerously high voltage at several points in the Servo-Charge amplifier, the AC line cord is automatically disconnected when the protective cage is removed from the top of the chassis.

PANELS

Acoustat has made some further contributions to electrostatic technology in the special design of its electrostatic panels. These panels are completely free of any arcing problems and further provide complete immunity from climate, temperature, and humidity factors. And, most importantly, *they cannot be damaged by overdriving*. These panels are guaranteed in normal use for a period of five years.

With over 6000 panels in the field, we have yet to experience our first "in service" failure, as the Servo-Charge amplifier will never produce a voltage of destructive level. We know of no other system, magnetic or electrostatic, that possesses this degree of indestructability.

It should be pointed out that the Acoustat Monitor electrostatic panels and the Servo-Charge amplifier are specifically designed for each other and are compatible *only* with each other.

The panels of the Acoustat Monitor are the result of years of research. Each single speaker contains 10 square feet of frontal radiating areas. The total diaphram front and back, considering the dipole radiation, of two speakers is 40 square feet.

Panel grid construction provides a far greater openness ratio than usual designs. Rather than the typical slot or "polka dot" perforations in sheet metal (where the diaphram area energized is blocked by the structure) Acoustat has created grids of military-specification, tight tolerance wire bonded to a strong plastic matrix. Each pair of speakers contains more than 2000 feet of this wire because of the fine spacing required for optimum sound production.

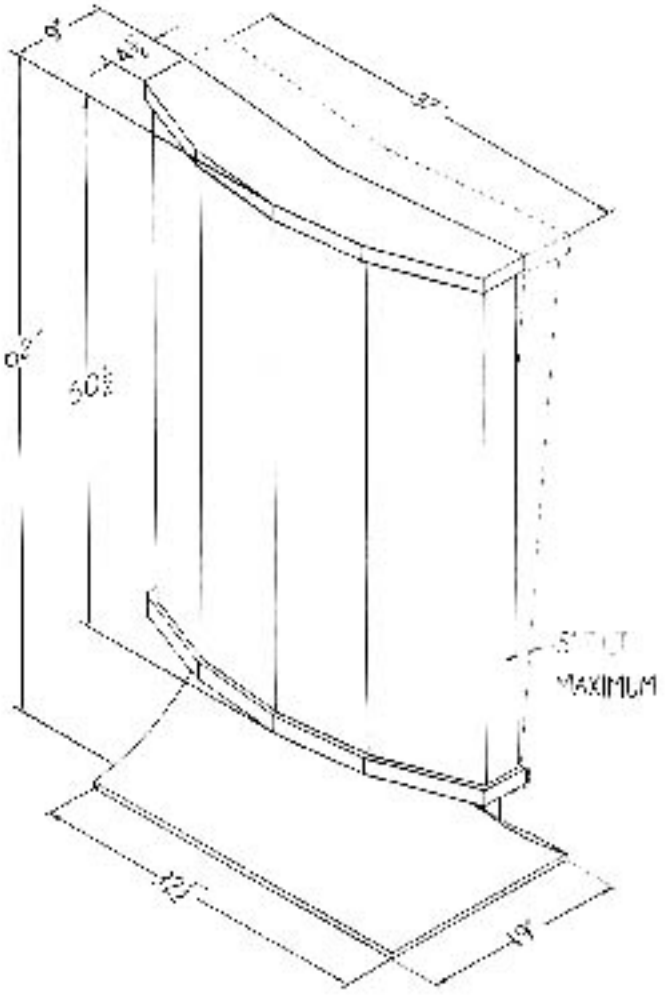
No Woofer, Mid-Range, or Tweeter Elements and No Crossover Networks

A very significant difference between the Acoustat approach and that of nearly all other electrostatics is the absence of any separate drivers; i.e. separate woofers, mid-range, or tweeter units. Each speaker does contain four panels which are angled for horizontal dispersion, but electrically they are one, and all are driven full-range. The enormous advantage of this design is the complete elimination of cross-over networks and their attendant time delay and phase distortion characteristics, thus producing a completely seamless sound.

Acoustat speakers remain the only crossoverless, truly full-range, direct drive electrostatics in production today.

PHYSICAL STRUCTURE

The winged screen panel array has been designed to be very open acoustically, and to provide high array reaction to the large mass of air it moves. This is largely the purpose of the massive hardwood slabs top and bottom. Four panels are used in a hemi-cylindrical array providing a wide horizontal listening stage. In addition, the vertical azimuth tilt is adjustable to provide optimum vertical dispersion. The winged screen array sits on top of an attractive pedestal which contains the Servo-Charge amplifier.



WHY AN INTEGRAL AMPLIFIER?

In the beginning, there were tube amplifiers. Tubes are basically high inpedance devices Magnetic speakers are low impedance loads. Hence, STEP-DOWN transformers were almost always present.

A ong came power transistors, which could directly drive magnetic speakers. The first generation of electrostatic designers then inverted the past and put in STEP-UP transformers to get back to the high impedance of these speakers.

Why wasn't it obvious that vacuum tubes were a much more natural and efficient match for electrostatics? Actually, this was obvious to a few different individuals involved in such research.

In the early 1960's, we built our first amplifier using the four quadrant output br dge, which was to become the mainstay of all Accustat amplifiers.

Its immediate promise was so obvious that we have never deviated from this basic output drive connection.

Every possible advantage is gained by tailor ng the amplifier to the electrostatic panels and not the other way around:

1. Output voltages can be generated by this design which are appropriate to the speaker: thus completely eliminating the need for audio step-up transformers and crossovers.
2. Low generator impedance, compared to the load impedance, can be assured at all frequencies: providing excellent panel control and damping.
3. Higher efficiency is attained, reducing amplifier requirements.
4. Any desirable equalization required for the flattest overall response can be economically implemented.

HOW MANY WATTS?

An interesting f unanswerable question in this case. Unanswerable because a full-range electrostatic is essentially a very large capacitor, and power cannot be measured into a capacitive load. In the laboratory, using a dummy resistive load, the Servo-Charge amplifier measures in the 100 watt range.

Because of high coupling efficiency of our high impedance amp ifier to the high impedance capacitive load which the panels represent a hundred watts becomes marvelously effective in producing shatteringly large amounts of sound pressure level and is able to do this staying well within the plate dissipation parameters of the output tubes. In an average listening room on music material heard at typical listening distances, a pair of Monitors will produce over 110 dB before amplifier clipping or over 1% total harmonic distortion of the total system occurs.

SERVO-CHARGE AMPLIFIER

These units are contained in the pedestals of the Monitor speakers and are of hybrid design employing solid state circuitry for all low level functions and the above described direct drive output from high-voltage tube elements, coupling directly to the speaker panels.

The output drive tubes are high voltage pentodes which are used in a conservatively rated application. Even on the most demanding musical mater al it is extremely difficult to reach the maximum dissipation level of the tubes, even momentarily. Tube life in an average application has generally exceeded one year, and the replacement cost is modest as matched sets are not required.

The Servo-Charge amplifier incorporates the fol owing features:

"Instant-On" Relay Circuitry

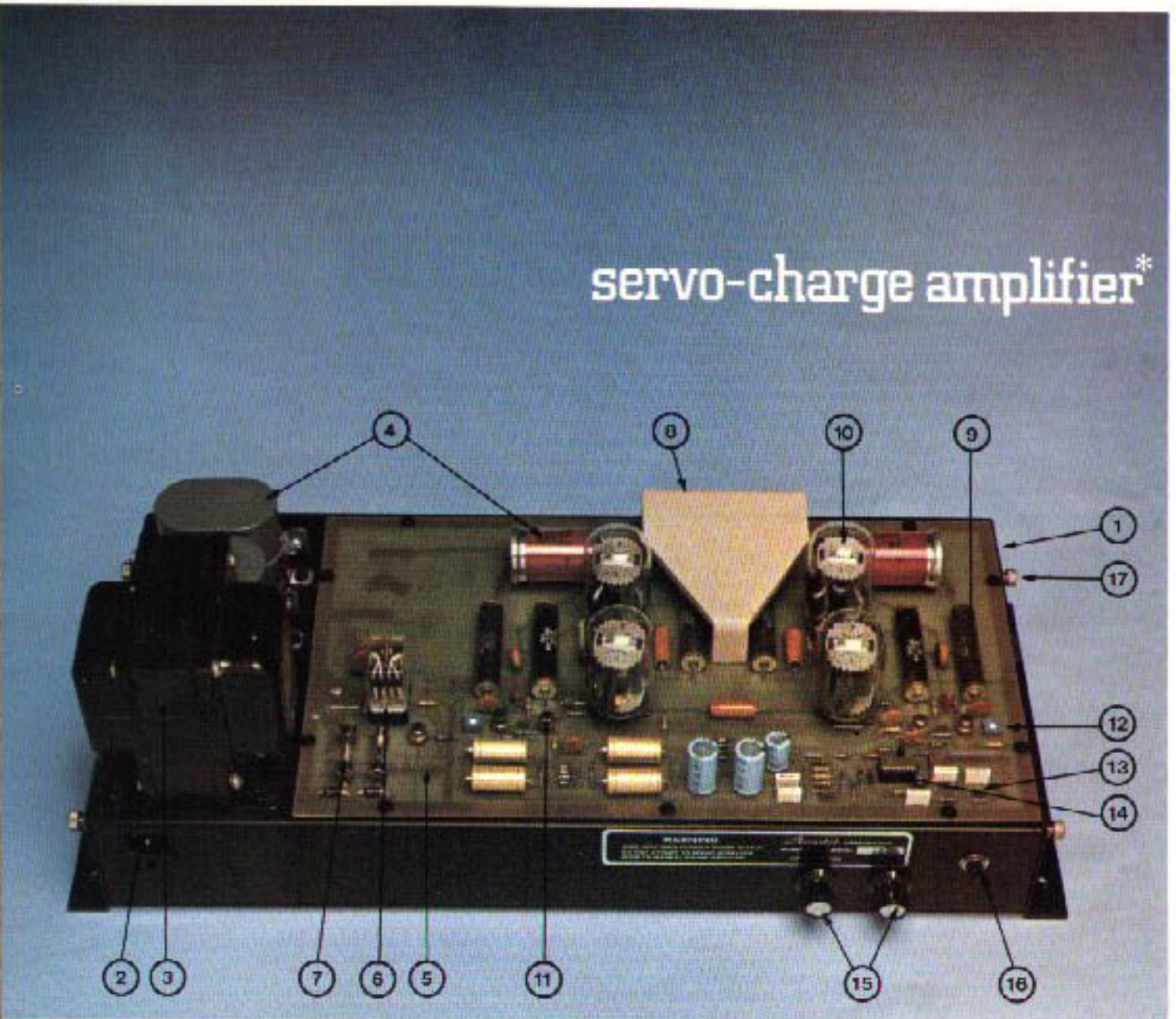
This feature, which eliminates the need for any power umb licals from the preamplifier source, consists of a unique audio triggered automatic turn-on circuit. The ampl fier is left connected to its wall outlet at all times. A very low power is left on the four vacuum tube filaments when the amplifier is not in use. This facilitates the instant turn-on when an audio signal is supplied, provides a damp-chaser effect and because switching power surges are eliminated greatly extends tube l fe. The cost of this stand-by operation is ess than 1¢ per day per speaker. After the audio signal has been removed for a period of approximately five minutes, the automatic circuitry w ll shut down the amplifier to the low power stand by mode

Low frequency equalization

Active equalization is used for the elim nation o' low frequency response aberrations caused by interaction of the reflecting wall surface with the dipole radiation pattern.

During extensive 1/3 octave frequency analysis n testing the response of the system, it was verified that a phenomenon of quarter wave-length reinforcement and half wave-length cancellation takes place in the lower frequencies. This is true for all dipole radiators in the proximity of a reflecting wall. With typical speaker to rear wall distances the net effect of this reinforcement-cancellation phenomenon is to produce a "hump" in the response at 90-100 Hz due to quarter wave length reinforcement and a "dip" at 180-200 Hz because of half wave-length cancellation. The solution to this problem which if left uncorrected causes a "woomy" sort of upper bass enhancement and lower midrange "drop-out", was to provide specific active equalization to correct the response.

servo-charge amplifier*



1. Heavy Duty 14 guage steel chassis.
2. International Standard three wire safety interlock (AC).
3. Heavy duty power transformer.
4. Military grade oil filled high voltage and output coupling capacitors.
5. Military grade glass-epoxy printed circuit board.
6. Automatic turn-on relay.
7. Separate fusing for high and low voltages.
8. High voltage guard with output jack assembly.
9. Military grade high voltage resistors.
10. Four quadrant tube output bridge using Schmitt-Wilkins connection.
11. High voltage transistors used in intermediate stages.
12. Centering pots for exact setup of output symetry.
13. All 1% resistors in low voltage circuitry.
14. High performance, low distortion IC for low voltage audio stages and automatic turn-on.
15. Controls for high frequency balance and gain.
16. Phono jack input from preamplifier.
17. Knurled thumbscrews facilitate easy access.

All circuitry direct coupled up to final output coupling capacitors.

*PATENT PENDING

ACOUSTAT
corporation

3101 Southwest First Terrace
Fort Lauderdale, Florida 33315
Phone: 305/462-6700







SPECIFICATIONS

Frequency Response: 30 - 20K Hz ± 3 dB

Sound Pressure Level - Program Material:
110 dB @ 20' - pair in 14' x 24' room

Harmonic Distortion:
At 3 dB below full output: Less than 1% from 30 - 20K Hz
At average listening levels: Close to instrumentation residual levels

Input Impedance: 50K ohms

Controls:
High frequency balance: ± 5 dB
Gain: ± 6 dB

Input sensitivity: 0.7 volts RMS for full output at 1K Hz with gain control at 12 o'clock position

WARRANTY

The Acoustat Monitor system carries a five year complete warranty on the panels and a five year parts (2 years parts and labor) warranty on the

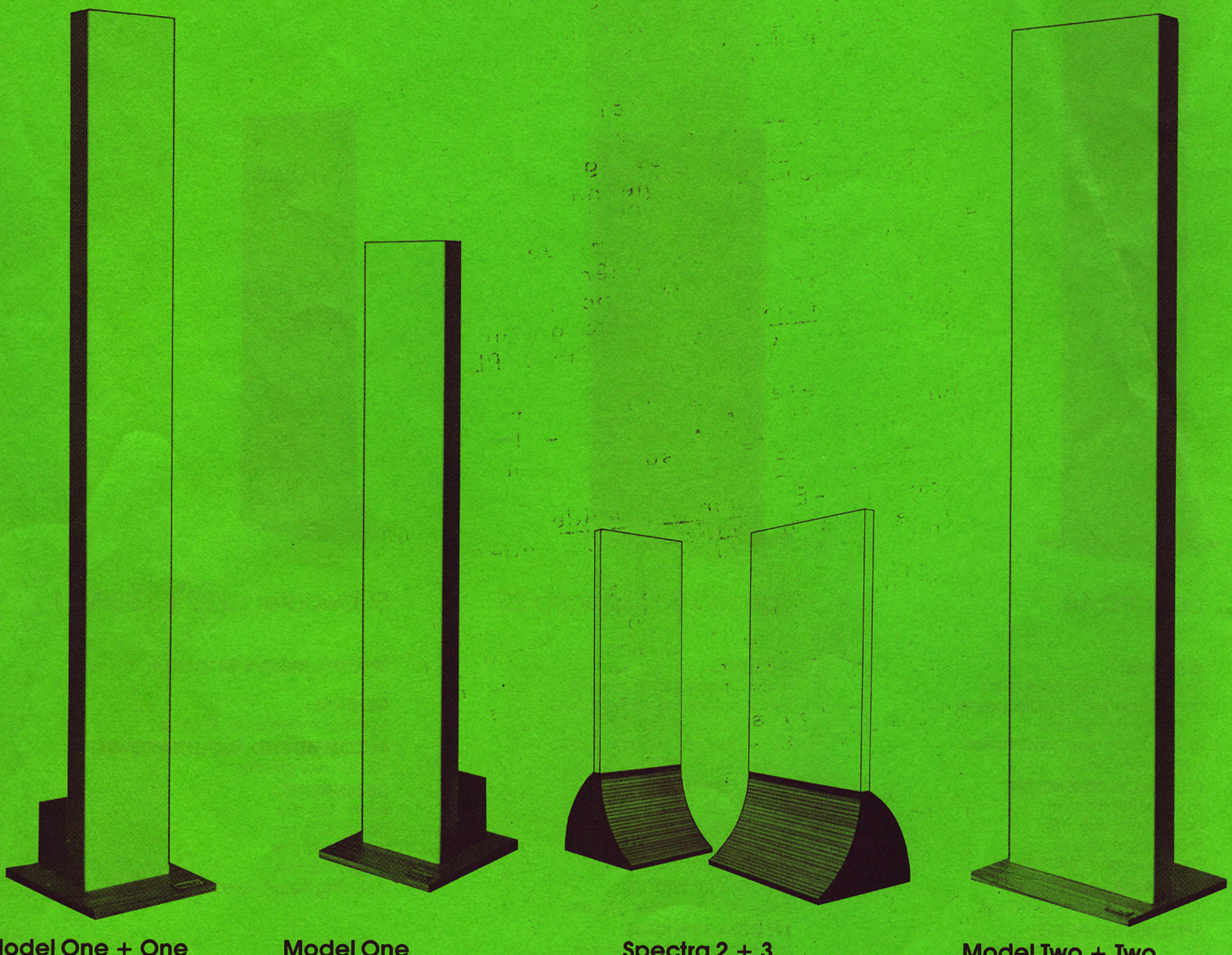
ACOUSTAT

BRINGING MUSIC TO LIFE

Preisliste/Liste de prix

1.8.89

	Paar/pair
Model one inkl. Subwoofer Swissversion	Fr. 5000.–
Model one + one	Fr. 5940.–
Model two + two (beige)	Fr. 7600.–
Spectra 2 (beige+[illegible])	Fr. 9600.–
Spectra 3 (beige)	Fr. 10300.–



Model One + One

Frequency Response:
30-20K Hz ± 2 dB

Sound Pressure Level:
110 dB @ 18' in a 14'x22' room.
(Programm Material Peaks)

Minimum Power Requirements:
70 Watts per channel

Nominal Impedance: 4 ohms

Power Consumption:
5 Watts (120v, 50/60 Hz)

Control: High Frequency Balance
(Controls frequencies above 10K Hz)

Dimensions: 240x28x9 cm

Weight: 33 kg (Net weight for one speaker with Interface)

Model One

Frequency Response:
30-18K Hz ± 3 dB

Sound Pressure Level:
108 dB @ 15' in a 14'x18' room.
(Program Material Peaks)

Minimum Power Requirements:
75 Watts per channel

Nominal Impedance: 4 ohms

Power Consumption:
5 Watts (120v, 50/60 Hz)

Control: High Frequency Balance
(Controls frequencies above 10K Hz)

Dimensions: panels 185x28x9 cm
Woofer Cube: 47x47x47 cm

Weight: 30 kg (one speaker with Interface) 25 kg woofer cube

Spectra 2 + 3

GENERAL:

Nominal impedance: 4 ohms

Minimum power requirements:
100 watts per channel

Power consumption:
5 watts (120 vac, 50/60 Hz)

COMMON DIMENSIONS:

Array depth: 55 mm

Base depth: 590 mm

Overall height: 1690 mm

SPECTRA 2 Width: 550 mm
Weight: 41 kg

SPECTRA 3 Width: 800 mm
Weight: 50 kg

STANDARD ARRAY GRILLE:
white or black cloth

Model Two + Two

Frequency Response:
28-20K Hz ± 2 dB

Sound Pressure Level:
115 dB @ 20' in a 15'x24' room.
(Program Material Peaks)

Minimum Power Requirements:
50 Watts per channel

Nominal Impedance: 4 ohms

Power Consumption:
5 Watts (120v, 50/60 Hz)

Control: High Frequency Balance
(Controls frequencies above 10K Hz)

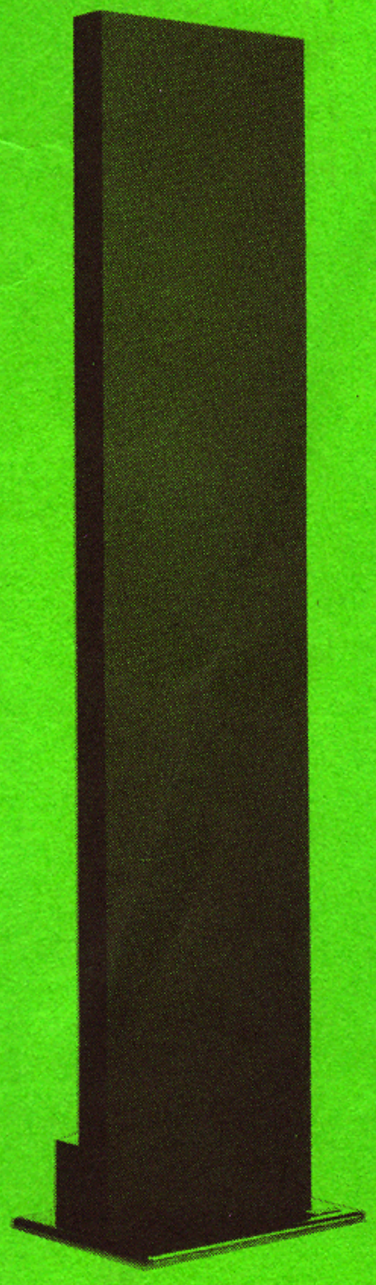
Dimensions: 240x51x9 cm

Weight: 43 kg (Net weight for one speaker with Interface)

ACOUSTAT

BRINGING MUSIC TO LIFE

		Paar/pair
Spectra 44		Fr. 10800.–
Spectra 33		Fr. 7900.–
Spectra 22		Fr. 6500.–
Subwoofer zu Spectra 22+33 SPW 1	Stk.	Fr. 1900.–



Spectra 44

GENERAL:
Nominal impedance: 4 ohms
Recommended amplifier power:
100 W/ch or greater
Bias supply power consumption:
Less than 5 watts

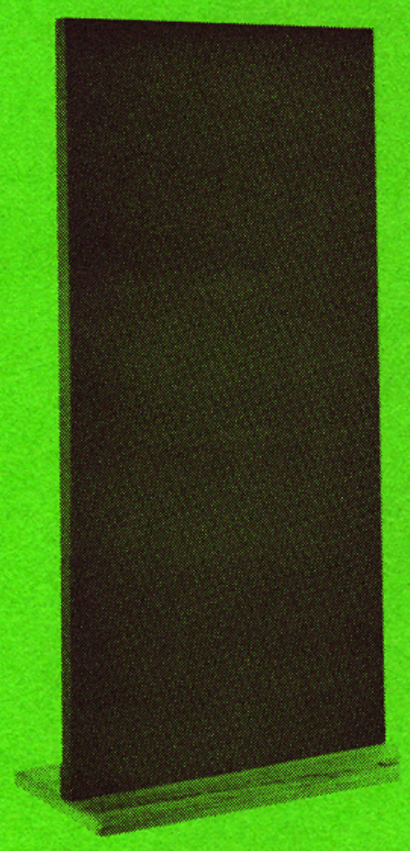
COMMON DIMENSION:
Array depth: 90 mm
Base depth: 435 mm
Base height: 25 mm
Overall height: 2390 mm

SPECTRA 44 WIDHTS:
Array: 550 mm, base: 590 mm

SPECTRA 66 WIDHTS:
Array: 810 mm, base: 845 mm

STANDARD GRILLE CLOTH:
Black, beige, charcoal gray or light gray

STANDARD BASE FINISH: Dark oak



Spectra 33 / Spectra 22

GENERAL:
Nominal impedance: 4 ohms
Recommended amplifier power:
100 W/ch or greater
Bias supply power consumption:
Less than 5 watts

COMMON DIMENSIONS:
Array depth: 55 mm
Base depth: 440 mm
Base height: 25 mm
Overall height: 1690 mm

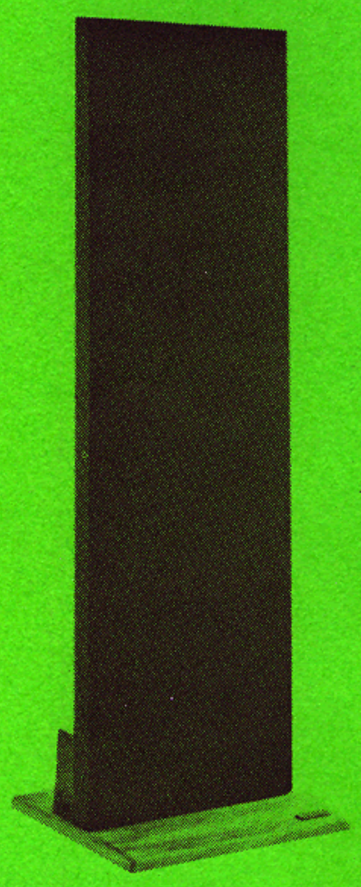
SPECTRA 22 WIDTHS:
Array: 550 mm, base: 590 mm

SPECTRA 33 WIDTHS:
Array 810 mm, base: 845 mm

STANDARD ARRAY CLOTH:
black or off-white

STANDARD BASE FINISH: Dark oak

WEIGHT: 22 = 37 kg 33 = 42 kg



Subwoofer zu 22+33 SPW 1

SPECTRA PASSIVE WOOFER 1:

GENERAL:
Nominal impedance: 12 ohms

RECOMMENDED AMPLIFIER POWER:
100 W/ch or greater

DIMENSIONS:
Width: 585 mm
Depth: 432 mm
Height: 480 mm
Height: 510 mm
including the provided spike feet

Authorized Dealer:

THORENS

THORENS-FRANZ AG
HARDSTRASSE 41
5430 WETTINGEN
TEL. 056/26 28 61
FAX 056/26 32 73

THORENS

A C O U S T A T

SAISON 1989-1990

****

SPECTRA 11 = enceinte hybride - BASS électrodynamique - MEDIUM/AIGU électrostatique - boitier noir - tissu anthracite prix non-fixé (premier de gamme) - livraison fin 1989

SPECTRA 22 = enceinte électrostatique - tissu noir ou beige - socle chêne foncé - Fr.6'500.-- la paire - livraison du stock. Sur commande = tissu gris - socles noir ou chêne naturel PLUS-VALUE Fr.300.--

SPECTRA 33 = enceinte électrostatique - tissu beige - socle chêne foncé Fr.7'900.-- la paire - livraison du stock. Sur commande = tissu gris ou noir - socles noir ou chêne naturel PLUS-VALUE Fr.300.--

SPW-1 = SUBWOOFER électrodynamique passif pour SPECTRA 22 et 33 tissu noir - socle chêne foncé - Fr.1'900.-- livr.du sock amplification active possible avec CROSSOVER additionnel. Sur commande = tissu beige ou gris - socle noir ou chêne naturel PLUS-VALUE Fr.300.--

SPECTRA 44 = enceinte électrostatique - tissu noir ou gris - socle chêne foncé - Fr.10'800.-- la paire - livraison du stock. Sur commande = tissu beige-socles noir PLUS-VALUE Fr.300.-

SPECTRA 66 = modèle HI-END sur commande - environ Fr.18'000.-- la paire données techniques sur demande

SPECTRA 3 = enceinte hybride - BASS électrodynamique - MEDIUM/AIGU électrostatique - mono ou biamplifiable avec CROSSOVER additionnel - bi-câblable - socle teck/tissu beige - Fr.10'300.-- la paire - livraison du stock

MODEL ONE + SUBWOOFER (Swissversion) = MEDIUM/AIGU électrostatique - tissu beige/socle teck - SUBWOOFER teck Fr.5'000.-- la paire inclus SUB - livraison du stock

ONE + ONE = enceinte électrostatique - tissu noir ou beige-socle teck Fr.5'940.-- la paire - livraison du stock

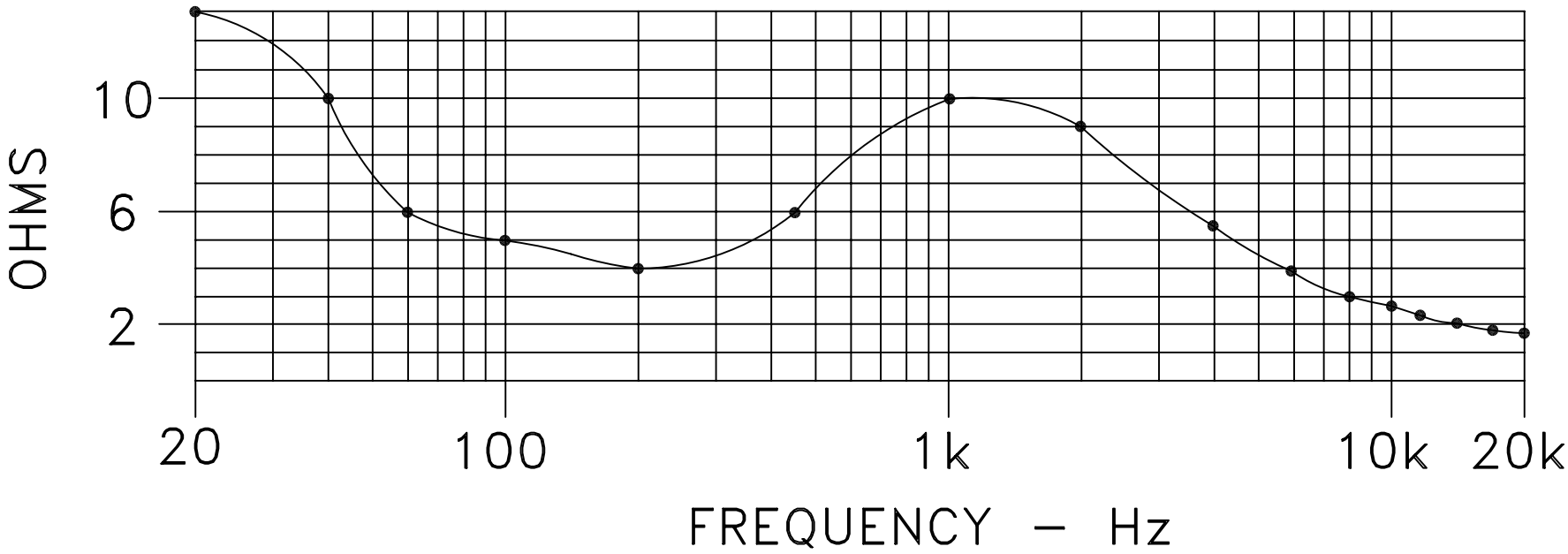
DELAIS DE LIVRAISON POUR COMMANDES SPECIALES = 4 à 6 semaines dès enregistrement de votre ordre.

Nous nous tenons à votre entière disposition pour tout renseignement complémentaire.

Sous réserve de modifications sans préavis.

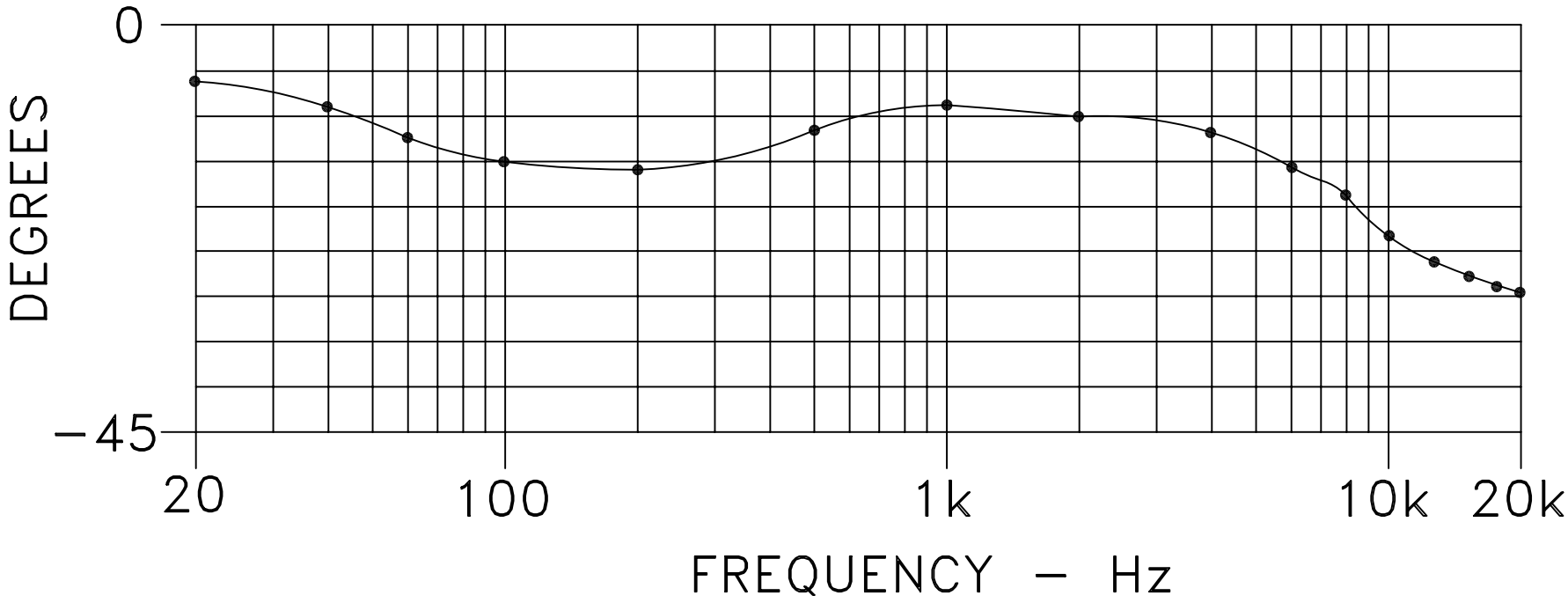
S.E.&O. Belmont, le 18 octobre 1989 - **REF.AC/02** - G.M.

IMPEDANCE PLOT



NOTE: VALUES PLOTTED FOR "MEDIUM" SETTING OF HIGH FREQUENCY CONTOUR SWITCH. IMPEDANCE SLIGHTLY LOWER ABOVE 10 KHZ FOR "HIGH" SETTING, AND SLIGHTLY HIGHER FOR "LOW" SETTING.

PHASE SHIFT PLOT



NOTE: VALUES PLOTTED FOR "MEDIUM" SETTING OF HIGH FREQUENCY CONTOUR SWITCH. PHASE SHIFT SLIGHTLY GREATER ABOVE 10 KHZ FOR "HIGH" SETTING, AND SLIGHTLY LESS FOR "LOW" SETTING.

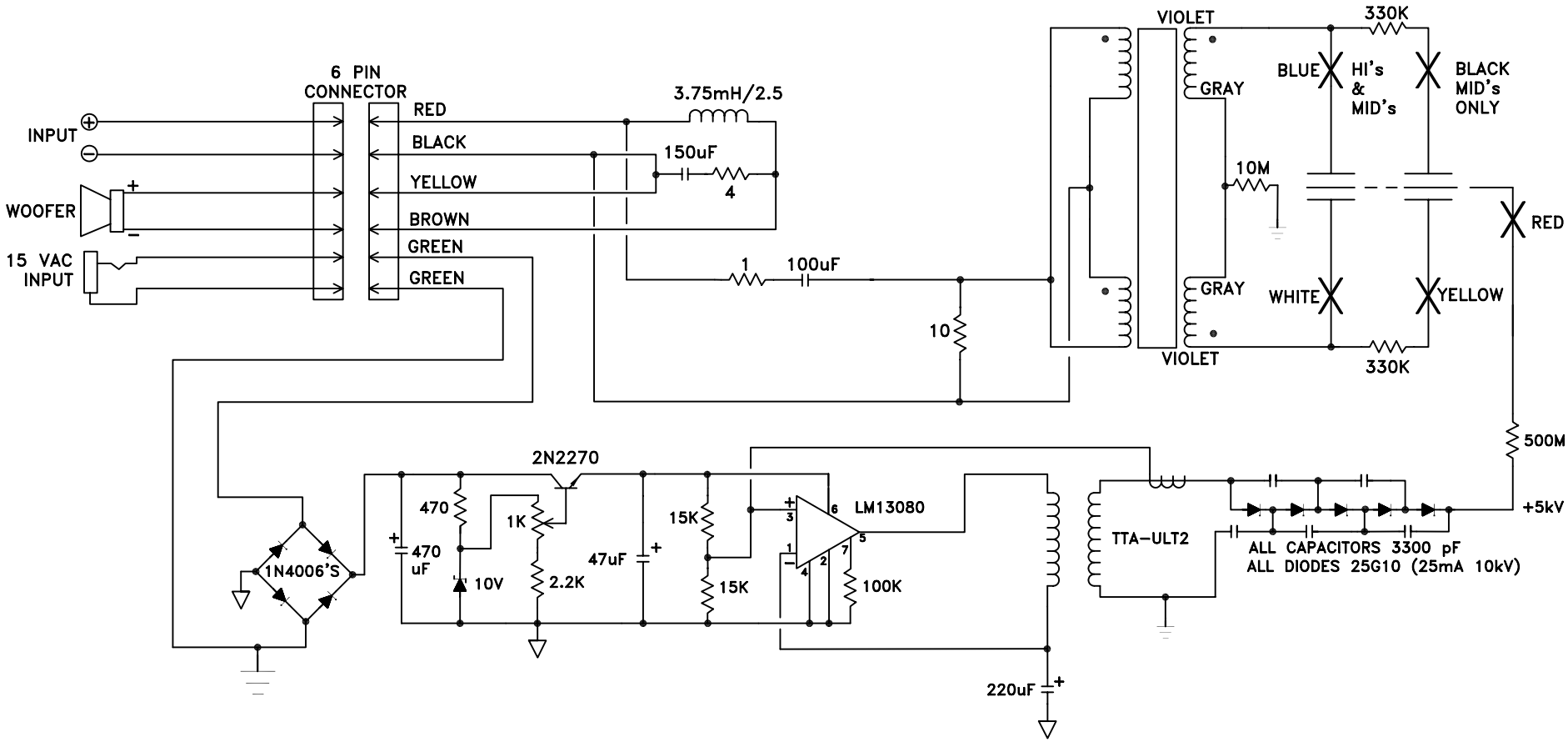
NOTES: UNLESS OTHERWISE SPECIFIED

1: ALL RESISTORS ARE OHMS

2: = LOW VOLTAGE GROUND

3: = HIGH VOLTAGE GROUND

MAGNE–KINETIC INTERFACE FOR SPECTRA 11



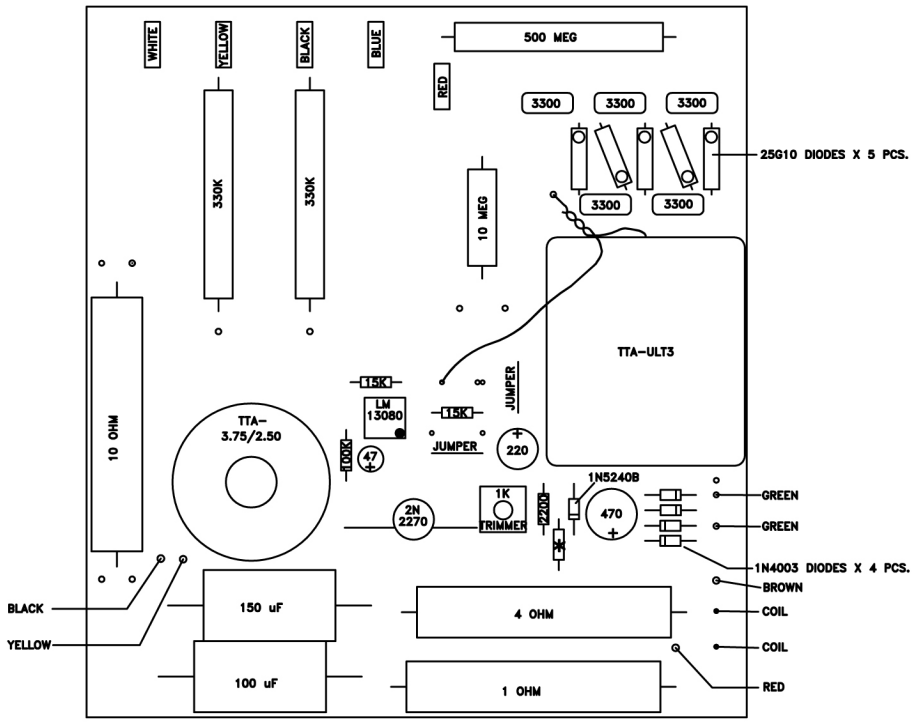
REVISIONS:

1. 5/29/91: UPDATED BIAS SUPPLY

ACOUSTAT

A DIVISION OF ROCKFORD CORP.

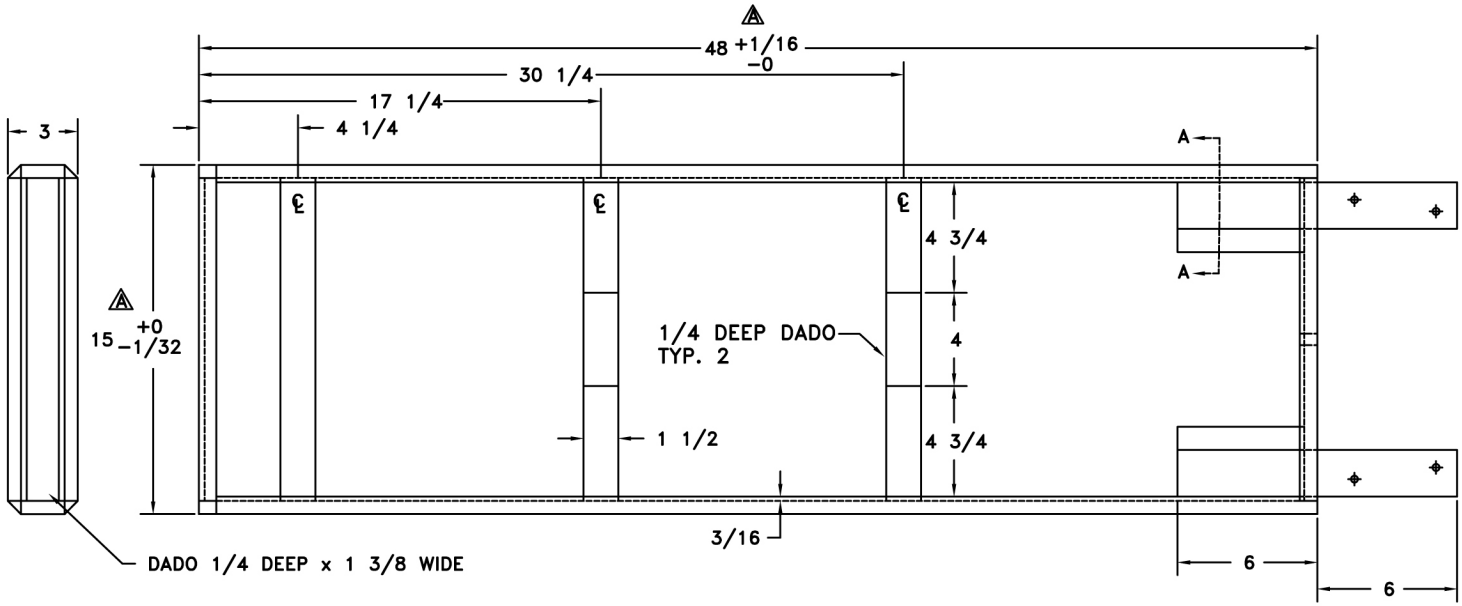
TEMPE, AZ., 85281, USA

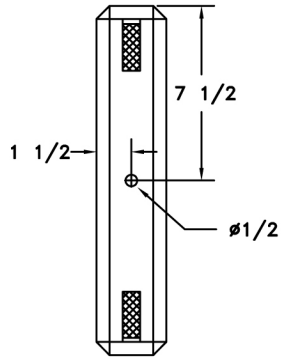


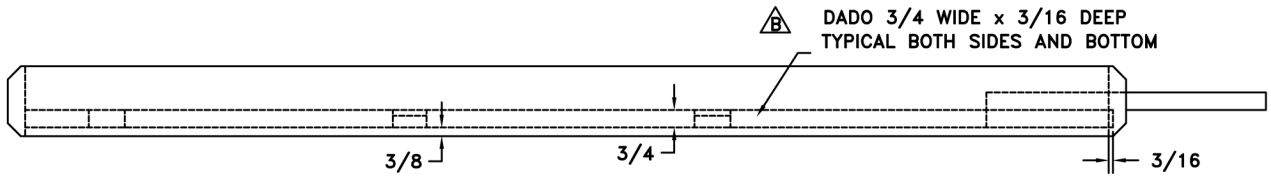
* = USE 100 OHMS FOR DOMESTIC
USE 470 OHMS FOR EXPORT

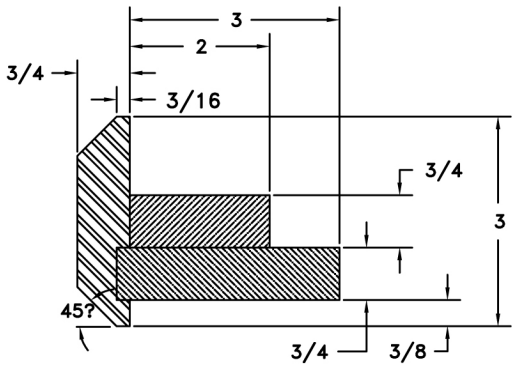
ACOUSTAT
A DIVISION OF ROCKFORD CORP

SPECTRA 11 PC LAYOUT

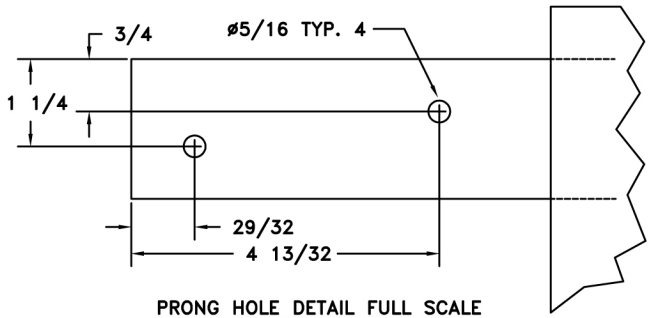








SECTION A–A FULL SCALE



PRONG HOLE DETAIL FULL SCALE
LEFT PRONG SHOWN
RIGHT PRONG IS MIRROR IMAGE

D HOLE POSITION TOLERANCE +/− 1/32

NOTES:

1. ALL DIMENSIONS IN INCHES
2. PROTRUDING PORTION OF PRONGS TO BE PAINTED BLACK

REVISIONS: DRAWING RE–DONE ON COMPUTER

9/25/90
A. ADD TOLERANCES TO OVERALL SIZE

B. ADD DADO DETAIL TO SIDES AND BOTTOM

C. ALL MATERIAL NOW 3/4 MDF

D. ADD TOLERANCES ON HOLE POSITIONS

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SPECTRA 11 FRAME

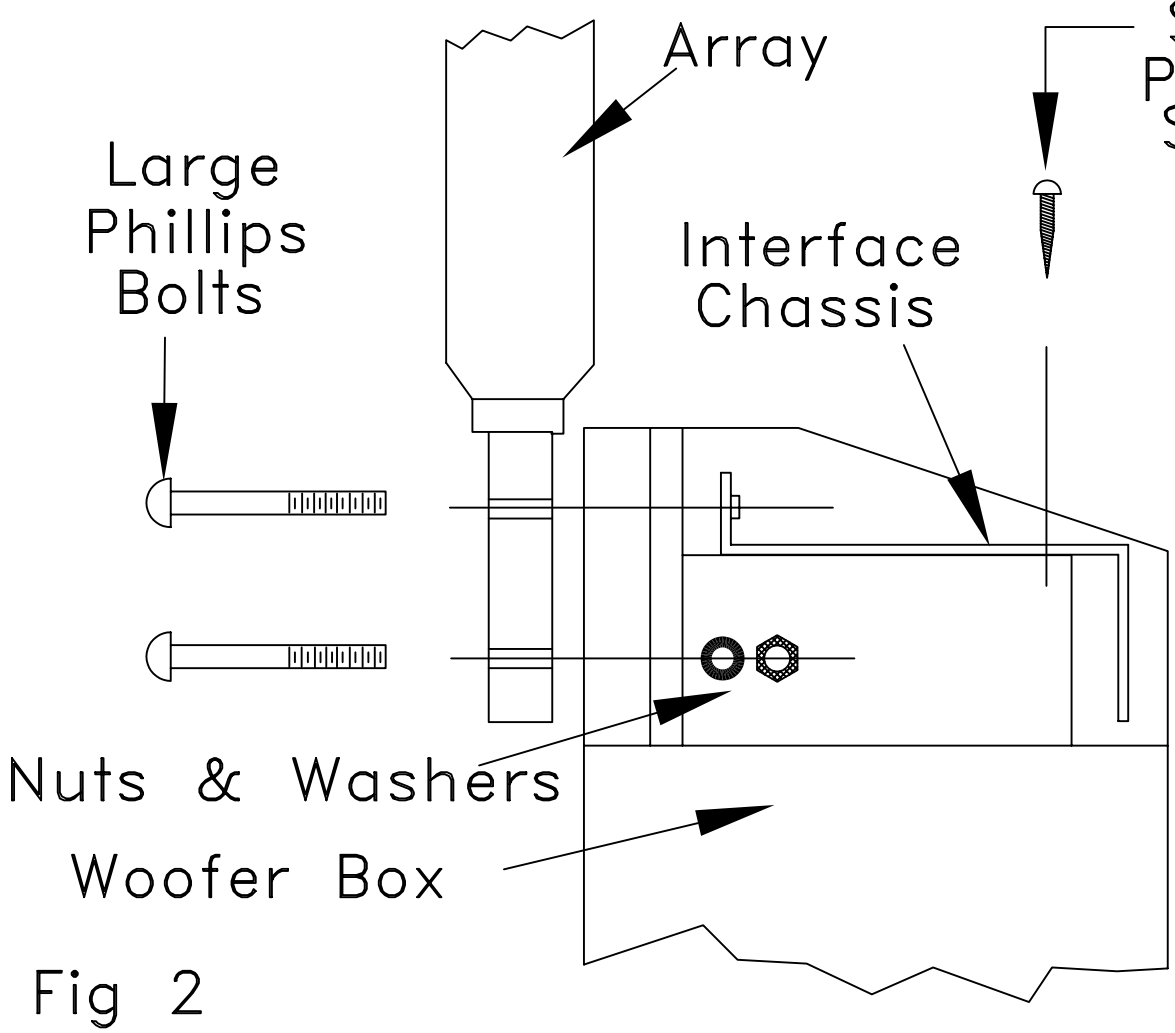

Array
Small
Phillips
Screw
Large
Phillips
Bolts
Interface
Chassis
Nuts & Washers
Woofer Box

Fig 2

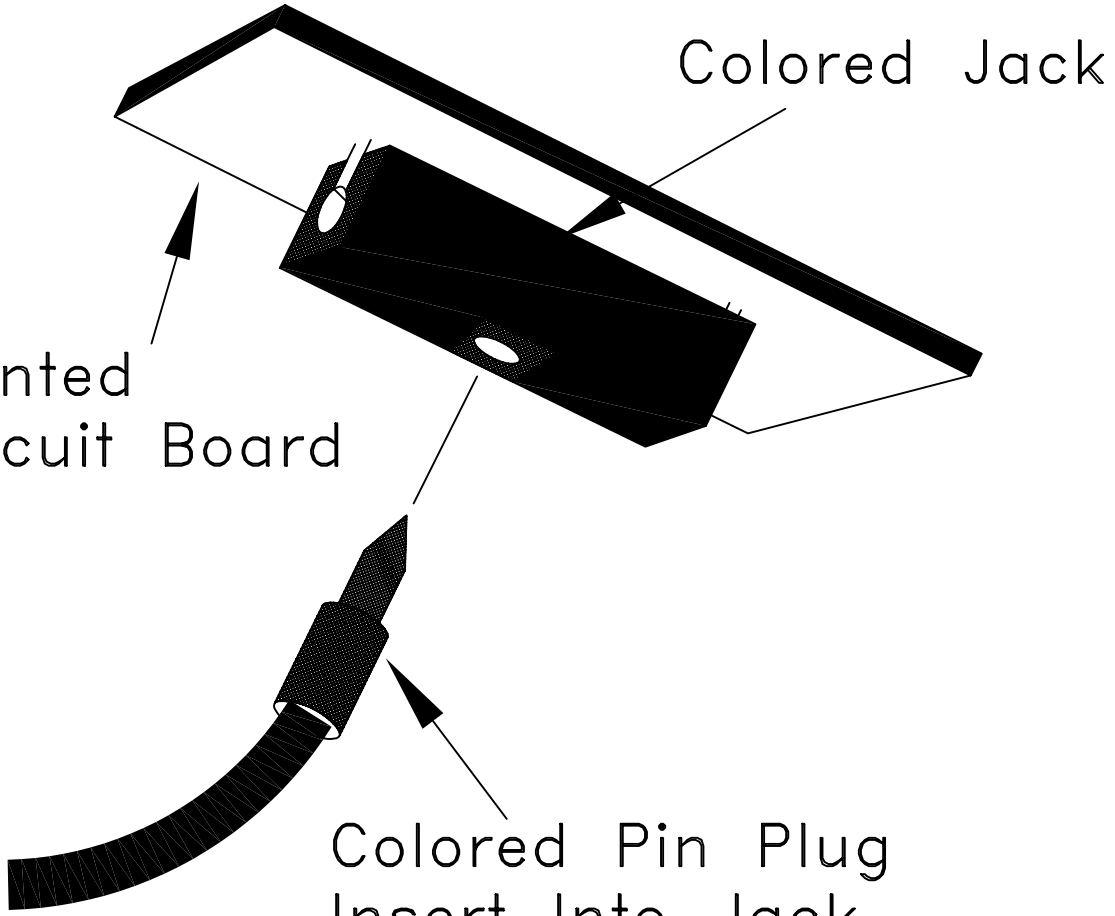

Colored Jack
Printed
Circuit Board
Colored Pin Plug
Insert Into Jack
Perpendicular to Board

Fig 3

OWNER'S MANUAL

SPECTRA 11
ELECTROSTATIC HYBRID
LOUDSPEAKER SYSTEM

ACOUSTAT

A Division of Rockford Corporation
613 South Rockford Drive
Tempe, Arizona 85281
602 - 967 - 3565

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Congratulations on your purchase of Acoustat Spectra Technology.

Break-In Period

Your new Acoustat loudspeaker requires a break-in period before full performance may be realized. Even though the speaker will begin to play within a few moments of being energized, and will sound quite good, a brand new speaker is characterized by a lower efficiency, reduced dynamic capability, and a generally "flat" dimensionality.

To "break-in" the speaker, simply play music through the system at moderate volume levels. The most dramatic improvement will occur within the first 20 hours of operation, although slight improvements may be noticed even at 50 hours of playing time.

The break-in period may be conducted all at once (i.e. leaving the system playing continuously) or may be accomplished over a number of playing sessions. This break-in phenomenon occurs only when the speaker is brand new. Even if a broken-in speaker has been de-energized for an extended period, it will again reach full performance within a few moments of being re-powered.

Using This Owner's Manual

We all have a tendency to read instruction manuals only if something doesn't work as intended. However, the assembly and installation of the Spectra loudspeaker, though simple, may not be obvious at first glance. Therefore, to maximize your enjoyment of this loudspeaker, please read through the entire manual before beginning.

This manual contains step-by-step information for assembling your Spectra, installation in the listening environment, and hook-up to the amplifier. We have also included additional information in an attempt to answer those most commonly asked questions.

Getting Started

There are a few warnings we will make now which will save you trouble later:

1) Spectra arrays are MIRROR IMAGE, i.e. there are LEFT and RIGHT arrays.

Each is identified by a small hole located in the TOP METAL CAPTURE PLATE, as well as a colored dot on the bottom surface of the array: RED for right, and GREEN for left. The hole is on the LEFT side of the LEFT array and RIGHT side of the RIGHT array--when viewed from the listening side. The two woofer boxes and two interface chassis are IDENTICAL.

2) The cloth arrays are easily soiled, and are very prone to picking up lint from being laid on a carpet. The protective plastic bag should be left on them until the arrays are brought into final installed upright position.

3) Spectra's sectored operation requires a complex connection-set from interface to array. Care is required when making the connections.

We will repeat these warnings when appropriate.

Assembly

Tool Required: Large (#2) Phillips Screwdriver

1) Gently pry off the grille frame from the front of the woofer box. It is held on by four plastic ball-in-socket fasteners. Set aside the grille frame for later re-attachment.

Refer to Figures 1 and 2 for the following steps.

2) Remove the two large bolts at the top-front of the enclosure, and set aside. These bolts secure the

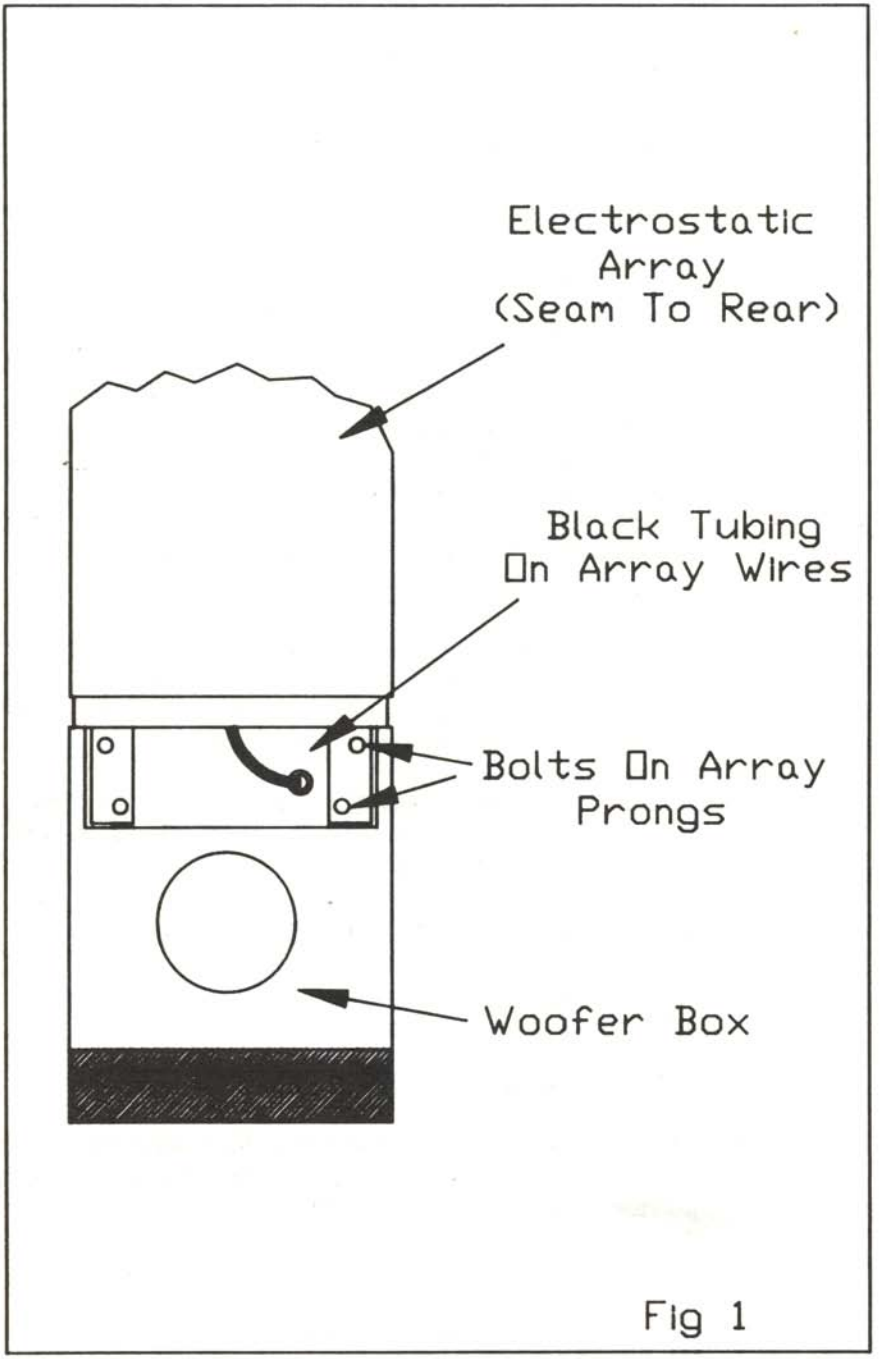

Electrostatic
Array
(Seam To Rear)
Black Tubing
On Array Wires
Bolts On Array
Prongs
Woofer Box

Fig 1

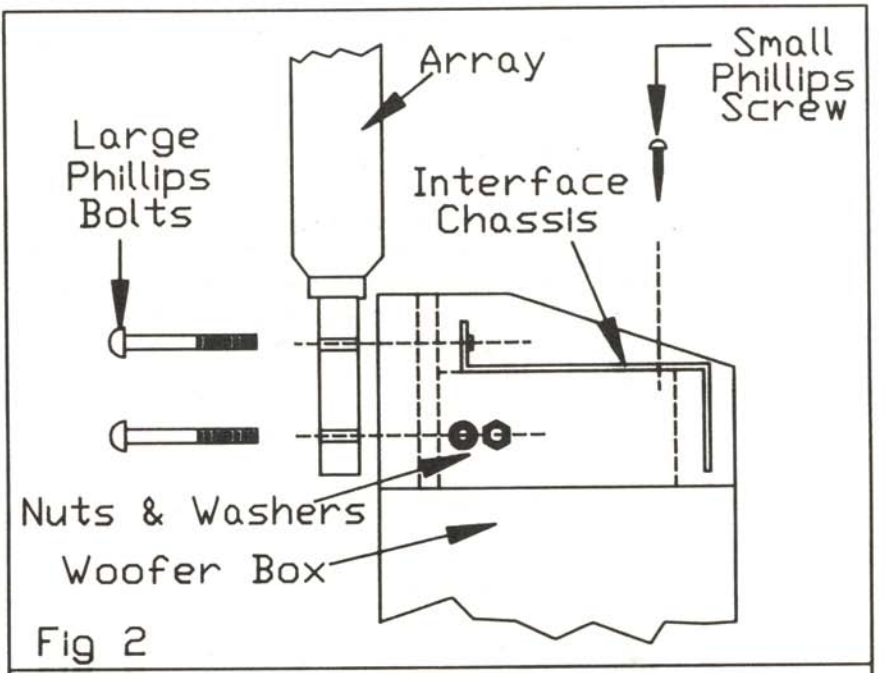

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Fig 2

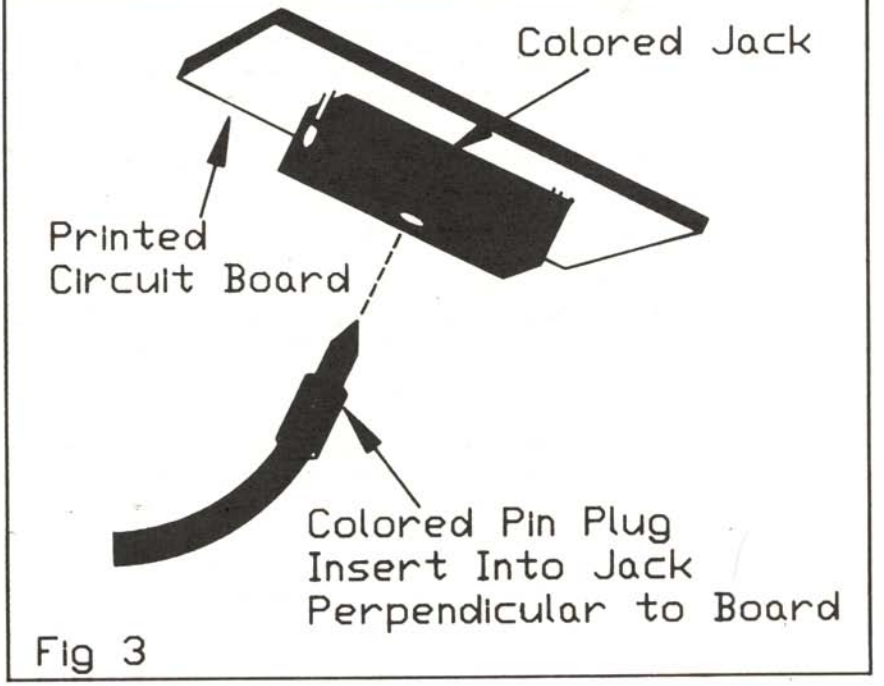

Colored Jack
Printed
Circuit Board
Colored Pin Plug
Insert Into Jack
Perpendicular to Board

Fig 3

electrostatic array as well the front edge of the interface chassis.

3) Remove and set aside the two small phillips-head screws on top of the interface chassis, at the outer rear edges.

4) Slide the chassis rearward about 2", and lift-up the front edge. Remove the plastic parts bag located under the chassis. Plug in the white connector to the mating receptacle on top of the woofer box. Note that this connector is keyed so that it inserts only one way. Insert fully until it snaps.

5) The parts bag should contain the following:

(1) Wall Transformer
(2) 1/4" - 20 x 2" Bolts
(2) 1/4" - 20 Nuts
(2) 1/4" Washers

6) Place the electrostatic array in position on the front of the woofer box, with the wires hanging down in front of the woofer, and the seam in the grille cloth toward the rear. It is recommended that an assistant support the array in position until step seven is completed.

Note - If the speaker is being assembled near its final location, you may want to choose the appropriate Left or Right array.

7) Insert a large bolt in each of the LOWER holes located on the prongs extending from the array. Place a washer and nut on the bolts from the rear and tighten. The array will now be self-supporting.

8) Feed the array wires through the hole in the front of the woofer box, with the black tubing covering the wires between the array and hole.

9) Again lift-up the front edge of the interface chassis, and locate the 5 colored jacks (RED, BLUE, BLACK, YELLOW, WHITE) on the printed circuit board. Plug the array wires

into these jacks, PERPINDICULAR TO THE BOARD, following the color code. Refer to Figure 3.

10) Slide the interface chassis forward, making sure that the array wires are not pinched or strained.

11) Insert the remaining large bolts in the upper prong holes, thread into the interface chassis, and tighten.

12) Insert and tighten (but do not overtighten) the phillips head screws on top of the chassis.

13) Re-install the woofer grille.

14) Repeat steps 1-13 for the other speaker.

We recommend that you keep all the boxes if possible. If storage space is limited, keep all of them for a while until you are satisfied that both speakers are performing properly.

Experience has shown that if service or a factory modification is ever needed, it is most likely to involve sending ONLY the interfaces to Acoustat. Our packaging materials are top-of-the-line and much more protective than most homemade arrangements. (See In Case of Difficulty.)

Disassembly of Speaker

Should your Spectra ever require disassembly for the purpose of moving or repair, simply follow the assembly instructions in reverse order, with one very important exception. After unbolting the interface chassis, but BEFORE disconnecting any internal wires, the speaker must be discharged.

» **WARNING: Always unplug the AC/DC input and audio feeds before accessing the inside of the interface.**

1) Even after the power is removed, a high voltage charge remains on the array for at least many hours.

2) To discharge the array, remove the RED pin-plug and touch its tip (while holding the wire's insulation, NOT the metal plug) to any other pin-plug connection. Expect to see a spark and hear a snap from the speaker.

3) The speaker will now be safely discharged, and disassembly may proceed.

Audio Input

The red/black input terminals are standard, 3/4" spacing, banana jacks. They may accept single or dual banana plugs, spade lugs, pin plugs, or bare wires.

The terminals are to be connected to the amplifier's output. Be sure to observe polarity markings for both channels: Red (+) to Red (+), and Black (-) to Black (-). All Acoustat loudspeakers are designed to preserve absolute phase integrity: i.e. when the red input terminal is positive with respect to the black terminal, the electrostat's diaphragm will move forward.

AC/DC Input

The miniature (3.5 mm) phone jack (located on the input cup, next to the audio inputs) connects to the ultrasonic bias power supply, which creates the +5000 volts necessary for electrostatic operation. The supplied wall transformer is to be connected to this input jack and plugged into an ALWAYS ON line outlet. Make sure that there are no wall switches or light dimmers associated with the outlet. All Acoustat loudspeakers are intended to be left on at all times to maintain full charge: power consumption is minimal.

THE LISTENING ENVIRONMENT

Room Size

The Spectra 11 is best suited to small to medium rooms: those with minimum dimensions of 10 to 18 feet. Quite acceptable performance will be obtained in larger rooms, but with a slight loss of total volume capability.

Some of the principal considerations which wil determine the performance potential of the speaker system as installed are:

1) **The Wall Behind The Speakers:** The walls should be neither excessively absorptive nor reflective. A highly reflective wall, such as large glass windows or smooth hard plaster, will tend to accentuate high frequencies. A highly absorptive wall such as heavy drapes or excessive application of specific sound absorbing materials, will tend to muffle high frequencies, as well as constrict the apparent depth of the sound stage.

2) **The Orientation of the Speaker System Within The Room:** For deepest low bass performance, the speakers should project sound along the longer axis of the room. This is true of all loudspeakers, and is in no way unique to Spectra. If this is not possible in your room, the performance will not be significantly compromised other than a slight loss of deep bass.

3) **Distance From the Rear Wall:** Since the Spectra is a dipole loudspeaker (producing sound from both sides) placing the speaker too close to the rear wall will yield substantially reduced bass output, due to rear-wave cancellations. A minimum speaker-to-rear wall distance of 3 feet is recommended, as measured from the rear center of the array perpendicular to the wall.

4) **Distance From the Side Walls:** Some space is desirable from the side walls, but the asymmetric nature of Spectra high frequency radiation makes side wall reflection less of a problem than with most other speakers. A spacing

of 1 foot is the minimum recommended distance from the side wall to the array's outer edge. In wide rooms, of course, this distance may be much greater.

5) **Toe-In and Distance Between Speakers:** There are numerous combinations of toe-in angle and distance between speakers that will yield excellent sonic performance. In most situations, the distance between speakers should be roughly equal to the distance from each speaker to the listening position. The speakers should also be toed-in at an angle so that they more-or-less face the listening position. Remember, these are general guidelines only. Room shape, furniture type, and personal taste are all important variables. Every listening environment is different, and experimentation is the key to satisfaction.

6) **The Area Between The Speakers:** This area should be kept clear of major obstructions to airflow if optimum imaging is to be achieved. The size, shape, and material of any objects placed between the speakers will determine the extent of any negative effects on imaging.

THEORY AND PRACTICE OF SPECTRA OPERATION

Spectra 11 represents a very high state of perfection of electrostatic hybrid loudspeakers.

The interface techniques allowing the **S**ymmetric **P**air **E**lectrically **C**urved **TRA**nsducer **(SPECTRA)** mode of operation were only perfected in late 1986.

At that time we made a quantum leap in the product of STEP-UP EFFICIENCY and BANDWIDTH which allowed us for the first time ever to combine traditional Acoustat high performance with the half-century old ideal of VARIABLE GEOMETRY operation.

This breakthrough solved the long standing impasse which had not allowed high SPL electrostats to have optimum behavior at all audio frequencies.

You will find Spectra has wide, pleasant dispersion at all frequencies, razor-sharp high-frequency time-alignment, and clean low bass.

Spectra achieves this by effectively changing size and shape at different frequencies. Spectra is about 3" wide at highest frequencies and about 9" wide at middle frequencies. The lowest frequencies are smoothly transitioned to an 8" dynamic woofer.

Spectra's excellent midrange results from the magic of wave physics which causes the 9" of array operational at these frequencies to act dispersively for waves leaving both the front and the rear of the array. Spectra is devoid of the midrange beaming common in planar speakers using large flat midrange radiators.

For those wishing more in-depth information about electrostats in general, and specifically Spectra, contact the factory and ask for our "White Paper" entitled "Full Range Electrostatic Loudspeakers." An electrical schematic is also available. However, the schematic is intended only for the academically curious: field repair is not recommended and not authorized.

GOOD LUCK AND GOOD LISTENING!

WARRANTY STATEMENT

The electrostatic elements of the Spectra 11 are warranted against defective materials and workmanship for the life of the product. The electronic components contained in the interface and the woofer are warranted against defective materials and workmanship for a period of five years from the original date of purchase. This warranty extends to the original owner, purchased from an authorized Acoustat dealer only. A dated proof of purchase must accompany all warranty claims.

For subsequent owners, the electrostatic elements, electronic components and the woofer are warranted against defective materials and workmanship for a period of five years from the date of manufacture. Manufacturing

date shall be determined from a code contained in the serial number.

During the warranty period, defective parts will be repaired or replaced, at Acoustat's option, without charge for labor or materials. The warranty does not cover transportation costs to the repair site. Acoustat will return warranty repairs to the owner freight pre-paid. This warranty does not cover damage due to negligence, misuse, modification, shipping damage or accident.

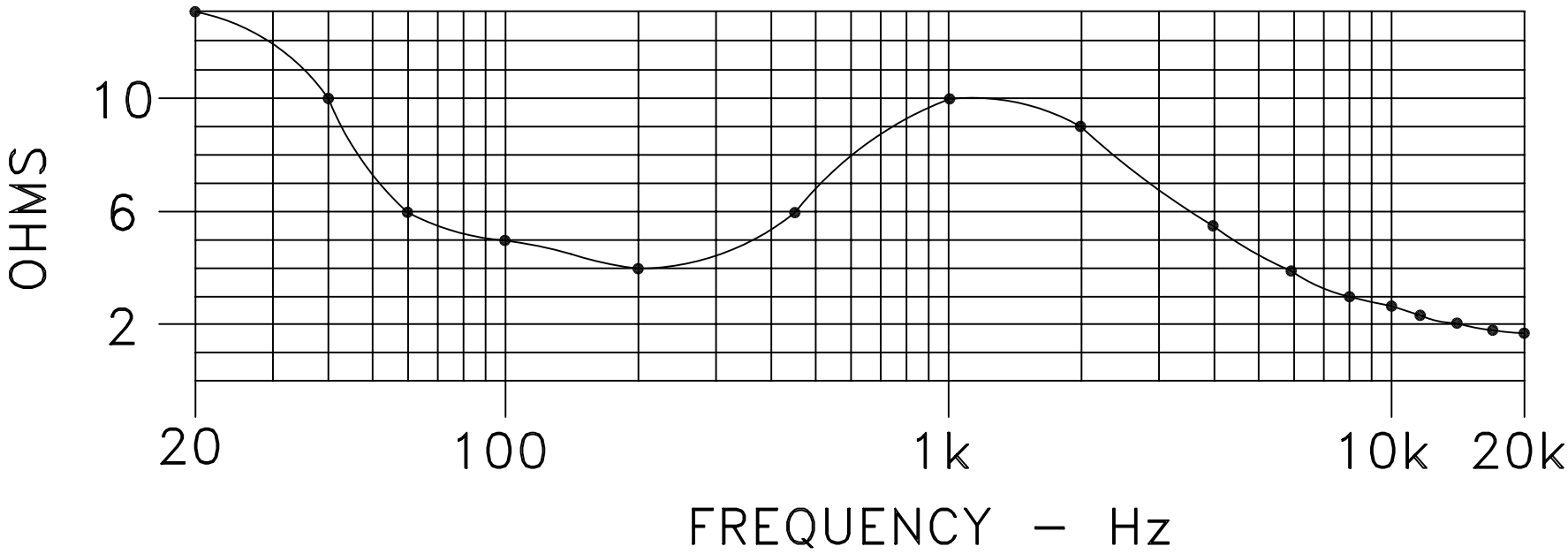
Except as provided herein, Acoustat makes no warranties, expressed or implied, including warranties of merchantability and fitness for a particular purpose. Some states do not permit limitation or exclusion of implied warranties; therefore the aforesaid limitations or exclusions may not apply to the purchaser.

IN CASE OF DIFFICULTY

The Spectra loudspeaker has been designed for a lifetime of trouble-free music enjoyment. On the rare occasions that an apparent malfunction should occur, be sure to check all system signal sources, fuses, and connecting cables. If investigation pinpoints the Spectra as the source of difficulty, please contact (by telephone, preferably) our Customer Service Department before sending any equipment for service. Very often, we can offer further trouble-shooting hints that simplify or even eliminate the need for factory service. Should your Spectra loudspeaker require factory service, please use original factory packaging for shipment, and include a copy of a dated Bill of Sale and a brief note describing the difficulty. Every effort will be made to perform service in a timely manner, with typical turn-around times of less than one week, exclusive of transit time.

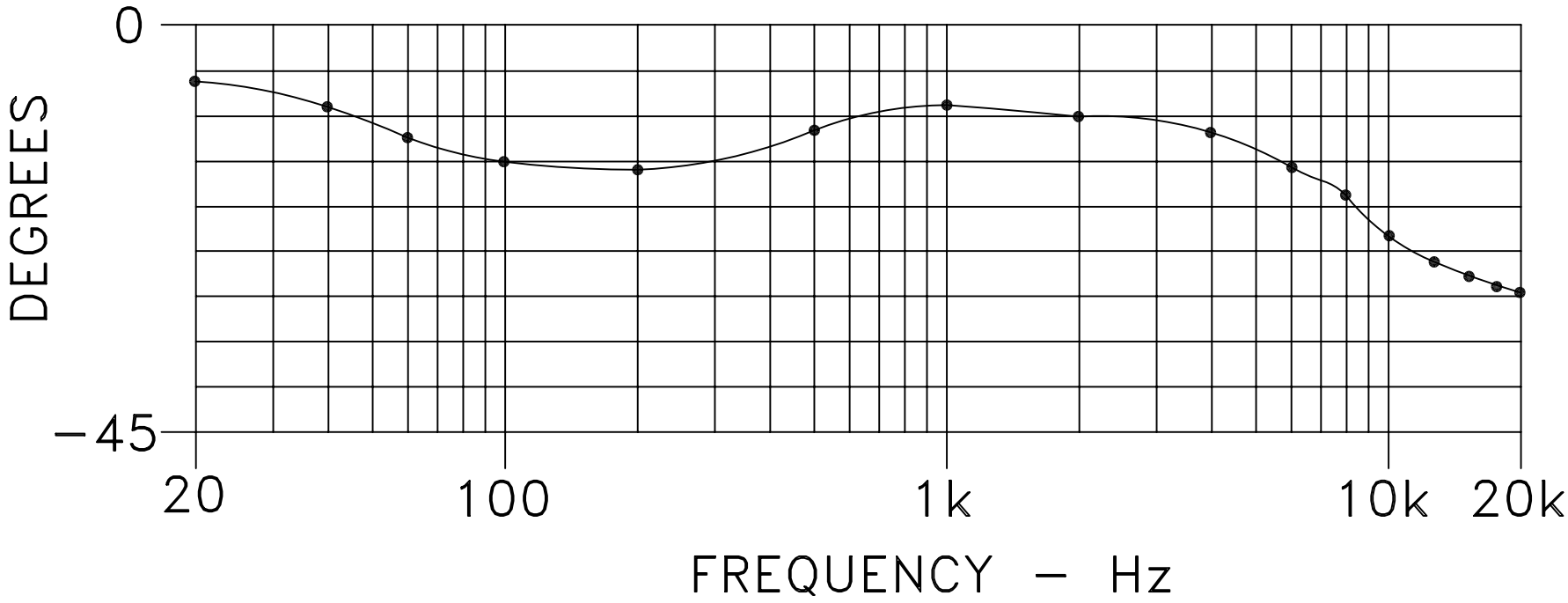
Acoustat
Division of Rockford Corporation
613 South Rockford Drive
Tempe, Arizona 85281
602-967-3565

IMPEDANCE PLOT



NOTE: VALUES PLOTTED FOR "MEDIUM" SETTING OF HIGH FREQUENCY CONTOUR SWITCH. IMPEDANCE SLIGHTLY LOWER ABOVE 10 KHZ FOR "HIGH" SETTING, AND SLIGHTLY HIGHER FOR "LOW" SETTING.

PHASE SHIFT PLOT



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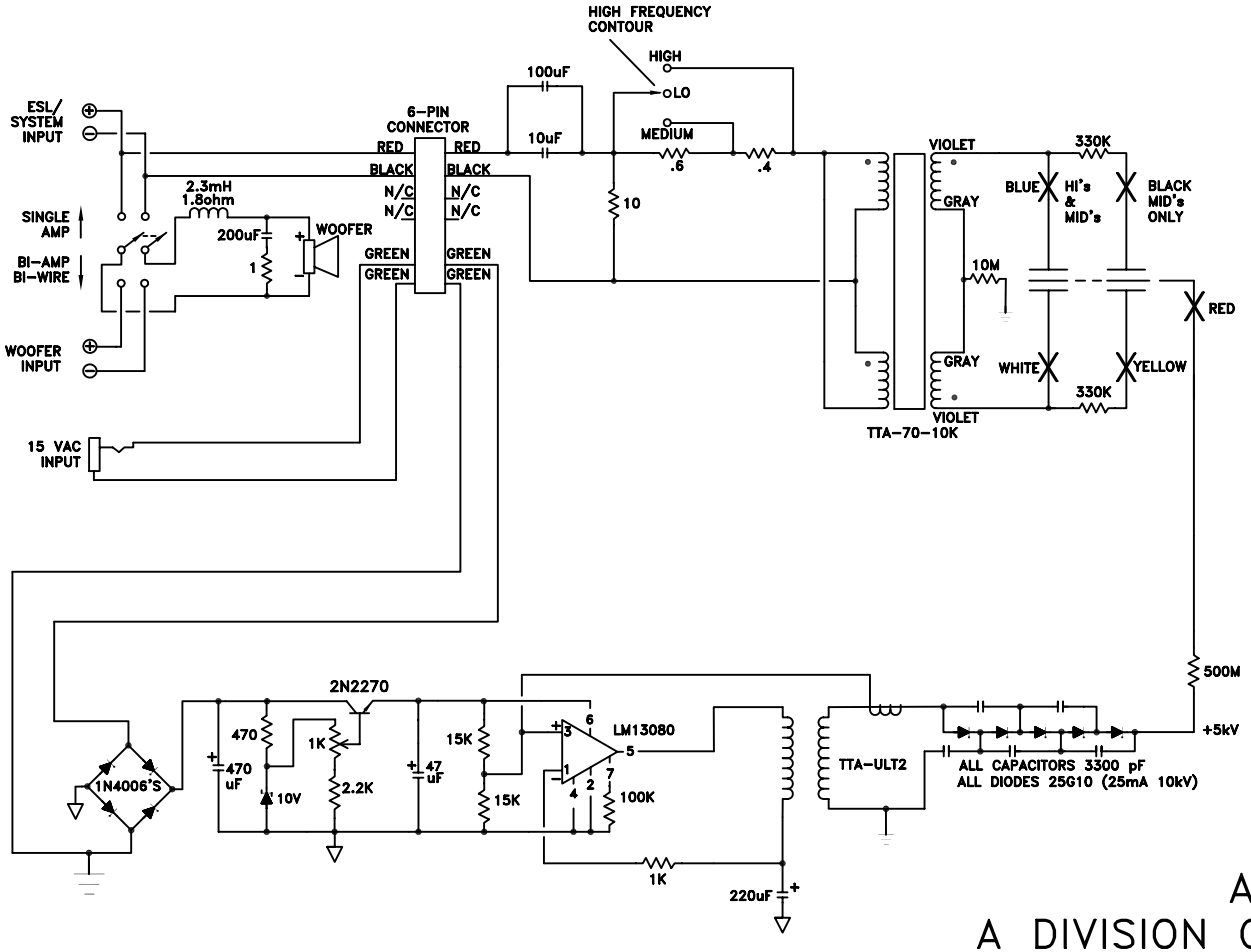
NOTES: UNLESS OTHERWISE SPECIFIED

1: ALL RESISTORS ARE OHMS

2: = LOW VOLTAGE GROUND

3: = HIGH VOLTAGE GROUND

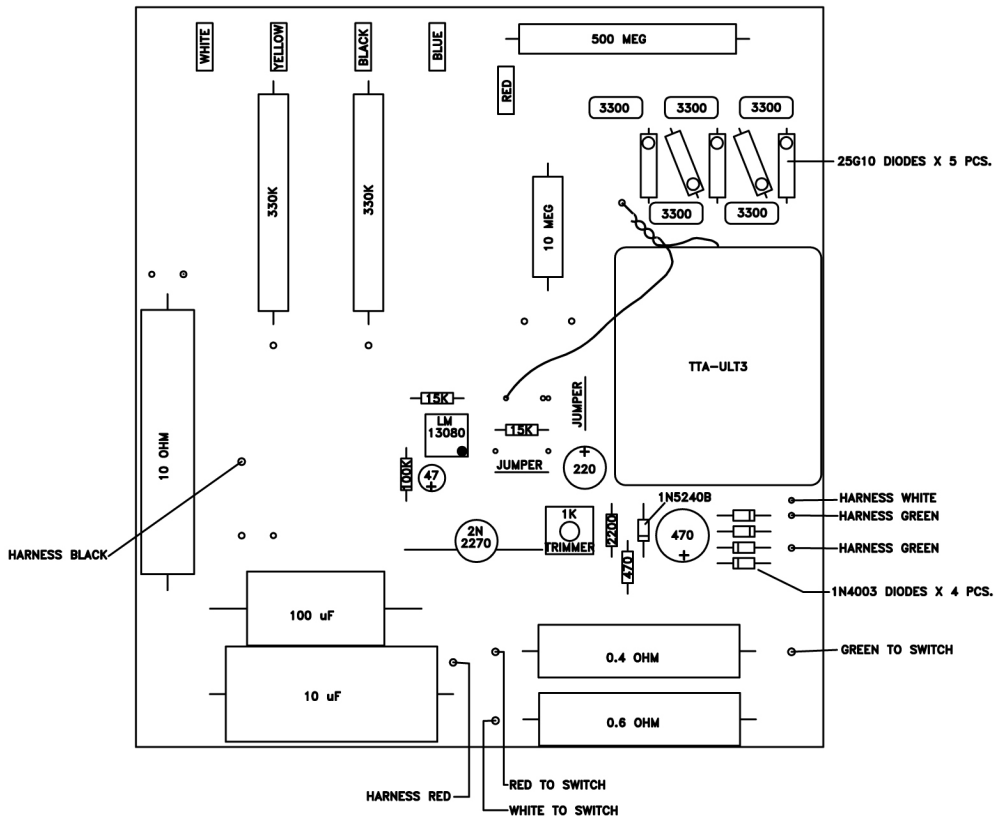
MAGNE–KINETIC INTERFACE FOR SPECTRA 1100



REVISIONS:

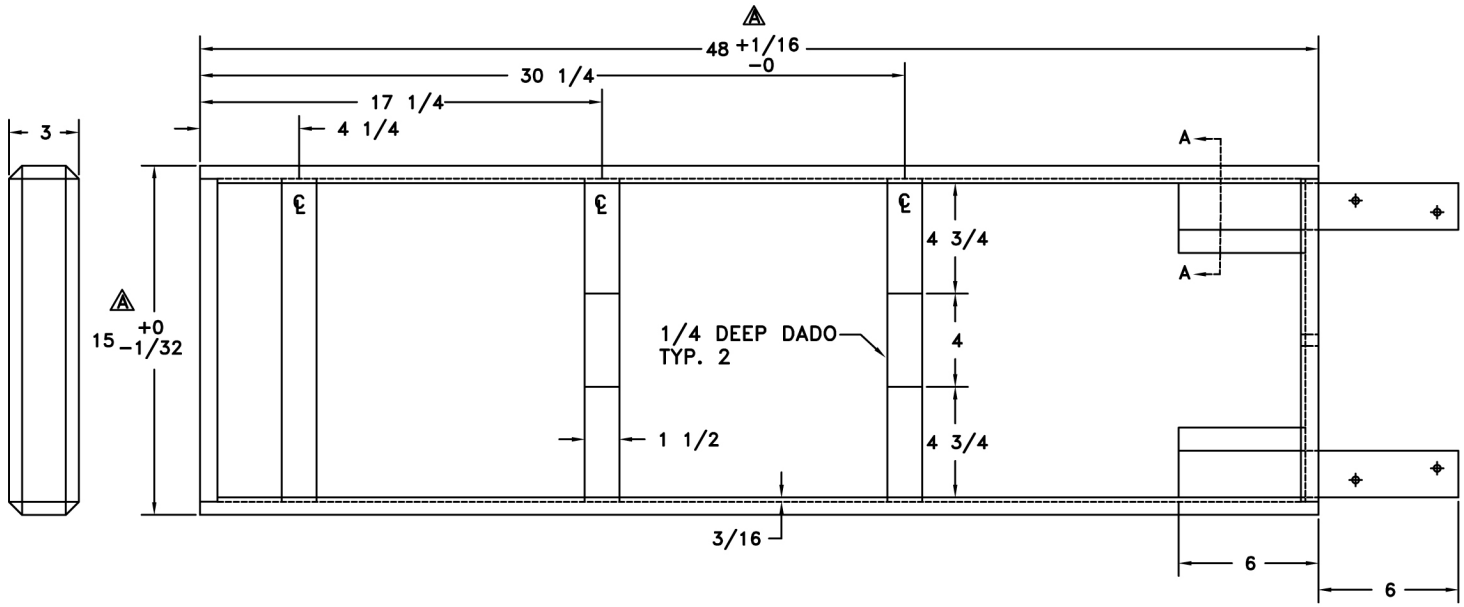
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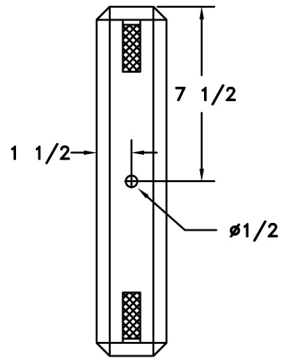
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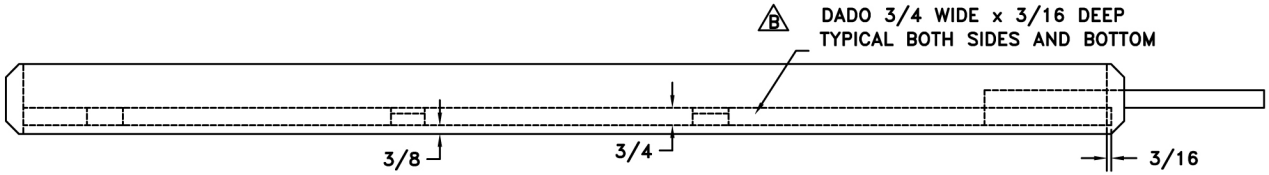


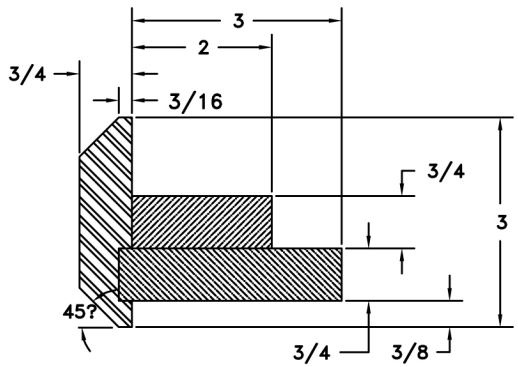
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A DIVISION OF ROCKFORD CORPORATION

SPECTRA 1100 PC LAYOUT

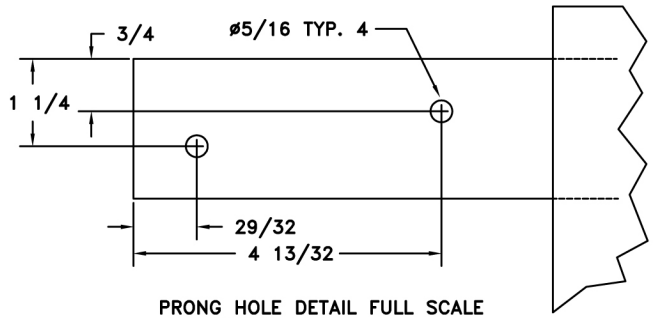








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ACOUSTAT
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SPECTRA 1100 FRAME

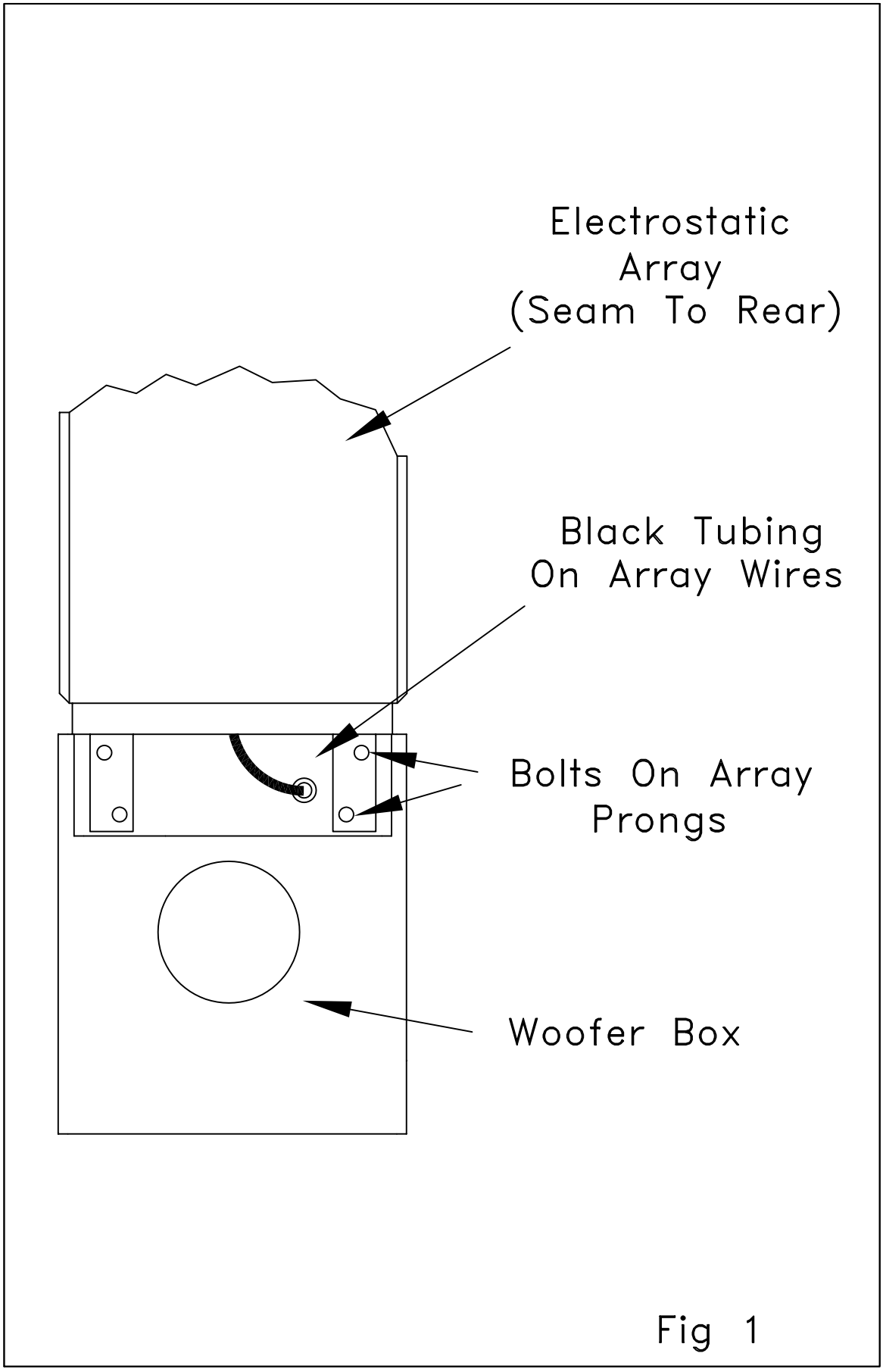

Electrostatic
Array
(Seam To Rear)
Black Tubing
On Array Wires
Bolts On Array
Prongs
Woofer Box

Fig 1

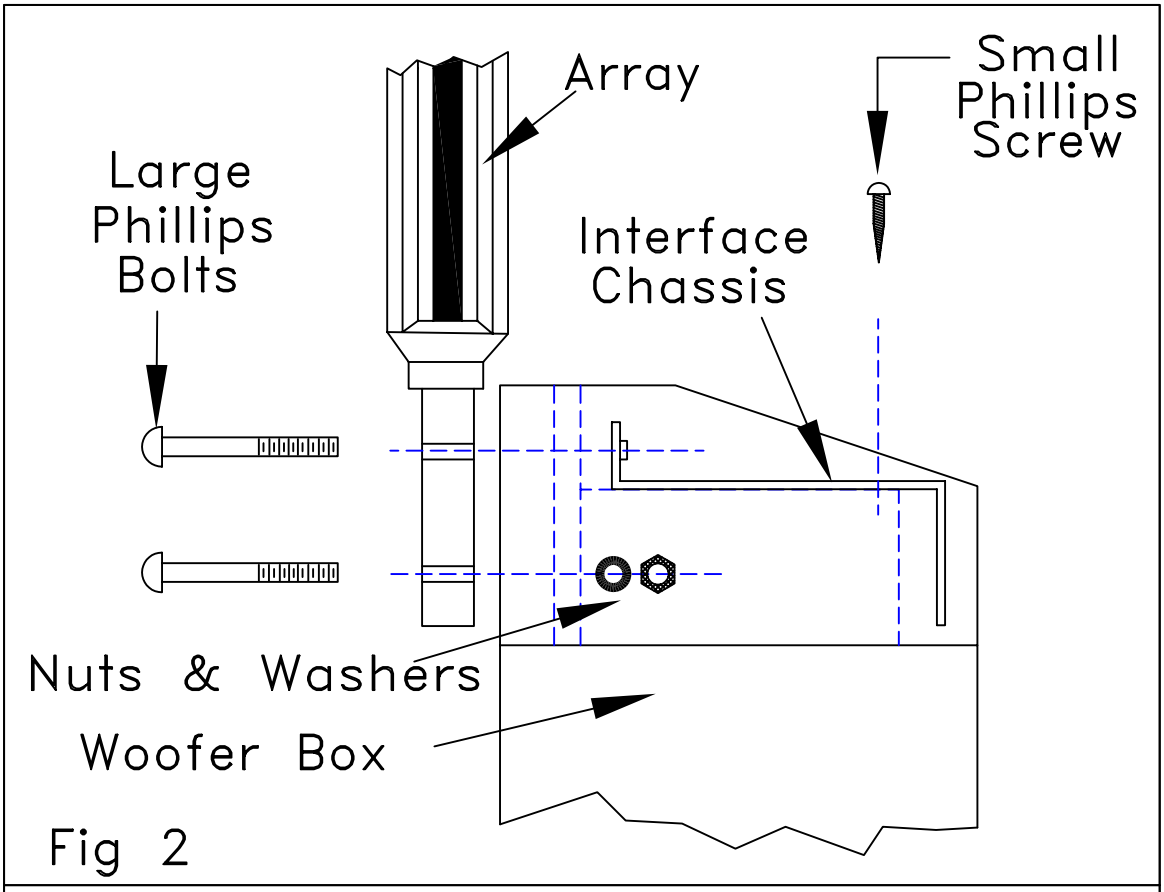

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Fig 2

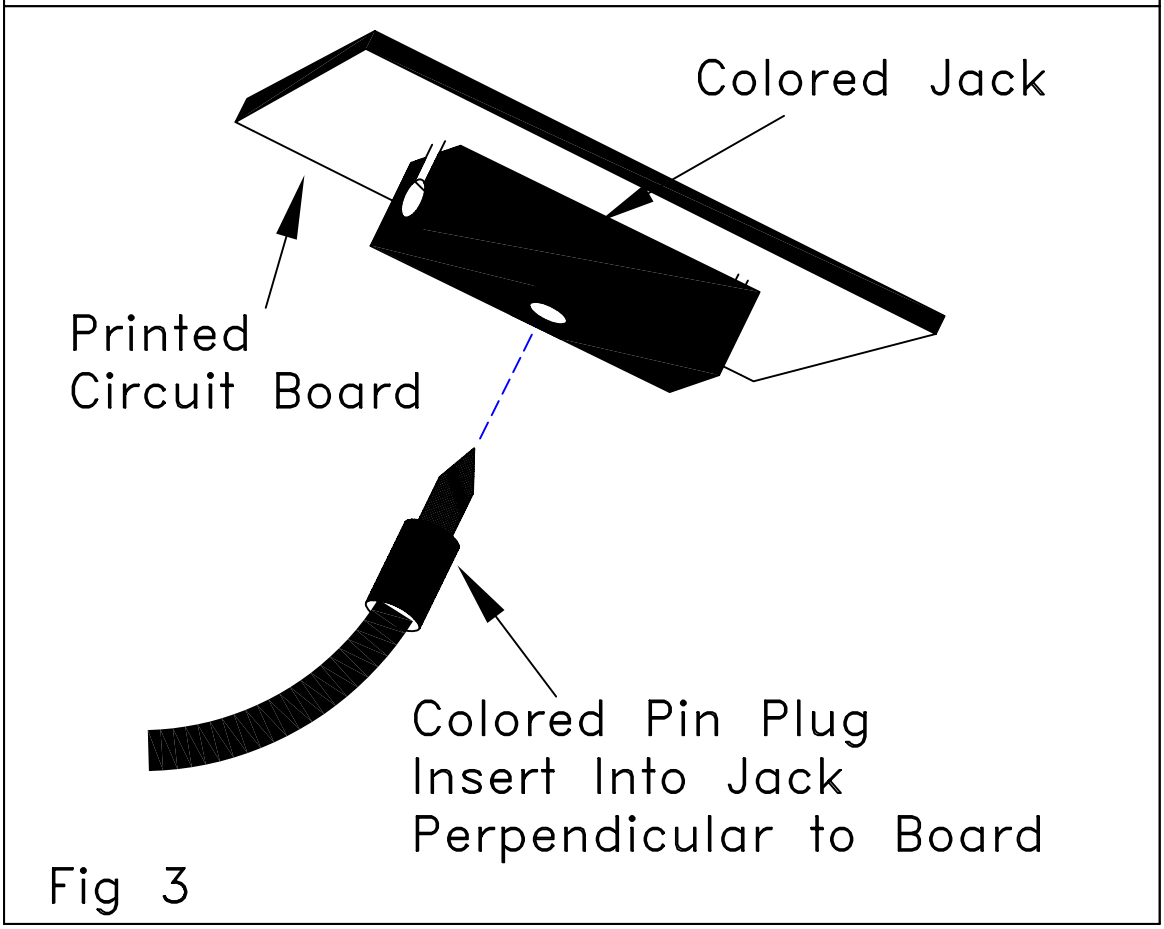

Colored Jack
Printed
Circuit Board
Colored Pin Plug
Insert Into Jack
Perpendicular to Board

Fig 3

STANDARD CONNECTION
SWITCH TO "SINGLE AMP"

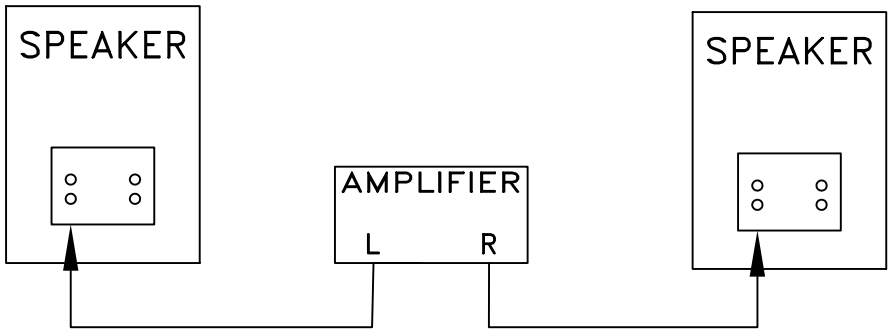


Fig. 4

BI-WIRE CONNECTION
SWITCH TO "BI-AMP/BI-WIRE"

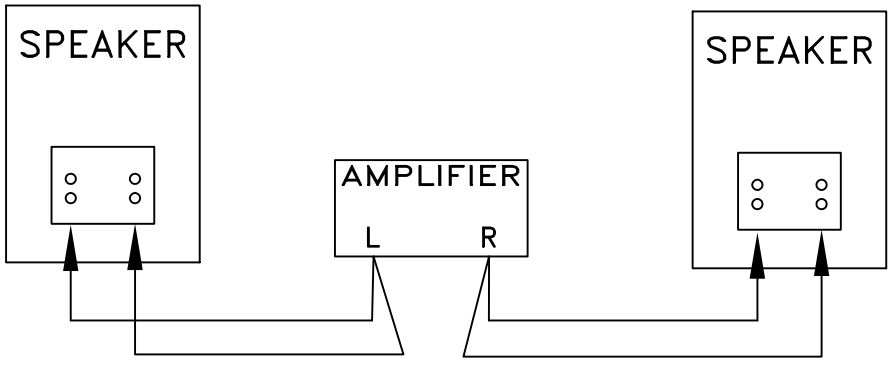


Fig. 5

BI–AMP CONNECTION
SWITCH TO "BI–AMP/BI–WIRE"

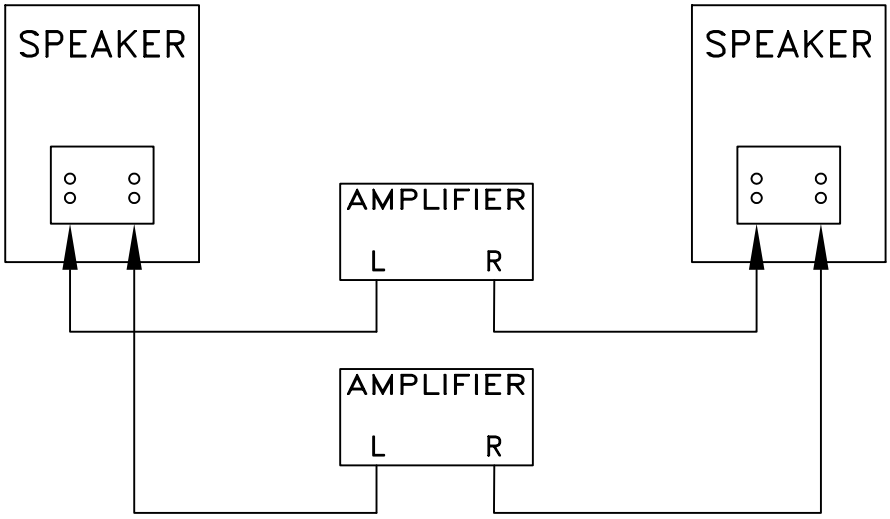


Fig. 6

ALTERNATE BI–AMP CONNECTION
SWITCH TO "BI–AMP/BI–WIRE"

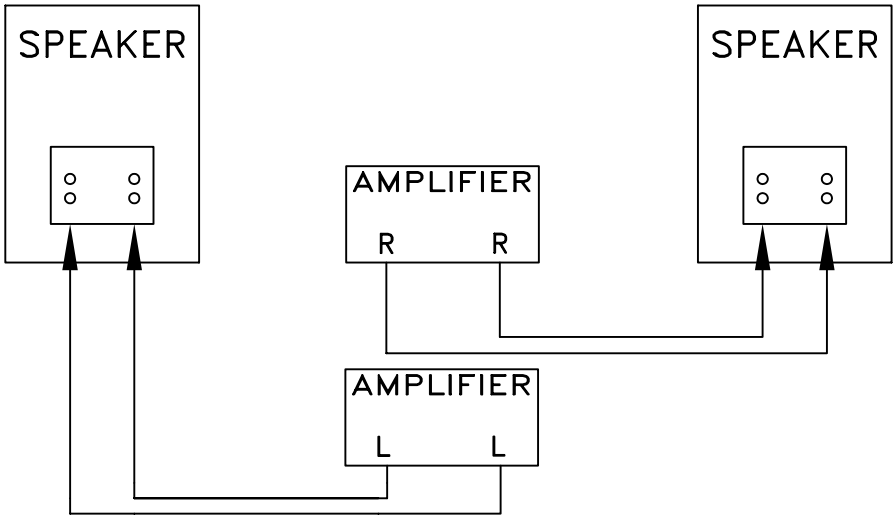


Fig. 7

OWNER'S MANUAL

SPECTRA 1100 ELECTROSTATIC LOUDSPEAKER SYSTEM

ACOUSTAT®

Acoustat
A Division of **Rockford** Corporation
613 South Rockford Drive
Tempe Arizona **65281** USA
602 -967 -3565

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Electrical Schematic ..... Page **21**

Congratulations on *your* purchase of Acoustat Spectra Technology

INTRODUCTION

Break-in Period

Your new Acoustat budspeaker requires a break-in period before full performance may be realized. Eyen though the speaker will begin to play within a few moments of being energized, and willsound quite good, a brand new speaker is characterized by a lower *efficiency,* reduced dynamic capability, and a generally "flat" dimensionality.

To "break-in' the speaker, simply play music through the system at moderate volume levels. The most dramatic improvement will occur within the first 20 hours of operation, although slight improvements may be noticed even at 50 hours of playing time.

The break-in period may be conducted all at once (i.e. leaving the system playing continuously) or may be accomplished over a number of playing sessions. This break-in phenomenon occurs only when the speaker is brand *new.* Even if a broken-in speaker has been de-energized for an extended period, it will again reach full performance within a few moments of being re-powered.

Using This Owner's Manual

We all have a tendency to read instruction manuals only if something doesn't work as intended. However, the assembly and installatiin of the Spectra loudspeaker, though simple, may not be obvious at first glance. Therefore, to maximize your enjoyment of this loudspeaker, please read through the entire manual before beginning.

This manual contains step-by-step information for assembling your Spectra, installation in the listening environment, and hook-up to the amplifier. We have also included additional information in an attempt to answer those most commonly asked questions.

ASSEMBLY & INSTALLATION

Getting Started

There are a few warnings we will make now which will save you trouble later:

1) Spectra arrays are MIRROR IMAGE, i.e. there are LEFT and RIGHT arrays.

Each is identified by a small label located on the rear edge of the top wood trim, as well as a colored dot on the bottom surface of the array: RED for right, and GREEN for left. The two woofer boxes and two interface chassis are IDENTICAL.

2) The cloth arrays are easily soiled, and are very prone to picking up lint from being laid on a carpet. The protective plastic bag should be left on them until the arrays are brought into final installed upright position

3) Spectra's sectored operation requires a complex connection-set from interface to array. Care is required when making the connections.

We will repeat these warnings when appropriate.

Assembly

Tool Required: Large (#2) Phillips Screwdriver

1) Gently pry off the grille frame from the front of the woofer box. It is held on by four plastic fasteners. Set aside the grille frame for later re-attachment.

Refer to Figures 1 and 2 for the following steps.

2) Remove the two large bolts at the top-front of the enclosure, and set aside. These bolts secure the electrostatic array as well the front edge of the interface chassis.

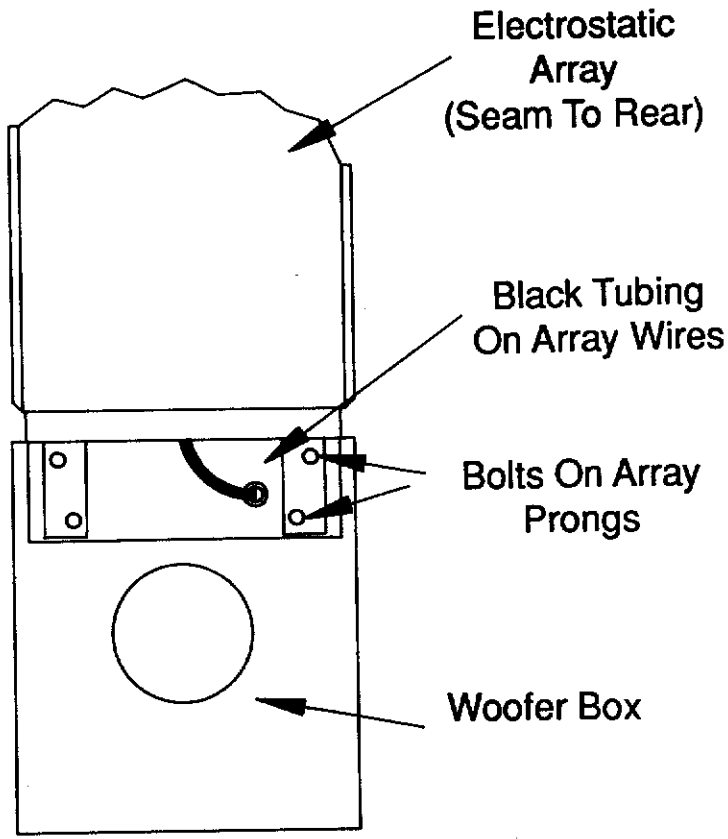


Fig. 1

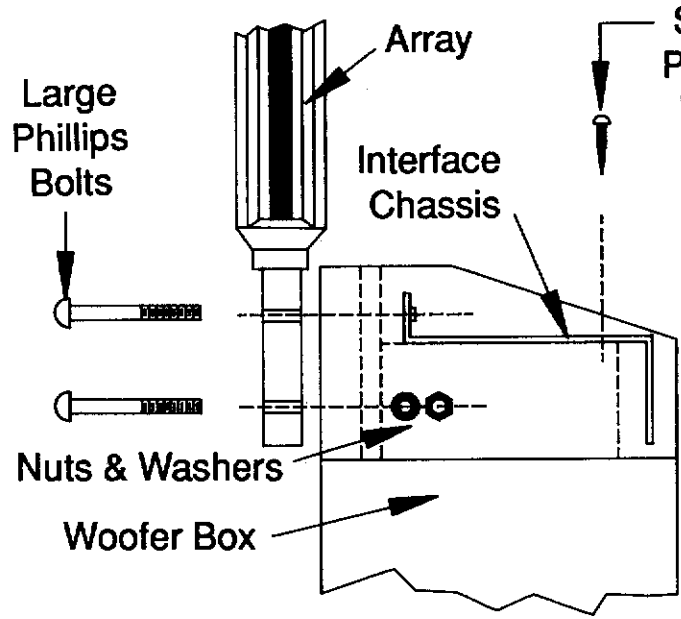


Fig. 2

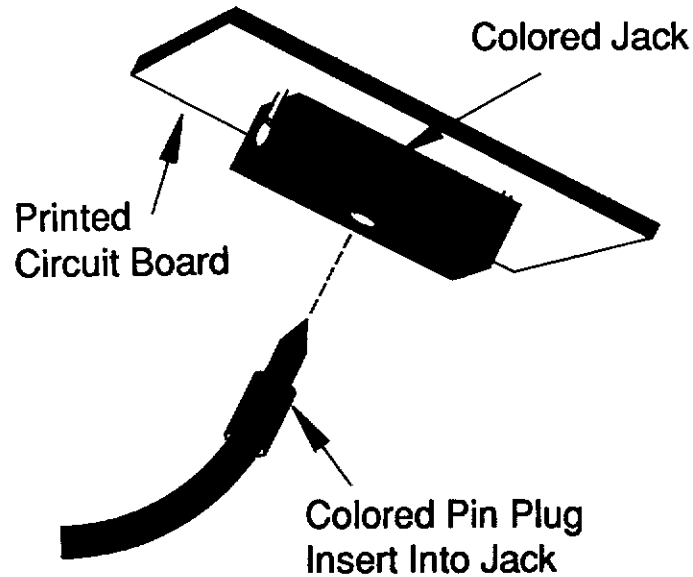


Fig. 3

3) Remove and set aside the **two** small Phillips-head screws on top of the interface chassis, **at** the outer rear edges.

4) Slide the chassis rearward about 2", and lift-up the front edge. Remove the plastic parts bag located under the chassis. Plug in the white connector to the mating receptacle on top of the woofer box. Note that this connector is keyed so that it inserts only one way. Insert fully until it snaps.

5) The parts bag should contain the following:

(1) Wall Transformer
(2) 1/4" - 20 x 2" Bolts
(2) 1/4" - 20 Nuts
(2) **1/4"** Washers
(4) Spiked Leveling Feet

6) Place the electrostatic array in position on the front of the woofer box, with the wires hanging down in front of the woofer, and the seam in the grille cloth toward the rear. It is recommended that an assistant support the array in position until step **#7** is completed.

Note: If the speaker is being assembled near its final location, you may want to choose the appropriate Left or Right array.

7) Insett a large bolt in each of the LOWER holes located on the prongs extending from the array, and adjust the position of the array so that the screws insert fully through the front of the woofer box. Place a washer and nut on the bolts from the rear **and** tighten. The array will now be self-supportting.

8) Feed the array wires through the hole in the front of the woofer box, with the black tubing covering the wires between the array and hole.

9) Again lift-up the front edge of the interface chassis, and locate the 5 colored jacks (RED, BLUE, BLACK, YELLOW, WHITE) on the printed circuit board. Plug the array wires into these jacks, PERPENDICULAR TO THE BOARD, following the color code. Refer to Figure **3.**

10) Slide the interlace chassis forward, making sure that the array wires are not pinched or strained.

11) Insert the remaining large bolts in the upper prong holes, thread into the interface chassis, and tighten.

12) insert and tighten (but do not overtighten) the Philips head screws on top of the chassis.

13) Re-install the woofer grille, aligning it to the front of the woofer box by first lining up the top edge of the grille against the plastic trim plate at the bottom of the array. Then seat the fasteners by pressing each of the four corners.

14) Repeat steps 1-13 for the other speaker.

We recommend that you keep all the boxes if possible. If storage space is limited, keep all of them for a while until you are satisfied that both speakers are performing properly.

Experience has shown that if service or a factory modification is ever needed, it is most likely to involve sending ONLY the interfaces to Acoustat. Our packaging materials are top-of the-line and much more protective than most home-made arrangements. (See In Case of Difficulty.)

Disassembly of Speaker

Should your Spectra ever require disassembly for the purpose of moving or repair, simply follow the assembly instructions in reverse order, ***with*** one very important exception. After unbolting the interface chassis, but BEFORE disconnecting any internal wires, the speaker must be discharged.

(cont.)

WARNING: Always unplug the AC (POWER) input and audio feeds before accessing the inside of the Interface.

1) Even after the power is removed, a high voltage charge remains on the array for at least many hours.

2) To discharge the array, remove the RED coded array wire and touch its tip (while holding the wire's insulation, NOT the metal plug) to any other array wire connection. Unless the speaker has been de-energized for some time, expect to see a spark and hear a snap from the speaker.

3) The speaker will ***now*** be safely discharged, and disassembly ***may*** procedd.

Audio Input

The red/black input terminals are standard, **3/4"spacing,** bananajacks. They may accept single or dual banana plugs, spade lugs, pin plugs, or bare wires.

There are four possible ways to connect the loudspeaker to the system amplifier(s). For all connections, be sure to observe polarity markings for both channels: Red (+) to Red (+), and Black (-) to Black (-). All Acoustat Loudspekaers are designed to preserve absolute phase integrity: i.e. when **the** red input terminal is positive with respect to the black terminal, the electrostat's diaphragm will move forward.

Standard Connection: See Figure Four. This configuration allows a single stereo amplifier to power both the electrostatic array and the woofer. To implement, connect the amplifier's output to the 'ESUSYSTEM INPUT" terminals, and set the switch to 'SINGLE AMP". No connection is made **lo** the "WOOFER INPUT terminals.

Bi-Wire Connection: See Figure Five. This configuration allows a single stero amplifier to power both the electrostatic array and the woofer. but allows use of **two** separate cables to feed each section. To implement, connect the amplifier's

output to the "ESUSYSTEM INPUT" terminals using one cable, and using another cable, connect the same amplifier channel's output to the WOOFER INPUT" terminals. Set the switch to the "BI-AMP/BI-WIRE" position.

Bi-Amp Connection: See Figure Six. This configuration allows one stereo amplifier to power the electrostatic array, and a second stereo amplifier to power the woofer. To implement, connect one amplifier's output to the "ESL SYSTEM INPUT terminals, and connect the second amplifier's output to the 'WOOFER input" terminals. Set the switch to the "BI-AMP/BI-WIRE" position. The two amplifiers need not be identical, but should have similar power ratings, and must have identical gain (sensitivity).

Alternate Bi-Amp Connection See Figure Seven. This configuration allows one stereo amplifier to power the left speaker, and a second stereo amplifier to power the right speaker. The advantage of this set up is that it allows each power amplifier to be placed close to the corresponding speaker, avoiding long speaker cable runs. To implement, connect one channel of the "left" amplifier to the left speaker's "ESUSYSTEM INPUT" terminals, and connect the other channel to the left speaker's WOOFER INPUT". Repeat the process for the right channel. Set the switch to BI-AMP/BI-WIRE" positiin. The two amplifiers MUST be identical for this configuration.

Note that the BI-AMP/BI-WIRE switch disconnects both (+) and (-) woofer terminals from the ESU System terminals, avoiding possible problems between amplifiers due to common connections.

For connections using **two** amplifiers, a means must be provided for splitting the signal from the preamplifier to each amplifier. Some preamps provide multiple outlets; others require the use a "Y" adapter. Consult your dealer for available options.

STANDARD CONNECTION
SWITCH TO "SINGLE AMP"

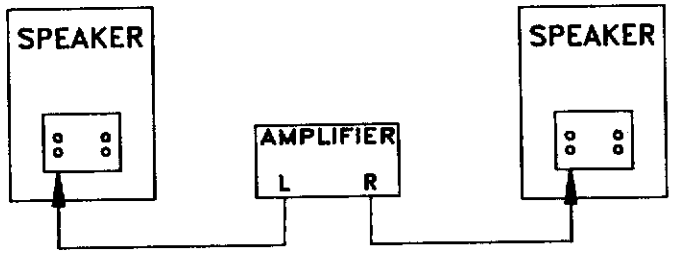


Fig. 4

BI-WIRE CONNECTION
SWITCH TO "BI-AMP / BI-WIRE"

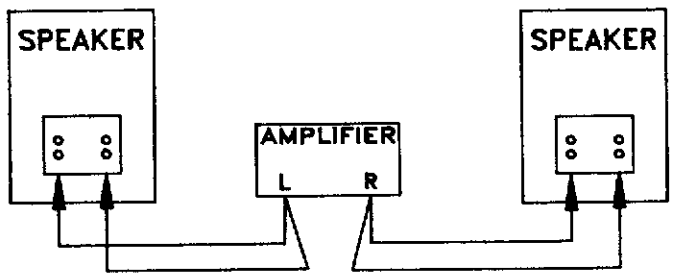


Fig. 5

BI-AMP CONNECTION
SWITCH TO "BI-AMP / BI-WIRE"

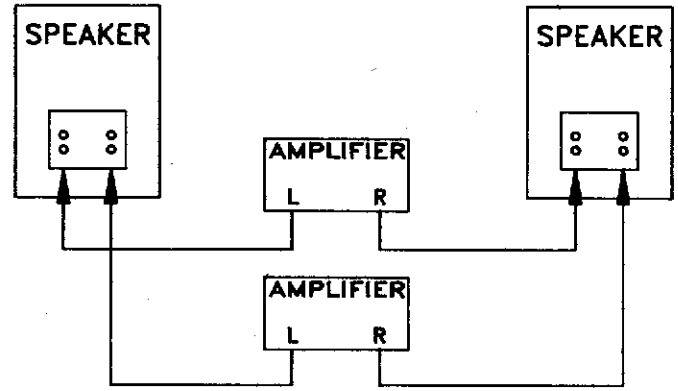


Fig. 6

ALTERNATE BI-AMP CONNECTION
SWITCH TO "BI-AMP / BI-WIRE"

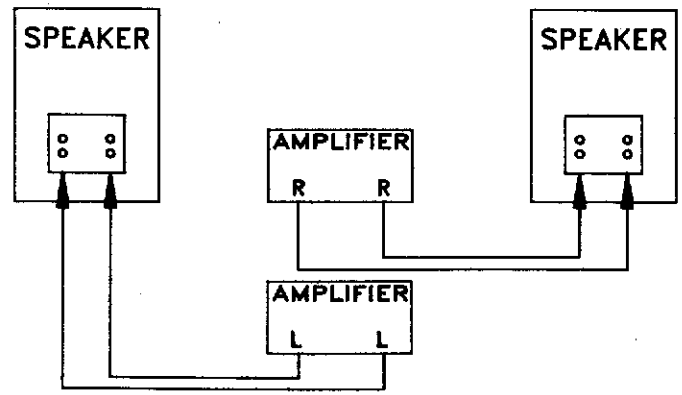


Fig. 7

Power Input

The miniature (3.5 mm) phone jack connects to the ultrasonic bias power supply, which creates the +5000 volts necessary for electrostatic operation. The supplied wall transformer is to be connected to this input jack arid plugged into an ALWAYS ON line outlet. Make sure that there are no wall switches or light dimmers associated with the outlet. All Acoustat loudspeakers are intended to be left on at all times lo maintain full charge: power consumption is minimal (about as much as a small night light).

NOTE: Before plugging in the wall transformer, make sure that it is rated for your local line (mains) voltage. The export transformer, labelled for 220 volts, is suitable for use with 220 to 240 volts, 50 to 60 Hz.

High Frequency Contour Switch

A three position switch has been provided on the rear of the interface chassis to adjust the top-octave response. Most situations will call for the "medium" setting. However, there is no "correct" setting: adjust this switch to suit your own preferences. Each step of the switch causes a change of about 2 dB at 20kHz.

Spiked feet

Four spiked feet have been included for installation on each speaker. The feet serve to firmly couple the speaker to the floor, yielding more solid bass response. The feet can also be used to level the speaker, as well as to "bite" through deep pile carpeting to better stabilize the speaker.

The speakers **should** be set-up in their final listening positions before installing the spiked feet, as moving the speaker with the spikes installed can be more difficult. Never drag the speaker across the ***floor with*** the spikes installed. To install, simply screw each foot into the receptacle located on the bottom of the woofer cabinet. Insert the threads fully unless the feet are being used to level the speaker, in whch case one or more feet can be **backed-out** to even the speaker on the floor.

The use of spiked feet on non-carpeted floors is generally not recommended due to the high chance of scratching or denting the floor. It is possible to level the speaker on non-carpeted flloors by substituting a hex- head 1/4"-20 x 1" bolt for the spiked foot. available from hardware stores.

THE LISTENING ENVIRONMENT

Room Size

The Spectra 1100 is best suited to small to medium rooms: those with minimum dimensions of 12 to 18 feet (3.5 to 5.5 meters). Quite acceptable performance will be obtained in larger rooms, but with a slight loss of total volume capabiliiy.

Some of the principal consideratiins which will determine the performance potential of the speaker system as installed are listed below. Remember, these are general guidelines only. Room shape, furniture type, and personal taste are all important variables. Every listening environment is different, and experimentation is the key to satisfaction.

The Wall Behind The Speakers: The walls should be neither excessively absorptive nor reflective. A highly reflective wall, such as large glass windows or smooth hard plaster, will tend to accentuate high frequencies. A highly absorptive wall such as heavy drapes or excessive application of specific sound absorbing materials, will tend to muffle high frequencies, as well as constrict the apparent depth of the sound stage. The High Frequency Contour switch can help to compensate for some of these variables.

The Orientation Of The Speaker System Within The Room: For deepest low bass performance, the speakers should project sound along the longer axis of the room. This is true of all loudspeakers, and is in no way unique to Spectra. If this is not possible in your room, the performance will not be significantly compromised other than a slight loss of deep bass.

Distance From The Rear Wall: Since the Spectra is a dipole loudspeaker (producing sound from both sides) placing the speaker too close to the rear wall will yield reduced bass output, due to rear-wave cancelations. A minimum speaker-to-rear wall distance of 3 feet (1 meter) is recommended, as measured from the rear center of the array perpendicular to the wall. Note also that the distance to the rear wall can be used in some situations to adjust the low frequency balance in the room.

Distance From The Side Walls: Some space is desirable from the side walls, but the asymmetric nature of Spectra's horizontal high frequency radiation makes side wall reflection less of a problem than with most other speakers. A spacing of 1 foot (30 cm) is the minimum recommended distance from the side wall to the array's outer edge. In wide rooms, of course, this distance may be much greater.

Toe-In And Distance Between Speakers: There are numerous combinations of toe-in angle and distance between speakers that will yield excellent sonic performance. In most situations, the distance between speakers should be roughly equal to the distance from each speaker to the listening position. The speakers should also be toed-in at an angle so that they more-or-less face the listening position.

The Area Between The Speakers: This area should be kept clear of major obstructions to airflow if optimum imaging is to be achieved. The size, shape, and material of any objects placed between the speakers will determine the extent of any negative effects on imaging.

ADDITIONAL INFORMATION

Specifications

PHYSICAL DIMENSIONS:

Height	**67.5" (171.5** cn)
Width	16' **(40.6** cm)
Array Depth	3" **(7.6** cn)
Woofer Depth	**16.75" (42.5 cn)**

RECOMMENDED AMPLIFIER POWER:
75 - 100 watts per channel or greater (based on ***8*** ohm amplifier rating). See further discussion under "Amplifier Recommendations".

BIAS POWER SUPPLY CONSUMPTION:
Less than **10** watts.

EFFICIENCY ***88*** dB SPL'

• (400 Hz, **1** watt into ***8*** ohms equivalent at one meter, extrapolated from measurements taken at **10** watts into ***8*** ohms equivalent, measured at a distance of **3.16** meters.)

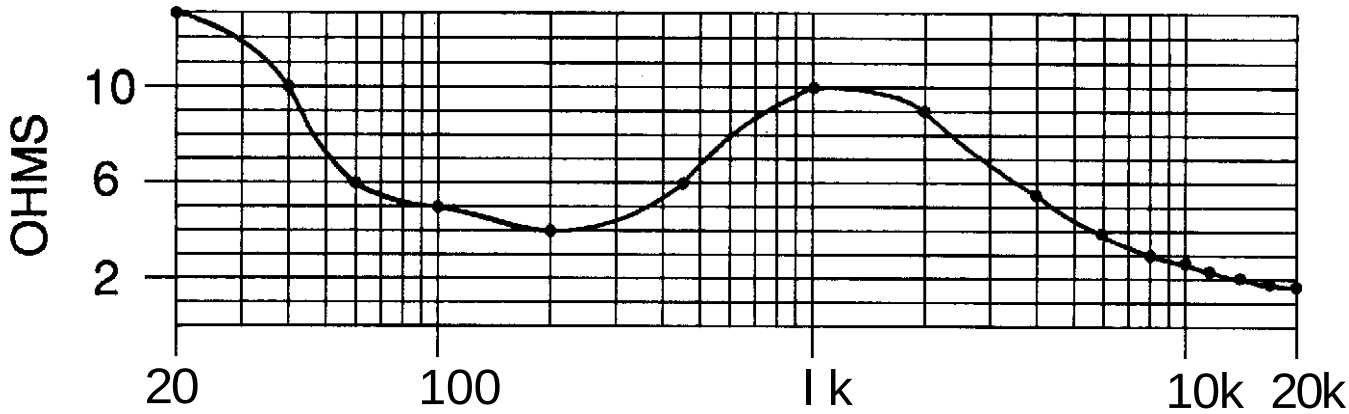
IMPEDANCE: Typically greater than **6** ohms, minimum of **2** ohms at high frequencies (see graph).

FREQUENCY RESPONSE: -3 dB **at** 30 Hz, -3 dB at 19 kHz ("High" setting)

CROSSOVERS:

Electrostat:	**250** Hz. **-6** dB per Octave electrical, **-12** dB effective acoustic rolloff.
Woofer:	**250** Hz. modified **-12** dB per octave, internal phase reversal.

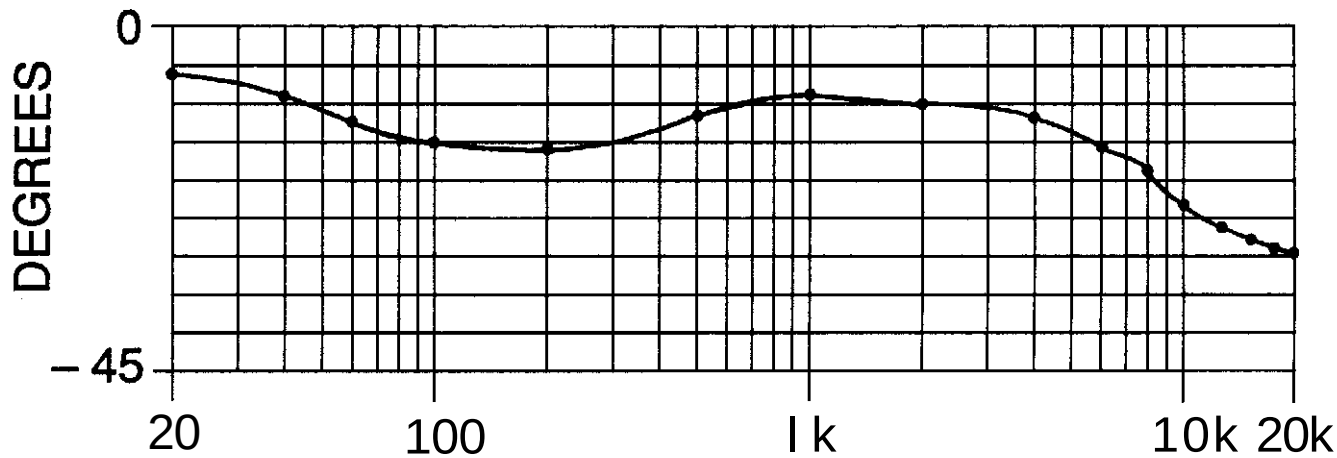
IMPEDANCE PLOT



FREQUENCY - Hz

NOTE: VALUES PLOTTED FOR "MEDIUM" SETTING OF HIGH FREQUENCY CONTOUR SWITCH. IMPEDANCE SLIGHTLY LOWER ABOVE 10 KHZ FOR "HIGH" SETTING, AND SLIGHTLY HIGHER FOR "LOW" SETTING.

PHASE SHIFT PLOT



FREQUENCY - Hz

NOTE: VALUES plotted FOR "MEDIUM" SETTING OF HIGH FREQUENCY CONTOUR SWITCH. PHASE SHIFT SLIGHTLY GREATER ABOVE 10KHZ FOR "HIGH" SETTING, AND SLIGHTLY LESS FOR "LOW SETTING.

AMPLIFIER RECOMMENDATIONS

As compared to most electrostatic loudspeakers, the Spectra 1100 possesses ***good*** efficiency and is relatively easy to drive. However, compared to traditional magnetic loudspeakers, the 1100 possesses only medium efficiency, and can occasionally posed driving difficulties at high frequencies where impedance can dip to as low as 2 ohms.

Therefore, when choosing a power amplifier, a few factors must be considered. The recommended minimum of 75-100 watts per channel will yield good results, but will not realize the speakers' full potential, especially in larger rooms. Amplifiers as large as **200** watts per channel may be used, as bng as good common Sense is employed: the speaker/a,plifier should not be pushed to the limit of distortion. The Spectra 1100 is very rugged, and the electrostatic panel itself cannot be damaged by excessive drive, but the interface electronics and woofer system do have finite power handling capacity. The advantage in using a large power amplifier is not so much to allow the system to play much louder, but rather to allow for unrestricted dynamic headroom. In bi-amping con-fgurations, the power requirements for each amplifier can be somewhat lower.

In addition to the 8 ohm power rating of the amplifier, the amplifier's ability to drive low impedances should be considered. Despite the speaker's rating of 2 ohms at high frequencies, the ampliiier does not necessarily have to be rated for 2 ohms, since this minimum occurs over only a very narrow frequency range. However, to yield optimum performance from the loudspeaker, the amplifier should be rated to drive 4 ohm loads, and/or be advertised as being a 'high current" design.

Acoustat does not generally recommend the used of mono-bridged amplifiers with Spectra loudspeakers. When a stereo amplifier is bridged into mono, each

half of the amplifier "sees" only half the bad impedance. Therefore, that 2 ohm minimum then becomes a 1 ohm minimum, which can cause overheating or instabiliiy in some amplifiers. At the very least, very few amplifiers can deliver more power at 1 ohm: most deliver considerably less.

The choice of amplifier device technology (transistor, MOSFET vacuum tube, etc.) is an entirely personal one. Acoustat does not favor one technology over another. Each amplifier must be evaluated on its own particular merits. The same comments hold true for the choice of speaker cable.

THEORY & PRACTICE OF SPECTRA OPERATION

Spectra 11***00*** represents a very high state of perfection of electrostatic hybrid loudspeakers.

The intedace techniques allowing the Symmetric Pair Electrically Curved Transducer (SPECTRA) mode of operation were only perfected in late 1986.

At that time Acoustat made a quantum leap in the product of STEP-UP EFFICIENCY and BANDWIDTH which allowed for fhe first time a combination of traditional Acoustat high pedormance with the half-century old ideal of VARIABLE GEOMETRY operation.

This breakthrough solved the long standing impasse which had not allowed high SPL electrostats to have optimum behavior at all audio frequencies.

You will find Spectra has wide, pleasant dispersion at all frequencies, razor-sharp high-frequency time alignment, and clean low bass.

Spectra achieves this by effectively changing size and shape at different frequencies. Spectra is about ***3"*** wide ***at*** highest frequencies and about 9" wide at middle frequencies. The lowest frequencies are

smmothy transitioned to an ***8"*** dynamic woofer. Spectra's excellent midrange results from the magic of wave physics which causes the 9" of array operatiinal at these frequencies to act dispersively for waves leaving both the front and the rear of the array. Spectra is devoid of the midrange beaming common in planar speakers using large flat midrange radiators.

For those wishing more in-depth information about electrostats in general and specifically spectra, contact the factory and ask for our "White Paper" entitled "Full Range Electrostatic Loudspeakers."

An electriial schematic is included in this owner's manual. However, the schematic is intended only for the academically curious: field repair is not recommended and **not** authorized.

WARRANTY STATEMENT

The electrostatic elements of the Spectra 1100 are warranted against defective materials and workmanship for the life of the product. The electronic components contained in the interface and the woofer are warranted against defective materials and workmanship for a period of five years from the original date of purchase. This warranty extends to the original owner, purchased from an authorized Acoustat dealer only. A dated proof of purchase must accompany all warranty claims.

For subsequent owners, the electrostatic elements, electronic components and the woofer are warranted against defective materials and workmanship for a period of five years from the date of manufacture. Manufacturing date shall be determined from a code contained in the serial number.

During the warranty period, defective parts will be repaired or replaced, at Acoustat's option, without charge for labor or materials. The warranty does not cover transportation costs to the repair site. Acoustat will return warranty repairs to the owner freight

The Spectra loudspeaker has been designed for a lifetime of trouble-free music enjoyment. On the rare **occasions** that an apparent malfunction should **oc-** cur, be sure to check all system signal sources, fuses, and connecting cables. If investigation pinpoints the Spectra as the source of difficulty please contact **(by** telephone, preferably) our Customer Service Department before sending any equipment for service. Very often, we can offer further trouble-shooting hints that simplify or even eliminate the need for factory service. Should your Spectra loudspeaker require factory service, please use original factory packaging for shipment and include a copy of a dated Bill of Sale and a brief note describing the difficulty. Every effort will be made to perform service in a timely manner, with typical turn-around times of about one week, exclusive of transit time.

ALL RETURNS TO THE FACTORY, REGARDLESS OF WARRANTY STATUS, REQUIRE PRIOR RETURN AUTHORIZATION.

Acoustat
A Division of Rockford Corporation
613 South Rockford Drive
Tempe, Arizona 85281
602-967-3565

ACOUSTAT

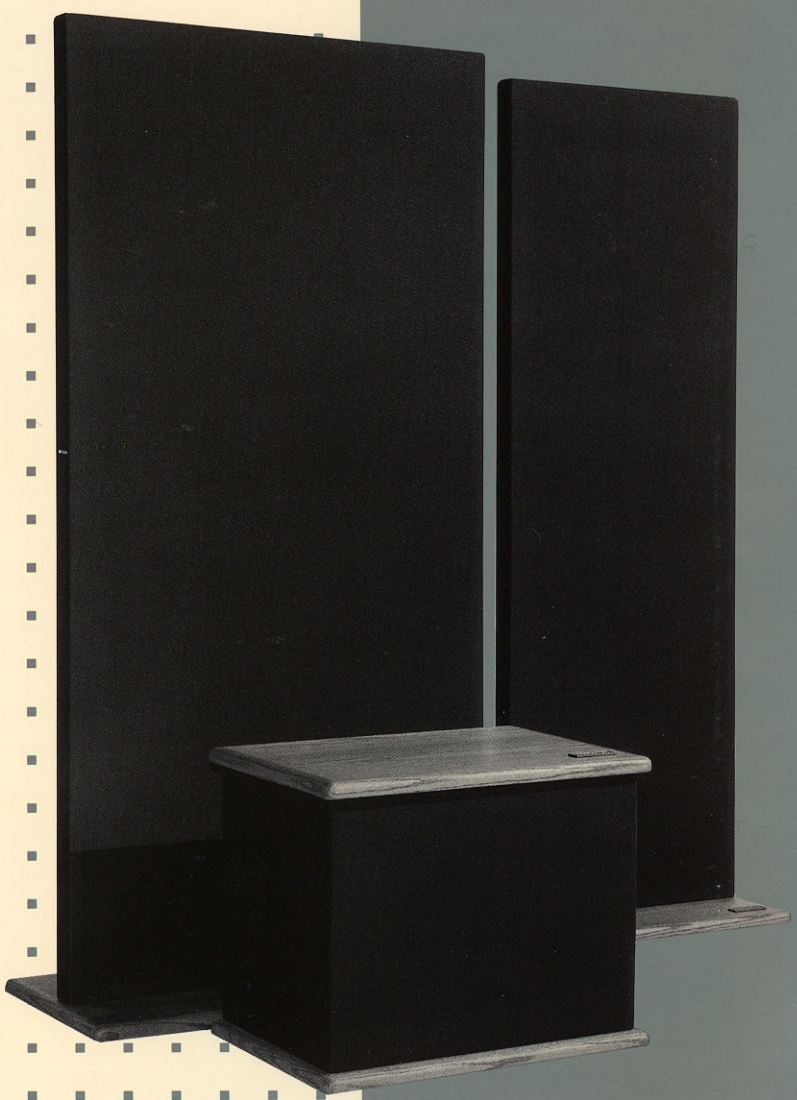
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33

SW

SPECTRA

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SPECTRA

■ Sound waves vary from about 55 feet long at 20 Hz to about ⅔ of an inch long at 20 kHz. It is for this reason that no speaker using constant area (curved, angled, or flat) for all frequencies can be optimum over this 1000:1 variation in wavelength.

■ A breakthrough in understanding the rules of the electrostat's drive transformer (interface), suggested a possible "variable area" solution—while still satisfying Acoustat's demand for efficiency and low end response. The result: the MK 2100 series interface allows us to implement a variable geometry electrostat changing its effective width as a function of frequency. Our success is the Symmetric Pair Electrically Curved Transducer (Spectra).

■ Spectra has wide, pleasant dispersion at all frequencies. Each speaker of the mirror image pair contains a narrow line source sector operating at all frequencies (bass, midrange, high). Adjacent sectors handle midrange and low frequencies. The remaining panel area reproduces bass only. The result is a speaker that uses the full area for maximum bass impact, and progressively narrower areas as frequency increases, for maximum dispersion and natural imaging.

■ Spectra is devoid of the midrange beaming and high frequency smearing of common planar speakers using large, constant area, curved or angled radiators.

DYNAMIC FREEDOM

■ As a full range electrostat, Spectra 33 can be driven 2-3 dB harder at low frequencies than Spectra 22. However, some present day source material will tax

the most capable of speakers, regardless of driving principle. Spectra 22 and particularly the 33 will handle all or most of the source material you care to listen to—*as a full range electrostat.*

■ An electrostat's high intimacy of drive can occasionally lead to ionization of the air between its elements, on heavy, deep bass material, resulting in restricted dynamics. The addition of Spectra Passive Woofer 1 below 100 Hz can extend both panel performance and total system dynamics by 8 dB or more!

■ Spectra 22 and 33 have a switch on the back of each interface, cutting in a 100 Hz crossover function before the electrostat and also activating a (full range) sub-woofer feed.

SPECTRA PASSIVE WOOFER 1 (SPW-1)

■ SPW-1 utilizes four 6.5″ side firing woofers (2 per channel) in a ported enclosure. It contains its own 100 Hz crossover unit, fuses and a switch allowing optional bi-amplification with electronic crossovers. Removable spike feet minimize room interaction.

■ The Spectra family of loudspeakers is available in a variety of matching veneers and grille sock colors.

THE EXPERIENCE

■ The uniqueness of Spectra is its ability to combine high dynamics and needed efficiency, while creating radiation patterns broad in the listening area but minimal at the side walls.

■ Most important of all, listening tells us that our "variable area" solution is absolutely correct. We eagerly await your listening evaluation of this new chapter in loudspeaker history.

SPECTRA 22/33 SPECIFICATIONS

GENERAL
Nominal impedance: 4 ohms
Recommended amplifier power: 100 W/ch or greater
Bias supply power consumption: Less than 5 watts

COMMON DIMENSIONS
Array depth: 2⅛"
Base depth: 17"
Base height: 1"
Overall height: 66"
MK-2123 interface: 5" deep, 6" high, 18" wide

SPECTRA 22 WIDTHS
Array: 21½," base: 23"

SPECTRA 33 WIDTHS
Array: 31¾," base: 33¼"

STANDARD GRILLE CLOTH
Black, gray or beige

STANDARD BASE FINISH
Dark oak

OPTIONAL BASE FINISHES
Natural oak, black oak @ additional cost

ARRAY TILT-BACK ADJUSTMENT
0 to 5 degrees

BUILT-IN CROSSOVER
100 Hz high-pass, switch selectable—switch simultaneously activates full range unfused, sub-woofer feed jacks

WARRANTY
We are proud to offer this unique warranty due to the virtual indestructible nature of Acoustat panels:
Acoustat guarantees our electrostatic panels against defective materials and workmanship for the life of the product. The electronic components contained in the interface are warranted against defective materials and workmanship for a period of ten years from the original date of purchase.
See complete warranty statement for details.

SPECTRA PASSIVE WOOFER 1

GENERAL
Nominal impedance: 12 ohms

RECOMMENDED AMPLIFIER POWER:
100 W/ch or greater

DIMENSIONS:
Width 23"
Depth 17"
Height 18¾"
Height 20" including the provided spike feet

WARRANTY
Acoustat guarantees against defective materials and workmanship for 5 years from the original date of purchase.

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■ Sound waves vary from about 55 feet long at 20 Hz to about ⅔ of an inch long at 20 kHz. It is for this reason that no speaker using constant area (curved, angled, or flat) for all frequencies can be optimum over this 1000:1 variation in wavelength.

■ A breakthrough in understanding the rules of the electrostat's drive transformer (interface), suggested a possible "variable area" solution—while still satisfying Acoustat's demand for efficiency and low end response. The result: the MK 2100 series interface allows us to implement a variable geometry electrostat changing its effective width as a function of frequency. Our success is the Symmetric Pair Electrically Curved Transducer (Spectra).

■ Spectra has wide, pleasant dispersion at all frequencies. Each speaker of the mirror image pair contains a narrow line source sector operating at all frequencies (bass, midrange, high). Adjacent sectors handle midrange and low frequencies. The remaining panel area reproduces bass only. The result is a speaker that uses the full area for maximum bass impact, and progressively narrower areas as frequency increases, for maximum dispersion and natural imaging.

■ Spectra is devoid of the midrange beaming and high frequency smearing of common planar speakers using large, constant area, curved or angled radiators.

DYNAMIC FREEDOM

■ As a full range electrostat, Spectra 33 can be driven 2-3 dB harder at low frequencies than Spectra 22. However, some present day source material will tax

the most capable of speakers, regardless of driving principle. Spectra 22 and particularly the 33 will handle all or most of the source material you care to listen to—*as a full range electrostat.*

■ An electrostat's high intimacy of drive can occasionally lead to ionization of the air between its elements, on heavy, deep bass material, resulting in restricted dynamics. The addition of Spectra Passive Woofer 1 below 100 Hz can extend both panel performance and total system dynamics by 8 dB or more!

■ Spectra 22 and 33 have a switch on the back of each interface, cutting in a 100 Hz crossover function before the electrostat and also activating a (full range) sub-woofer feed.

SPECTRA PASSIVE WOOFER 1 (SPW-1)

■ SPW-1 utilizes four 6.5" side firing woofers (2 per channel) in a ported enclosure. It contains its own 100 Hz crossover unit, fuses and a switch allowing optional bi-amplification with electronic crossovers. Removable spike feet minimize room interaction.

■ The Spectra family of loudspeakers is available in a variety of matching veneers and grille sock colors.

THE EXPERIENCE

■ The uniqueness of Spectra is its ability to combine high dynamics and needed efficiency, while creating radiation patterns broad in the listening area but minimal at the side walls.

■ Most important of all, listening tells us that our "variable area" solution is absolutely correct. We eagerly await your listening evaluation of this new chapter in loudspeaker history.

SPECTRA

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SW

■ The electrostatic method of sound recreation has been the reference standard for accuracy in loudspeakers for over a quarter century. Their advantages over other transducers arise from two basic premises: 1) The radiating surface is extra-ordinarily low in mass. 2) The entire surface is driven by a uniform field. Magnetic methods of drive (planar or cone) do not yield the control, linearity or uniformity-of-force provided naturally by the electrostatic method.

■ Over the last 20 years, Acoustat's chief engineer, James C. Strickland, has perfected this technology and many of his breakthroughs are directly responsible for the current state of the art: 1) Virtually indestructible full range panels. 2) Invention of the Magne-Kinetic (MK) Transformer Interface (US Pat. 4323736) allowing the use of any high-quality amplifier with electrostatic speakers. 3) Development of variable area Spectra series.

■ Acoustat's quest for sonic accuracy represents the spirit of an industry. We invite you to experience Acoustat—then share our excitement.

SPECTRA 22/33 SPECIFICATIONS

GENERAL
Nominal impedance: 4 ohms
Recommended amplifier power: 100 W/ch or greater
Bias supply power consumption: Less than 5 watts

COMMON DIMENSIONS
Array depth: 2⅛"
Base depth: 17"
Base height: 1"
Overall height: 66"
MK-2123 interface: 5" deep, 6" high, 18" wide

SPECTRA 22 WIDTHS
Array: 21½," base: 23"

SPECTRA 33 WIDTHS
Array: 31¾," base: 33¼"

STANDARD GRILLE CLOTH
Black, gray or beige

STANDARD BASE FINISH
Dark oak

OPTIONAL BASE FINISHES
Natural oak, black oak @ additional cost

ARRAY TILT-BACK ADJUSTMENT
0 to 5 degrees

BUILT-IN CROSSOVER
100 Hz high-pass, switch selectable—switch simultaneously activates full range unfused, sub-woofer feed jacks

WARRANTY
We are proud to offer this unique warranty due to the virtual indestructible nature of Acoustat panels:
Acoustat guarantees our electrostatic panels against defective materials and workmanship for the life of the product. The electronic components contained in the interface are warranted against defective materials and workmanship for a period of ten years from the original date of purchase.
See complete warranty statement for details.

SPECTRA PASSIVE WOOFER 1

GENERAL
Nominal impedance: 12 ohms

RECOMMENDED AMPLIFIER POWER:
100 W/ch or greater

DIMENSIONS:
Width 23"
Depth 17"
Height 18¾"
Height 20" including the provided spike feet

WARRANTY
Acoustat guarantees against defective materials and workmanship for 5 years from the original date of purchase.

ACOUSTAT
Rockford Corporation
613 S. Rockford Dr.
Tempe, AZ 85281
602-967-3565

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RETAIL PRICE LIST

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RETAIL

SPECTRA SERIES 22 / 33

SPECTRA 22 - Two panel variable width array	$1,850
SPECTRA 33 - Three panel variable width array	2,250
Standard Finish: dark oak CWD base, beige or black cloth	
Optional Base Finishes: light oak or black oak	$ 75

SPECTRA SERIES 2 / 3

SPECTRA 2 - Two panel variable width array with woofer	$2,795
SPECTRA 3 - Three panel variable width array with woofer	2,995
Standard Finish: teak or black tambour base, beige or black cloth	
Optional Tambour Finishes: consult factory for colors and price.	

MEDALLION SERIES

ONE - Single panel with subwoofer	$1,299
ONE + ONE - Two panel vertical line source	1,750
THREE - Three panel curved array	2,199
TWO + TWO - Four panel vertical array	2,599
SIX*- Six panel vertical array	4,500
EIGHT*- Eight panel vertical array	5,500
Standard Finish: teak base, beige or black cloth	
Optional Base Finishes: walnut, oak, rosewood, gloss black	$ 75

*one stereo amplifier per channel is recommended

All speakers priced per pair.

A Division of

Rockford Corporation

613 S. Rockford Drive

Tempe, AZ, 85281

1-602-967-3565

ACOUSTAT

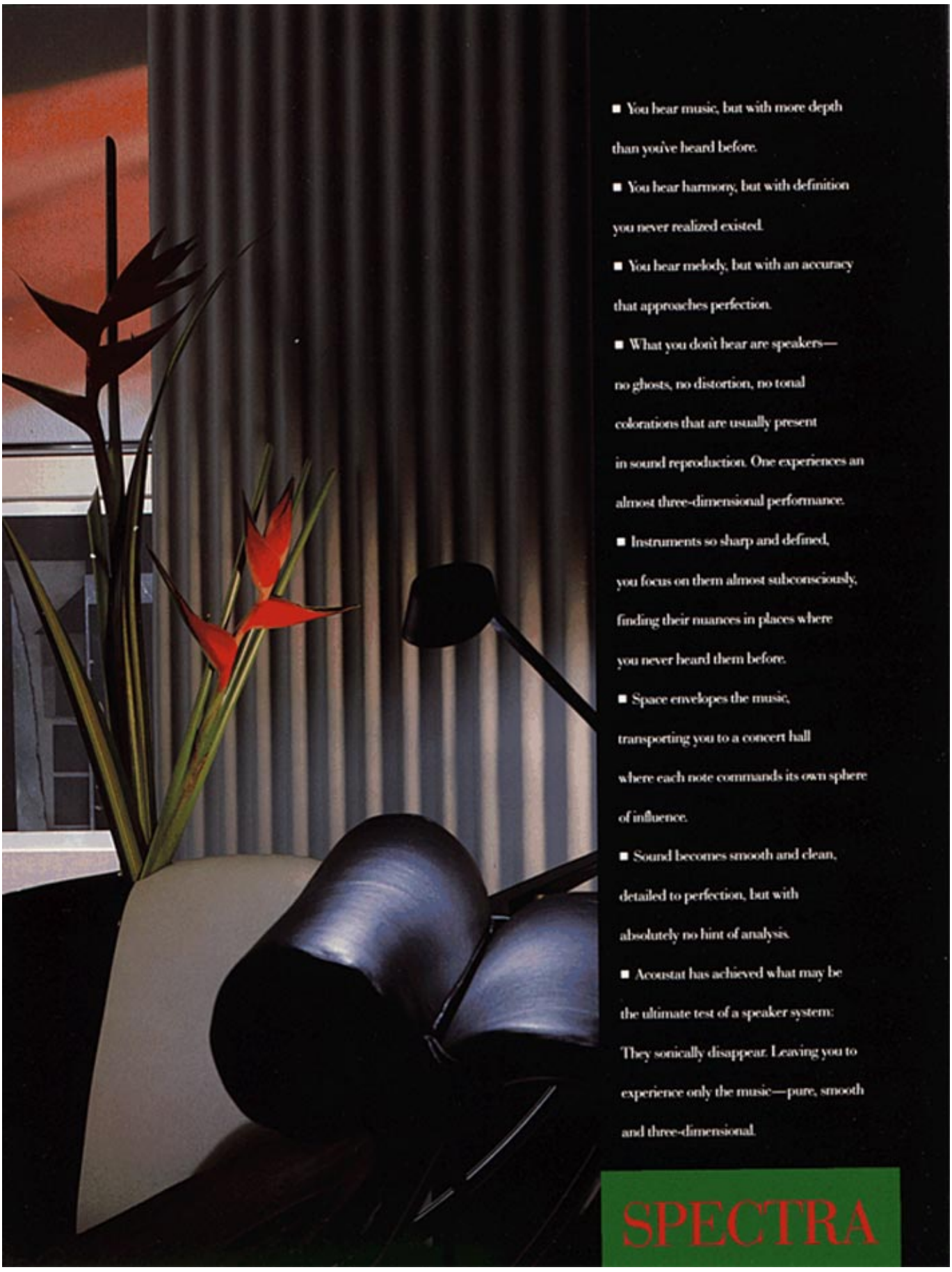
SPECTRA

22

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33


ACOUSTAT



■ You hear music, but with more depth than you've heard before.

■ You hear harmony, but with definition you never realized existed.

■ You hear melody, but with an accuracy that approaches perfection.

■ What you don't hear are speakers—no ghosts, no distortion, no tonal colorations that are usually present in sound reproduction. One experiences an almost three-dimensional performance.

■ Instruments so sharp and defined, you focus on them almost subconsciously, finding their nuances in places where you never heard them before.

■ Space envelopes the music, transporting you to a concert hall where each note commands its own sphere of influence.

■ Sound becomes smooth and clean, detailed to perfection, but with absolutely no hint of analysis.

■ Acoustat has achieved what may be the ultimate test of a speaker system: They sonically disappear. Leaving you to experience only the music—pure, smooth and three-dimensional.

SPECTRA



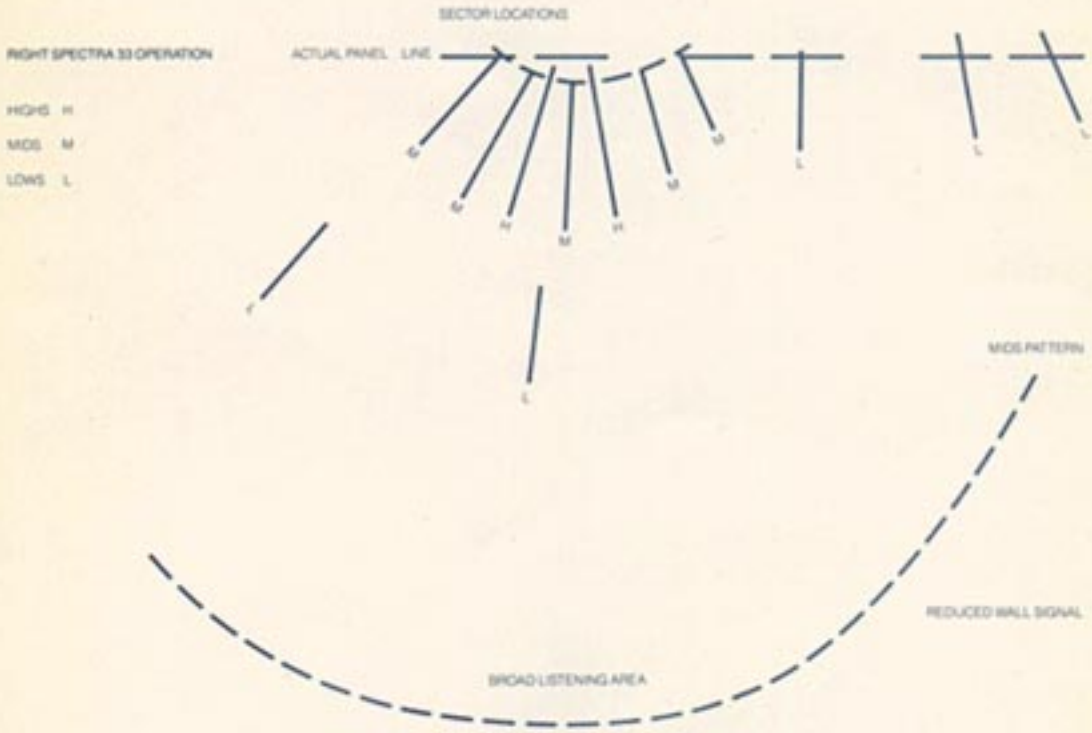
THE SPECTRA 22 AND 33 BY ACOUSTAT.
SCULPTURE "CM10-30" BY JONATHAN BONNER
COURTESY OF THE HAND AND THE SPIRIT GALLERY

• Spectra is a full-range line source only 33 inches wide at all frequencies. It is a larger-area, electrically curved array at dispersion-critical mid-range frequencies. At lowest frequencies, it is the large, lateral, full-surface array required to efficiently couple the longest wavelengths. Only one narrow sector is operated full range—all others use a progressive high-frequency rolloff. Hence the highest frequencies come almost entirely from this full-range sector. The rolloff to the two sectors surrounding the full-range sector is accomplished using two resistors.

• These two resistors also cause the voltage waveforms on these two surrounding sectors to be delayed by periods in the range of 1/10 000 second, depending on the exact frequency in question. In this period sound travels about 1.3". Thus a sector so delayed acts like a sector set back 1.3" further from you.

• When the waves being reproduced this way are *only* in the midrange band and below, having wavelengths of several inches to many feet, the only effect of the fractional-wavelength set-back along the generating surface is to disperse the direction of radiation toward the set-back radiating area.

• By using a mirror-image pair of Spectra 22 or 33 speakers this unique actualization of variable geometry creates radiation patterns broad in the listening area, but minimal at the side walls. It brings the concert hall into your listening room with enough good seats for your family and friends.



22

TECHNOLOGICAL SCULPTURE WHOSE FUNCTION IS MUSIC

33

33

SPECTRA 22/33 SPECIFICATIONS

GENERAL
Nominal impedance: 4 ohms
Recommended amplifier power: 100 W/ch or greater
Bias supply power consumption: Less than 5 watts

COMMON DIMENSIONS
Array depth: 2⅛"
Base depth: 17"
Base height: 1"
Overall height: 66"
MK-2123 interface: 5" deep, 6" high, 15" wide

SPECTRA 22 WIDTHS
Array: 21½", base: 23"

SPECTRA 33 WIDTHS
Array: 31¾", base: 33¼"

STANDARD ARRAY CLOTH
Black or off-white

STANDARD BASE FINISH
Dark oak

OPTIONAL BASE FINISHES
Natural oak, black oak, @ additional cost

ARRAY TILT-BACK ADJUSTMENT
0 to 5 degrees

BUILT-IN CROSSOVER
100 Hz high-pass, switch selectable—switch simultaneously activates full range unfused sub-woofer feed jacks

WARRANTY
Limited lifetime—transferrable.
See warranty statement for details.

ACOUSTAT

A DIVISION OF

ROCKFORD CORPORATION

TEMPE, AZ 85281

22

Design: FORMAZ

OWNER'S MANUAL

SPECTRA 22 AND 33 ELECTROSTATIC LOUDSPEAKER SYSTEM

ACOUSTAT

A Division of Rockford Corporation
612 South Rockford Drive

Spectra 22 and 33 are the easiest speakers to assemble ever manufactured by Acoustat. However, there are a few warnings we will make now which will save you trouble later:

1) Spectra arrays are MIRROR IMAGE, i.e. there are LEFT and RIGHT arrays.

Each is identified by a small hole (3/16" diameter) located in the TOP METAL CAPTURE PLATE. The hole is on the LEFT side of the LEFT array and RIGHT side of the RIGHT array--when viewed from the listening side. The two interfaces and bases are IDENTICAL.

2) The hardwood bases are easily scratched. They require careful handling and following of precautions given later.

3) The light colored cloth arrays are easily soiled, and all colors are very prone to picking up lint from being laid on a carpet. The protective plastic bag should be left on them until the arrays are brought into final installed upright position.

4) Spectra's sectored operation requires a more complex connection-set from interface to array than previous constant-area Acoustats. More care is required when making the connections.

We will repeat these warnings when appropriate.

INTERFACE/BASE ASSEMBLY

1) Remove the interfaces (step-up transformer units) from their shipping cartons. Needed hardware is enclosed in a hardware bag in each interface carton.

2) Remove the hardwood bases from their shipping carton.

3) Referring to FIGURE 1, place one of the interfaces in INVERTED position, on the rug or other protective surface.

4) Select the four 1" screws and the four METAL flat washers from the hardware bag.

5) Carefully place one of the hardwood bases (INVERTED) over the inverted interface so that its mounting holes align with the threaded holes in the bottom of the interface. Avoid excessive sliding of wood on metal.

Be sure the 4-hole pattern on the base is closest to the REAR of the interface.

6) Using the 1" screws and METAL flat-washers, start all four screws through the base and into the threaded holes on the interface.

7) Tighten all 4 screws firmly.

8) Turn the mated base/interface right side up.

The other base is identically assembled.

ARRAY MOUNTING

Referring to FIGURE 2:

1) Place one of the interface-shipping plastic bags over the entire front part of the hardwood base, to prevent marring the wood surface.

2) Lay the selected array face down on the floor with its top on the floor, and its bottom resting up over the protective plastic bag you placed over the base. If you have removed the array protective bag, lay it under the array for protection from the floor.

3) Retrieve the 3 sleeved wire-bundles out of the end of the array-shipping bag.

4) Study the wiring diagram insert in FIGURE 2 carefully. The COLORS YELLOW and BLACK appear on TWO pin-plugs and on TWO pin-jacks. On closer inspection you will see that the proper connections are unambiguous--there are two DIFFERENT GROUPS: A BLUE group and a WHITE group.

jacks. There is only one correct set of these connections, but there are 5039 incorrect ones.

----------WARNING----------

The next steps have a very high chance of scratching the hardwood base. Both the TILT BRACKETS and the STAPLES under the array are quite capable of scratching the wood. It is highly desirable to use TWO PEOPLE if possible for these steps.

BEFORE you stand up the array:

1) RECHECK for the presence of the protective plastic bag covering the front of the wood base.

2) LOCATE the four 1/2" screws and the four black NYLON flat washers.

3) Carefully stand up the array. Now bring the array back to mate with the interface. You will have to guide the wire bundles into a "U-TURN" loop fitting into the empty space at the right end of the interface and also get the TILT BRACKETS to enter INSIDE the edges of the interface.

4) Make sure than none of the individual wires get pinched between the TILT BRACKET and the interface side.

5) Now install two of the 1/2" screws through each side of the interface, into the threaded inserts in the TILT BRACKETS. Be sure to include the black NYLON washers under each screw head.

6) At this time you can remove the protective sheet covering the wood base and the protective bag over the array.

Remember, the light cloth is easily soiled and your hands are likely now oily from handling the hardware.

The TOP screws serve as pivot points and the bottom screws, when loosened, allow up to 5 degrees of back tilt for the array. The effects of array tilt are discussed later.

The other speaker is assembled identically. Remember to check again the LEFT and RIGHT identifiers before you make final placement.

We recommend that you keep all the boxes if possible. If storage space is limited, keep all of them for a while until you are satisfied that both speakers are performing properly.

In any event you should keep PERMANENTLY the two INTERFACE boxes, and all the plastic parts from all the cartons, as these take little space and will save you money if you ever need new boxes in the future.

Experience has shown that if service or a factory modification is ever needed, it is most likely to involve sending ONLY the interfaces to Acoustat. Our packaging materials are top-of-the-line and much more protective than most homemade arrangements. (See In Case of Difficulty.)

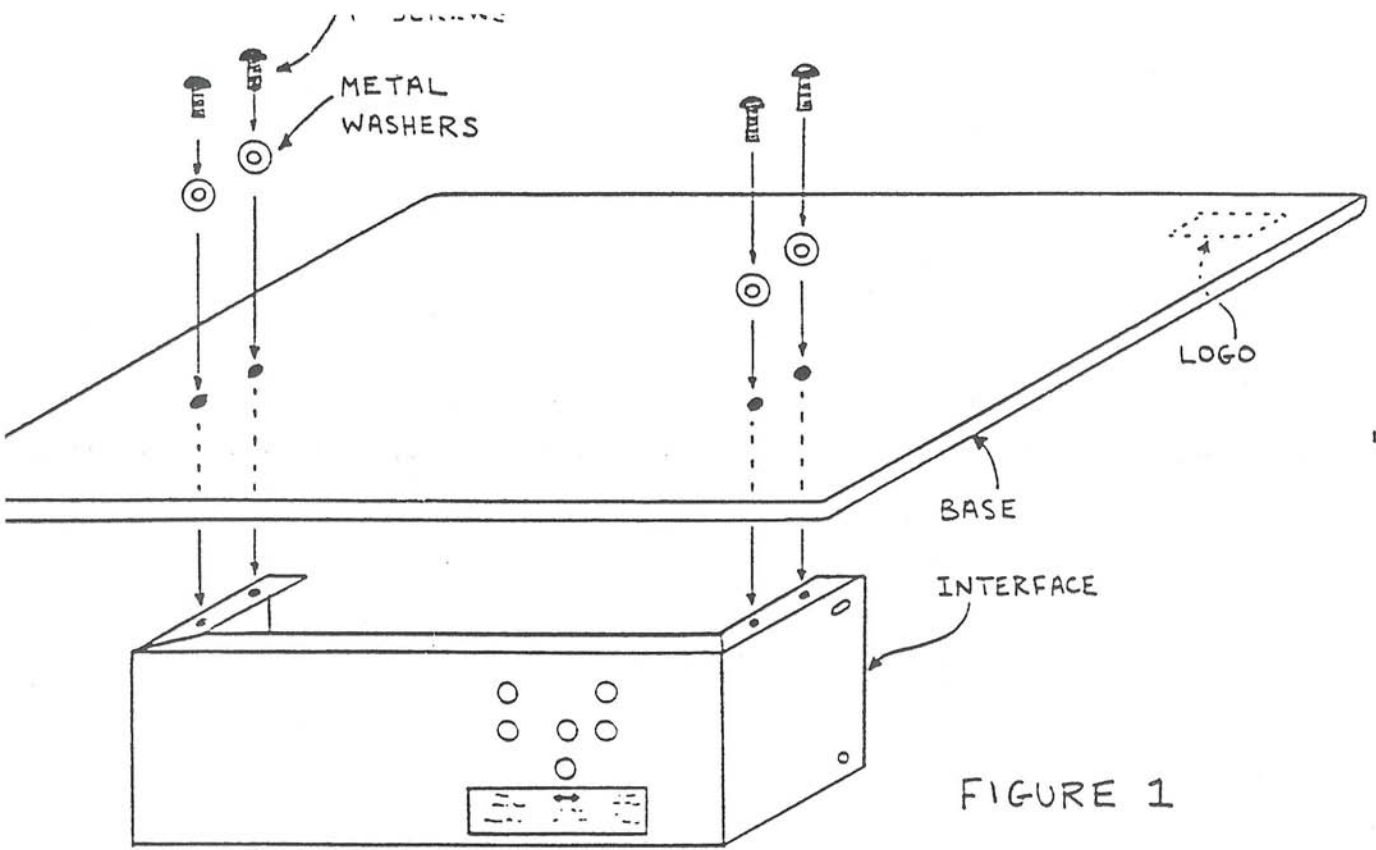


FIGURE 1

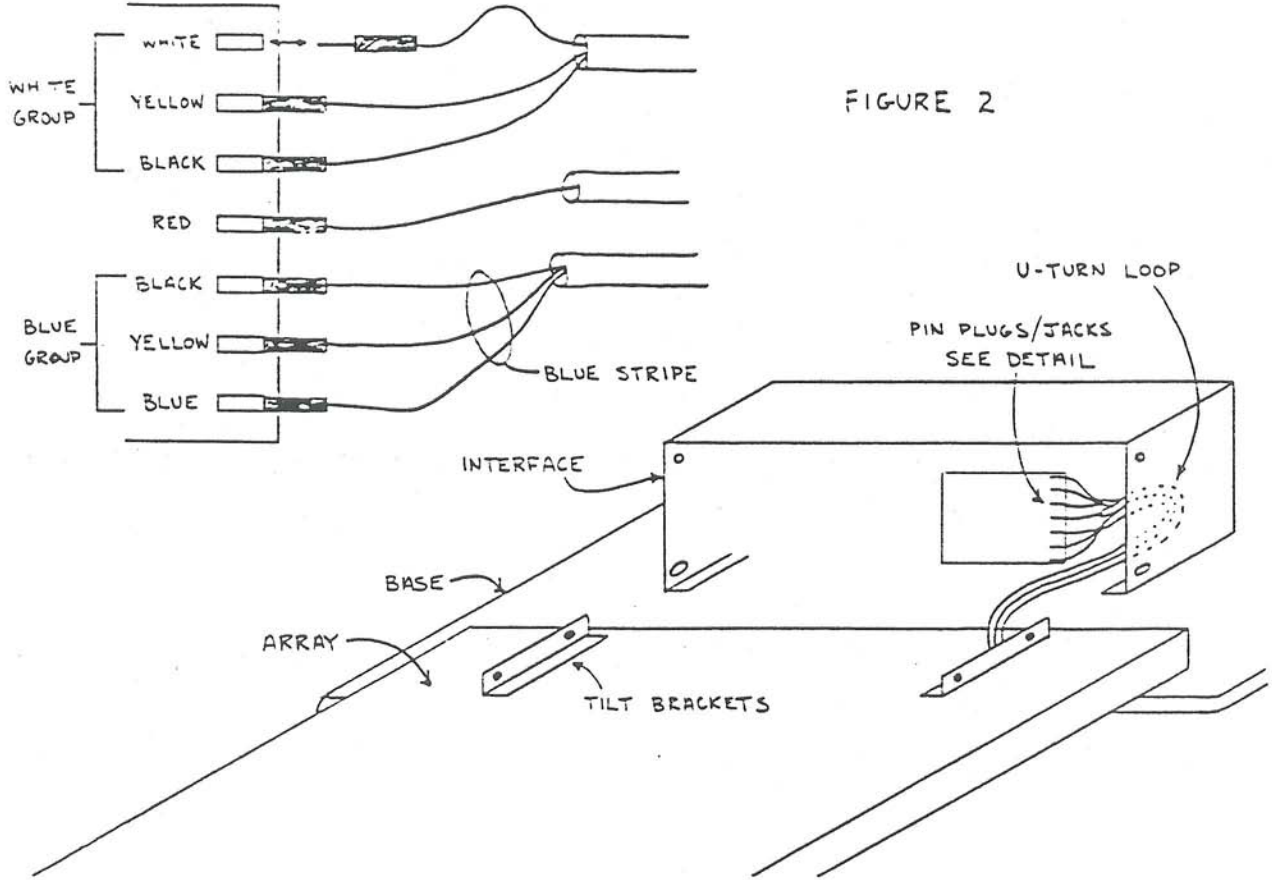

WHITE
YELLOW
BLACK
WHITE GROUP
RED
BLACK
YELLOW
BLUE
BLUE GROUP
BLUE STRIPE
U-TURN LOOP
PIN PLUGS/JACKS
SEE DETAIL
INTERFACE
BASE
ARRAY
TILT BRACKETS

FIGURE 2

THEORY AND PRACTICE OF SPECTRA OPERATION

Spectra 22 and 33 represent a very high state of perfection of full range electrostatic loudspeakers. They also represent exceptional value in terms of performance-to-cost ratio.

The interface techniques allowing the Symmetric Pair Electrically Curved TRAnsducer (SPECTRA) mode of operation were only perfected in late 1986.

At that time we made a quantum leap in the product of STEP-UP EFFICIENCY and BANDWIDTH which allowed us for the first time ever to combine traditional Acoustat high performance with the half-century old ideal of VARIABLE GEOMETRY operation.

This breakthrough solved the long standing impasse which had not allowed high SPL full range electrostatics to have optimum behavior at all audio frequencies.

You will find Spectra has wide, pleasant dispersion at all frequencies, razor-sharp high-frequency time-alignment, and clean low bass.

Spectra achieves this by effectively changing size and shape at different frequencies. Spectra is about 3" wide at highest frequencies, about 13" wide at middle frequencies, and full array-width at lowest frequencies.

Spectra's excellent midrange results from the magic of wave physics which causes the 13" of array operational at these frequencies to act dispersively for waves leaving both the front and the rear of the array. Spectra is devoid of the midrange beaming common in planar speakers using large flat midrange radiators.

ROOM PLACEMENT

Spectra, like all full range electrostatics, needs some "breathing space" behind the array for best low frequency

The walls near the speakers should usually be neither excessively absorptive nor reflective.

Some space is desirable from the side walls, but the asymmetric nature of Spectra higher frequency radiation makes side wall reflections less a problem than with most other speakers.

The full range radiation of a Spectra emerges from a vertical sector centered approximately 7" into the array from the INBOARD edge. You will probably want to cant the speakers in so that this line directly faces your center listening spot. However Spectra's quality listening window is unusually wide for an electrostatic.

ARRAY TILT

Spectra, like all line source type radiators is much more directional vertically than horizontally. The array-tilt is provided so that the high frequency response can be optimized for different listening heights while keeping reasonable speaker height. No tilt may be preferred for always seated conditions, but if conditions require considerable stand-up listening a few degrees of tilt will be preferable.

INTERFACE REAR PANEL

There are TWO pairs of binding posts on the interface. One pair is the INPUT to the Spectra system from the power AMPLIFIER. The other pair is an OUTPUT to feed a SUB-WOOFER which has its own crossover network at 100 Hz. Normal FULL-RANGE electrostatic operation is achieved in the ARRAY FULL RANGE/WOOFER OFF position of the toggle switch.

When the switch is thrown to the ARRAY ABOVE 100 Hz/WOOFER ON position, LOW frequencies are removed from the electrostatic array and ALL frequencies coming in

the INPUT posts are sent out the OUTPUT posts--for a subwoofer.

Unexpected loss of bass can often be traced to sinister forces activating this switch since your last listening. It is embarassing to have this problem discovered by an audiophile friend, if you fail to notice it.

The 5 AMP SLO-BLO FUSE is ONLY in the electrostatic path, and does not protect the woofer out-feed jacks. This is done to enhance system flexibility. Take care to avoid accidental shorts on wires connected to the OUTPUT jacks, particularly if exceptionally high current amplifiers are in service.

If so equipped, the LINE cord is to be plugged in to 120 volt 50/60 Hz, unless the Interface is otherwise labelled. The cord should be connected to an ALWAYS ON outlet which has no SWITCHES or LIGHT DIMMERS in series with the outlet. Line-power consumption is less than 5 watts.

For interfaces manufactured after approximately December 1, 1988, the line powered bias supply has been upgraded to a low voltage input, ultrasonic bias power supply. This improved circuit offers tight regulation of the bias voltage (meaning that variations in line voltage do not affect speaker operation) and far greater unit-to-unit consistency.

The supplied wall transformer is to be connected to the labelled inupt jack on the rear of the interface, and plugged into an ALWAYS ON line outlet. The pilot lamp on the interface will glow whenever the low voltage supply is connected.

CARE AND FEEDING OF THE HARDWOOD BASES

The hardwood bases are hand finished with Watco Danish Oil. This top quality finish penetrates the wood providing deep protection while enhancing its natural beauty. Watco Satin Wax is then hand rubbed and buffed into the wood, bringing the finish to a high lustre.

This high quality oil finish is easily maintained. We recommend these steps for optimum preservation, preferably once a month.

1) Apply a coat of Satin Oil to clean and polish.

2) Wipe dry with a clean soft cloth.

NATURAL OAK bases should be oiled with Satin Oil and waxed with Natural Satin Wax.

DARK OAK bases should be oiled with Satin Oil and waxed with Dark Satin Wax.

For repairing minor scratches use Watco Danish Oil Finish:

Dark Oak bases should be repaired using Black Walnut Oil.

Natural Oak bases should be repaired using Natural Oil.

Care must be used on speakers with light fabric to shield the cloth from being stained near the base. You can use a piece of cardboard as a protective "fence" as you apply the processes discussed above.

GOOD LUCK AND GOOD LISTENING!

ANTY STATEMENT

The electrostatic elements of the Spectra 22 and 33 are warranted against defective materials and workmanship for the life of the product. The electronic components contained in the interface are warranted against defective materials and workmanship for a period of ten years from the original date of purchase. This warranty extends to the original owner, purchased from an authorized Acoustat dealer only. A dated proof of purchase must accompany all warranty claims.

For subsequent owners, both the electrostatic elements and electronic components are warranted against defective materials and workmanship for a period of ten years from the date of manufacture. Manufacturing date shall be determined from a code contained in the serial number.

During the warranty period, defective parts will be repaired or replaced, at Acoustat's option, without charge for labor or materials. The warranty does not cover transportation costs to the repair site. Acoustat will return warranty repairs to the owner freight pre-paid. This warranty does not cover damage due to negligence, misuse, modification, shipping damage or accident.

Except as provided herein, Acoustat makes no warranties, expressed or implied, including warranties of merchantability and fitness for a particular purpose. Some states do not permit limitation or exclusion of implied warranties; therefore the aforesaid limitations or exclusions may not apply to the purchaser.

IN CASE OF DIFFICULTY

The Spectra loudspeaker has been designed for a lifetime of trouble-free music enjoyment. On the rare occasions that an apparent malfunction should occur, be sure to check all system signal sources, fuses, and connecting cables. If investigation pinpoints the Spectra as the source of difficulty, please contact (by telephone, preferably) our Customer Service Department before sending any equipment for service. Very often, we can offer further troubleshooting hints that simplify or even eliminate the need for factory service. Should your Spectra loudspeaker require factory service, please use original factory packaging for shipment, and include a copy of a dated Bill of Sale and a brief note describing the difficulty. Every effort will be made to perform service in a timely manner, with typical turnaround times of less than one week, exclusive of transit time.

Acoustat
Division of Rockford Corporation
613 South Rockford Drive
Tempe, Arizona 85281
602-967-3565

22

SPECTRA

33

ACOUSTAT


ACOUSTAT



■ You hear music, but with more depth than you've heard before.

■ You hear harmony, but with definition you never realized existed.

■ You hear melody, but with an accuracy that approaches perfection.

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SPECTRA



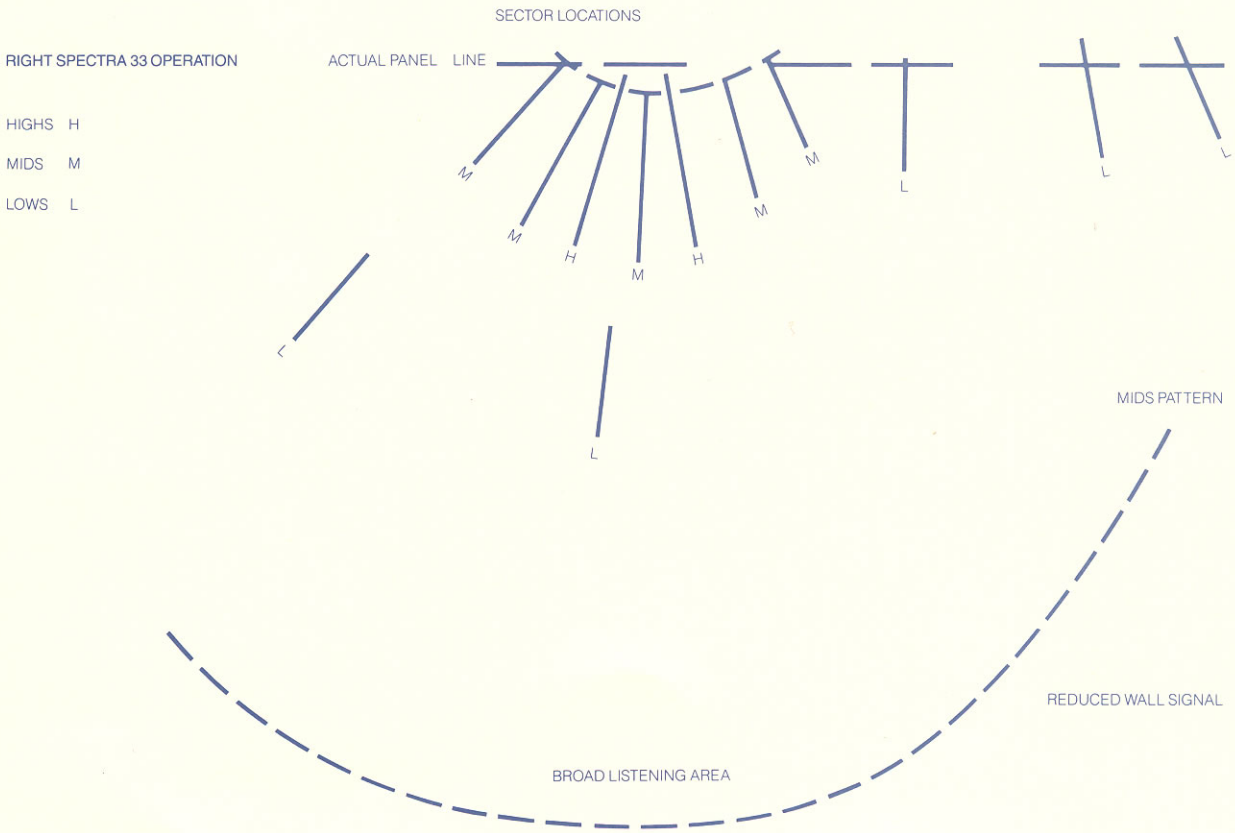
THE SPECTRA 22 AND 33 BY ACOUSTAT.
SCULPTURE "CM10-30" BY JONATHAN BONNER
COURTESY OF THE HAND AND THE SPIRIT GALLERY

■ Spectra is a full-range line source only 3.3 inches wide at all frequencies. It is a larger-area, electrically curved array at dispersion-critical mid-range frequencies. At lowest frequencies, it is the large, lateral, full-surface array required to efficiently couple the longest wavelengths. Only one narrow sector is operated full range—all others use a progressive high-frequency rolloff. Hence the highest frequencies come almost entirely from this full-range sector. The rolloff to the two sectors surrounding the full-range sector is accomplished using two resistors.

■ These two resistors also cause the voltage waveforms on these two surrounding sectors to be delayed by periods in the range of 1/10 000 second, depending on the exact frequency in question. In this period sound travels about 1.3″ Thus a sector so delayed acts like a sector set back 1.3″ further from you.

■ When the waves being reproduced this way are *only* in the midrange band and below, having wavelengths of several inches to many feet, the only effect of the fractional-wavelength set-back along the generating surface is to disperse the direction of radiation toward the set-back radiating area.

■ By using a mirror-image pair of Spectra 22 or 33 speakers this unique actualization of variable geometry creates radiation patterns broad in the listening area, but minimal at the side walls. It brings the concert hall into your listening room with enough good seats for your family and friends.



Design: FORMAZ

33

SPECTRA 22/33 SPECIFICATIONS

GENERAL
Nominal impedance: 4 ohms
Recommended amplifier power: 100 W/ch or greater
Bias supply power consumption: Less than 5 watts

COMMON DIMENSIONS
Array depth: 2⅛"
Base depth: 17"
Base height: 1"
Overall height: 66"
MK-2123 interface: 5" deep, 6" high, 18" wide

SPECTRA 22 WIDTHS
Array: 21½," base: 23"

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Array: 31¾," base: 33¼"

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Black or off-white

STANDARD BASE FINISH
Dark oak

OPTIONAL BASE FINISHES
Natural oak, black oak, @ additional cost

ARRAY TILT-BACK ADJUSTMENT
0 to 5 degrees

BUILT-IN CROSSOVER
100 Hz high-pass, switch selectable—switch simultaneously activates full range unfused sub-woofer feed jacks

WARRANTY
Limited lifetime—transferrable.
See warranty statement for details.

ACOUSTAT

A DIVISION OF

ROCKFORD CORPORATION

TEMPE, AZ 85281

22

Design: FORMAZ

AU BANC D'ESSAIS ENCEINTE ACOUSTIQUE

ACOUSTAT SPECTRA 22

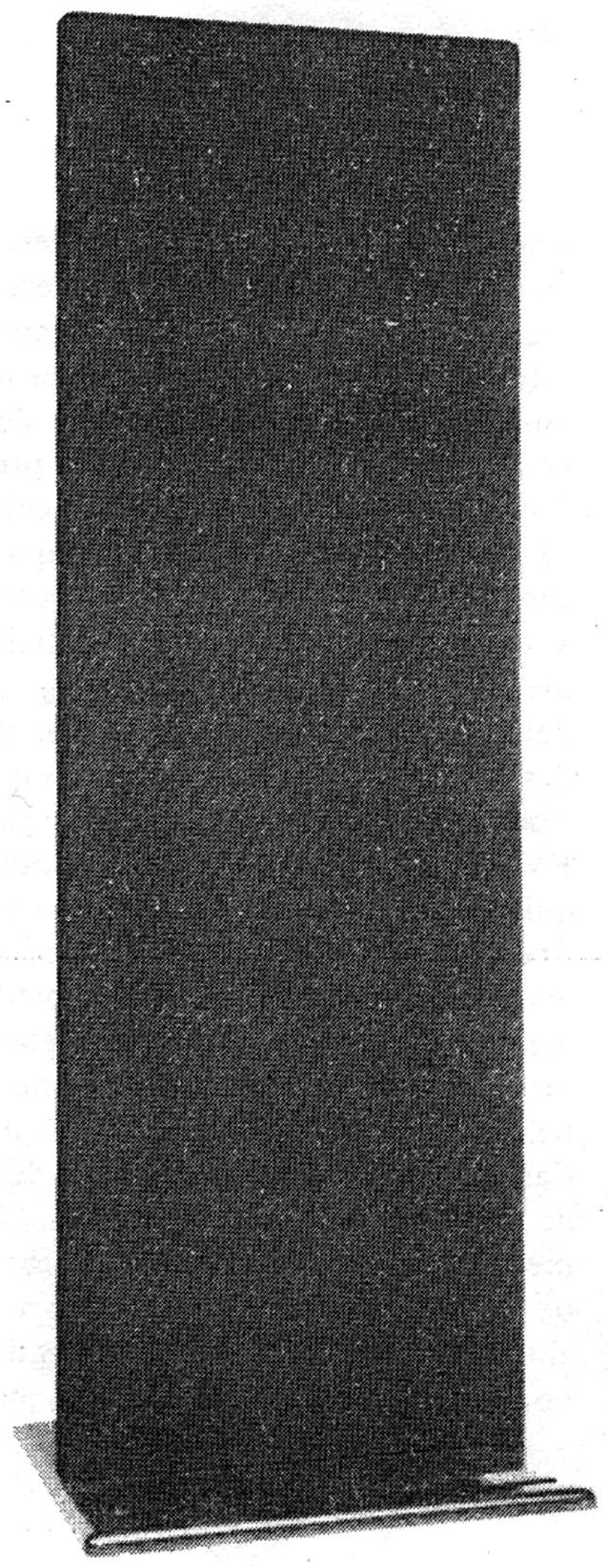
La société américaine Acoustat est spécialisée, depuis 1974, dans la réalisation de haut-parleurs électrostatiques de superbe facture, utilisant de nombreuses techniques particulières en matière de couplage, pour obtenir une bonne interface avec les amplis et un bon contrôle de directivité.

Il est curieux de constater qu'elle débuta en 1972 par la réalisation de l'un des tous premiers amplificateurs hybrides transistors/tubes spécialement étudié pour attaquer directement des cellules électrostatiques. Puis vint la mise au point par James Strickland d'une cellule électrostatique large bande reprenant une configuration assez similaire à celle des cellules Janszen en particulier pour le support alvéolaire et le réseau fin des conducteurs isolés servant d'électrodes entre lesquelles joue la fine feuille de mylard. Cette cellule fut associée à un amplificateur de tension (sans transformateur adaptateur) dans l'enceinte 10i en 1976 qui fut l'une des révélations de l'époque.

Au début des années 80 toute une nouvelle gamme d'électrostatiques Acoustat pouvait fonctionner avec n'importe quel type d'amplificateur grâce à l'incorporation dans leur base d'un transformateur à deux voies dit « Magne-Kinetic ».

La gamme actuelle se compose en particulier des nouveaux modèles Spectra 22 et 33, panneaux au rayonnement contrôlé afin d'assurer une diffusion sans perte de niveau de l'extrême grave à l'aigu sur une large surface d'écoute.

En effet, l'un des problèmes liés au grand panneau électrostatique isodynamique réside dans des lobes de directivité dits en « paquerettes » qui, comme les pétales de la fleur du même nom, ont des bords très irréguliers et de ce fait réduisent souvent à une position bien déterminée le point d'écoute si on ne veut pas au moindre mouvement de tête voir les solistes sauter d'un panneau à l'autre suivant la hauteuur de la note jouée. Le fonctionnement en doublet arrange certes les choses (en particulier dans le bas médium) mais cela ne va pas sans mal si on tient compte des réflexions parasites en fonction de la distance par rapport aux murs latéraux et arrière.



Aussi, les ingénieurs d'Acoustat ont voulu combattre ce phénomène en réalisant une source d'émission large bande très étroite 8,2 cm accompagnée dans le grave par des surfaces latérales (de part et d'autre) de grande surface. De ce fait, on peut considérer la cellule centrale très étroite fonctionnant en large bande comme une source de dispersion curviligne jusque dans l'extrême aigu. Les deux panneaux latéraux sont coupés progressivement dans le médium aigu par deux résistances. Celles-ci produisent aussi un léger retard en fonction des fréquences de 1/10000 ème de seconde. Pendant cette période de temps le son a parcouru une longueur d'environ 3 cm. Cette variation légère dans le temps d'émission des panneaux latéraux et du centre détermine une image globale virtuelle symétrique en arrière du panneau. L'idée n'est pas nouvelle, il suffit de se reporter au fonctionnement du Quad ESL 63 qui dispose d'une sorte de ligne de retard entre les électrodes centrales et extérieures (B.E N° 92). Les ingénieurs d'Acoustat ont appliqué ce principe à des cellules électrostatiques de grande hauteur.

En effet, la Spectra 22 mesure 55 cm de large pour 1,65 m de haut et 5,5 d'épaisseur (pied support de 42 cm de profondeur). Le panneau proprement dit peut s'incliner en arrière de quelques degrés, prenant appui sur le gros bloc des transformateurs dissimulé par un cache très rigide. Sur celui-ci on trouve aussi le départ du cordon d'alimentation secteur ainsi que les deux prises fiches bananes avec un inverseur pour un fonctionnement soit en large bande soit seulement, au-dessus de 100 Hz, pour une utilisation en biamplification avec un subwoofer dans l'extrême grave (celà ne nous semble pas nécessaire en usage domestique normal). Un fusible de protection est placé sur l'alimentation. Les cellules sont montées sur un cadre rigide en bois recouvert par une housse en jersey agraffée au sommet et à la base. La cellule au centre très étroite, de 8,2 cm de large, a une hauteur, d'après nos investigations, de 1,19 m de haut. Les deux autres cellules de part et d'autre font 19 cm de large sur la même hauteur. Ces deux cellules ont leur bande passante coupée progressivement dans le

collé point par point (pas de vibration parasite).

Entre ces deux grilles la membrane en mylard est tendue recouverte d'un enduit légèrement conducteur. La tension de polarisation du diaphragme doit être de l'ordre de 5 000 V et la résistance interne de 500 Mohms. L'arrière des cellules est amorti par du feutre. La construction très robuste, confirmant notre expérience avec certains modèles de la première série Acoustat, laisse augurer d'une grande robustesse.

Auditeur B

Les enceintes électrosatiques Acoustat Spectra 22 nécessitaient quelques préliminaires d'installation et d'adaptation avec les autres maillons avant de tirer de quelconques conclusions sur les transcriptions sonores.

Tout d'abord, il faut tenir compte, même si l'onde arrière est amortie, du rayonnement en doublet du panneau, donc de la distance par rapport au mur arrière et de son caractère réfléchissant ou .
Au minimum 1 m paraît nécessaire. De plus après plusieurs expériences il vaut mieux les placer parallèle à la zone d'écoute et légèrement inclinées vers l'arrière 2 à 5° et se placer à au moins 3 m. En électronique il ne faudra pas compter sur moins de 100 W sur 4 ohms si on ne veut pas écrêter à la moindre pointe de dynamique. Toujours d'après notre expérience les Acoustat fonctionnent bien avec des amplis mosfet ou des tubes capables de fournir beaucoup de courant et indifférent à une courbe d'impédance qui varie pas mal en fonction de la fréquence. Enfin, véritable miroir des sources, il faut faire très attention à la qualité des lecteurs CD et autre table de lecture car elles ne font pas de cadeau. Il ne s'agit pas de limitation d'utilisation mais simplement d'adaptation optimale en fonction d'un caractère affiné de haute définition. On ne fait pas ses achats avec une formule 1, de même avec une paire d'Acoustat il faut que tout l'environnement soit à la hauteur.

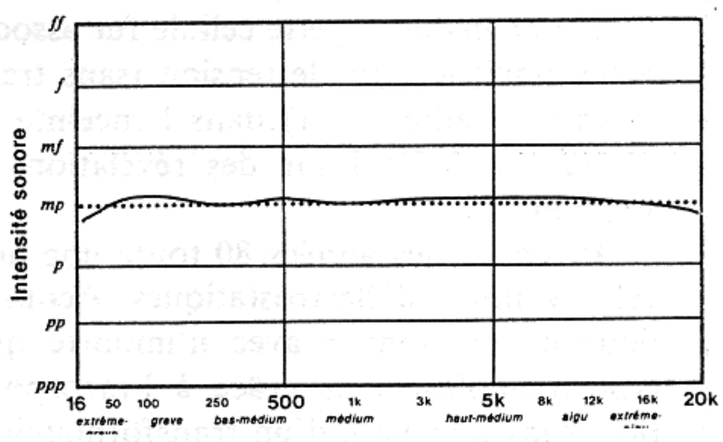
Dés les premières minutes les Spectra se caractérisent par une très large dispersion

médium aigu par deux résistances. Cependant, toujours d'après nos recherches, ces deux cellules sont reliées aux transformateurs indépendants à point milieu pour un couplage correct. La transition s'effectue graduellement et évite ainsi les problèmes d'intermodulation des fréquences graves sur les fréquences aigues. Chaque cellule fonctionne suivant le principe push-pull et à charge constante. Elle bénéficie d'une structure très robuste bâtie autour de deux grilles en matériau synthétique avec des alvéoles carrées. Sur chacune d'elles un réseau de câbles isolé par des gaines en PVC (pour éviter les effets de flashage) est qui ne contraint pas l'auditeur à un point fixe dans la zone d'écoute. Cela est particulièrement agréable et évite d'avoir le sentiment de la tête bloquée dans un étau, sinon on court après le soliste. Deuxième point la belle transcription du grave qui (avec l'ampli idoine) possède rapidité, délicatesse de timbre et beaucoup de matière. Enfin le médium très ouvert apporte énormément de définition et de beauté. Ainsi sur des choeurs très complexes on n'entend pas une bouillie plus ou moins confuse mais bien

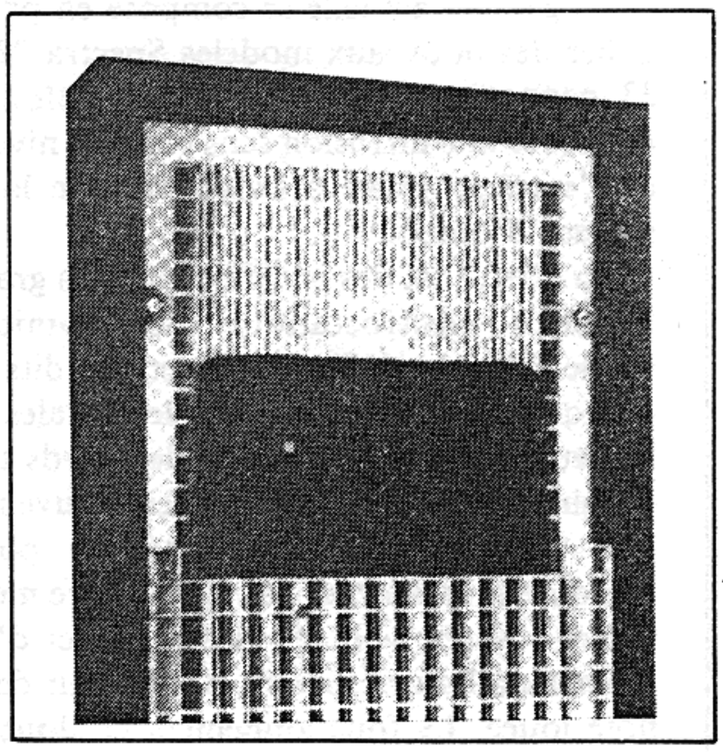
distinctement chacune des voix avec leur complexe structure harmonique. De même sur les petites formations à cordes les instruments conservent leur véritable couleur même quand ils jouent à l'unisson et cela est très rare. La distinction est permanente avec un sens du raffinement dans l'aigu extraordinaire grâce à une diversité des timbres qui procure un nouvel éclairage aux reflets délicats sans manièrisme. Mélange de chaleur, de fermeté et d'une certaine transparence les Acoustat servent aussi en arrière de leur propre plan une image dont les sources savent rester ponctuelles et où les instruments ont enfin une taille réelle.

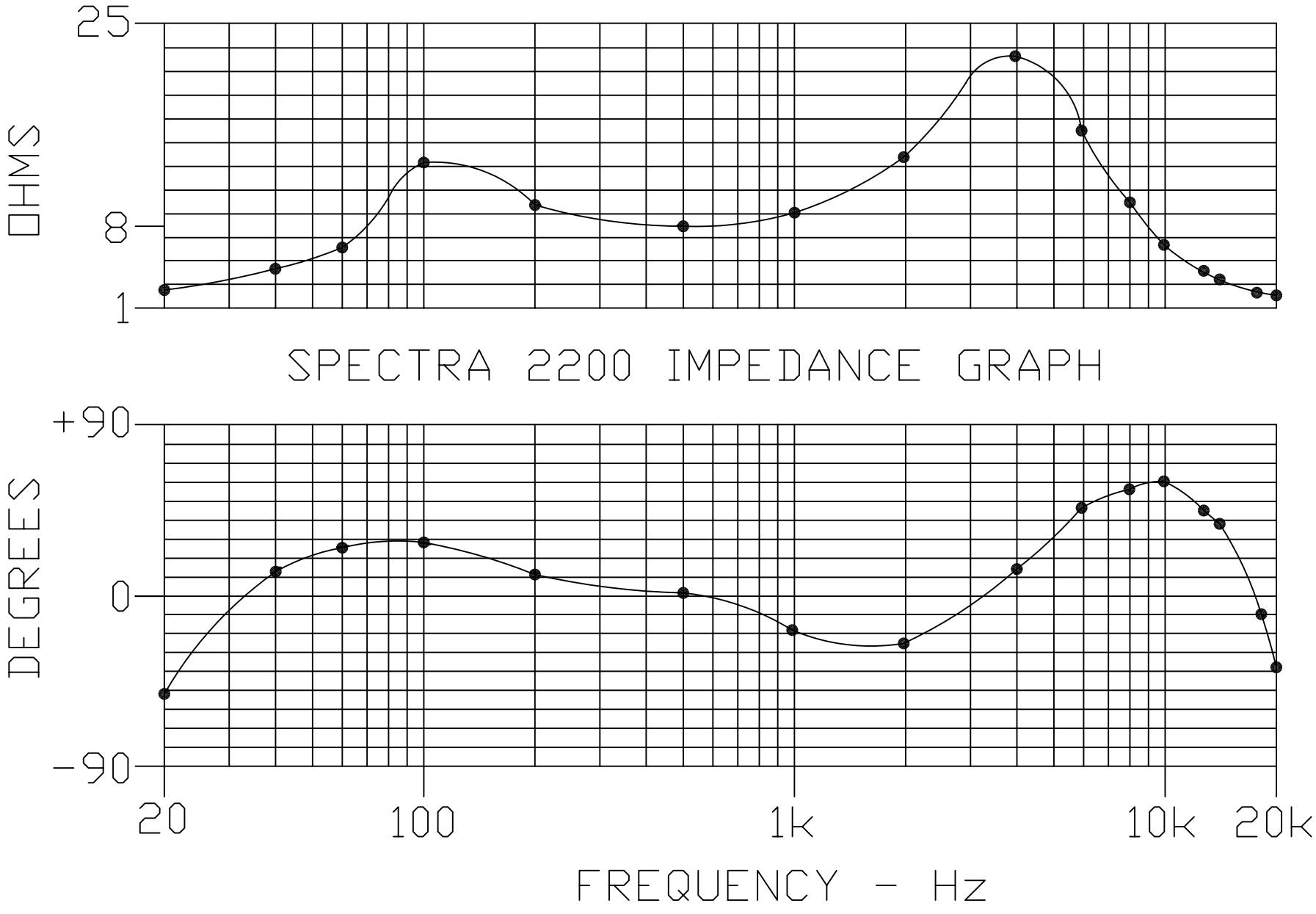
L'expression musicale atteint une rare

« intelligence » communicative sans être frustante mais sans tomber non plus dans certains excès d'éblouissement passager. Les Acoustat Spectra 22 sont des systèmes électrostatiques pour esthète sonore de la musique. Rien de tapageur, toute vulgarité de timbre ou d'excentricité dynamique sont exclues. Leur charme ne se découvre pas à la sauvette, sachez les apprécier à leur juste valeur, elles méritent une attention toute particulière pour leur mise en œuvre correcte, le raffinement des vraies sonorités est à ce prix.



Equilibre subjectif pour l'Auditeur B


Vue de l'une des cellules électrostatiques de l'Acoustat.


25
OHMS
8
1
SPECTRA 2200 IMPEDANCE GRAPH
+90
DEGREES
0
-90
20
100
1k
10k
20k
FREQUENCY - Hz

NOTES: UNLESS OTHERWISE SPECIFIED

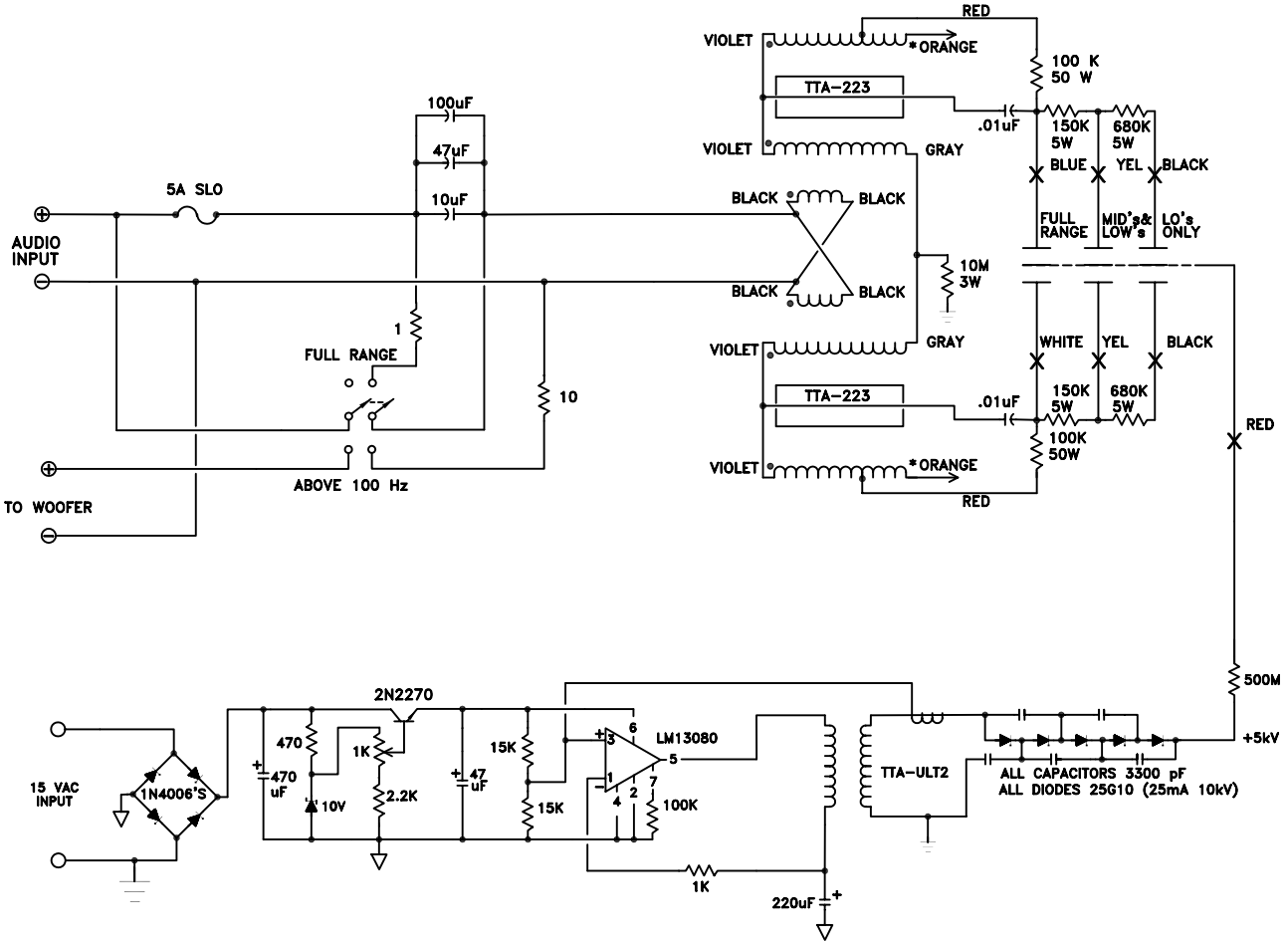
1: ALL RESISTORS ARE OHMS

2: = LOW VOLTAGE GROUND

3: = HIGH VOLTAGE GROUND

4: * = TRANSFORMER TAP
RED FOR SPECTRA 2200
ORANGE FOR SPECTRA 3300

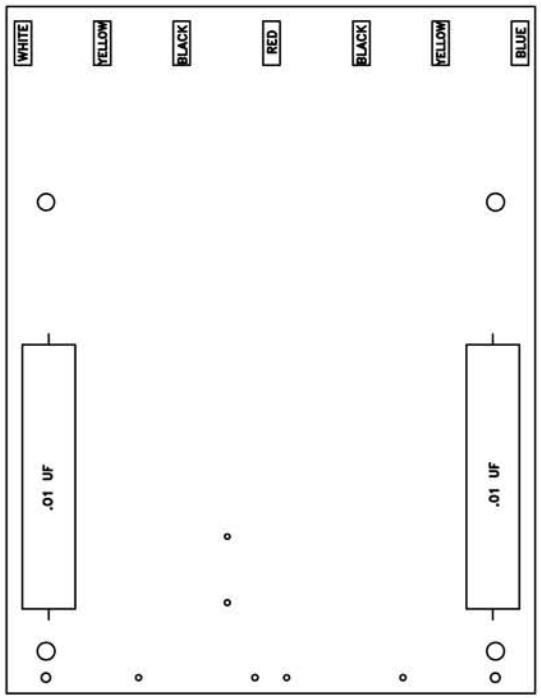
MK-2123
MAGNE-KINETIC INTERFACE FOR SPECTRA 2200/3300



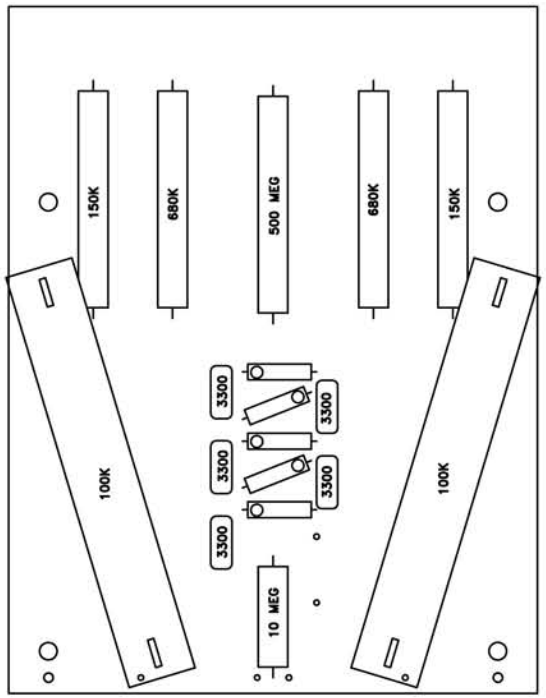
REVISIONS:

1. 5/29/91: UPDATED BIAS SUPPLY

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SOLDER SIDE

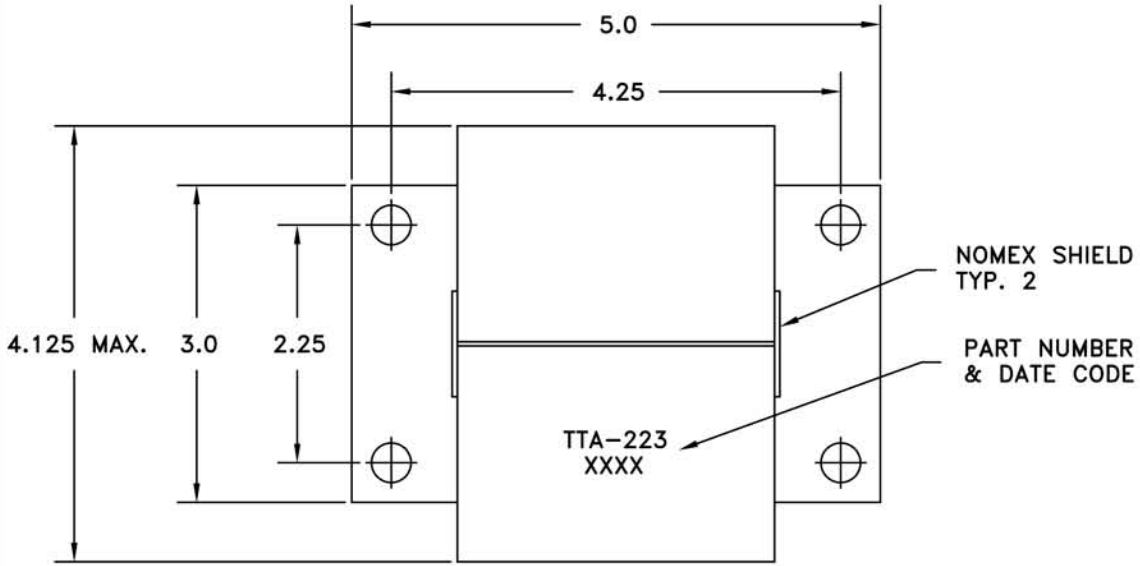


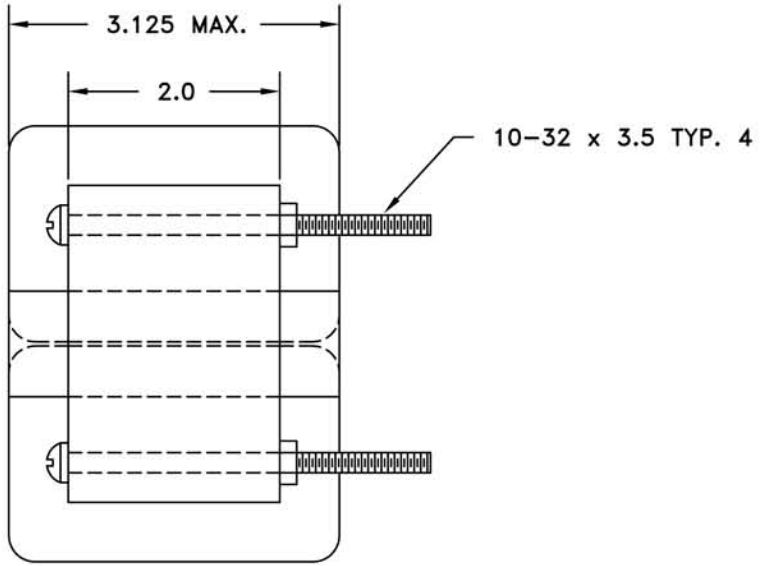
COMPONENT SIDE

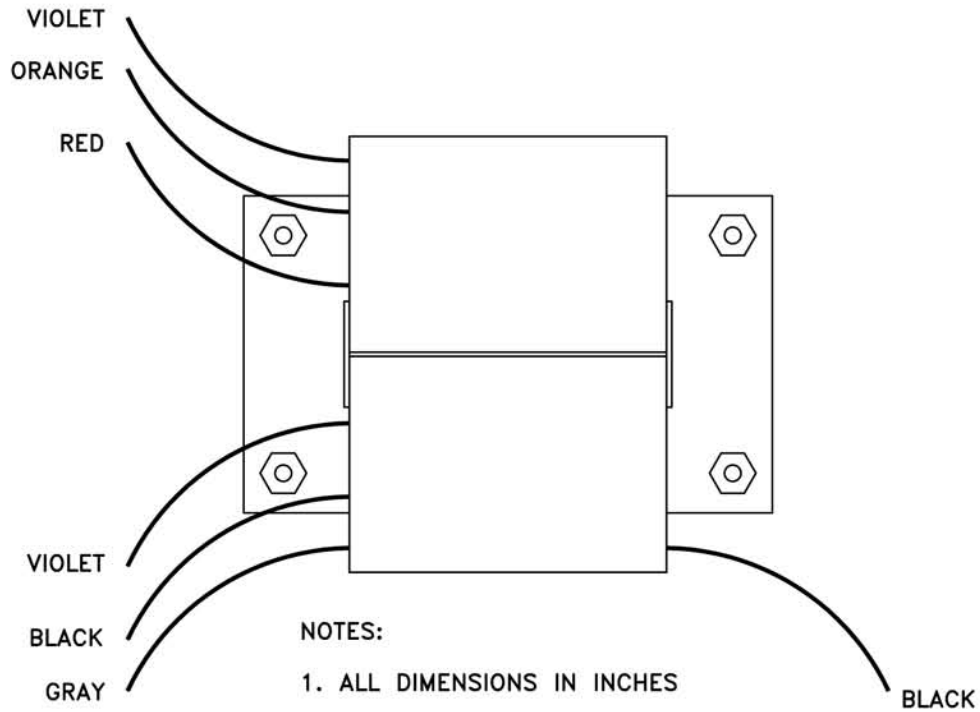
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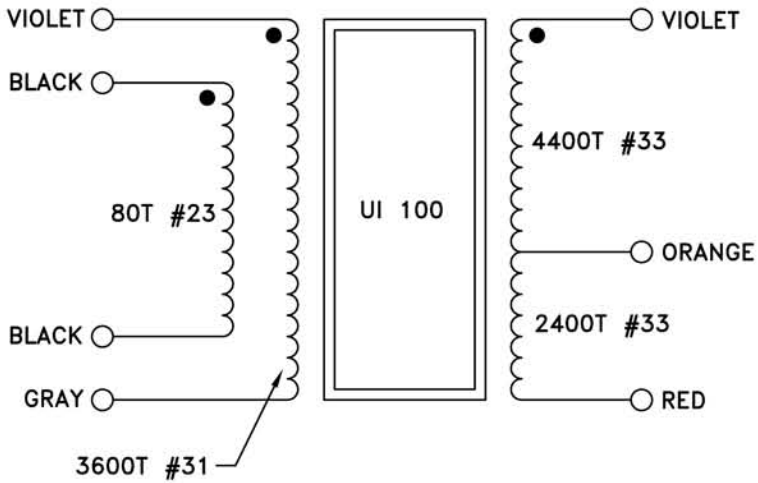
2200/3300 PC LAYOUT

ANY TECHNICAL QUESTIONS REGARDING THIS PRINT SHOULD BE REFERRED TO ANDY SZABO (602)967-3565 EXT. 3036









NOTES:

1. ALL DIMENSIONS IN INCHES
2. 3 MIL NOMEX INSULATION
3. 6 KV HIGH POT TEST
4. ALL LEADS 20 GA. TEFLON, 14" LONG INCLUDING 1/2" STRIP

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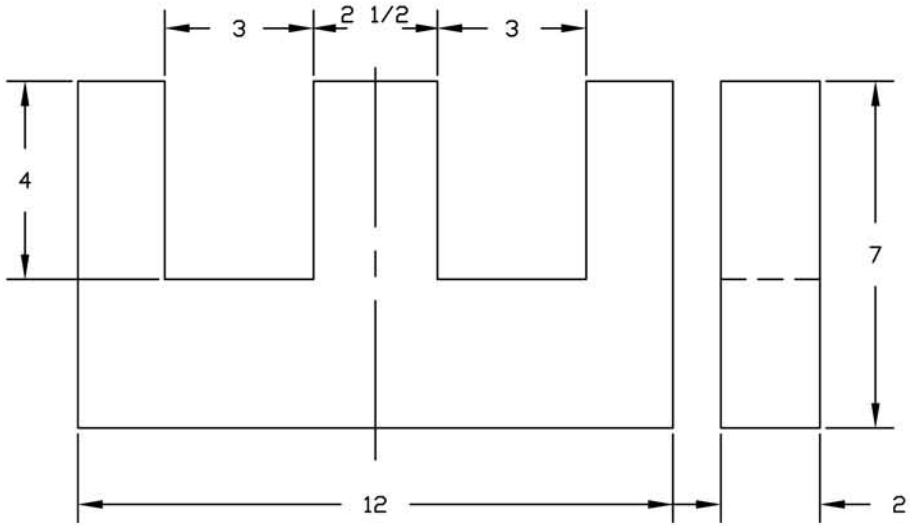
2200/3300 TRANSFORMER

FILENAME: C:\ACAD\22003300\TTA223

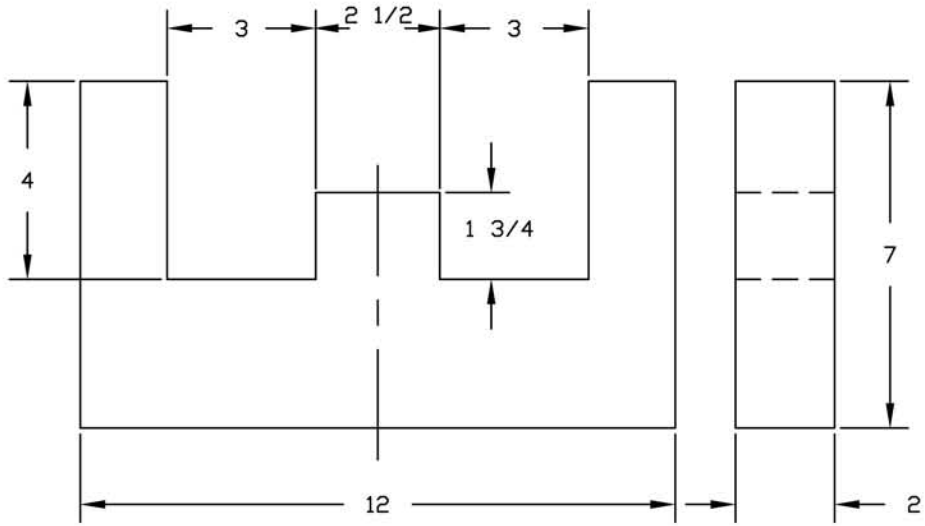
ANY TECHNICAL QUESTIONS REGARDING THIS PRINT SHOULD BE REFERRED TO ANDY SZABO (602)967-3565 EXT. 3036

NOTES: UNLESS OTHERWISE SPECIFIED
1: ALL DIMENSIONS ARE INCHES
2: "E" SHAPE SUPPORT IS IDENTICAL TO CENTER SUPPORT. EXCEPT FOR HEIGHT OF CENTER LEG.

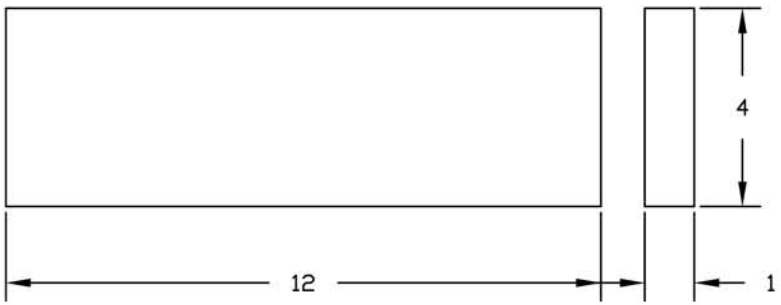
CENTER SUPPORT PMA F 022 SET = 2 PCS.



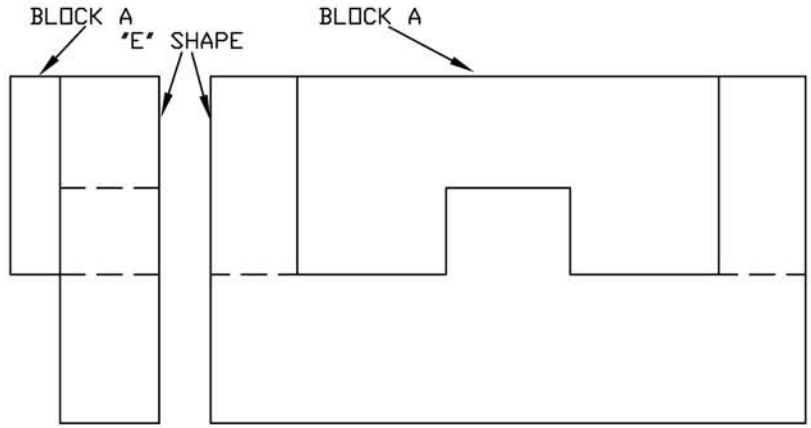
"E" SHAPE SUPPORT



BLOCK A



END SUPPORT PMA F 023 SET = 4 PCS.

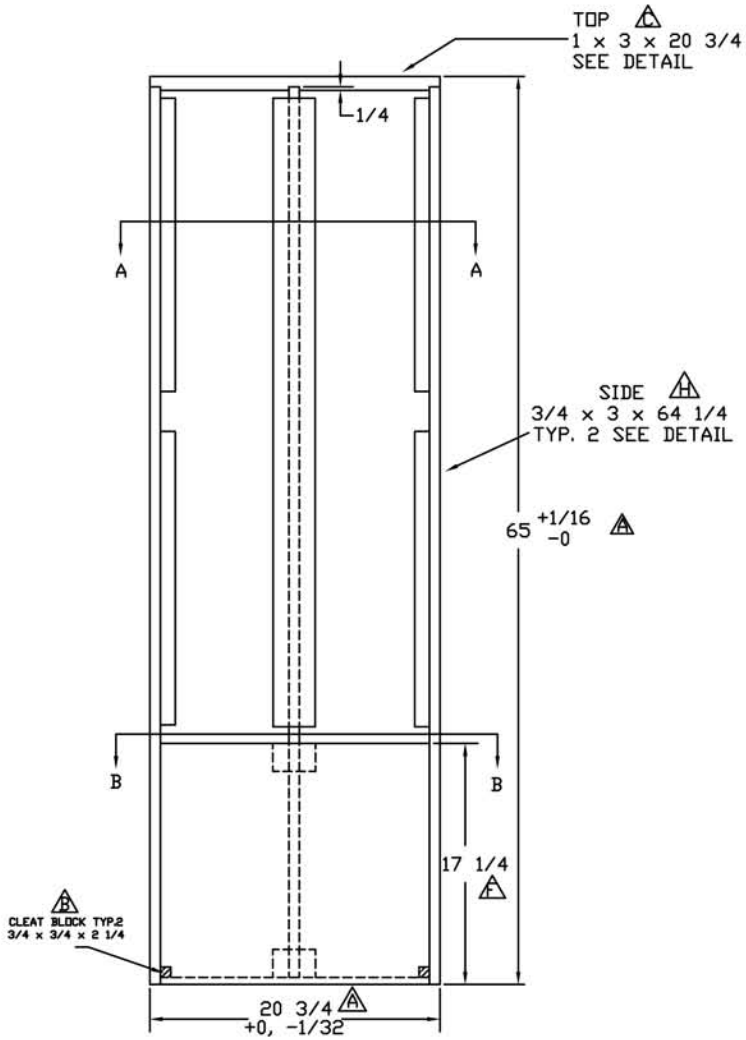


SIDE VIEW

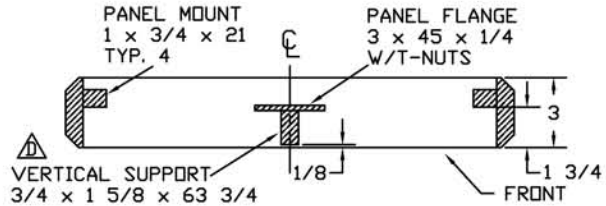
TOP VIEW

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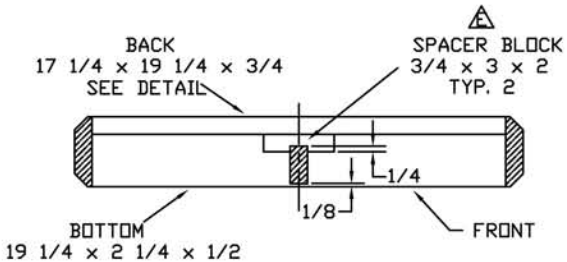
2200/3300 FOAM



REAR VIEW



SECTION A-A



SECTION B-B

NOTES: UNLESS OTHERWISE SPECIFIED
1: ALL DIMENSIONS ARE INCHES
2: MATERIALS:
1 MDF: TOP
3/4 MDF: SIDES, BACK, VERTICAL SUPPORT, SPACER BLOCKS
1/4 LUAN: PANEL FLANGES
ALDER: PANEL MOUNTS
3: SCALE: REAR VIEW-1/5
CROSS SECTIONS-1/3

REVISIONS:
9/25/90

A. ADD TOLERANCES TO OVERALL SIZE
B. ADD CLEAT BLOCKS TO BOTTOM CORNERS
C. CHANGE STYLE OF TOP
D. CHANGE LENGTH OF VERTICAL SUPPORT
E. CHANGE STYLE OF SPACER BLOCK
F. CHANGE HEIGTH OF BACK
G. REVISE MATERIAL LIST
H. CHANGE LENGTH OF SIDE
I. TRANSFER DRAWING TO D SIZE

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SPECTRA 2200 FRAME

ANY TECHNICAL QUESTIONS REGARDING THIS PRINT SHOULD BE REFERRED TO ANDY SZABO (602)967-3565 EXT. 3036

NOTES:

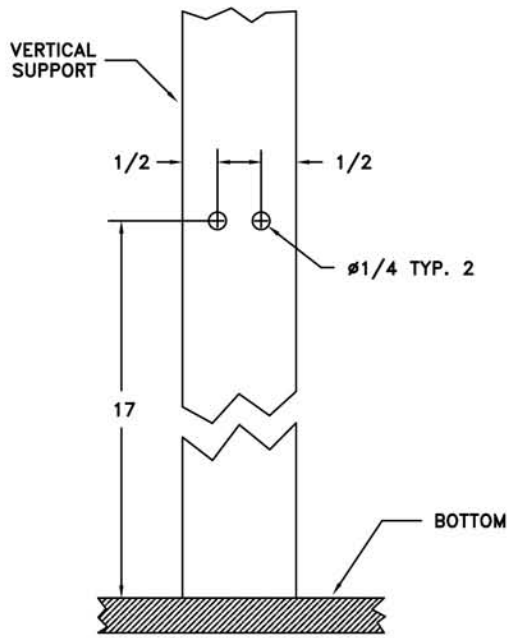
1. ALL DIMENSIONS IN INCHES
2. MATERIAL 3/4 MDF
3. INSTALL SIX PRONG 1/4–20 T–NUTS FROM REAR OF 5/16 HOLES

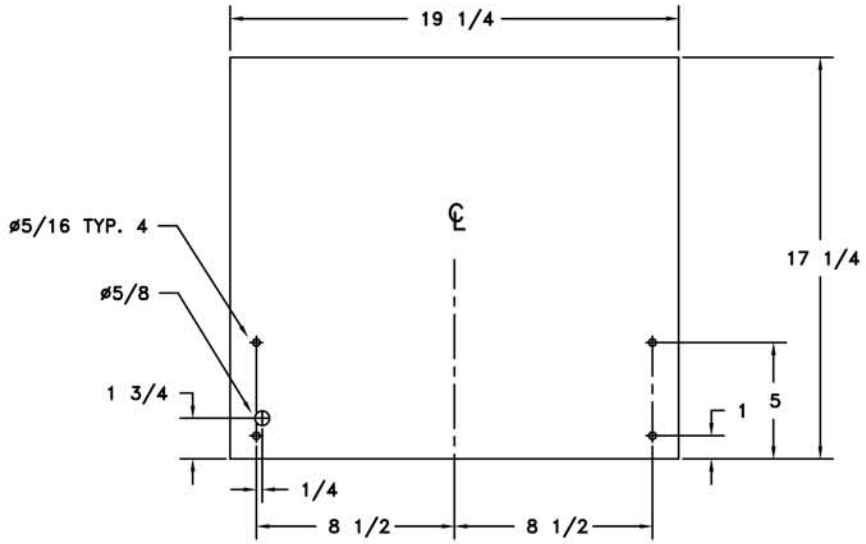
REVISIONS:

9/25/90
ADD CROSS–SECTION OF TOP

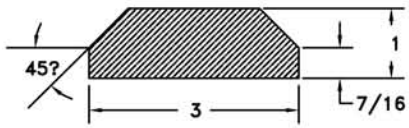
1/31/91
ADD WIRE HOLE DETAIL VIEW
CHANGE PRINT SIZE FROM C TO D

WIRE HOLE DETAIL
SCALE–FULL

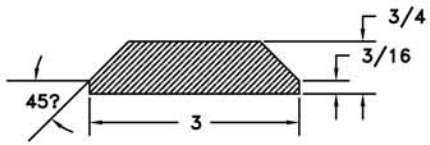




BOTTOM BACK–VIEW FROM REAR
SCALE 1/3



BEVEL CROSS SECTION
SCALE–FULL
TOP



BEVEL CROSS SECTION
SCALE–FULL
SIDES TYP. 2

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SPECTRA 2200 FRAME DETAILS

ANY TECHNICAL QUESTIONS REGARDING THIS PRINT SHOULD BE REFERRED TO ANDY SZABO (602)967–3565 EXT. 3036

NOTES:

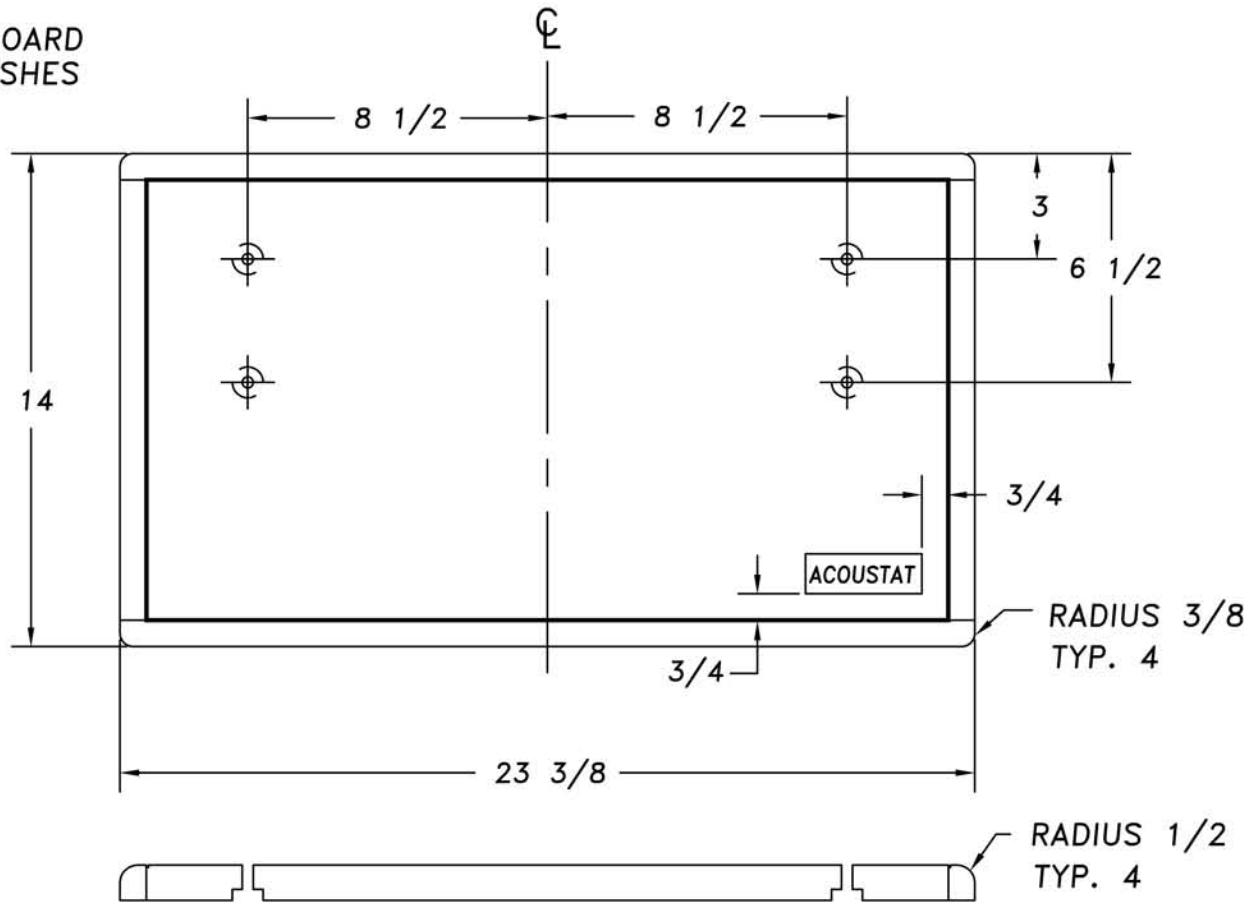
1. ALL DIMENSIONS INCHES

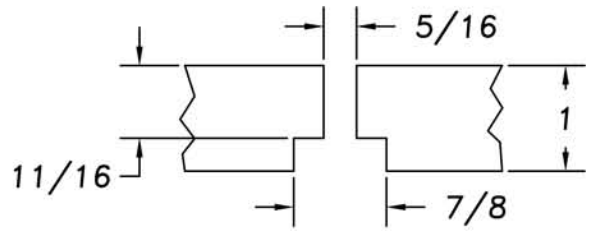
2. MATERIAL: OAK VENEER PARTICLE BOARD
   SOLID OAK BANDING, VARIOUS FINISHES

3. PART NUMBER SUFFIX:
   X= BSD– DARK OAK
      BSL– LIGHT OAK
      BSBL– BLACK OAK

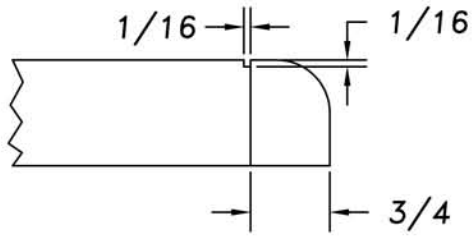
REVISIONS:

6/12/90 CHANGED WIDTH FROM 23 1/4
TO 23 3/8
ADDED LOGO POSITION





COUNTERBORE DETAIL

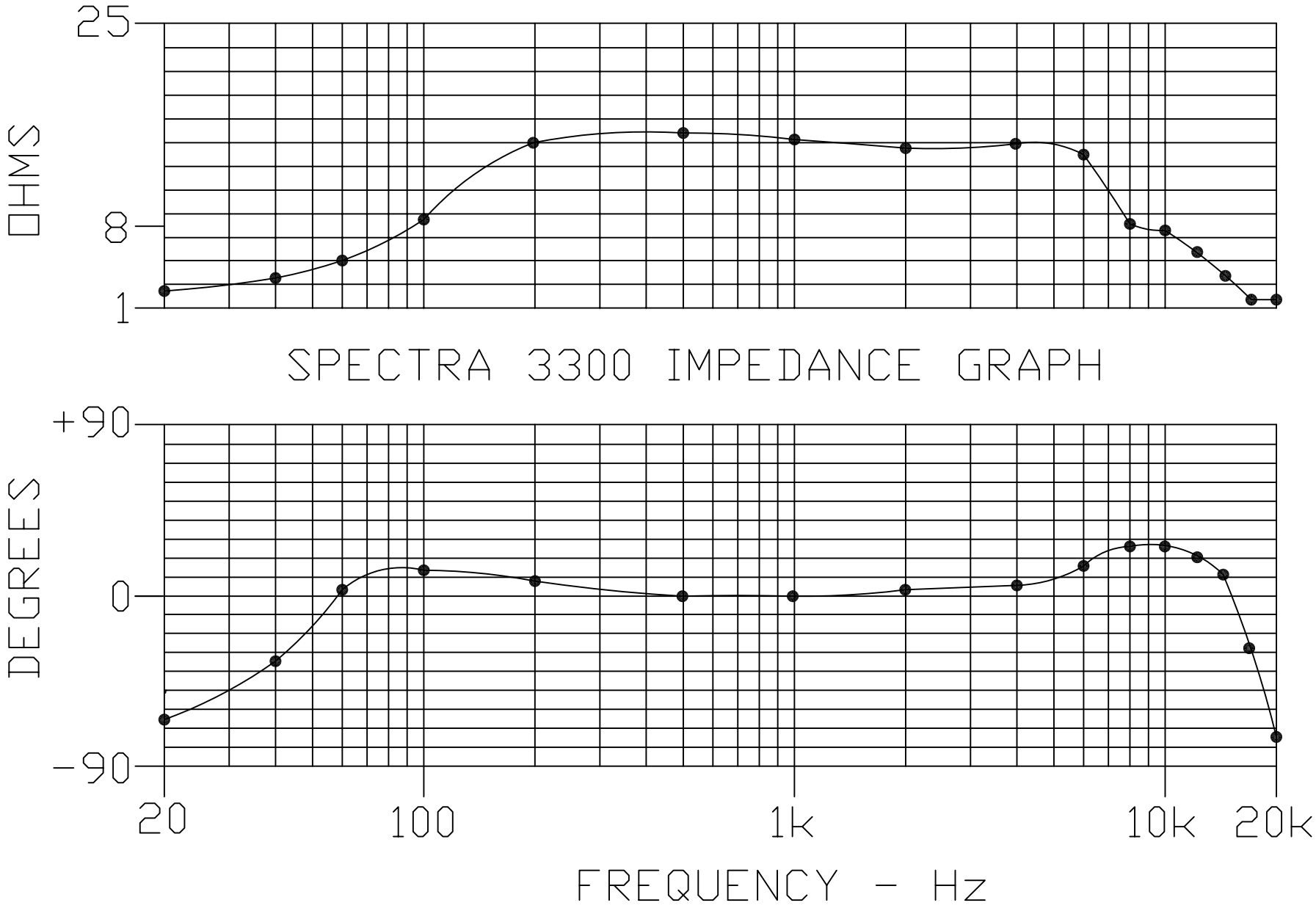


EDGE DETAIL

ANY TECHNICAL QUESTIONS REGARDING THIS PRINT SHOULD BE REFERRED TO ANDY SZABO (602)967–3565 EXT. 3036

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2200 WOOD BASE


25
8
1
OHMS
SPECTRA 3300 IMPEDANCE GRAPH
+90
0
-90
DEGREES
20
100
1k
10k
20k
FREQUENCY - Hz

NOTES: UNLESS OTHERWISE SPECIFIED

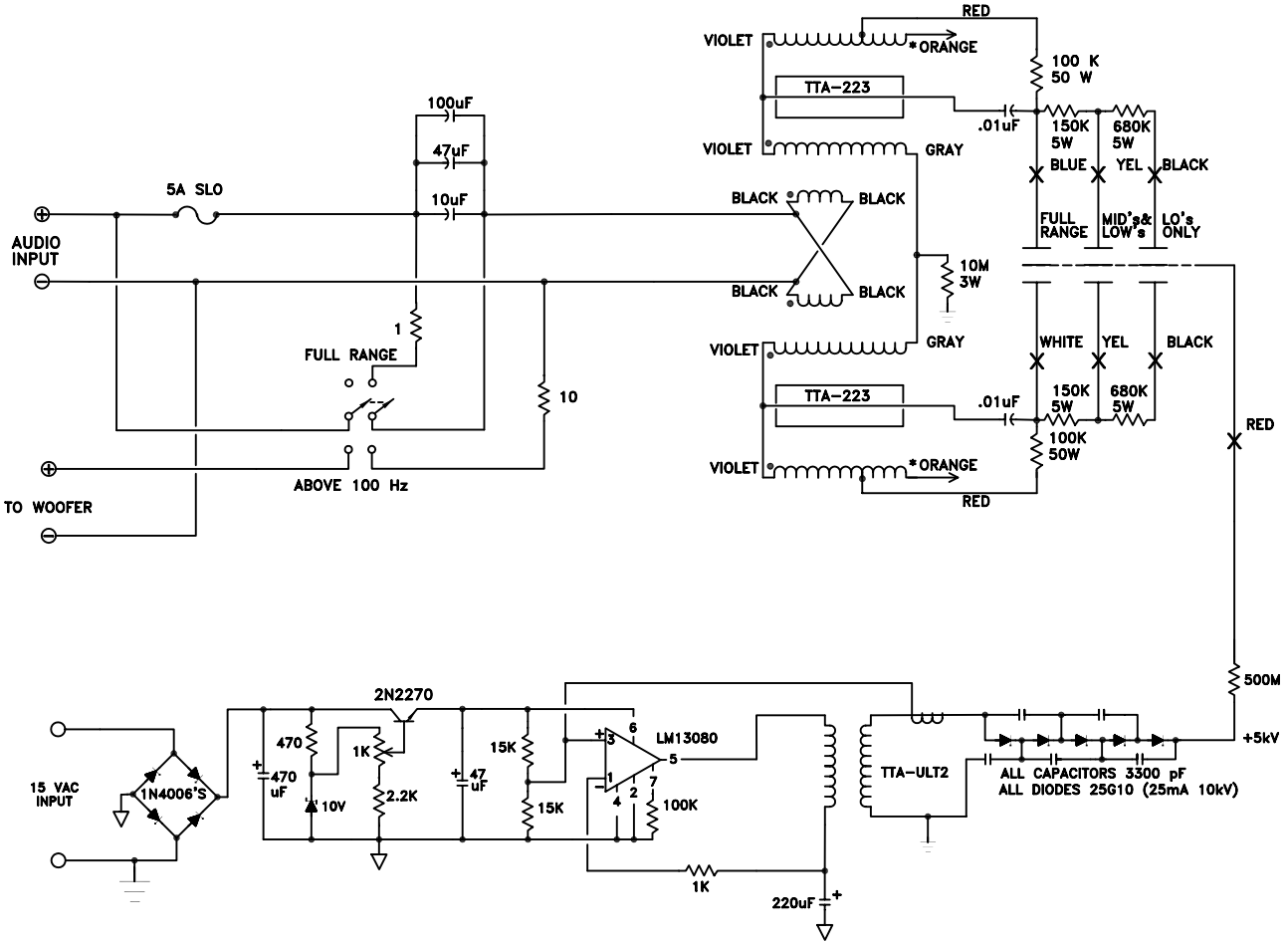
1: ALL RESISTORS ARE OHMS

2: = LOW VOLTAGE GROUND

3: = HIGH VOLTAGE GROUND

4: * = TRANSFORMER TAP
RED FOR SPECTRA 2200
ORANGE FOR SPECTRA 3300

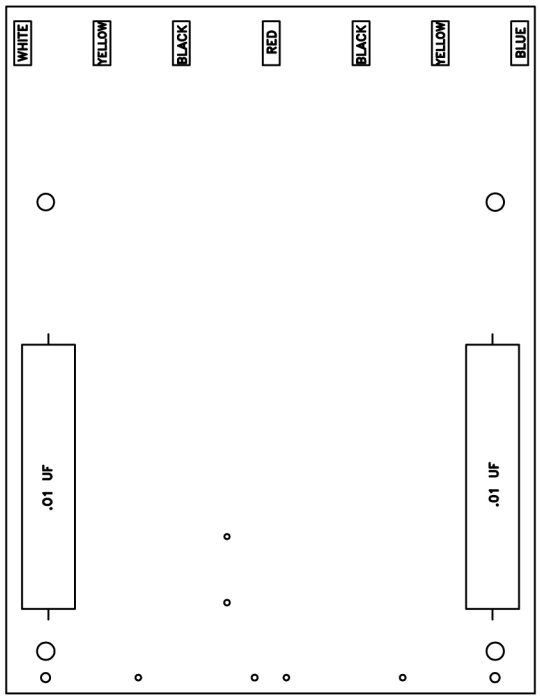
MK-2123
MAGNE-KINETIC INTERFACE FOR SPECTRA 2200/3300



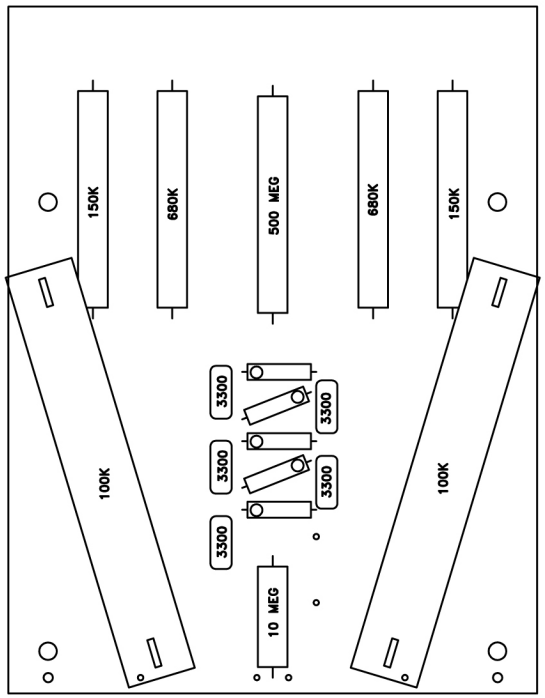
REVISIONS:

1. 5/29/91: UPDATED BIAS SUPPLY

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SOLDER SIDE

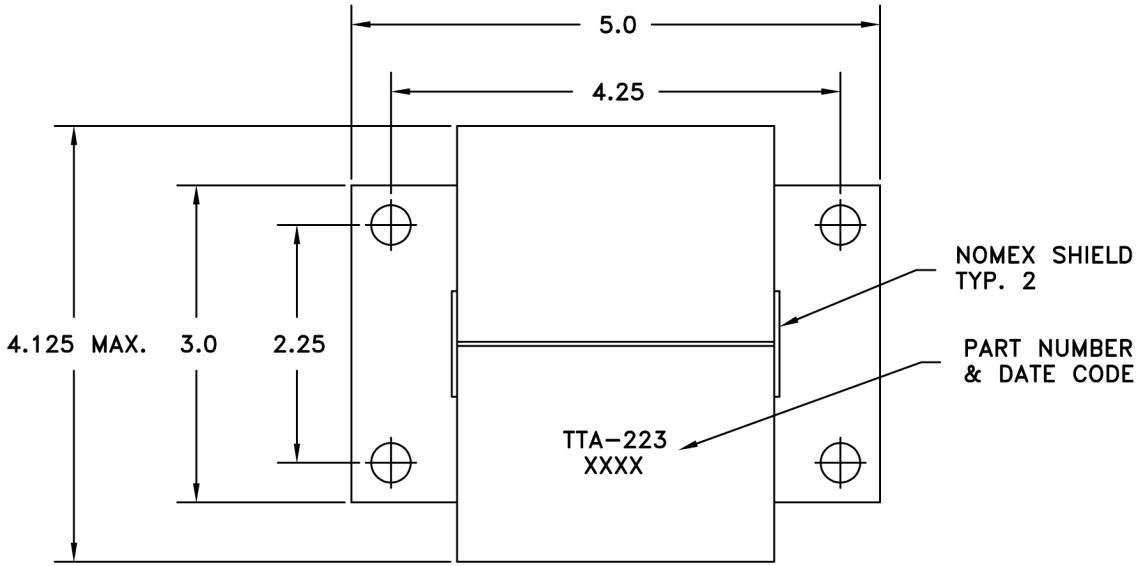


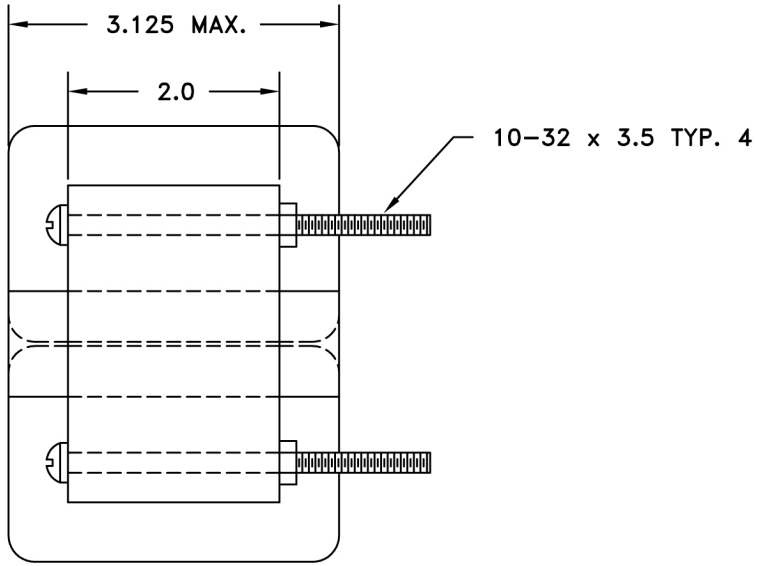
COMPONENT SIDE

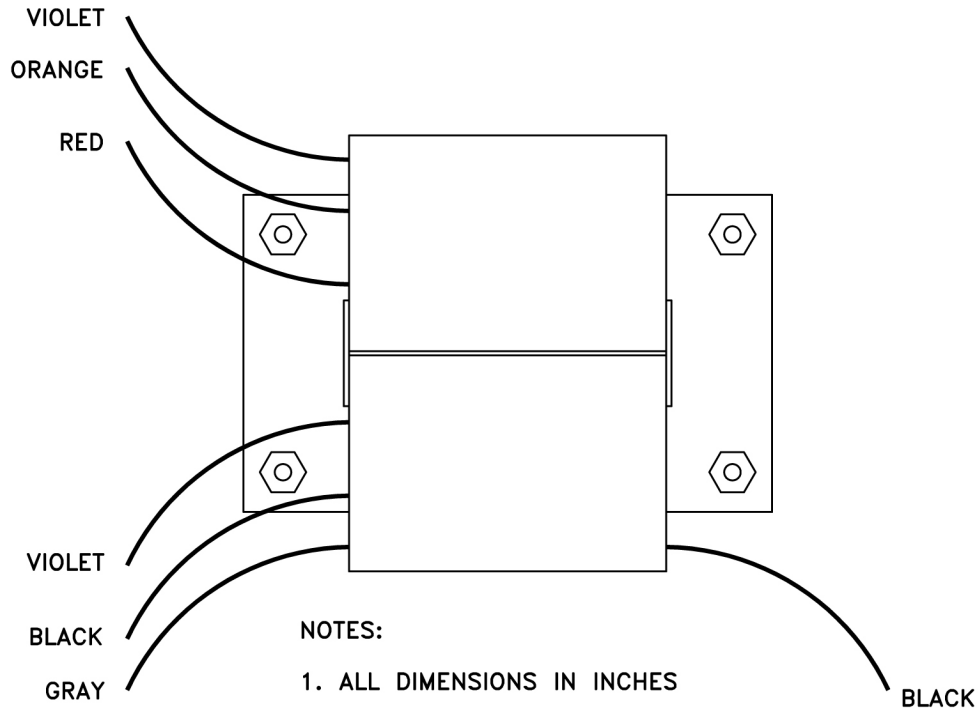
ACOUSTAT
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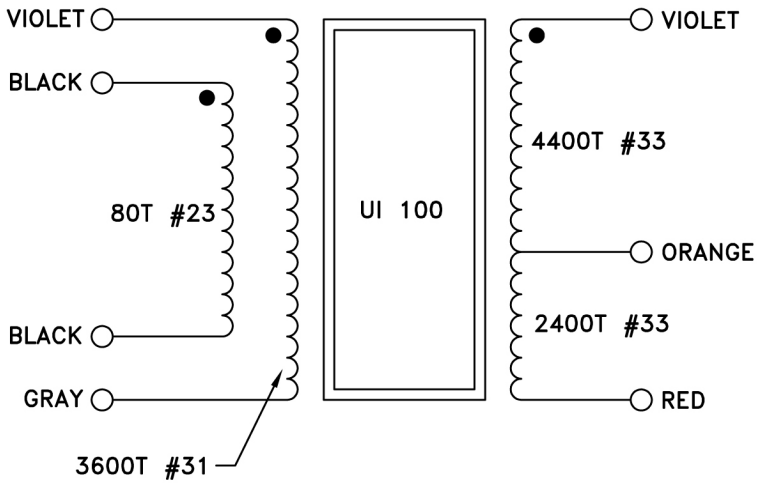
2200/3300 PC LAYOUT

ANY TECHNICAL QUESTIONS REGARDING THIS PRINT SHOULD BE REFERRED TO ANDY SZABO (602)967-3565 EXT. 3036









NOTES:

1. ALL DIMENSIONS IN INCHES
2. 3 MIL NOMEX INSULATION
3. 6 KV HIGH POT TEST
4. ALL LEADS 20 GA. TEFLON, 14" LONG INCLUDING 1/2" STRIP

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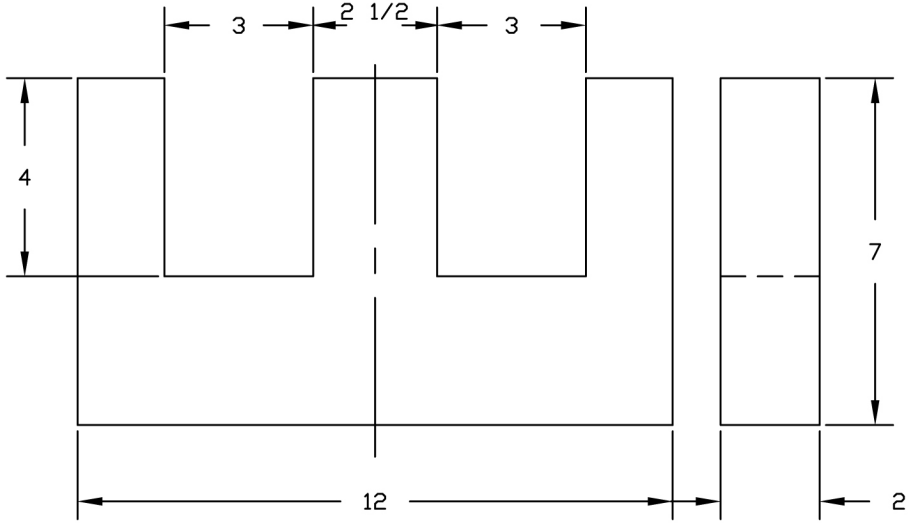
2200/3300 TRANSFORMER

FILENAME: C:\ACAD\22003300\TTA223

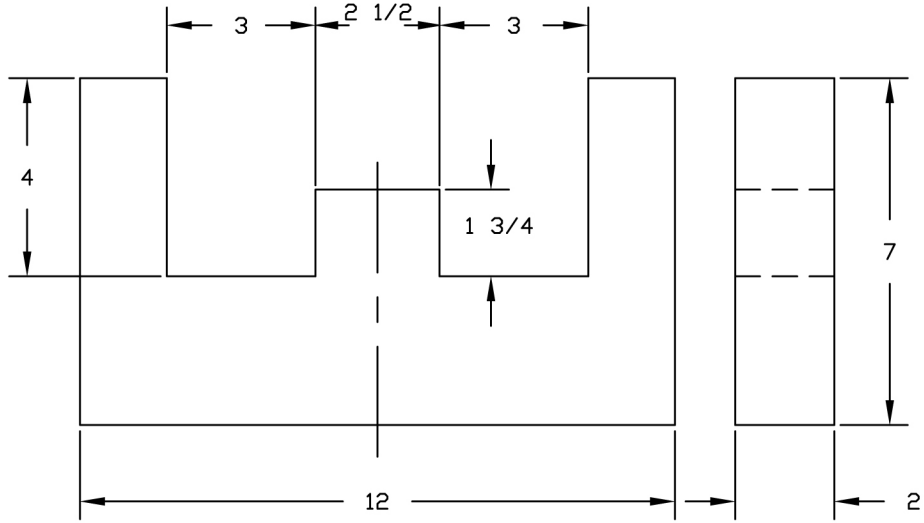
ANY TECHNICAL QUESTIONS REGARDING THIS PRINT SHOULD BE REFERRED TO
ANDY SZABO (602)967-3565 EXT. 3036

NOTES: UNLESS OTHERWISE SPECIFIED
1: ALL DIMENSIONS ARE INCHES
2: "E" SHAPE SUPPORT IS IDENTICAL TO CENTER SUPPORT, EXCEPT FOR HEIGHT OF CENTER LEG.

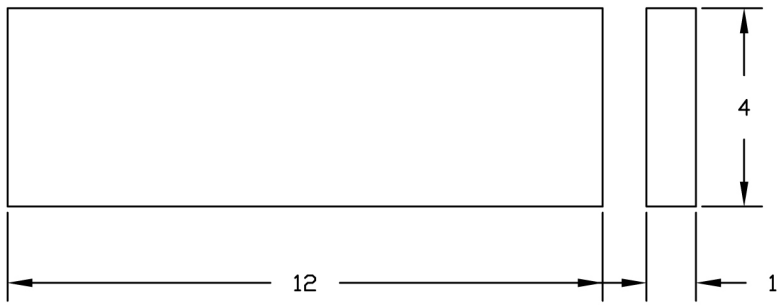
CENTER SUPPORT PMA F 022 SET = 2 PCS.



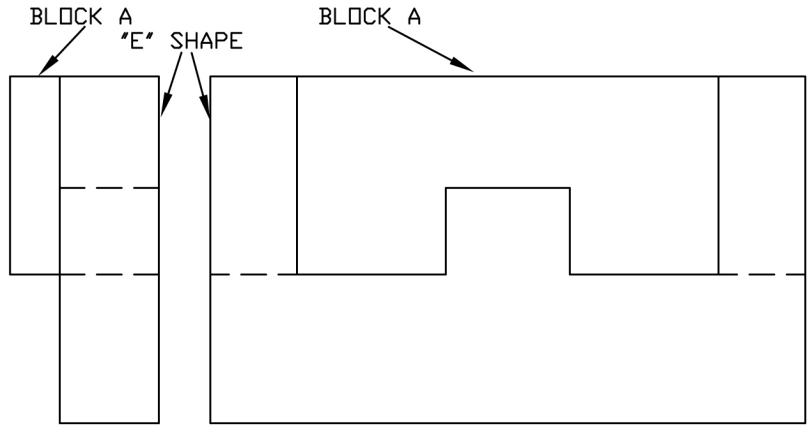
"E" SHAPE SUPPORT



BLOCK A



END SUPPORT PMA F 023 SET = 4 PCS.

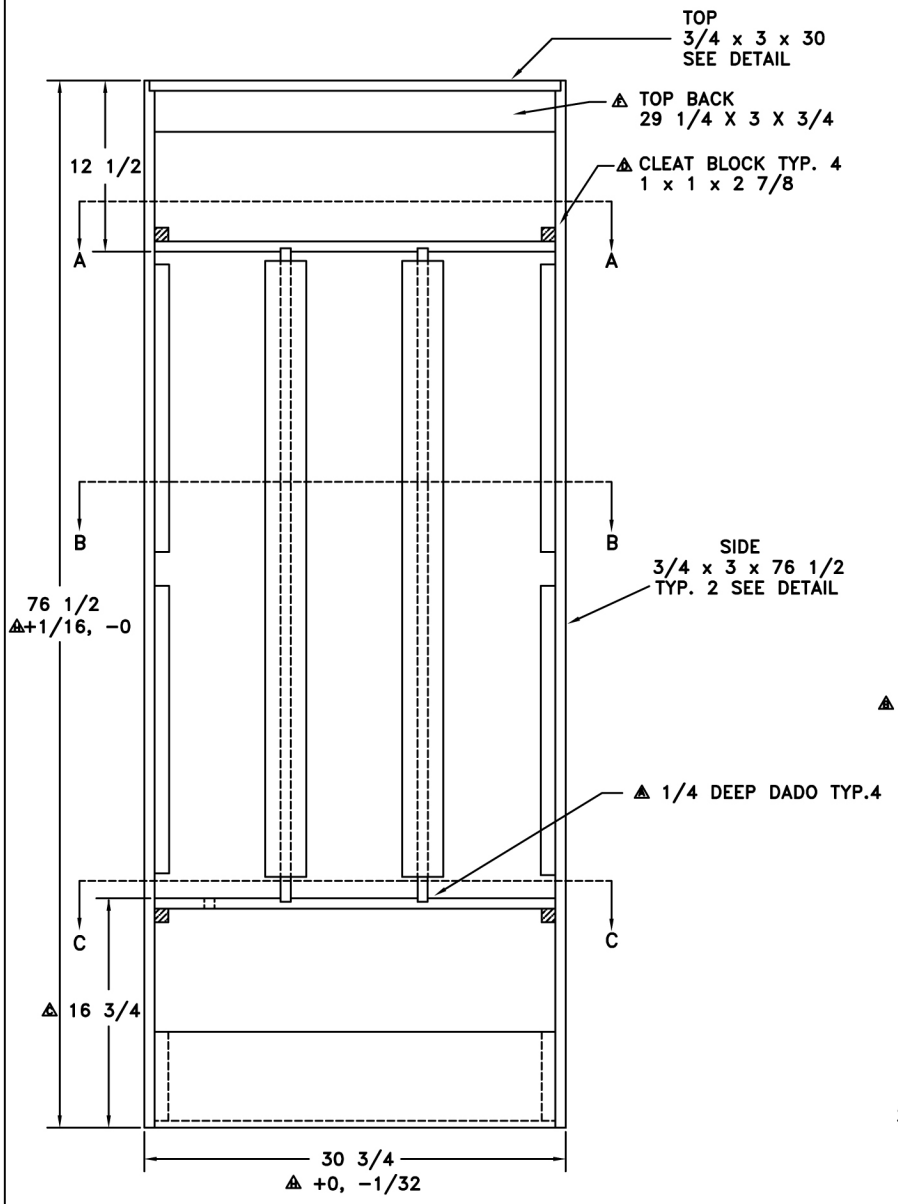


SIDE VIEW

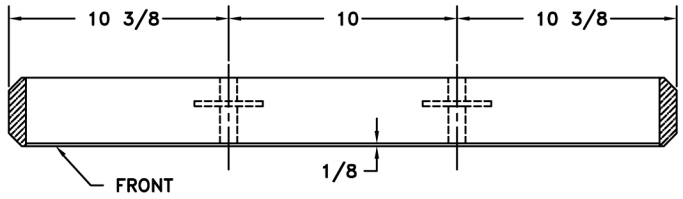
TOP VIEW

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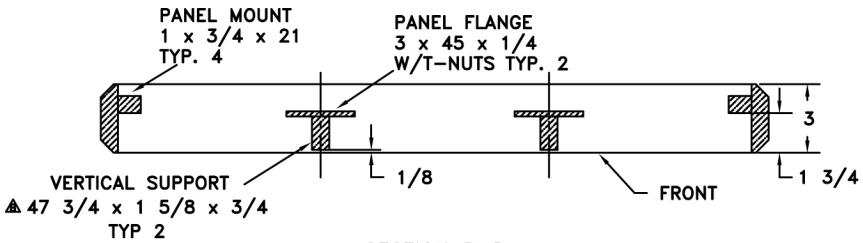
2200/3300 FOAM



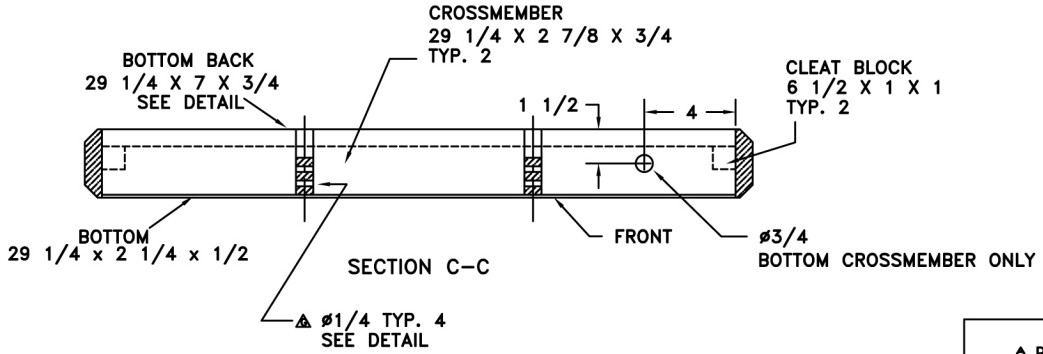
REAR VIEW



SECTION A–A



SECTION B–B



SECTION C–C

NOTES:

1. ALL DIMENSIONS INCHES
2. MATERIALS:
   3/4 MDF: BOTTOM BACK, TOP, SIDES, VERTICAL SUPPORTS, CROSSMEMBERS, TOP BACK
   1/2 9-PLY: BOTTOM
   1/4 LUAN: PANEL FLANGES
   ALDER: PANEL MOUNTS, CLEAT BLOCKS
3. SCALE– REAR VIEW: 1/5
   SECTIONS: 1/3
4. CROSSMEMBERS ARE FLUSH WITH REAR, 1/8 SET BACK FROM FRONT
5. POSITION 10–32 T-NUTS ON PANEL FLANGES SO THAT PANEL IS WITHIN 1/4 OF TOP OF OPENING.

REVISIONS

7/5/90

A. DADO CROSSMEMBERS 1/4 AT VERTICAL SUPPORTS
B. CHANGE LENGTH OF VERTICAL SUPPORT FROM 46 1/2 TO 47 3/4
C. LOWERED BOTTOM CROSSMEMBER FROM 17 1/2 TO 16 3/4
D. ADDED CLEAT BLOCKS ON TOP & BOTTOM CROSSMEMBERS
E. ADDED NOTE #5
F. ADDED TOP BACK
G. ADDED WIRE HOLES AT BOTTOM OF VERTICAL SUPPORTS
H. ADDED TOLERANCES TO OVERALL SIZE

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SPECTRA 3300 FRAME

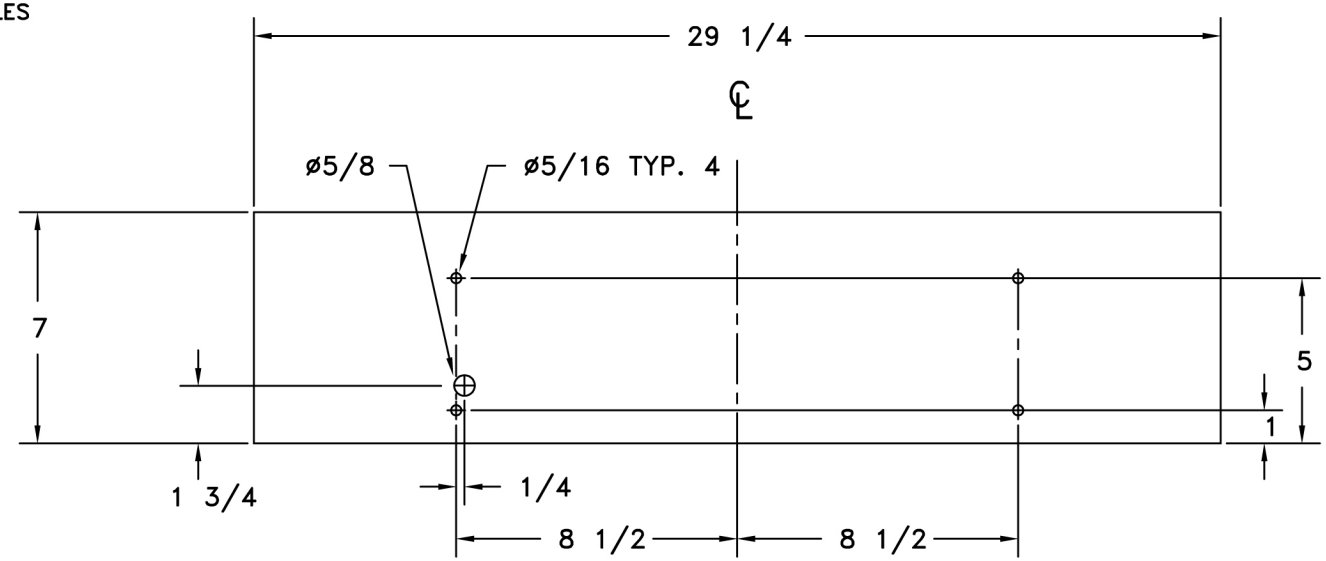
NOTES:

1. ALL DIMENSIONS IN INCHES
2. INSTALL 1/4–20 6–PRONG T–NUTS FROM INSIDE OF 5/16 HOLES

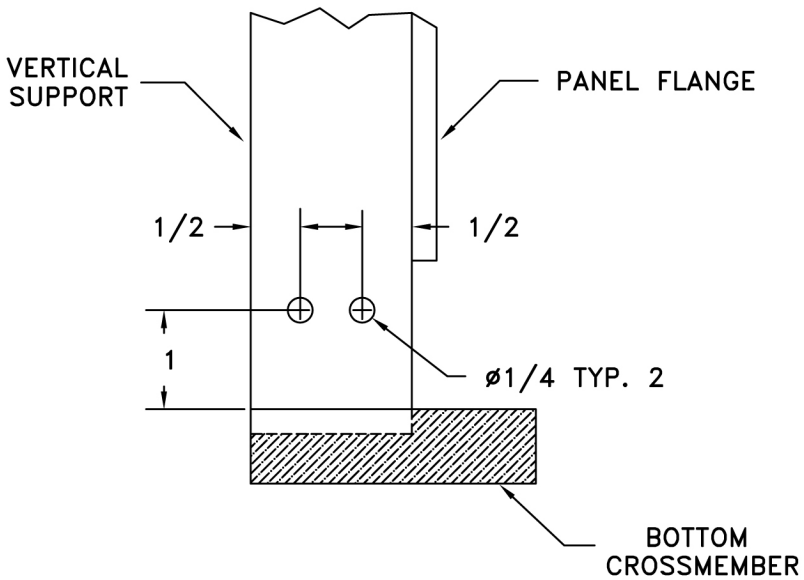
REVISIONS

7/6/90

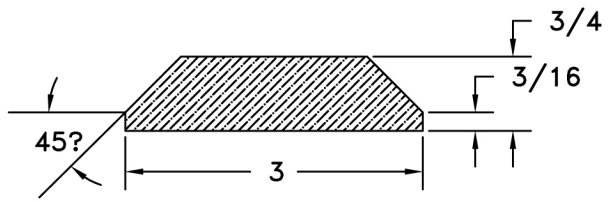
ADDED WIRE HOLE DETAIL VIEW



BOTTOM BACK–VIEW FROM REAR
SCALE 1/3



WIRE HOLE DETAIL
TYP. BOTH VERTICAL SUPPORTS



BEVEL CROSS SECTION
SCALE–FULL
TYP. TOP & SIDES

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SPECTRA 3300 FRAME DETAILS

NOTES:

1. ALL DIMENSIONS INCHES

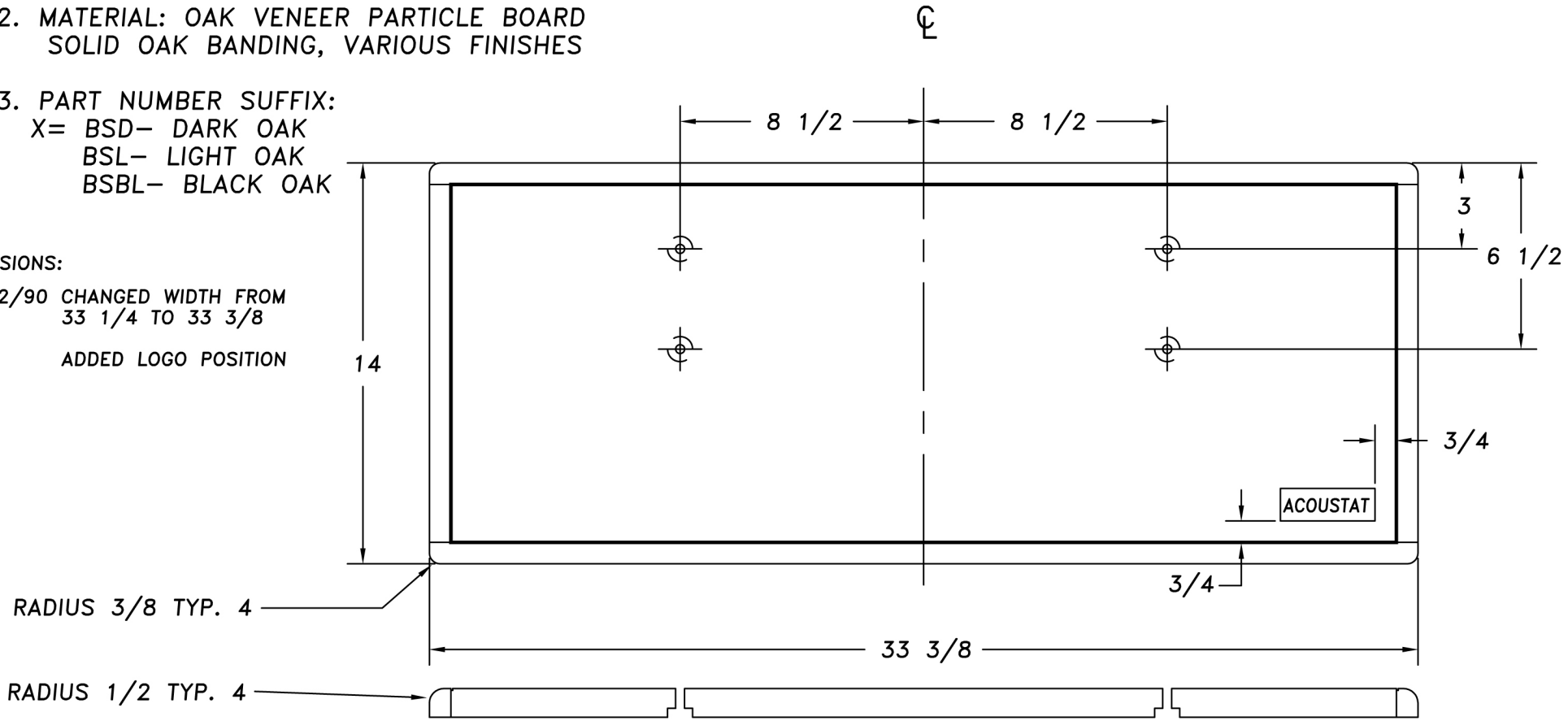
2. MATERIAL: OAK VENEER PARTICLE BOARD
   SOLID OAK BANDING, VARIOUS FINISHES

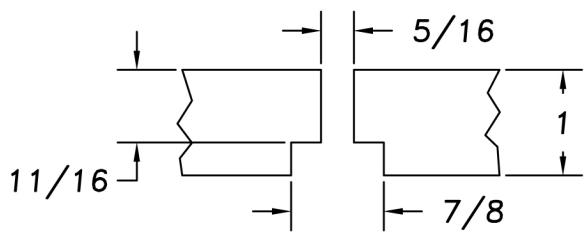
3. PART NUMBER SUFFIX:
   X= BSD– DARK OAK
   BSL– LIGHT OAK
   BSBL– BLACK OAK

REVISIONS:

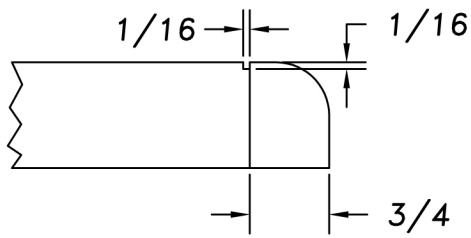
6/12/90 CHANGED WIDTH FROM
33 1/4 TO 33 3/8

ADDED LOGO POSITION





COUNTERBORE DETAIL



EDGE DETAIL

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3300 WOOD BASE

PLEASE NOTE: This is the original manuscript for the Acoustat Spectra 4400/6600 Owner's Manual. It is text-only, and includes no diagrams. There may be minor differences between this version and the final published version. See "Schematics" and "Specifications" for further information on these models.

OWNER'S MANUAL

SPECTRA 4400 & 6600
ELECTROSTATIC
LOUDSPEAKER SYSTEM

A Division Of Rockford Corporation

613 South Rockford Drive
Tempe, Arizona 85281 USA
602 - 967 - 3565

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Congratulations on your purchase of Acoustat Spectra Technology. The Spectra 4400 and Spectra 6600 offer the listener virtually unlimited dynamics in medium to large rooms, while still maintaining precise sound-staging and high frequency time-alignment.

INTRODUCTION

BREAK IN PERIOD

Your new Acoustat loudspeaker requires a break-in period before full performance may be realized. Even though the speaker will begin to play within a few moments of being energized, and will sound quite good, a brand new speaker is characterized by a lower efficiency, reduced dynamic capability, and a generally "flat" dimensionality.

To "break-in" the speaker, simply play music through the system at moderate volume levels. The most dramatic improvement will occur within the first 20 hours of operation, although slight improvements may be noticed even at 50 hours of playing time.

The break-in period may be conducted all at once (i.e. leaving the system playing continuously) or may be accomplished over a number of playing sessions. This break-in phenomenon occurs only when the speaker is brand new. Even if a broken-in speaker has been de-energized for an extended period, it will again reach full performance within a few moments of being re-powered.

USING THIS OWNER'S MANUAL

We all have a tendency to read instruction manuals only if something doesn't work as intended. However, the assembly and installation of the Spectra loudspeaker, though simple, may not be obvious at first glance. Therefore, to maximize your enjoyment of this loudspeaker, please read through the entire manual before beginning.

This manual contains step-by step information for assembling your Spectra, installation in the listening environment, and hook-up to the amplifier. We have also included additional information in an attempt to answer those most commonly asked questions.

ASSEMBLY & INSTALLATION

GETTING STARTED

There are a few warnings we will make now which will save you trouble later:

1) Spectra arrays are MIRROR IMAGE, i.e. there are LEFT and RIGHT arrays. Each is identified by a small hole located in the TOP METAL CAPTURE PLATE, as well as a colored dot on the bottom surface of the array: RED for right, and GREEN for left. The hole is on the LEFT side of the LEFT array and RIGHT side of the RIGHT array--when viewed from the listening side. The two interfaces and bases are IDENTICAL.

2) The hardwood bases are easily scratched. They require careful handling and following of precautions given later.

3) The light colored cloth arrays are easily soiled, and all colors are very prone to picking up lint from being laid on a carpet. The protective plastic bag should be left on them until the arrays are brought into final installed upright position.

4) Spectra's sectored operation requires a complex connection-set from interface to array. Care is required when making the connections.

We will repeat these warnings when appropriate.

INTERFACE/BASE ASSEMBLY

1) Remove the interfaces (step-up transformer units) from their shipping cartons. Needed hardware is enclosed in a hardware bag in each interface carton. Each bag should contain the following:

.....1 Wall Transformer
.....4 Black Nylon Washers
.....4 Metal Washers
.....4 1" (long) Phillips Head Screws
.....4 1/2" (short) Allen Head Screws
.....1 Allen Wrench

2) Remove the hardwood bases from their shipping carton.

3) Referring to FIGURE 1, place one of the interfaces in INVERTED position, on the rug or other protective surface.

4) Select the four 1" screws (longer of the two sizes supplied) and the four METAL flat washers from the hardware bag.

5) Carefully place one of the hardwood bases (INVERTED) over the inverted interface so that its mounting holes align with the threaded holes in the bottom of the interface, and that the logo is positioned as shown in FIGURE 1. Avoid excessive sliding of wood on metal.

6) Using the 1" screws and METAL flat-washers, start all four screws through the base and into the threaded holes on the interface.

7) Tighten all 4 screws firmly.

8) Turn the mated base/interface right side up. The other base is identically assembled.

ARRAY MOUNTING

Referring to FIGURE 2:

1) Place one of the interface-shipping plastic bags over the entire front part of the hardwood base, to prevent marring the wood surface.

NOTE: If the speaker is being assembled near its final position, you may want to choose the appropriate Left or Right speaker.

2) Carefully lay the selected array face down on the floor with its top on the floor, and its bottom resting up over the protective plastic bag you placed over the base. If you have removed the array protective bag, lay it under the array for protection from the floor.

3) Retrieve the 3 sleeved wire-bundles out of the end of the array-shipping bag.

4) Study the wiring diagram in FIGURE 2 carefully. The colors YELLOW and BLACK appear on TWO pin-plugs and on TWO pin-jacks. On closer inspection you will see that the proper connections are unambiguous--there are two DIFFERENT GROUPS: A BLUE group and a WHITE group.

5) Connect the 7 color-coded pin-plugs into the proper pin-jacks. There is only one correct set of these connections, but there are 5039 incorrect ones.

WARNING: The next steps have a very high chance of scratching the hardwood base. Both the TILT BRACKETS and the STAPLES under the array are quite capable of scratching the wood. It is necessary to use TWO PEOPLE for these steps.

BEFORE you stand up the array:

1) RECHECK for the presence of the protective plastic bag covering the front of the wood base.

2) LOCATE the four 1/2" Allen Head screws (shorter of the two sizes supplied) and the four black NYLON flat washers.

3) Carefully stand up the array. Now bring the array back to mate with the interface. You will have to guide the wire bundles into a "U-TURN" loop fitting into the empty space at the right end of the interface and also get the brackets to enter INSIDE the edges of the interface.

NOTE: If the brackets seem too wide to fit inside the interface chassis, or are vertically mis-aligned, the brackets' mounting screws may be temporarily loosened and the brackets re-aligned.

4) Make sure than none of the individual wires get pinched between the tilt bracket and the interface side.

5) Now install two of the 1/2" screws through each side of the interface, into the threaded inserts in the tilt brackets. Be sure to include the black nylon washers under each screw head, and tighten with supplied Allen wrench.

6) At this time you can remove the protective sheet covering the wood base and the protective bag over the array.

Remember, the light cloth is easily soiled and your hands are likely now oily from handling the hardware.

The other speaker is assembled identically. Remember to check again the LEFT and RIGHT identifiers before you make final placement.

We recommend that you keep all the boxes if possible. If storage space is limited, keep all of them for a while until you are satisfied that both speakers are performing properly.

In any event you should keep PERMANENTLY the two INTERFACE boxes, and all the plastic foam parts from all the cartons, as these take little space and will save you money if you ever need new boxes in the future.

Experience has shown that if service or a factory modification is ever needed, it is most likely to involve sending ONLY the interfaces to Acoustat. Our packaging materials are top-of-the-line and much more protective than most home-made arrangements. (See In Case of Difficulty.)

DISASSEMBLY OF SPEAKER

Should your Spectra ever require disassembly for the purpose of moving or repair, simply follow the assembly instructions in reverse order, with one very important exception. After unbolting the array from the interface, but BEFORE disconnecting any internal wires, the speaker must be discharged.

WARNING: Always unplug the AC (POWER) input and audio feeds before accessing the inside of the interface.

1) Even after the power is removed, a high voltage charge remains on the array for at least many hours.

2) To discharge the array, remove the center RED pin-plug and touch its tip (while holding the wire's insulation, NOT the metal plug) to any other pin-plug connection. Unless the speaker has been de-energized for some time, expect to see a spark and hear a snap from the speaker.

3) The speaker will now be safely discharged, and disassembly may proceed.

AUDIO INPUT

The red/black input terminals are standard, 3/4" spacing, banana jacks. They may accept single or dual banana plugs, spade lugs, pin plugs, or bare wires.

The terminals are to be connected to the amplifier's output. Be sure to observe polarity markings for both channels: Red (+) to Red (+), and Black (-) to Black (-). All Acoustat loudspeakers are designed to preserve absolute phase integrity: i.e. when the red input terminal is positive with respect to the black terminal, the diaphragm will move forward.

AUDIO FUSE

The rear panel fuse is directly in the audio path to protect the interface electronics in case of amplifier over driving or failure, and to protect the amplifier in case of speaker failure. If in need of replacement, always use a 5 ampere fuse (Type 3AG) with a slow-blow characteristic. The voltage rating of the fuse is not important. Evidence suggesting damage due to a larger than recommended fuse value may void the warranty for that repair.

POWER INPUT

The miniature (3.5 mm) phone jack connects to the ultrasonic bias power supply, which creates the +5000 volts necessary for electrostatic operation. The supplied wall transformer is to be connected to this input jack and plugged into an ALWAYS ON line outlet. Make sure that there are no wall switches or light dimmers associated with the outlet. All Acoustat loudspeakers are intended to be left on at all times to maintain full charge: power consumption is minimal (about as much as a small night light). The pilot lamp on the interface will glow whenever power is applied.

NOTE: Before plugging in the wall transformer, make sure that it is rated for your local line (mains) voltage. The export transformer, labelled for 220 volts, is suitable for use with 220 to 240 volts, 50 to 60 Hz.

MODIFYING BASS RESPONSE

The apparent bass response of you Spectra will depend on the nature of the room, and the speaker system's position within that room. The factors affecting this are outlined in the following section "The Listening Environment."

If, after extended experimentation and listening, you are not satisfied with the amount of bass produced, it is possible to slightly modify the low-end response.

A few cautions are in order. First, the change that can be made will affect frequencies as high as 200 Hz. So, if you are attempting to change only very low frequencies, the modification may affect a broader range than desired. Secondly, the modification is neither quick nor easy, and should be attempted only by those experienced with electronic assembly techniques. It is for this reason that the specific instructions are NOT included in this manual. We recommend that the modification be performed at the factory.

For the Spectra 4400, it is possible to boost response by 1 dB, or cut response by 1 or 2 dB. The dB figure corresponds to the 30-40 Hz region. The amount of boost or cut will decrease as frequency increases.

For the Spectra 6600, no cut in response is available, but the bass response may be boosted by 1, 2, or 3 dB. Consult the factory for further details.

THE LISTENING ENVIRONMENT

ROOM SIZE

The Spectra 4400 is best suited to medium to large rooms: those with minimum dimensions of 15 to 20

feet. Quite acceptable performance will be obtained in smaller rooms, but with a slight loss of deep bass, and a sound stage that, at least on some recordings, will be "larger than life." The Spectra 6600 is best suited for large rooms, with dimensions larger than 20 feet. Again, smaller listening environments will yield good results, but with the same possible penalties in bass response and sound staging.

Some of the principal considerations which will determine the performance potential of the speaker system as installed are listed below. Remember, these are general guidelines only. Room shape, furniture type, and personal taste are all important variables. Every listening environment is different, and experimentation is the key to satisfaction.

THE WALL BEHIND THE SPEAKERS

The walls should be neither excessively absorptive nor reflective. A highly reflective wall, such as large glass windows or smooth hard plaster, will tend to accentuate high frequencies. A highly absorptive wall such as heavy drapes or excessive application of specific sound absorbing materials, will tend to muffle high frequencies, as well as constrict the apparent depth of the sound stage.

THE ORIENTATION OF THE SPEAKER SYSTEM WITHIN THE ROOM

For deepest low bass performance, the speakers should project sound along the longer axis of the room. This is true of all loudspeakers, and is in no way unique to Spectra. If this is not possible in your room, the performance will not be significantly compromised other than a slight loss of deep bass.

DISTANCE FROM THE REAR WALL

Since the Spectra is a dipole loudspeaker (producing sound from both sides) placing the speaker too close to the rear wall will yield substantially reduced bass output, due to rear-wave cancellations. A minimum speaker-to-rear wall distance of 3 feet (1 meter) is recommended, as measured from the rear center of the array perpendicular to the wall.

DISTANCE FROM THE SIDE WALLS

Some space is desireable from the side walls, but the asymmetric nature of Spectra high frequency radiation makes side wall reflection less of a problem than with most other speakers. A spacing of 1 foot (30 cm) is the minimum recommended distance from the side wall to the array's outer edge. In wide rooms, of course, this distance may be much greater.

TOE-IN AND DISTANCE BETWEEN SPEAKERS

There are numerous combinations of toe-in angle and distance between speakers that will yield excellent sonic performance. In most situations, the distance between speakers should be roughly equal to the distance from each speaker to the listening position. The speakers should also be toed-in at an angle so that they more-or-less face the listening position.

THE AREA BETWEEN THE SPEAKERS

This area should be kept clear of major obstructions to airflow if optimum imaging is to be achieved. The size, shape, and material of any objects placed between the speakers will determine the extent of any negative effects on imaging.

ADDITIONAL INFORMATION

CARE OF THE HARDWOOD BASES AND TRIM

The hardwood bases and trim are hand finished with ~~Watco~~ brand Danish Oil. This top quality finish penetrates the wood providing deep protection while enhancing its natural beauty. Watco Satin Wax is then hand rubbed and buffed into the wood, bringing the finish to a high lustre. This high quality oil finish is easily

maintained. We recommend these steps for optimum preservation, preferably once a month.

1) Apply a coat of Satin Oil to clean and polish.

2) Wipe dry with a clean soft cloth.

NATURAL OAK bases should be oiled with Satin Oil and waxed with Natural Satin Wax.

DARK OAK bases should be oiled with Satin Oil and waxed with Dark Satin Wax.

For repairing minor scratches use Watco Danish Oil Finish:

Dark Oak bases should be repaired using Black Walnut Oil.

Natural Oak bases should be repaired using Natural Oil.

Care must be used on speakers with light fabric to shield the cloth from being stained. You can use a piece of cardboard as a protective "fence" as you apply the processes discussed above.

BLACK OAK bases and trim have a painted finish and should not be treated as above. Clean these surfaces with a damp cloth to remove dust and dirt.

SPECIFICATIONS

PHYSICAL DIMENSIONS: inches (cm)

SPECTRA 4400: .....Array Height: 94 (238.8)
.....including base

.....Array Width: 22.5 (57.2)

.....Array Depth: 3.5 (8.9)

.....Base Width: 24.25 (61.6)

.....Base Depth: 17 (43.2)

SPECTRA 6600: .....Array Height: 94 (238.8)
.....including base

.....Array Width: 32.75 (83.2)

.....Array Depth: 3.5 (8.9)

.....Base Width: 34.5 (87.6)

.....Base Depth: 17 (43.2)

RECOMMENDED AMPLIFIER POWER: 100 watts per channel or greater (based on an 8 ohm amplifier rating). See further discussion under "Amplifier Recommendations".

BIAS POWER SUPPLY CONSUMPTION: Less than 10 watts.

IMPEDANCE: Typically greater than 6 ohms, minimum of 1.5 ohms at high frequencies. See graphs.

EFFICIENCY: (400 Hz, 1 watt into 8 ohms equivalent at one meter)*

.....4400: 87 dB SPL
.....6600: 89 dB SPL

* extrapolated from measurements taken at 10 watts into 8 ohms equivalent, measured at a distance of 3.16 meters.

AMPLIFIER RECOMMENDATIONS

As compared to traditional magnetic loudspeakers, the 4400 and 6600 possess only medium efficiency, and can occasionally pose driving difficulties at high frequencies where impedance can dip to as low as 1.5 ohms.

Therefore, when choosing a power amplifier, a few factors must be considered. The recommended minimum of 100 watts per channel will yield good results, but will not realize the speakers' full potential, especially in larger rooms. Amplifiers as large as 250-300 watts per channel may be used, as long as good common sense is employed: the speaker/amplifier should not be pushed to the limit of distortion. The Spectra is very rugged loudspeaker, and the electrostatic panel itself cannot be damaged by excessive drive, but the interface electronics do have finite power handling capacity. The advantage in using a large power amplifier is not so much to allow the system to play much louder, but rather to allow for unrestricted dynamic headroom.

In addition to the 8 ohm power rating of the amplifier, the amplifier's ability to drive low impedances should be considered. Despite the speaker's rating of less than 2 ohms at high frequencies, the amplifier does not necessarily have to be rated for 2 ohms, since this minimum occurs over only a very narrow frequency range. However, to yield optimum performance from the loudspeaker, the amplifier should be rated to drive 4 ohm loads, and/or be advertised as being a "high current" design.

Acoustat does not generally recommend the used of mono-bridged amplifiers with Spectra loudspeakers. When a stereo amplifier is bridged into mono, each half of the amplifier "sees" only half the load impedance. Therefore, that 1.5 ohm minimum then becomes a .75 ohm minimum, which can cause overheating or instability in some amplifiers. At the very least, very few amplifiers can deliver more power at 1 ohm: most deliver considerably less.

The choice of amplifier device technology (transistor, MOSFET, vacuum tube, etc.) is an entirely personal one. Acoustat does not favor one technology over another. Each amplifier must be evaluated on its own particular merits. The same comments hold true for the choice of speaker cable.

THEORY AND PRACTICE OF SPECTRA OPERATION

Spectra 4400 and 6600 represent a very high state of perfection of full range electrostatic loudspeakers.

The interface techniques allowing the Symmetric Pair Electrically Curved TRAnsducer (SPECTRA) mode of operation were only perfected in late 1986.

At that time Acoustat made a quantum leap in the product of STEP-UP EFFICIENCY and BANDWIDTH which allowed for the first time a combination of traditional Acoustat high performance with the half-century old ideal of VARIABLE GEOMETRY operation.

This breakthrough solved the long standing impasse which had not allowed high SPL full range electrostatics to have optimum behavior at all audio frequencies.

You will find Spectra has wide, pleasant dispersion at all frequencies, razor-sharp high-frequency time-alignment, and clean low bass.

Spectra achieves this by effectively changing size and shape at different frequencies. Spectra is about 3" wide at highest frequencies, about 13" wide at middle frequencies, and full array-width at lowest frequencies.

Spectra's excellent midrange results from the magic of wave physics which causes the 13" of array operational at these frequencies to act dispersively for waves leaving both the front and the rear of the array. Spectra is devoid of the midrange beaming common in planar speakers using large flat midrange radiators.

For those wishing more in-depth information about electrostats in general, and specifically Spectra, contact the factory and ask for our "White Paper" entitled "Full Range Electrostatic Loudspeakers." An electrical schematic is included in this manual. However, the schematic is intended only for the academically curious: field repair is not recommended and not authorized.

WARRANTY STATEMENT

The electrostatic elements of the Spectra 4400 and 6600 are warranted against defective materials and workmanship for the life of the product. The electronic components contained in the interface are warranted against defective materials and workmanship for a period of ten years from the original date of purchase. This warranty extends to the original owner, purchased from an authorized Acoustat dealer only. A dated proof of purchase must accompany all warranty claims.

For subsequent owners, both the electrostatic elements and electronic components are warranted against defective materials and workmanship for a period of ten years from the date of manufacture. Manufacturing date shall be determined from a code contained in the serial number.

During the warranty period, defective parts will be repaired or replaced, at Acoustat's option, without charge for labor or materials. The warranty does not cover transportation costs to the repair site. Acoustat will return warranty repairs to the owner freight pre-paid. This warranty does not cover damage due to negligence, misuse, modification, shipping damage or accident.

Except as provided herein, Acoustat makes no warranties, expressed or implied, including warranties of merchant-ability and fitness for a particular purpose. Some states do not permit limitation or exclusion of implied warranties; therefore the aforesaid limitations or exclusions may not apply to the purchaser.

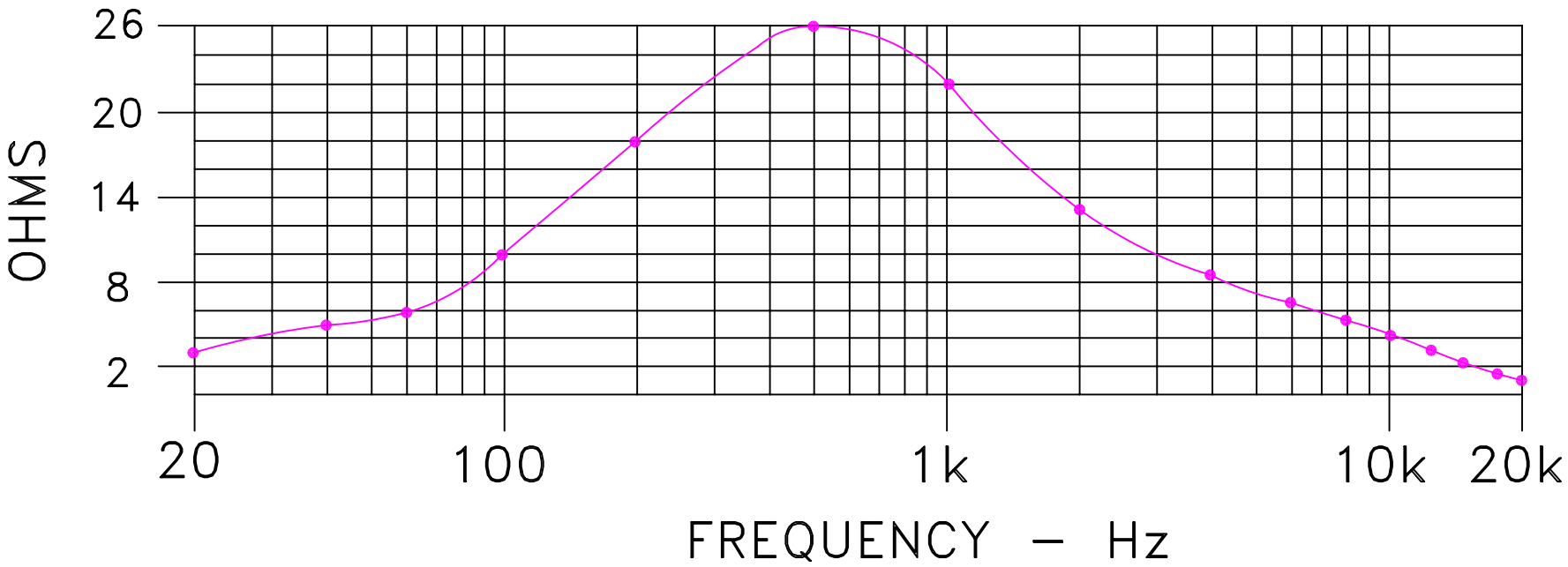
IN CASE OF DIFFICULTY

The Spectra loudspeaker has been designed for a lifetime of trouble-free music enjoyment. On the rare occasions that an apparent malfunction should occur, be sure to check all system signal sources, fuses, and connecting cables. If investigation pinpoints the Spectra as the source of difficulty, please contact (by telephone, preferably) our Customer Service Department before sending any equipment for service. Very often, we can offer further trouble-shooting hints that simplify or even eliminate the need for factory service. Should your Spectra loudspeaker require factory service, please use original factory packaging for shipment, and include a copy of a dated Bill of Sale and a brief note describing the difficulty. Every effort will be made to perform service in a timely manner, with typical turn-around times of about one week, exclusive of transit time.

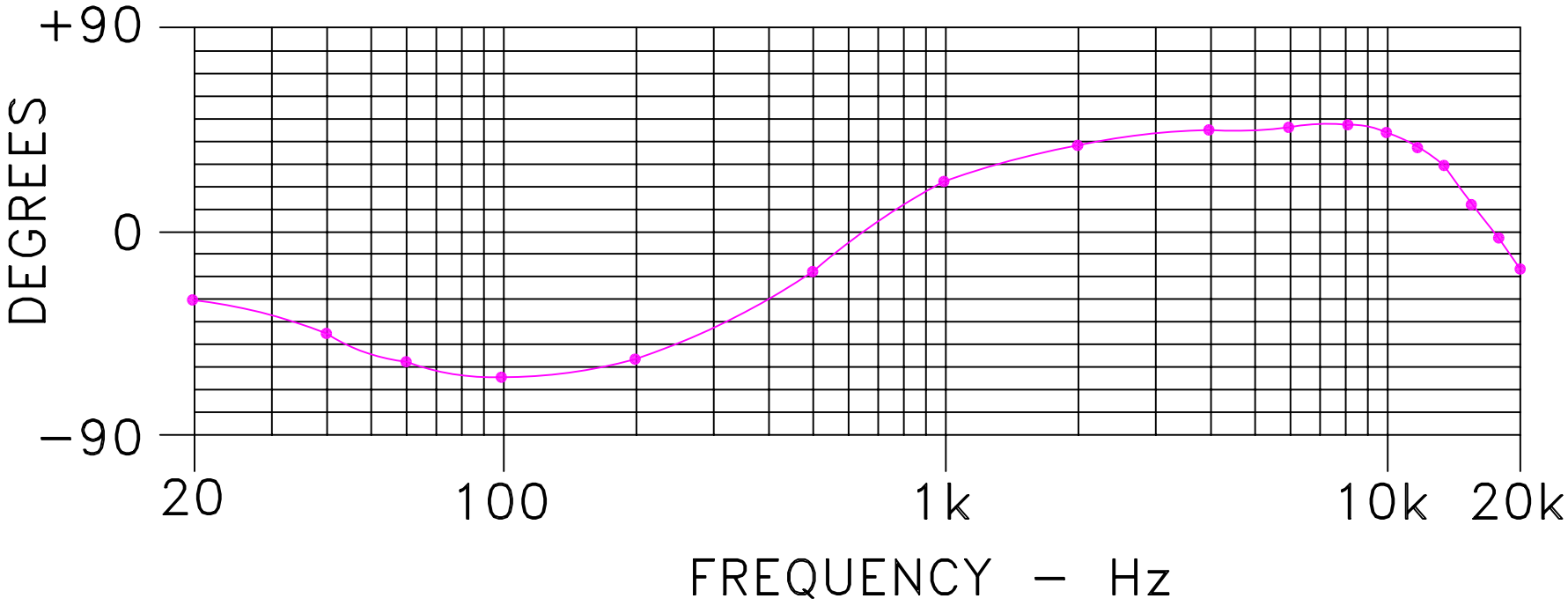
ALL RETURNS TO THE FACTORY, REGARDLESS OF WARRANTY STATUS, REQUIRE PRIOR RETURN AUTHORIZATION.

Acoustat
Division of Rockford Corporation
613 South Rockford Drive
Tempe, Arizona 85281
602-967-3565

IMPEDANCE PLOT
SPECTRA 4400



PHASE SHIFT PLOT
SPECTRA 4400



NOTES: UNLESS OTHERWISE SPECIFIED

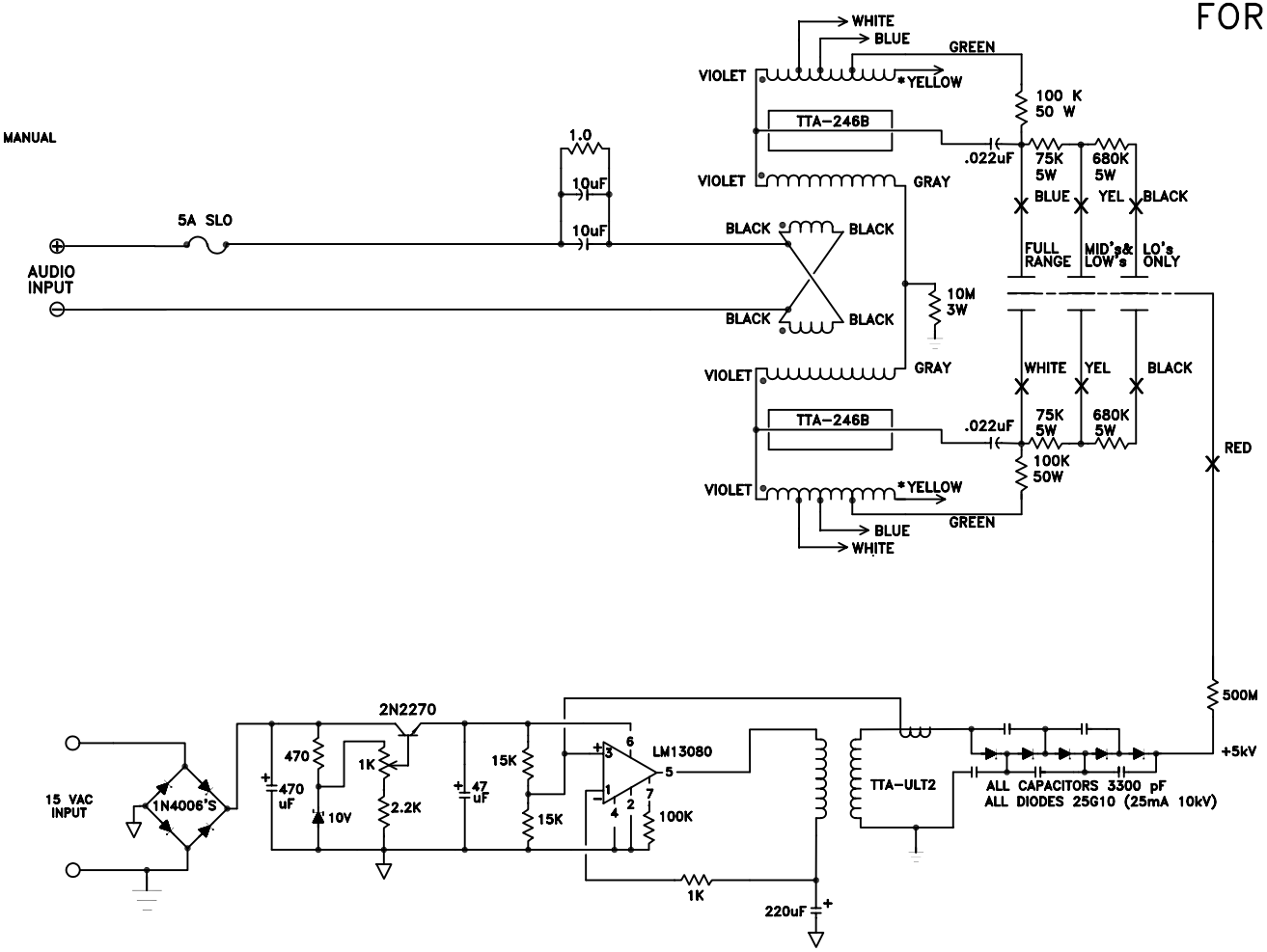
1: ALL RESISTORS ARE OHMS

2: = LOW VOLTAGE GROUND

3: = HIGH VOLTAGE GROUND

4: * = TRANSFORMER TAP
GREEN FOR SPECTRA 4400
WHITE FOR SPECTRA 6600
BLUE/YELLOW = SEE OWNERS MANUAL

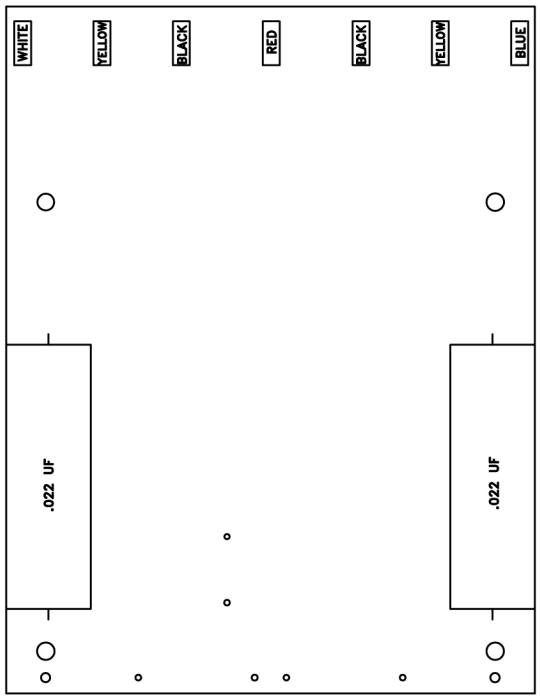
MK-2146
MAGNE-KINETIC INTERFACE
FOR SPECTRA 4400/6600



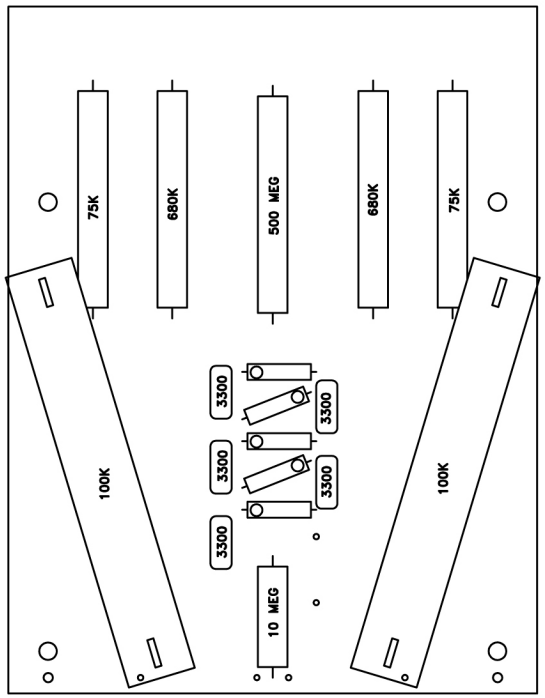
REVISIONS:

1. 5/29/91: UPDATED BIAS SUPPLY

ACOUSTAT
A DIVISION OF ROCKFORD CORP.
TEMPE, AZ., 85281, USA



SOLDER SIDE

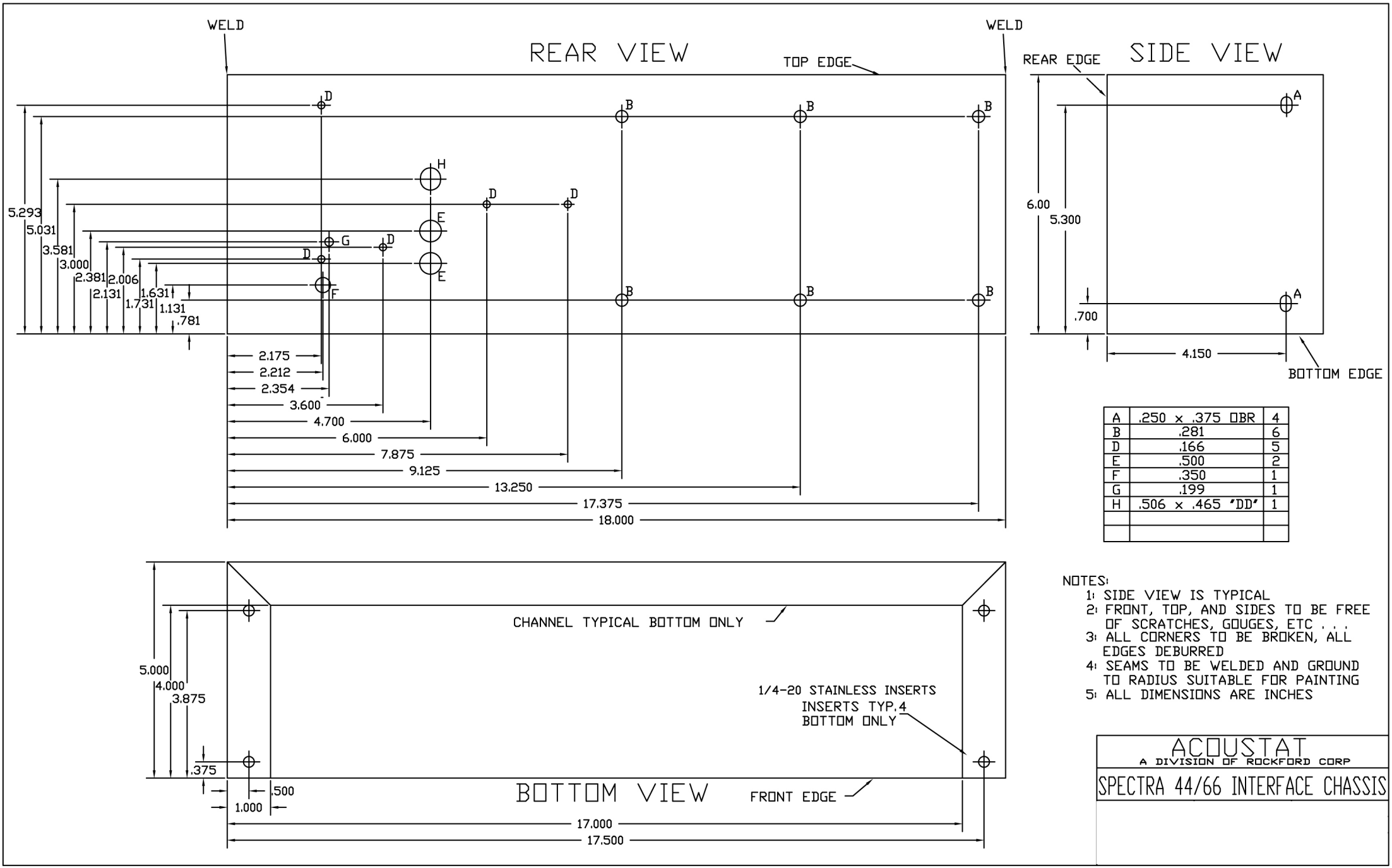


COMPONENT SIDE

ACOUSTAT
A DIVISION OF ROCKFORD CORPORATION

4400/6600 PC LAYOUT

ANY TECHNICAL QUESTIONS REGARDING THIS PRINT SHOULD BE REFERRED TO ANDY SZABO (602)967-3565 EXT. 3036



A	.250 x .375 OBR	4
B	.281	6
D	.166	5
E	.500	2
F	.350	1
G	.199	1
H	.506 x .465 "DD"	1

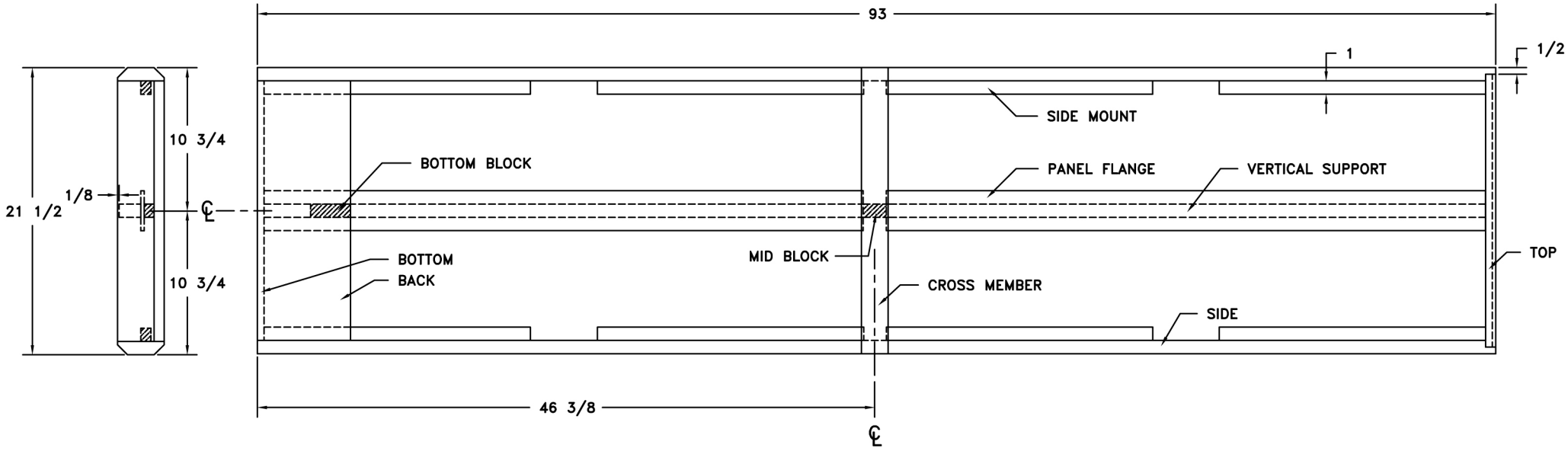
NOTES:
1. SIDE VIEW IS TYPICAL
2. FRONT, TOP, AND SIDES TO BE FREE OF SCRATCHES, GOUGES, ETC . . .
3. ALL CORNERS TO BE BROKEN, ALL EDGES DEBURRED
4. SEAMS TO BE WELDED AND GROUND TO RADIUS SUITABLE FOR PAINTING
5. ALL DIMENSIONS ARE INCHES

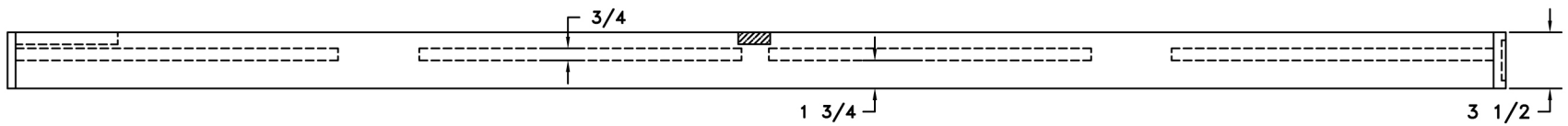
ACOUSTAT
A DIVISION OF ROCKFORD CORP

SPECTRA 44/66 INTERFACE CHASSIS

NOTES:

1. ALL DIMENSIONS ARE INCHES
2. MATERIAL... 1"MDF: SIDES, VERTICAL SUPPORTS, BLOCKS
   3/4" MDF: BACK, TOP, CROSSMEMBER
   1/2" 9-PLY: BOTTOM
   1/4" LUAN: PANEL FLANGES
   ALDER: SIDE MOUNTS



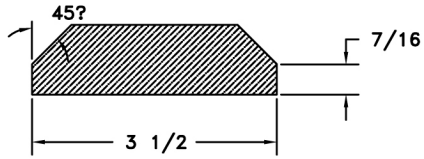


ACOUSTAT
A DIVISION OF ROCKFORD CORPORATION

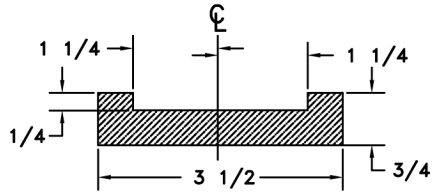
4400 FRAME

ANY TECHNICAL QUESTIONS REGARDING THIS PRINT SHOULD BE REFERRED TO ANDY SZABO (602)967-3565 EXT. 3036

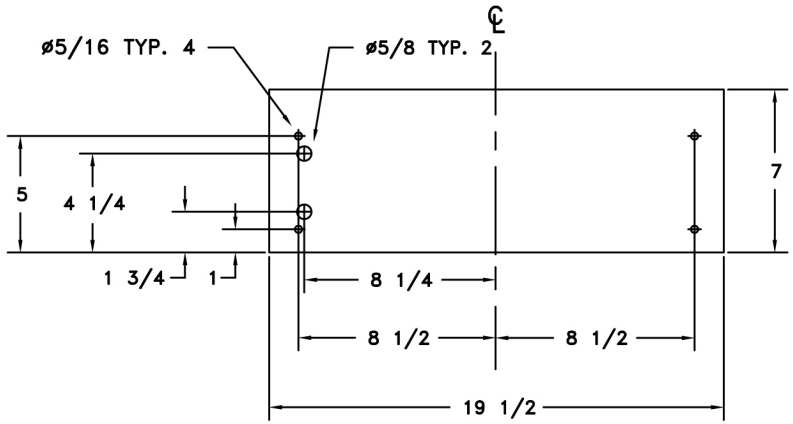
PART	QUANTITY	DIMENSIONS	COMMENTS
TOP	1	20 1/2 x 3 1/2 x 3/4	SEE DETAIL
SIDE	2	93 x 3 1/2 x 1	SEE DETAIL
BOTTOM	1	19 1/2 x 2 3/4 x 1/2	
BACK	1	19 1/2 x 7 x 3/4	SEE DETAIL
CROSSMEMBER	1	21 1/2 x 2 x 3/4	
MID BLOCKS	1	1 1/2 x 1 x 1	
BOTTOM BLOCKS	1	3 x 1 x 3/4	
PANEL FLANGES	2	3 x 45 x 1/4	W/T-NUTS
SIDE MOUNTS	8	1 x 3/4 x 20	
VERTICAL SUPPORT	1	91 3/4 x 1 5/8 x 1	



SIDE: CROSS SECTION
SCALE: FULL



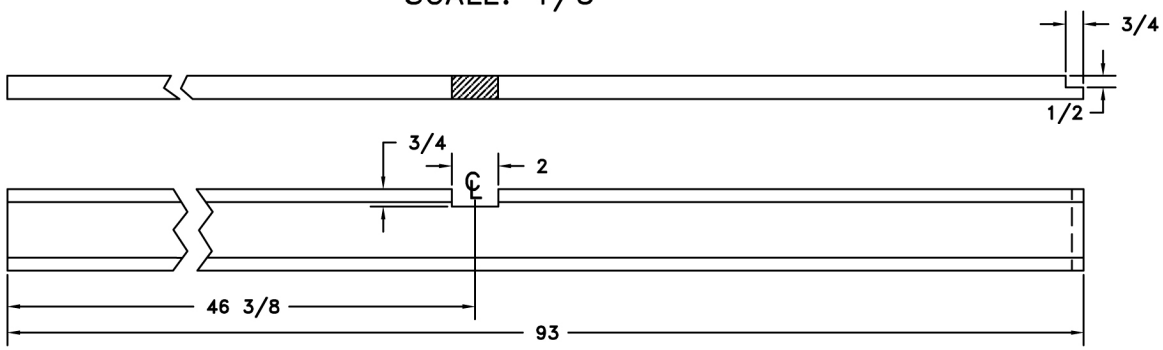
TOP: CROSS SECTION
SCALE: FULL



BACK DETAIL
SCALE: 1/3

INSTALL 1/4"-20 X 9/16" 6-PRONG T-NUTS
FROM INSIDE OF 5/16" HOLES

SIDE DETAIL
SCALE: 1/3



ACOUSTAT
A DIVISION OF ROCKFORD CORPORATION

4400 FRAME DETAILS

ANY TECHNICAL QUESTIONS REGARDING THIS PRINT SHOULD BE REFERRED TO ANDY SZABO (602)967-3565 EXT. 3036

NOTES:

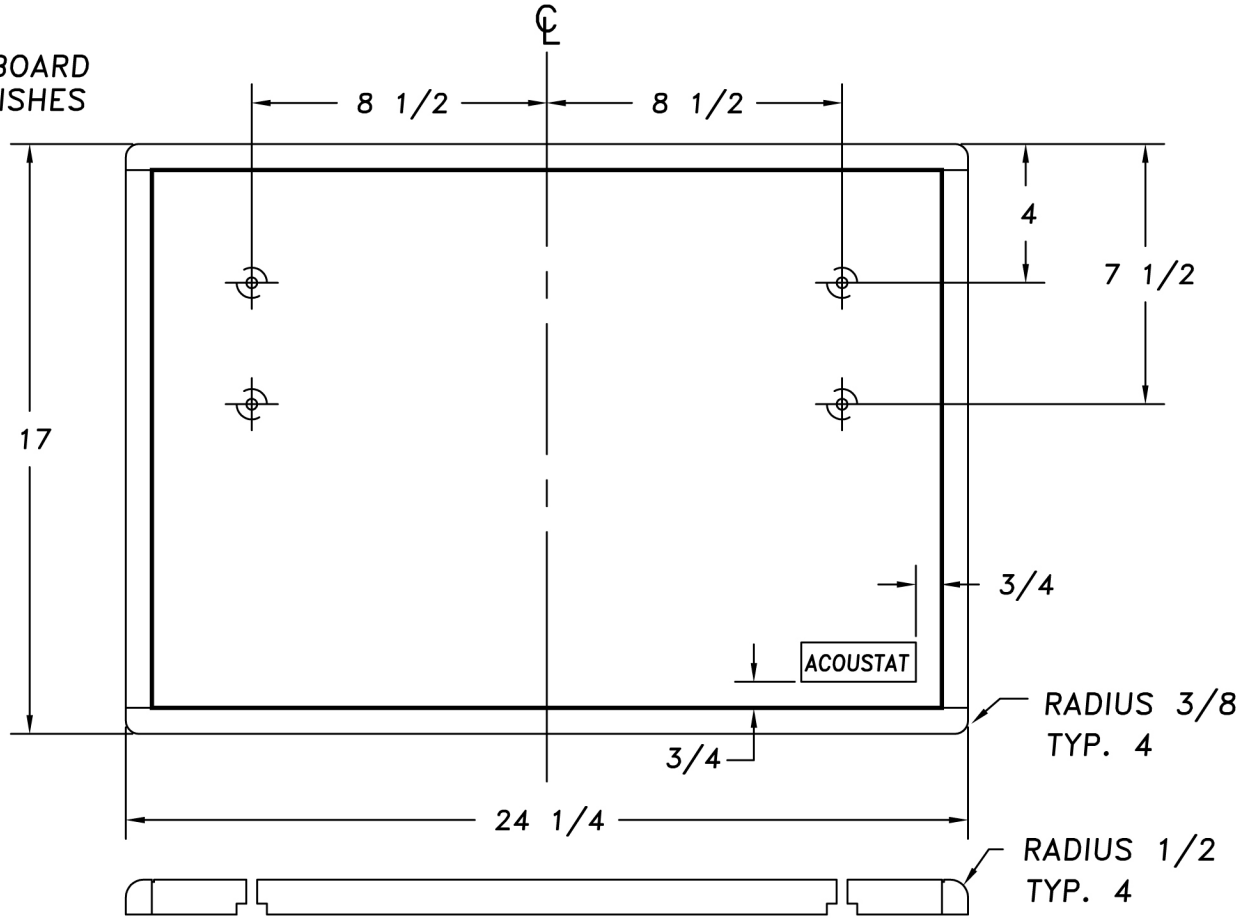
1. ALL DIMENSIONS INCHES

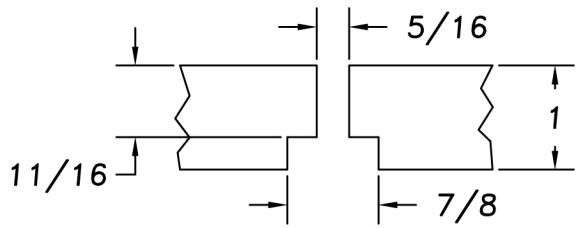
2. MATERIAL: OAK VENEER PARTICLE BOARD
   SOLID OAK BANDING, VARIOUS FINISHES

3. PART NUMBER SUFFIX:
   X= BSD– DARK OAK
      BSL– LIGHT OAK
      BSBL– BLACK OAK

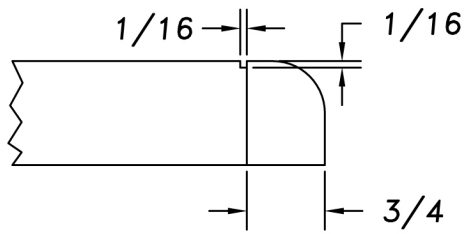
REVISIONS:

6/12/90 CHANGED 14 DEPTH TO 17
ADDED LOGO POSITION





COUNTERBORE DETAIL

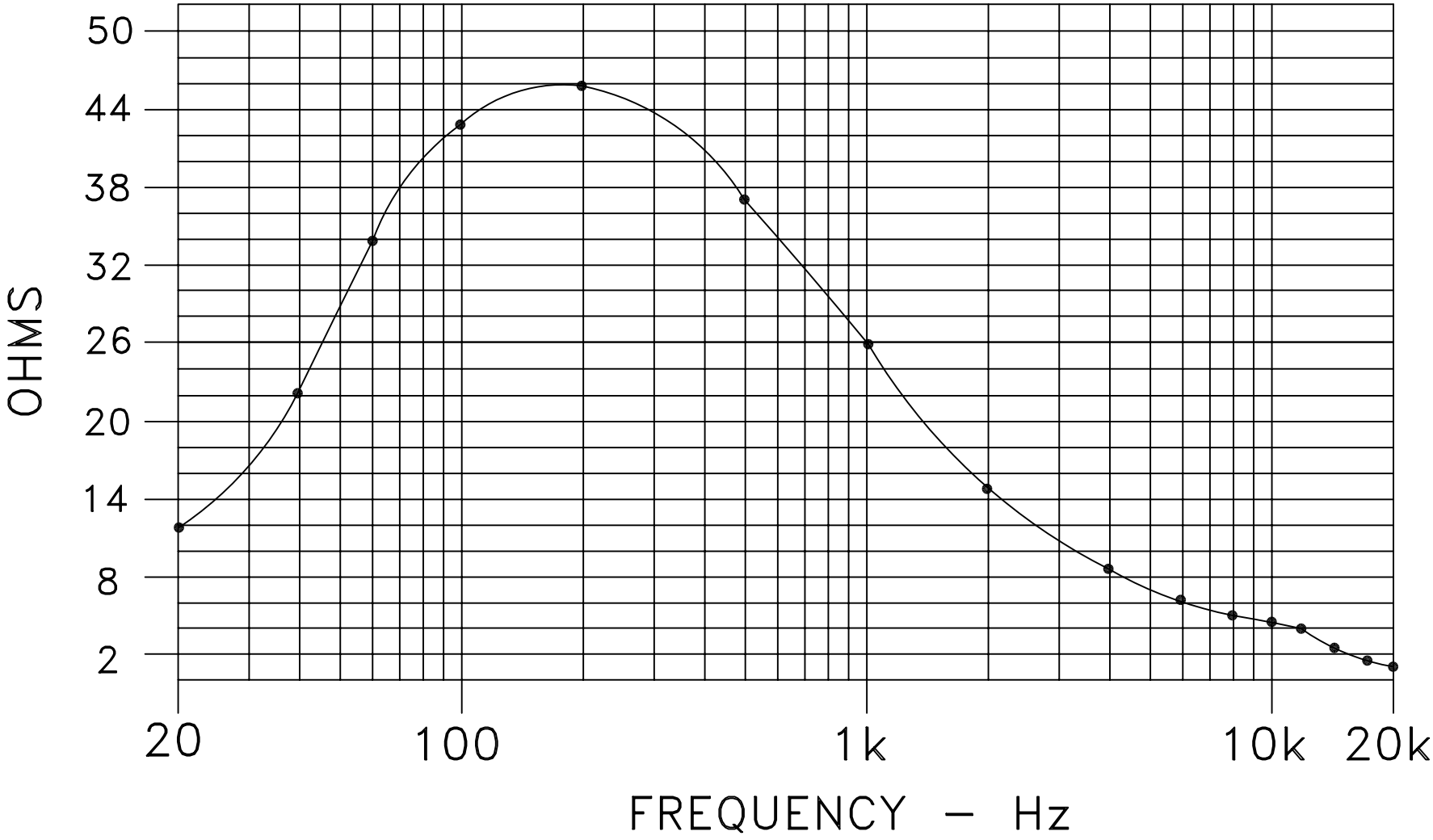


EDGE DETAIL

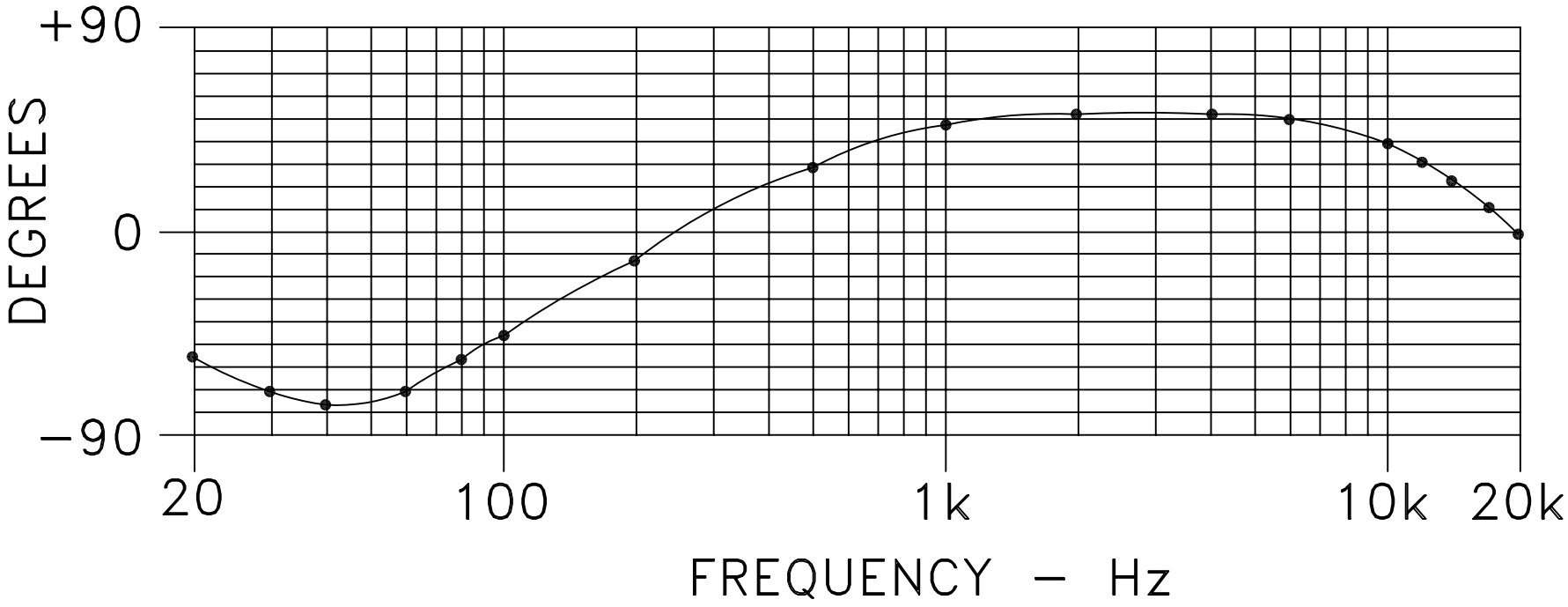
ACOUSTAT
A DIVISION OF ROCKFORD CORP

4400 WOOD BASE

IMPEDANCE PLOT
SPECTRA 6600



PHASE SHIFT PLOT
SPECTRA 6600



NOTES: UNLESS OTHERWISE SPECIFIED

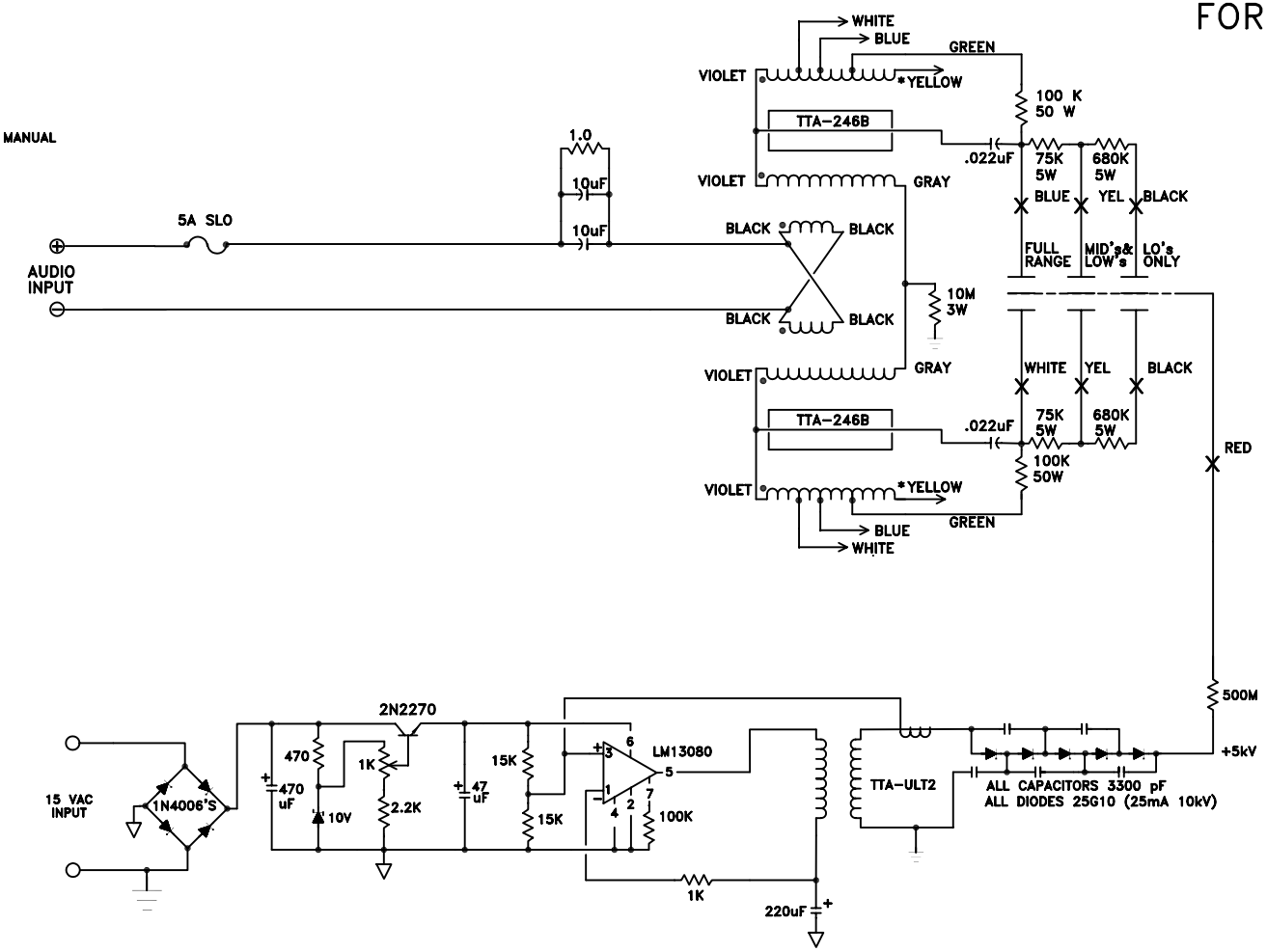
1: ALL RESISTORS ARE OHMS

2: = LOW VOLTAGE GROUND

3: = HIGH VOLTAGE GROUND

4: * = TRANSFORMER TAP
GREEN FOR SPECTRA 4400
WHITE FOR SPECTRA 6600
BLUE/YELLOW = SEE OWNERS MANUAL

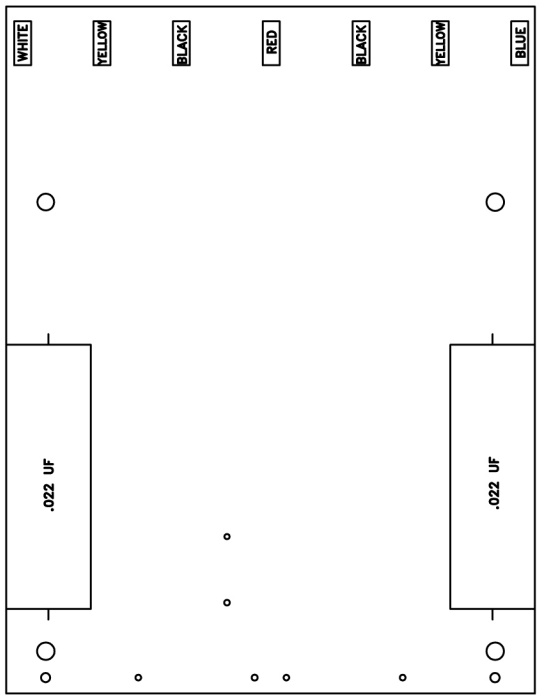
MK-2146
MAGNE-KINETIC INTERFACE
FOR SPECTRA 4400/6600



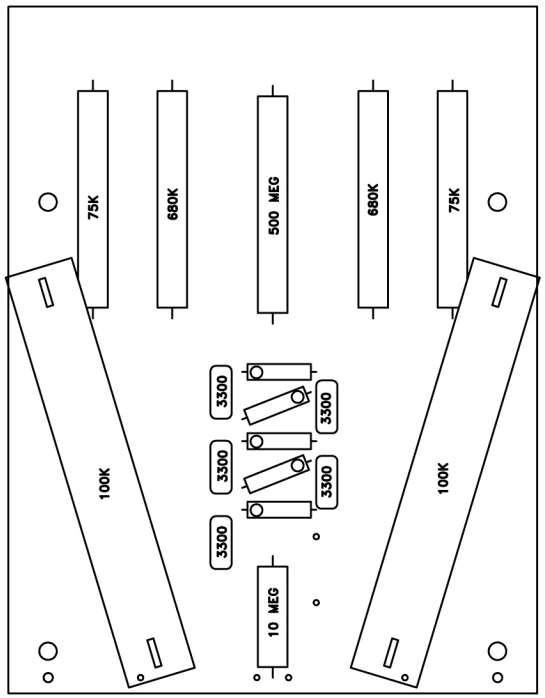
REVISIONS:

1. 5/29/91: UPDATED BIAS SUPPLY

ACOUSTAT
A DIVISION OF ROCKFORD CORP.
TEMPE, AZ., 85281, USA



SOLDER SIDE

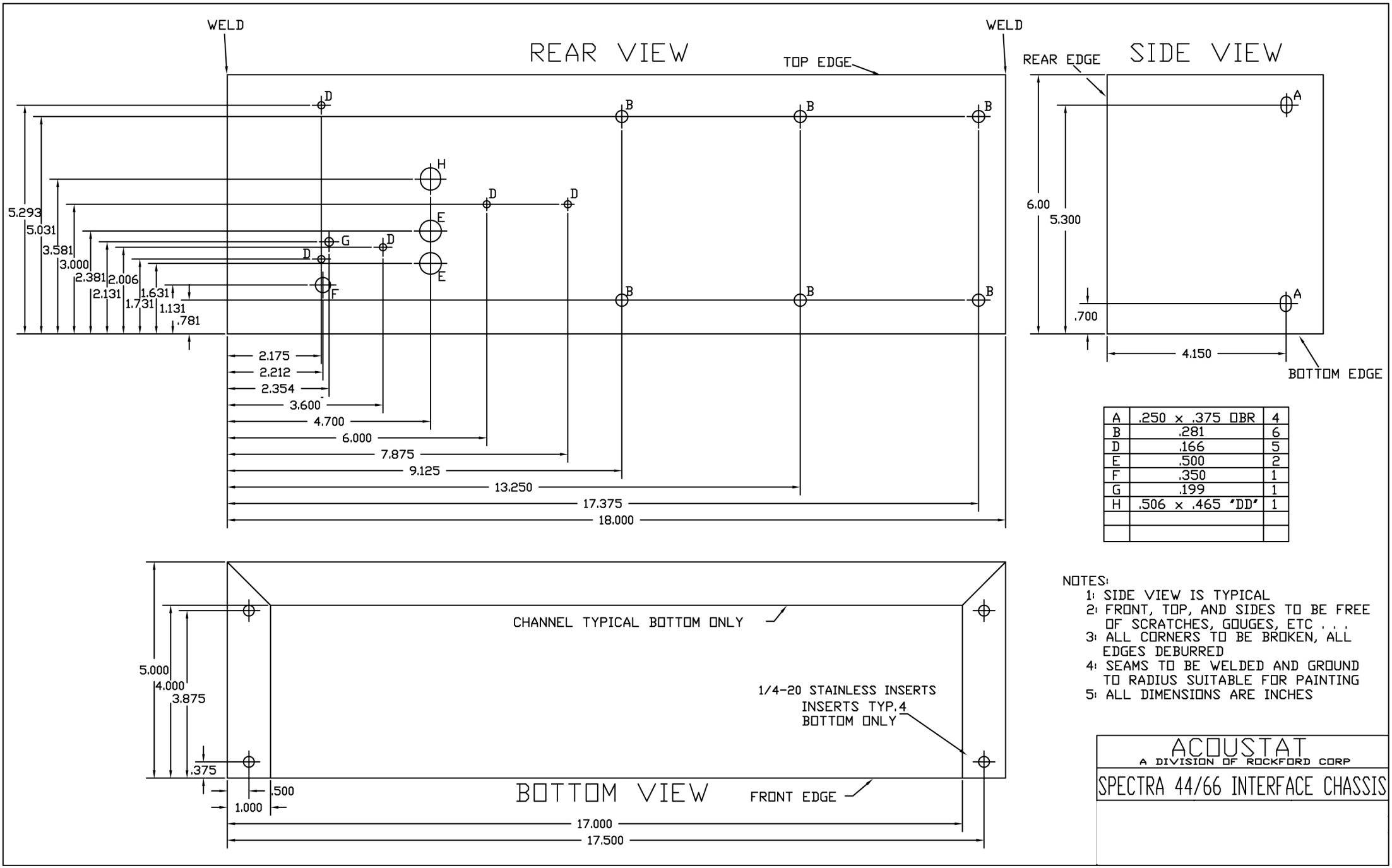


COMPONENT SIDE

ACOUSTAT
A DIVISION OF ROCKFORD CORPORATION

4400/6600 PC LAYOUT

ANY TECHNICAL QUESTIONS REGARDING THIS PRINT SHOULD BE REFERRED TO ANDY SZABO (602)967-3565 EXT. 3036



A	.250 x .375 OBR	4
B	.281	6
D	.166	5
E	.500	2
F	.350	1
G	.199	1
H	.506 x .465 "DD"	1

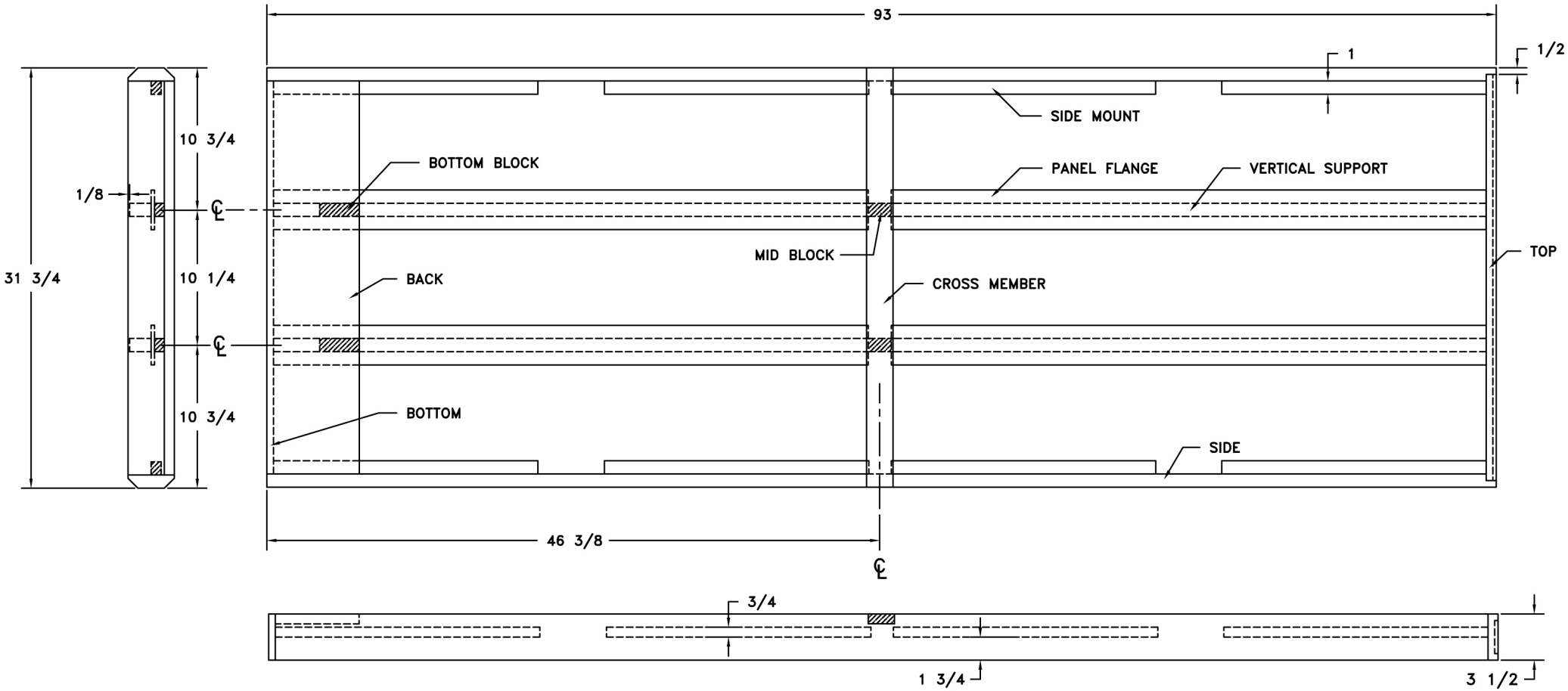
NOTES:
1. SIDE VIEW IS TYPICAL
2. FRONT, TOP, AND SIDES TO BE FREE OF SCRATCHES, GOUGES, ETC . . .
3. ALL CORNERS TO BE BROKEN, ALL EDGES DEBURRED
4. SEAMS TO BE WELDED AND GROUND TO RADIUS SUITABLE FOR PAINTING
5. ALL DIMENSIONS ARE INCHES

ACOUSTAT
A DIVISION OF ROCKFORD CORP

SPECTRA 44/66 INTERFACE CHASSIS

NOTES:

1. ALL DIMENSIONS ARE INCHES
2. MATERIAL... 1"MDF: SIDES, VERTICAL SUPPORTS, BLOCKS
   3/4" MDF: BACK, TOP, CROSSMEMBER
   1/2" 9-PLY: BOTTOM
   1/4" LUAN: PANEL FLANGES
   ALDER: SIDE MOUNTS

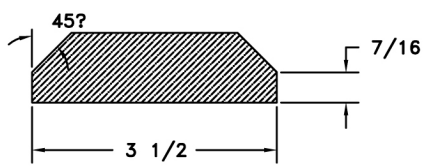


ACOUSTAT
A DIVISION OF ROCKFORD CORPORATION

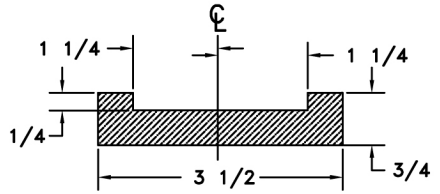
6600 FRAME

ANY TECHNICAL QUESTIONS REGARDING THIS PRINT SHOULD BE REFERRED TO ANDY SZABO (602)967-3565 EXT. 3036

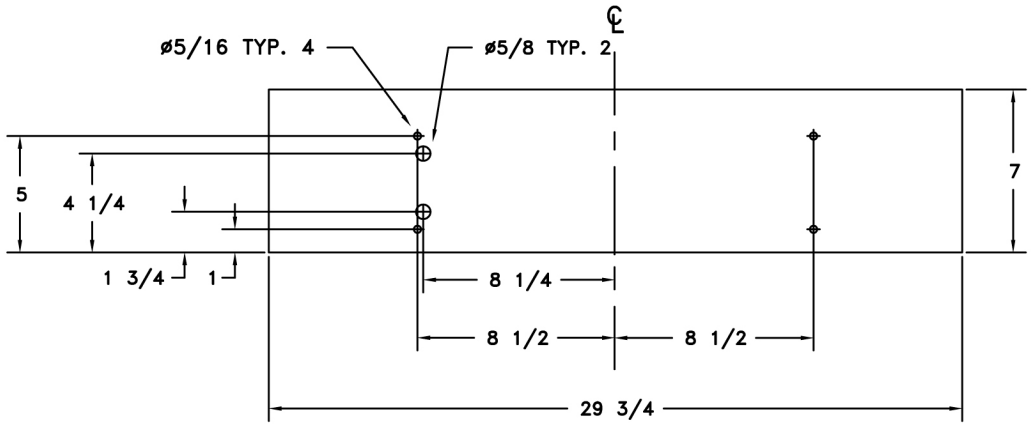
PART	QUANTITY	DIMENSIONS	COMMENTS
TOP	1	30 3/4 x 3 1/2 x 3/4	SEE DETAIL
SIDE	2	93 x 3 1/2 x 1	SEE DETAIL
BOTTOM	1	29 3/4 x 2 3/4 x 1/2	
BACK	1	29 3/4 x 7 x 3/4	SEE DETAIL
CROSSMEMBER	1	31 3/4 x 2 x 3/4	
MID BLOCKS	2	1 1/2 x 1 x 1	
BOTTOM BLOCKS	2	3 x 1 x 3/4	
PANEL FLANGES	4	3 x 45 x 1/4	W/T-NUTS
SIDE MOUNTS	8	1 x 3/4 x 20	
VERTICAL SUPPORT	2	91 3/4 x 1 5/8 x 1	



SIDE: CROSS SECTION
SCALE: FULL



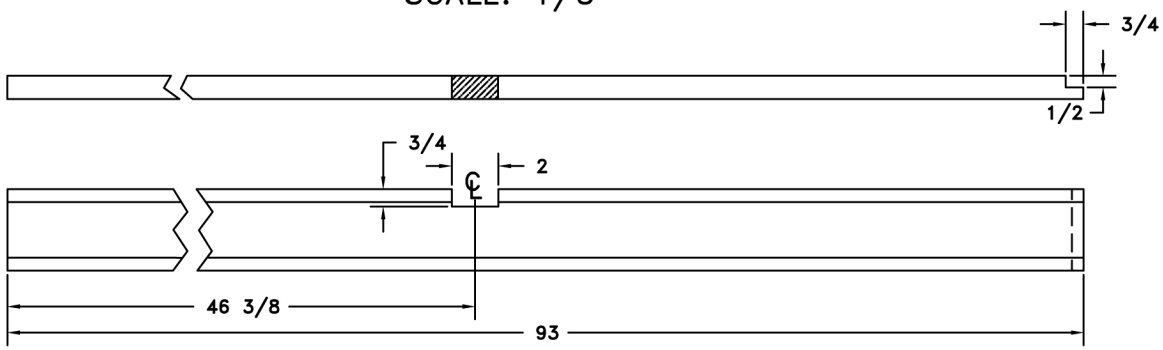
TOP: CROSS SECTION
SCALE: FULL



BACK DETAIL
SCALE: 1/3

INSTALL 1/4"-20 X 9/16" 6-PRONG T-NUTS
FROM INSIDE OF 5/16" HOLES

SIDE DETAIL
SCALE: 1/3



ACOUSTAT
A DIVISION OF ROCKFORD CORPORATION

6600 FRAME DETAILS

ANY TECHNICAL QUESTIONS REGARDING THIS PRINT SHOULD BE REFERRED TO ANDY SZABO (602)967-3565 EXT. 3036

NOTES:

1. ALL DIMENSIONS INCHES

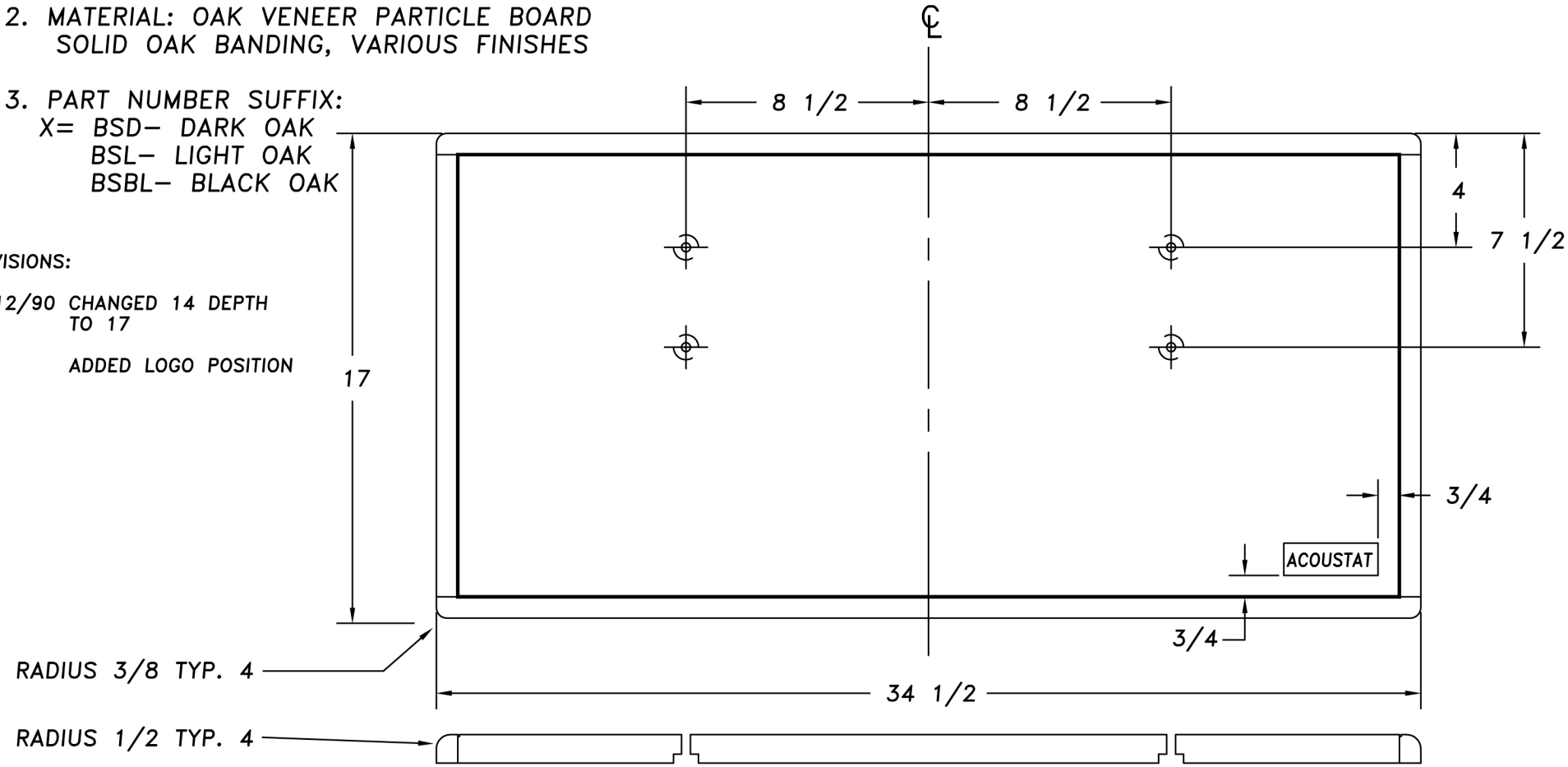
2. MATERIAL: OAK VENEER PARTICLE BOARD
   SOLID OAK BANDING, VARIOUS FINISHES

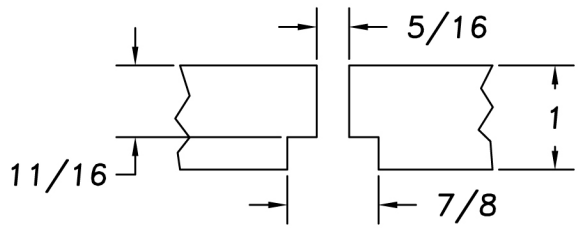
3. PART NUMBER SUFFIX:
   X= BSD– DARK OAK
   BSL– LIGHT OAK
   BSBL– BLACK OAK

REVISIONS:

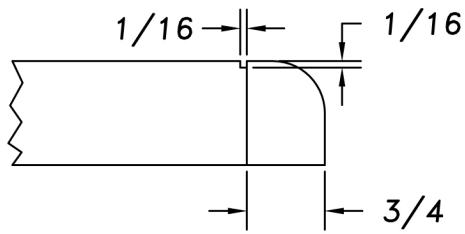
6/12/90 CHANGED 14 DEPTH
TO 17

ADDED LOGO POSITION





COUNTERBORE DETAIL



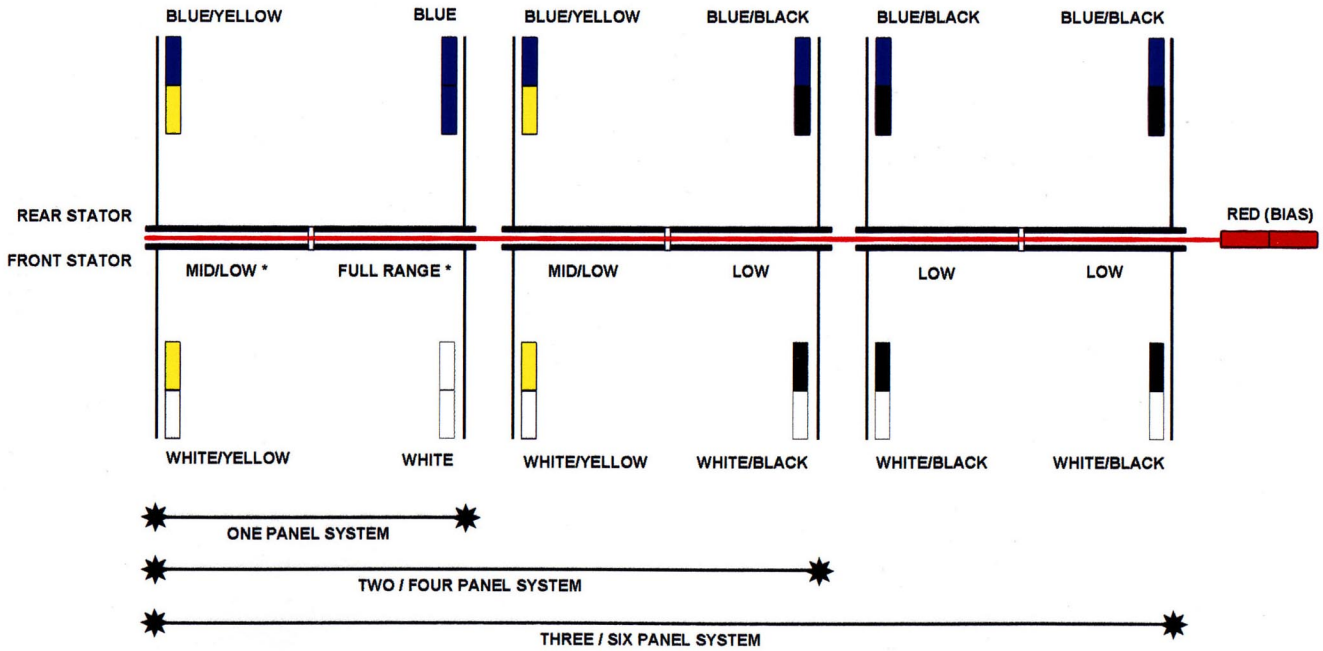
EDGE DETAIL

ACOUSTAT
A DIVISION OF ROCKFORD CORP

6600 WOOD BASE

ACOUSTAT SPECTRA SERIES
SECTOR FREQUENCY ASSIGNMENTS & WIRING COLOR CODES

RIGHT SPEAKER SHOWN
LEFT SPEAKER MIRROR IMAGE



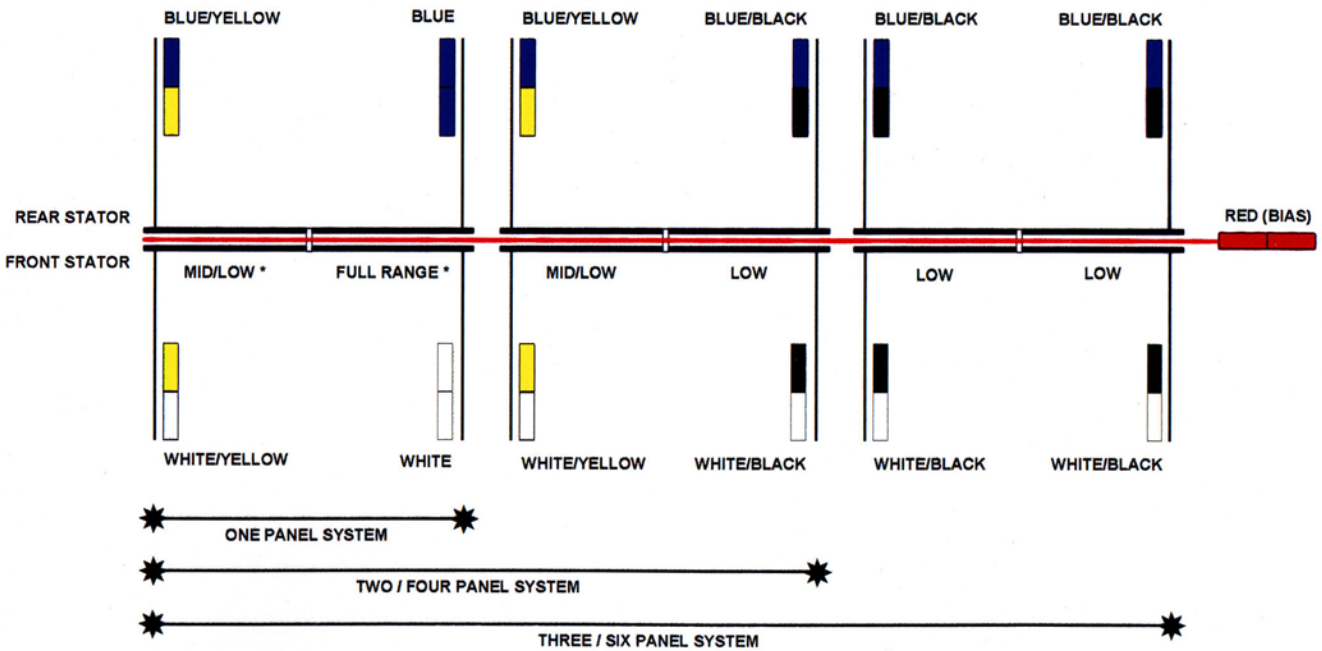
(*) ROLLED-OFF BELOW ~150 Hz FOR ONE PANEL SYSTEMS
ONE PANEL: SPECTRA 11, 1100
TWO PANEL: SPECTRA 2, 22, 2200
THREE PANEL: SPECTRA 3, 33, 3300
FOUR PANEL: SPECTRA 44, 4400
SIX PANEL: SPECTRA 66, 6600

ALL AREA DRIVEN AT LOW FREQUENCIES
PARTIAL AREA DRIVEN AT MID FREQUENCIES
NARROW AREA DRIVEN AT HIGH FREQUENCIES

AJS 3-05-03
FILE: SPECTRA.SIG

ACOUSTAT SPECTRA SERIES
SECTOR FREQUENCY ASSIGNMENTS & WIRING COLOR CODES

RIGHT SPEAKER SHOWN
LEFT SPEAKER MIRROR IMAGE



(*) ROLLED-OFF BELOW ~150 Hz FOR ONE PANEL SYSTEMS

ONE PANEL: SPECTRA 11, 1100

TWO PANEL: SPECTRA 2, 22, 2200

THREE PANEL: SPECTRA 3, 33, 3300

FOUR PANEL: SPECTRA 44, 4400

SIX PANEL: SPECTRA 66, 6600

ALL AREA DRIVEN AT LOW FREQUENCIES

PARTIAL AREA DRIVEN AT MID FREQUENCIES

NARROW AREA DRIVEN AT HIGH FREQUENCIES

AJS 3-05-03

FILE: SPECTRA.SIG

ACOUSTAT

22

33

SW

SPECTRA

SPECTRA

■ Sound waves vary from about 55 feet long at 20 Hz to about ⅔ of an inch long at 20 kHz. It is for this reason that no speaker using constant area (curved, angled, or flat) for all frequencies can be optimum over this 1000:1 variation in wavelength.

■ A breakthrough in understanding the rules of the electrostat's drive transformer (interface), suggested a possible "variable area" solution—while still satisfying Acoustat's demand for efficiency and low end response. The result: the MK 2100 series interface allows us to implement a variable geometry electrostat changing its effective width as a function of frequency. Our success is the Symmetric Pair Electrically Curved Transducer (Spectra).

■ Spectra has wide, pleasant dispersion at all frequencies. Each speaker of the mirror image pair contains a narrow line source sector operating at all frequencies (bass, midrange, high). Adjacent sectors handle midrange and low frequencies. The remaining panel area reproduces bass only. The result is a speaker that uses the full area for maximum bass impact, and progressively narrower areas as frequency increases, for maximum dispersion and natural imaging.

■ Spectra is devoid of the midrange beaming and high frequency smearing of common planar speakers using large, constant area, curved or angled radiators.

DYNAMIC FREEDOM

■ As a full range electrostat, Spectra 33 can be driven 2-3 dB harder at low frequencies than Spectra 22. However, some present day source material will tax

the most capable of speakers, regardless of driving principle. Spectra 22 and particularly the 33 will handle all or most of the source material you care to listen to—*as a full range electrostat.*

■ An electrostat's high intimacy of drive can occasionally lead to ionization of the air between its elements, on heavy, deep bass material, resulting in restricted dynamics. The addition of Spectra Passive Woofer 1 below 100 Hz can extend both panel performance and total system dynamics by 8 dB or more!

■ Spectra 22 and 33 have a switch on the back of each interface, cutting in a 100 Hz crossover function before the electrostat and also activating a (full range) sub-woofer feed.

SPECTRA PASSIVE WOOFER 1 (SPW-1)

■ SPW-1 utilizes four 6.5" side firing woofers (2 per channel) in a ported enclosure. It contains its own 100 Hz crossover unit, fuses and a switch allowing optional bi-amplification with electronic crossovers. Removable spike feet minimize room interaction.

■ The Spectra family of loudspeakers is available in a variety of matching veneers and grille sock colors.

THE EXPERIENCE

■ The uniqueness of Spectra is its ability to combine high dynamics and needed efficiency, while creating radiation patterns broad in the listening area but minimal at the side walls.

■ Most important of all, listening tells us that our "variable area" solution is absolutely correct. We eagerly await your listening evaluation of this new chapter in loudspeaker history.

SPECTRA

22

33

SW

■ The electrostatic method of sound recreation has been the reference standard for accuracy in loudspeakers for over a quarter century. Their advantages over other transducers arise from two basic premises: 1) The radiating surface is extra-ordinarily low in mass. 2) The entire surface is driven by a uniform field. Magnetic methods of drive (planar or cone) do not yield the control, linearity or uniformity-of-force provided naturally by the electrostatic method.

■ Over the last 20 years, Acoustat's chief engineer, James C. Strickland, has perfected this technology and many of his breakthroughs are directly responsible for the current state of the art: 1) Virtually indestructible full range panels. 2) Invention of the Magne-Kinetic (MK) Transformer Interface (US Pat. 4323736) allowing the use of any high-quality amplifier with electrostatic speakers. 3) Development of variable area Spectra series.

■ Acoustat's quest for sonic accuracy represents the spirit of an industry. We invite you to experience Acoustat—then share our excitement.

SPECTRA 22/33 SPECIFICATIONS

GENERAL
Nominal impedance: 4 ohms
Recommended amplifier power: 100 W/ch or greater
Bias supply power consumption: Less than 5 watts

COMMON DIMENSIONS
Array depth: 2⅛"
Base depth: 17"
Base height: 1"
Overall height: 66"
MK-2123 interface: 5" deep, 6" high, 18" wide

SPECTRA 22 WIDTHS
Array: 21½," base: 23"

SPECTRA 33 WIDTHS
Array: 31¾," base: 33¼"

STANDARD GRILLE CLOTH
Black, gray or beige

STANDARD BASE FINISH
Dark oak

OPTIONAL BASE FINISHES
Natural oak, black oak @ additional cost

ARRAY TILT-BACK ADJUSTMENT
0 to 5 degrees

BUILT-IN CROSSOVER
100 Hz high-pass, switch selectable—switch simultaneously activates full range unfused, sub-woofer feed jacks

WARRANTY
We are proud to offer this unique warranty due to the virtual indestructible nature of Acoustat panels:
Acoustat guarantees our electrostatic panels against defective materials and workmanship for the life of the product. The electronic components contained in the interface are warranted against defective materials and workmanship for a period of ten years from the original date of purchase.
See complete warranty statement for details.

SPECTRA PASSIVE WOOFER 1

GENERAL
Nominal impedance: 12 ohms

RECOMMENDED AMPLIFIER POWER:
100 W/ch or greater

DIMENSIONS:
Width 23"
Depth 17"
Height 18¾"
Height 20" including the provided spike feet

WARRANTY
Acoustat guarantees against defective materials and workmanship for 5 years from the original date of purchase.

ACOUSTAT
Rockford Corporation
613 S. Rockford Dr.
Tempe, AZ 85281
602-967-3565

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RETAIL PRICE LIST

4•1•88

ACOUSTAT

RETAIL

SPECTRA SERIES 22 / 33

SPECTRA 22 - Two panel variable width array	$1,850
SPECTRA 33 - Three panel variable width array	2,250
Standard Finish: dark oak CWD base, beige or black cloth	
Optional Base Finishes: light oak or black oak	$ 75

SPECTRA SERIES 2 / 3

SPECTRA 2 - Two panel variable width array with woofer	$2,795
SPECTRA 3 - Three panel variable width array with woofer	2,995
Standard Finish: teak or black tambour base, beige or black cloth	
Optional Tambour Finishes: consult factory for colors and price.	

MEDALLION SERIES

ONE - Single panel with subwoofer	$1,299
ONE + ONE - Two panel vertical line source	1,750
THREE - Three panel curved array	2,199
TWO + TWO - Four panel vertical array	2,599
SIX*- Six panel vertical array	4,500
EIGHT*- Eight panel vertical array	5,500
Standard Finish: teak base, beige or black cloth	
Optional Base Finishes: walnut, oak, rosewood, gloss black	$ 75

*one stereo amplifier per channel is recommended

All speakers priced per pair.

A Division of

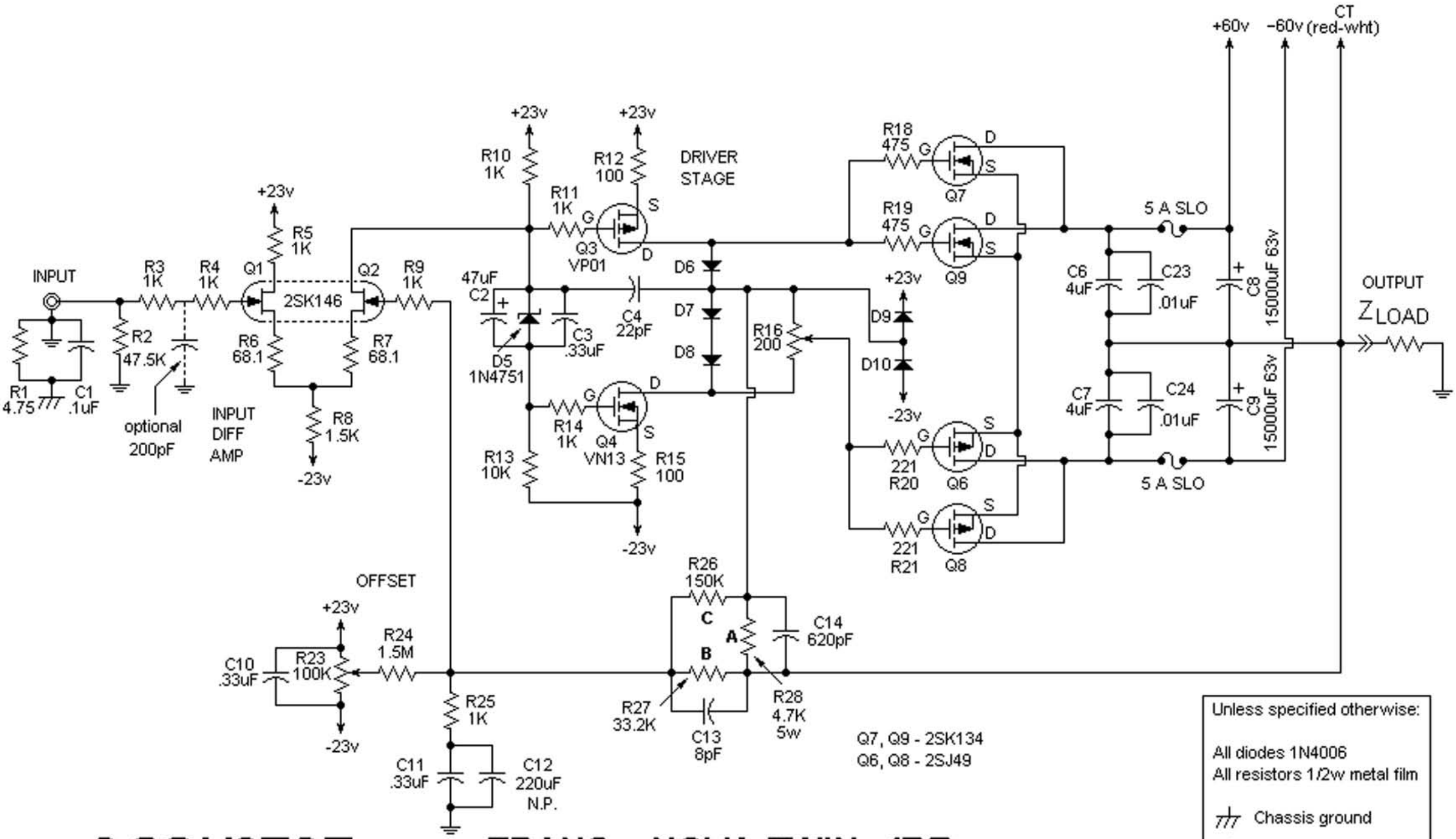
Rockford Corporation

613 S. Rockford Drive

Tempe, AZ, 85281

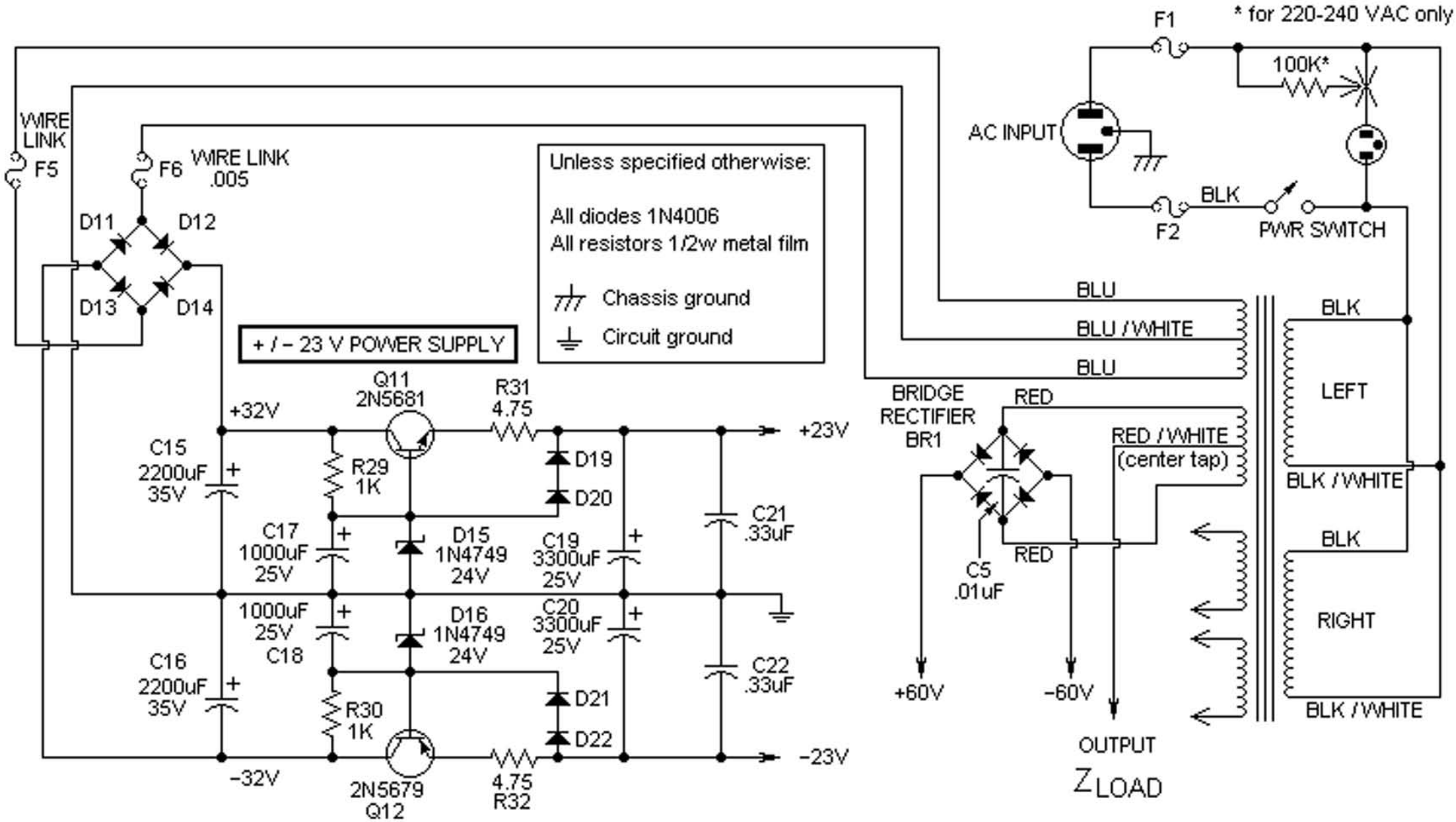
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ACOUSTAT



ACOUSTAT

TRANS - NOVA TWIN 120



ACOUSTAT

TRANS - NOVA TWIN 120

ACOUSTAT® SINCE 1962 · ITALY

Series TNT200

USER GUIDE



Thank you for your purchasing our Woofer.

Our product is the one of advanced science and technology, which can bring you wonderful and perfect prolong audio entertainments.

To optimize its functions while you operating the unit and for your safety, you should read attentively this manual and retain the manual for future reference.

All the packing materials should be reserved for reusing if the unit needs sending to the maintenance shop in the future. You should also please fill in the table below, which is helpful also if the unit needs maintaining in the future.

TNT200 Woofer	
Purchasing date:	Intaller:
Unit No.:	Distributor's No.:
Setting up date:	Distributor's add.:

Brief introduction

ACOUSTAT TNT200 is an originate passive Sub-woofer specially designed for AC-3/DTS Digital Theatre, which can fully satisfy the need of reproduction of quality ultra low acoustic frequency in Hi-Fi and Home Theatre. It adopts ACOUSTAT exclusive composite metal cone and special 8'f0 professional sub-woofer plastic edge unit, along with powerful linear magnetic circuit structure, with the features of long linear stroke, clear reproduction effect, vigorous ultra low frequency with abundant sub-woofing sense, avoiding the disadvantages of unclear, fuss, bad sense of gradation, messy, building up solid and accurate acoustic field, living up to the extreme requirement of sub-woofer by Hi-Fi fans, and it is applicable both in Home Theatre and Hi-fi appreciation. Along with the hi-tech HI-FI design by ACOUSTAT'f0 s electro-acoustic expert, you may casually experience the unprecedented vigor of power.

System: TNT200 Woofer	
Impedance: 8Ω	Power: 100W
Frequency range: 32Hz~250Hz	Sensitivity: 85dB/m/w

Connection Layout

1、Firstly, turn off the general power switch of the amplifier.

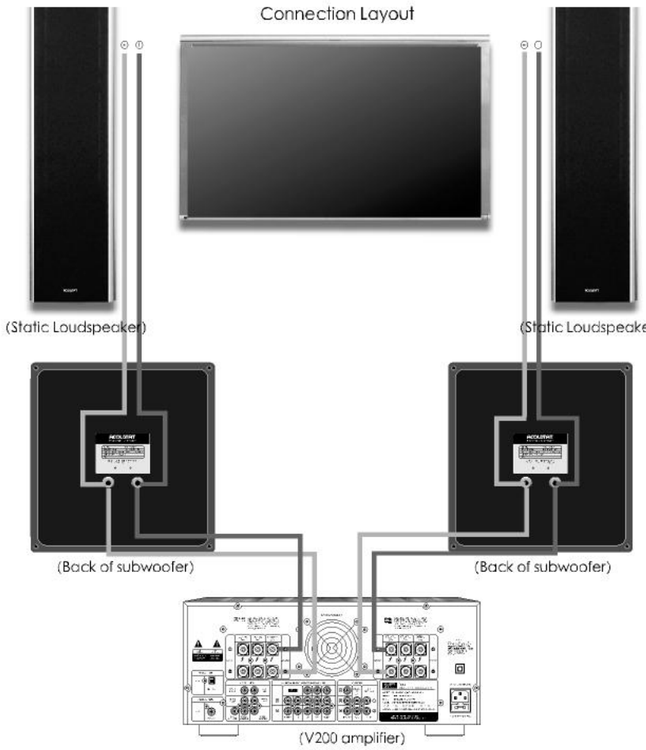
2、Take out the accessory speaker connection wires with care

3、Connect the speaker wires between the positive and negative poles of the amplifier and TNT200 Woofer respectively.

4、Connect the wires of the static speakers to the positive and negative output poles in TNT200 Woofer.

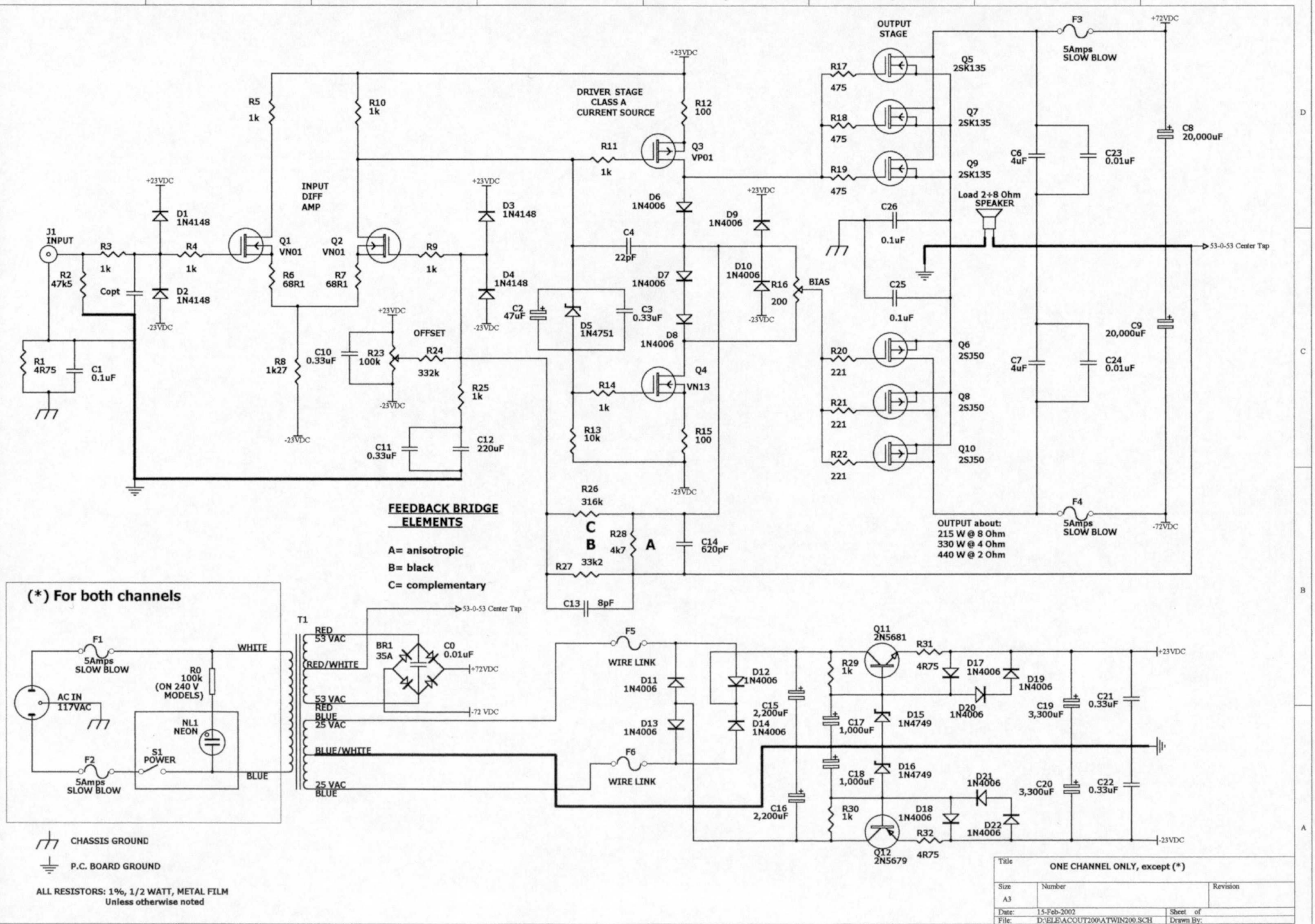


TNT200 Woofer



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ACOUSTAT®
SINCE 1962 · ITALY WWW.ACOUSTAT.COM.CN


OUTPUT STAGE
DRIVER STAGE CLASS A CURRENT SOURCE
INPUT DIFF AMP
OFFSET
BIAS
Load 2÷8 Ohm SPEAKER
53-0-53 Center Tap
+23VDC
-23VDC
+72VDC
-72VDC
J1 INPUT
R1 4R75
R2 47k5
R3 1k
R4 1k
Copt
C1 0.1uF
D1 1N4148
D2 1N4148
D3 1N4148
D4 1N4148
Q1 VN01
Q2 VN01
R5 1k
R6 68R1
R7 68R1
R8 1k27
R9 1k
R10 1k
C2 47uF
C3 0.33uF
D5 1N4751
C10 0.33uF
R23 100k
R24 332k
R25 1k
C11 0.33uF
C12 220uF
R11 1k
Q3 VP01
R12 100
R13 10k
R14 1k
Q4 VN13
R15 100
C4 22pF
D6 1N4006
D7 1N4006
D8 1N4006
D9 1N4006
D10 1N4006
R16 200
R17 475
R18 475
R19 475
Q5 2SK135
Q7 2SK135
Q9 2SK135
C6 4uF
C23 0.01uF
C8 20,000uF
C26 0.1uF
C25 0.1uF
R20 221
R21 221
R22 221
Q6 2SJ50
Q8 2SJ50
Q10 2SJ50
C7 4uF
C24 0.01uF
C9 20,000uF
F3 5Amps SLOW BLOW
F4 5Amps SLOW BLOW
R26 316k
R27 33k2
R28 4k7
C13 8pF
C14 620pF
A
B
C
FEEDBACK BRIDGE ELEMENTS
A= anisotropic
B= black
C= complementary
OUTPUT about:
215 W @ 8 Ohm
330 W @ 4 Ohm
440 W @ 2 Ohm
(*) For both channels
F1 5Amps SLOW BLOW
F2 5Amps SLOW BLOW
AC IN 117VAC
R0 100k (ON 240 V MODELS)
NL1 NEON
S1 POWER
WHITE
BLUE
T1
RED 53 VAC
RED/WHITE
53 VAC RED
BLUE 25 VAC
BLUE/WHITE
25 VAC BLUE
BR1 35A
C0 0.01uF
F5 WIRE LINK
F6 WIRE LINK
D11 1N4006
D13 1N4006
D12 1N4006
D14 1N4006
C15 2,200uF
C16 2,200uF
Q11 2N5681
Q12 2N5679
R29 1k
R30 1k
R31 4R75
R32 4R75
D15 1N4749
D16 1N4749
D17 1N4006
D18 1N4006
D19 1N4006
D20 1N4006
D21 1N4006
D22 1N4006
C17 1,000uF
C18 1,000uF
C19 3,300uF
C20 3,300uF
C21 0.33uF
C22 0.33uF
CHASSIS GROUND
P.C. BOARD GROUND
ALL RESISTORS: 1%, 1/2 WATT, METAL FILM
Unless otherwise noted
Title ONE CHANNEL ONLY, except (*)
Size A3
Number
Revision
Date: 15-Feb-2002
Sheet of
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Drawn By:

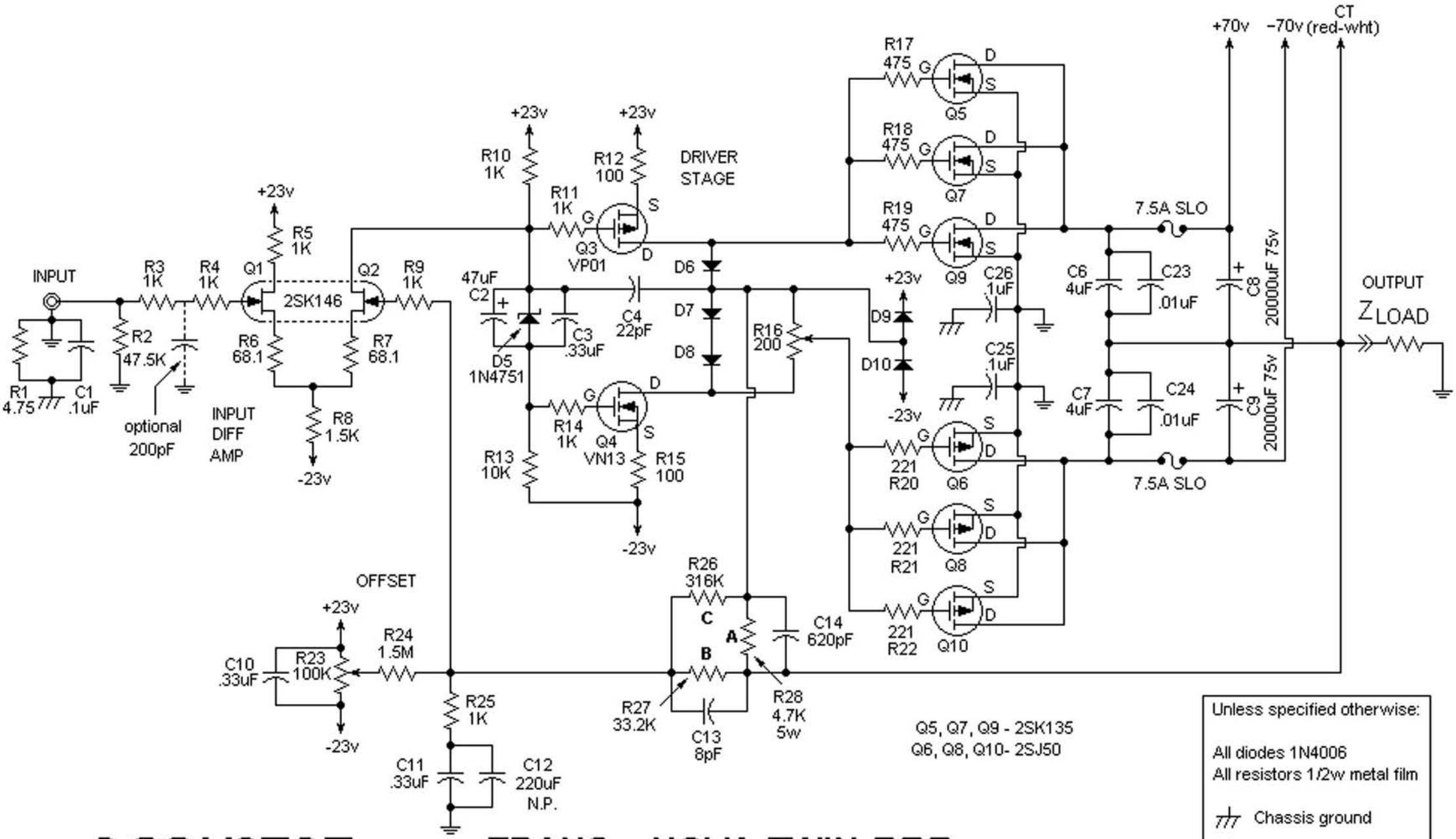
Commercial Solid State Amplifiers
Brand: Acoustat
Spec Sheet: Acoustat Twin 200, Parts list

Capacitors						
Designator	Value	Tolerance	V rated	Material	Manufacturer	Remarks
Copt	200pF	10%		POLYPROPYLENE		Optional capacitor to avoid HF input
C0	0.01uF	10%	250VAC			
C1	0.1uF			CERAMIC DISC		
C2	47uF		35VDC	ELECTROLYTIC		
C3	0.33uF	10%	250VAC	POLYPROPYLENE		
C4	22pF			SILVER MICA		
C5	???					missing in the original schematic or maybe it was C0, but unreadable
C6	4uF	5%	250VAC	POLYPROPILENE		
C7	4uF	5%	250VAC	POLYPROPILENE		
C8	20,000uF		75VDC	ELECTROLYTIC		
C9	20,000uF		75VDC	ELECTROLYTIC		
C10	0.33uF	10%	250VAC	POLYPROPYLENE		
C11	0.33uF	10%	250VAC	POLYPROPYLENE		
C12	220uF		35VDC	NON-POLARIZED		
C13	8pF	+/-1pF	x	SILVER MICA		
C14	620pF	2%	x	POLYSTYRENE		
C15	2,200uF		35VDC	ELECTROLYTIC		
C16	2,200uF		35VDC	ELECTROLYTIC		
C17	1,000uF		25VDC	ELECTROLYTIC		
C18	1,000uF		25VDC	ELECTROLYTIC		
C19	3,300uF		25VDC	ELECTROLYTIC		
C20	3,300uF		25VDC	ELECTROLYTIC		
C21	0.33uF	10%	250VAC	POLYPROPYLENE		
C22	0.33uF	10%	250VAC	POLYPROPYLENE		
C23	0.01uF	10%	250VAC	POLYSTYRENE		
C24	0.01uF	10%	250VAC	POLYSTYRENE		
C25	0.1uF	10%		CERAMIC DISC		
C26	0.1uF	10%		CERAMIC DISC		
Diodes						
Designator	Value	Tolerance	V rated	Material	Manufacturer	Remarks
D1	1N4148			GLASS		
D2	1N4148			GLASS		

D3	1N4148			GLASS		
D4	1N4148			GLASS		
D5	1N4751	30V	DO41	GLASS		
D6	1N4006		DO41	PLASTIC		
D7	1N4006		DO41	PLASTIC		
D8	1N4006		DO41	PLASTIC		
D9	1N4006		DO41	PLASTIC		
D10	1N4006		DO41	PLASTIC		
D11	1N4006		DO41	PLASTIC		
D12	1N4006		DO41	PLASTIC		
D13	1N4006		DO41	PLASTIC		
D14	1N4006		DO41	PLASTIC		
D15	1N4749	24V	DO41	GLASS		
D16	1N4749	24V	DO41	GLASS		
D17	1N4006		DO41	PLASTIC		
D18	1N4006		DO41	PLASTIC		
D19	1N4006		DO41	PLASTIC		
D20	1N4006		DO41	PLASTIC		
D21	1N4006		DO41	PLASTIC		
D22	1N4006		DO41	PLASTIC		
BR1	x	35 A		Diode Bridge		
Transistors						
Designator	Value	Tolerance	V rated	Material	Manufacturer	Remarks
Q1	VN0106		TO39	with heatsink	Supertex	TO39-SUPERSEDED
Q2	VN0106		TO39	with heatsink	Supertex	TO39-SUPERSEDED
Q3	VP0106		TO39	with heatsink	Supertex	TO39-SUPERSEDED
Q4	VN1306		TO39	with heatsink	Supertex	TO39-still available
Q5	2SK135		TO3	on heatsink	Hitachi	Available c/o SEMELAB
Q6	2SJ50		TO3	on heatsink	Hitachi	Available c/o SEMELAB
Q7	2SK135		TO3	on heatsink	Hitachi	Available c/o SEMELAB
Q8	2SJ50		TO3	on heatsink	Hitachi	Available c/o SEMELAB
Q9	2SK135		TO3	on heatsink	Hitachi	Available c/o SEMELAB
Q10	2SJ50		TO3	on heatsink	Hitachi	Available c/o SEMELAB
Q11	2N5681		TO39	with heatsink	Semelab	
Q12	2N5679		TO39	with heatsink	Semelab	
Resistors						
Designator	Value	Tolerance	V rated	Material	Manufacturer	Remarks
R0	100k	5%	RN55	1/2W, Metal film		ON 240 V

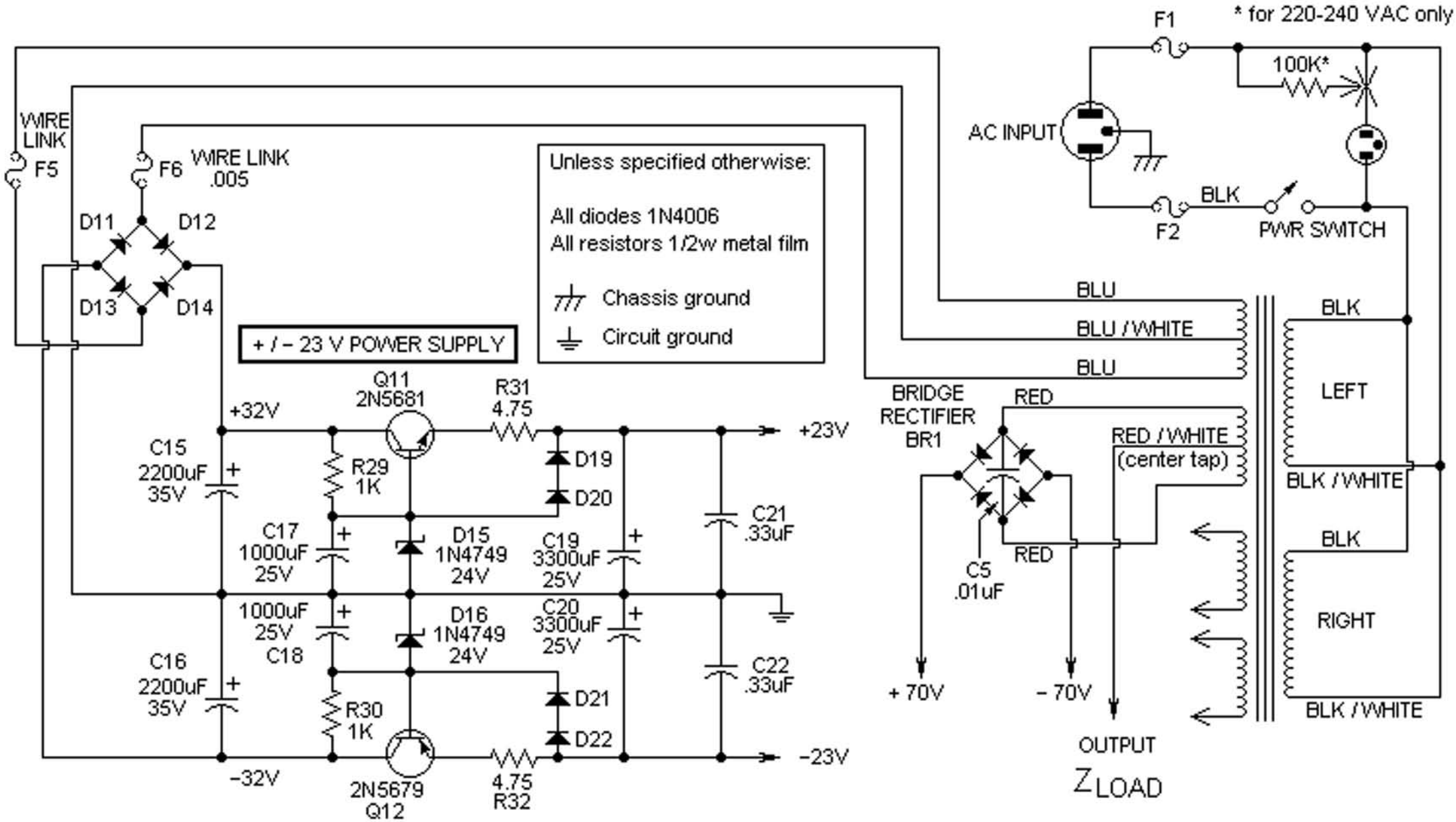
						MODELS
R1	4R75	5%	RN55	1/2W, Metal film		
R2	47k5	1%	RN55	1/2W, Metal film		
R3	1k	1%	RN55	1/2W, Metal film		
R4	1k	1%	RN55	1/2W, Metal film		
R5	1k	1%	RN55	1/2W, Metal film		
R6	68R1	1%	RN55	1/2W, Metal film		
R7	68R1	1%	RN55	1/2W, Metal film		
R8	1k27	1%	RN55	1/2W, Metal film		
R9	1k	1%	RN55	1/2W, Metal film		
R10	1k	1%	RN55	1/2W, Metal film		
R11	1k	1%	RN55	1/2W, Metal film		
R12	100	1%	RN55	1/2W, Metal film		
R13	10k	1%	RN55	1/2W, Metal film		
R14	1k	1%	RN55	1/2W, Metal film		
R15	100	1%	RN55	1/2W, Metal film		
R16	200	10%		BIAS TRIMMER		
R17	475	1%	RN55	1/2W, Metal film		
R18	475	1%	RN55	1/2W, Metal film		
R19	475	1%	RN55	1/2W, Metal film		
R20	221	1%	RN55	1/2W, Metal film		
R21	221	1%	RN55	1/2W, Metal film		
R22	221	1%	RN55	1/2W, Metal film		
R23	100k	10%		OFFSET TRIMMER		
R24	332k	1%	RN55	1/2W, Metal film		
R25	1k	1%	RN55	1/2W, Metal film		
R26	316k	1%	RN55	1/2W, Metal film		
R27	33k2	1%	RN55	1/2W, Metal film		
R28	4k7	5%		5W, Metal Oxide Film		
R29	1k	1%	RN55	1/2W, Metal film		
R30	1k	1%	RN55	1/2W, Metal film		
R31	4R75	1%	RN55	1/2W, Metal film		
R32	4R75	1%	RN55	1/2W, Metal film		
Load 2÷8 Ohm				SPEAKER		
Fuses						
Designator	Value	Tolerance	V rated	Material	Manufacturer	Remarks
F1	5 Amps			SLOW BLOW		
F2	5 Amps			SLOW BLOW		
F3	5 Amps			SLOW BLOW		
F4	5 Amps			SLOW BLOW		
F5	0.005" diam			WIRE LINK		

F6	0.005" diam			WIRE LINK		
Miscalleneous						
Designator	Value	Tolerance	V rated	Material	Manufacturer	Remarks
T1				Transformer		1 Prim 117VAC, 4 dual Secs
J1				Connector		INPUT
NL1				Neon Lamp		
S1				Power Switch		
AC IN				SOCKET		117VAC AC LINE



ACOUSTAT

TRANS - NOVA TWIN 200



ACOUSTAT

TRANS - NOVA TWIN 200

ACOUSTAT

TRANS-NOVA®
TWIN-200

OWNER'S MANUAL

INTRODUCTION

Congratulations on your purchase of the Acoustat Trans-Nova Twin-200 power amplifier, the most innovative NEW technology in audio amplification devices. With proper installation and use, this amplifier should provide many years of trouble free music enjoyment. Please be certain to read this manual over completely to familiarize yourself with your new amplifier before placing it in service.

WARRANTY STATEMENT

A limited 5 year warranty from date of purchase is provided by Acoustat on the TNT-200 power amplifier. This applies to the original purchaser only. However, because Acoustat feels that a fine audio product should be warranted regardless of owner, the warranty is transferable to all subsequent owners, based not upon date of original purchase, but upon original date of manufacture. This warranty is subject to the conditions and limitations stated within the documents on page 9 of this manual.

It is your responsibility to complete and return the warranty registration card. While this card does not determine your eligibility for warranty, it will allow Acoustat to inform you of any possible updates to the amplifier, as well as any new product news that may be of interest to you. This warranty card also aids Acoustat in its efforts to bring fine audio components to music lovers everywhere, by using the additional information that you provide. So PLEASE fill it out completely and return within 20 days of purchase.

USE CAUTIONS

The Acoustat TNT-200 power amplifier is unique in its ability to maintain an exceptionally wide bandwidth at high power levels (100 watts at 400K Hz). For this reason, the TNT-200 could amplify RF at its input, and if present at abnormally high levels, the amplifier can blow its internal fuses. Large amounts of DC at the input will have a similar effect. While a properly functioning preamplification system will not cause any problems, some systems have been shown to exhibit one or both of the above malfunctions.

Whereas DC at the amplifier's input at high enough levels to cause troubles must certainly be considered caused by a defective component, RF interference may be the result of close proximity to a transmitter. If this is the case in your particular application, Acoustat has provided a location on the main printed circuit boards for an additional RF filter capacitor to be installed. While the addition of this RF filter may cause some minor sonic degradation in the best audio systems, it will, however, solve any problems associated with severe RF interference. If your application suggests use of this filter, please call the factory service department at 305/462-6700 for instructions on how to accomplish this modification.

FUSES

The TNT-200 amplifier has six fuses, all located internally. The four 5 amp slo-blo rail fuses are located directly on the PC boards of each amplifier channel. The two 7½ amp slo-blo line fuses are located on the center chassis brace, close to the AC line cord. ALL fuses are slo-blo type, which MUST BE REPLACED WITH THE SAME VALUE. A hex-key wrench has been provided for removal of the top and bottom cover (four screws) if the need to replace fuses does arise. Two spare fuses are provided also.

There are NO speaker protection fuses in the TNT-200. Since this amplifier is capable of very high power output, you should consult your speaker's owner's manual for any recommendations on speaker fusing - to prevent possible damage to the speaker by over-powering.

PACKAGING

SAVE ALL PACKAGING MATERIALS. Your Acoustat amplifier is a precision electronic instrument and must be properly cartoned whenever shipment is necessary. ONLY the original packaging will insure safe transport. (If lost or damaged, replacement cartons can be obtained from Acoustat at a nominal charge.)

WARNING

TO PREVENT ELECTRICAL SHOCK OR FIRE HAZARD, DO NOT EXPOSE THIS EQUIPMENT TO RAIN OR MOISTURE. DO NOT OPERATE WITH COVERS REMOVED. REFER ALL SERVICING TO QUALIFIED PERSONNEL.

INSTALLATION

It is important that adequate airflow above and below the unit be provided. The special feet used on the amplifier are designed to provide adequate spacing only when the unit is placed on a smooth, hard surface. Never operate the unit while it is sitting on a surface such as a rug or carpet, since airflow will be restricted and inadequate for proper cooling.

It is normal for the TNT-200 to run warm to the touch at idle. If the unit is operated at high output levels for very extended periods of time, you may wish to use an auxillary cooling fan. Under normal operating conditions, a cooling fan is not necessary.

BREAK-IN

The TNT-200 power amplifier will require several hours of initial playing time to reach its full sonic potential. This is a normal function of the "healing" time of new capacitors. After this initial break-in period, the amplifier will reach its full sonic potential after turn-on (after stable operating temperatures and voltages have been reached.)

CONNECTION

The TNT-200 rear panel input jacks are located on the lower left and upper right of the amplifier chassis. Left and right are identified by a red (right) and black (left) washer under each input jack. Directly above/below each input jack are a pair of 5-way binding post output jacks, identified + (red) and - (black).

Connect the amplifier to the preamplifier using only the highest quality audio interconnect cables (RCA phono to RCA phono). Make sure there is a good tight fit of the ground shield over the input jack. (High quality interconnects will play a major role in the sonic performance achieved - consult your dealer for recommendations.)

Connect the speakers to the amplifier using the best available speaker wires. Take care to observe polarity, i.e.: RED binding post to speaker + terminal. BLACK binding post to speaker - terminal. It is extremely important that a good, solid connection be made. Use either a high quality banana plug or spade lug, and make sure there is a good tight fit.

CAUTION: THE TNT-200 AMPLIFIER "FLOATS" THE CHASSIS WITH RESPECT TO THE AUDIO GROUNDS. FOR THIS REASON, IF THE SPEAKER CABLES WERE TO TOUCH ANY POINT ON THE CHASSIS WHILE CONNECTED TO THE OUTPUT TERMINALS WHILE THE AMPLIFIER IS PLAYING, THE AMPLIFIER MAY STOP OPERATING, OR HUM, OR DEVELOP SOME OTHER FORM OF MALFUNCTION. IT IS THEREFORE VERY IMPORTANT TO USE SPEAKER CABLES THAT ARE INSULATED AT ALL POINTS OTHER THAN AT THE TIP (SPADE OR BANANA).

It is recommended that you always turn the power amplifier on AFTER the preamplifier has been turned on and has stabilized, to prevent possible damage to loudspeakers caused by preamp turn-on transients. It follows from this, of course, that the power amp also be turned-off BEFORE the preamp.

Connect the AC line cord to the AC power outlet in your home, or to an accessory outlet with a 750 watt capability. Turn the front panel power switch on - a green indicator should light.

DESIGN THEORY

Your Acoustat TNT-200 power amplifier owes much of its exceptional performance to the use of an innovative new output-stage topology never used in any audio amplifier ever sold. Other amplifier output stages are typically connected in one of two configurations, either as voltage followers or as a transconductance stage (which is common in tube amplifiers).

The follower type is particularly ill-adapted to the power MOSFET, the device used in the TNT-200 amplifier, as well as in other recent entries into the high performance solid-state power amplifier market. This voltage follower topology does not allow use of either full rail-to-rail dynamic range or (power) gain-bandwidth product. The second type of output connection is also not well suited to the power MOSFET since pure transconductance-mode operation of the output stage necessitates large amounts of "long-loop" (multi-stage) negative feedback.

Acoustat's ANISOTROPIC* output configuration is a third fundamental connection alternative, which is a pure TRANSresistance-NOdal Voltage Amplifier - i.e. TRANS-NOVA stage. This output form achieves the best characteristics of the two established types, without their disadvantages. This stage has many fascinating properties such as:

* U.S. Pat. #4,467,288

1) Stage input voltages cause output currents.
2) Stage input currents cause output voltages.
3) Full (power) gain-bandwidth product is achieved.
4) Distortion, damping, phase and noise properties of a follower are preserved.
5) Full rail-to-rail dynamic range of the MOSFET's are used, with NO gate-enhancement loss.
6) "Gain" is described in OHMS in lieu of dB (approx. 4k Ohms here) 1 Ohm = 1 volt/1 amp. The output stage, into 8 ohms, shows about 500:1 current gain and 10:1 voltage gain for an aggregate power gain of 37 dB. This high output-stage power gain results in a circuit simplicity which directly improves sonic integrity.
7) Actual driver-stage speed is increased over a source-follower connection by a factor of ten for the same driver-stage power. This surprising result comes directly from the physics of capacitor-charging energy.

This new topology, synergized with the several-hundred-megahertz (power) gain-bandwidth product of the MOSFET's yields the incredible 0.6 microsecond rise time, 165 v/us slew-rate and 400K Hz bandwidth (-3 dB) of the TNT-200 power amplifier.

The second major innovation in the TNT-200 is facilitated by the TNT-200 circuit, and is called Complement Feedback*. This circuit invention "complements" or "perfects" the deficiencies of classic negative feedback (Black-1937) so amazingly that with only 20 dB of "loop-closure" feedback, the TNT-200 yields zero (nodal) output stage distortion and zero output impedance, resulting in a damping factor of over 1000:1.

This connection also completely eliminates any need for current-limit protection against load faults. In addition, the high-speed performance of this amplifier is achieved into complex loads without any sonically questionable choke (stability) "band-aids" applied to the output path. We submit that this is truly a state-of-the-art approach to amplifier design, and further, that surviving amplifier designs of the future will follow this pure field-effect route. The speed-toughness-linearity product of the MOSFET is not even remotely attainable in bipolar devices, or in any practical application of tube technology. Best of all, the amazing technical claims are highly correlated to real-world sonic improvements, improvements that you will hear even upon first listening to your new Acoustat TRANS-NOVA Twin-200 power amplifier.

ADJUSTMENTS

The Acoustat Trans-Nova amplifier has been fully adjusted and tested at the factory for maximum performance. For this reason it is strongly recommended that the following adjustments NOT be performed other than by a qualified technician at time of servicing.

BIAS ADJUSTMENT: The quiescent (idling) current of the TNT-200 amplifier is carefully set at the factory and should require re-adjustment only when repairs or circuit component changes are made.

Acoustat does not recommend increasing the bias above the factory setting of 300ma. This will cause the amplifier to run hotter than normal, with no sonic improvement.

* U.S. Pat. #4,467,288

The procedure for setting the bias is as follows:

1. Disconnect AC power, all signal inputs and output loads (speakers) from the amplifier.
2. Remove the top and bottom covers.
3. Each channel of the amp has a large (mother) and small (slave) PC board. Remove the fuse from the large PC board.
4. Connect the alligator clip leads of an ammeter (digital or other type with good accuracy), in place of the fuse. (Note: the negative lead from the meter should be connected to the fuse clip nearest the black heavy gauge wire, for correct polarity.)
5. Apply AC power. Adjust the trimmer potentiometer (marked "bias" on the foil side of the PC board), for a meter reading of 300 ma.
6. After a few minutes warm-up, the meter reading may change slightly. Re-adjust, if necessary.
7. Remove AC power and re-insert the fuse. Repeat the procedure for the other channel of the amplifier.

DC OFFSET ADJUSTMENT: This is also an adjustment which is carefully set by factory technicians, and should not require re-adjustment.

To check DC offset of the TNT-200:

1. Remove all input signal and output connections from the amplifier. Apply AC power.
2. Connect a DC voltmeter (digital is recommended), across the red and black binding posts on one channel. A reading of 0 volts ± 50mv is normal.
3. If an adjustment is necessary, locate the trimmer potentiometer near the center of the large (mother) PC board. (This control is mounted in an "offset" position, when compared with other square parts on the board, and is marked "DC off." on the foil side of the PC board.)
4. Slowly change the control setting until a 0 volt ± 50mv reading is obtained.
5. Repeat the procedure for the other channel.

SERVICE INFORMATION

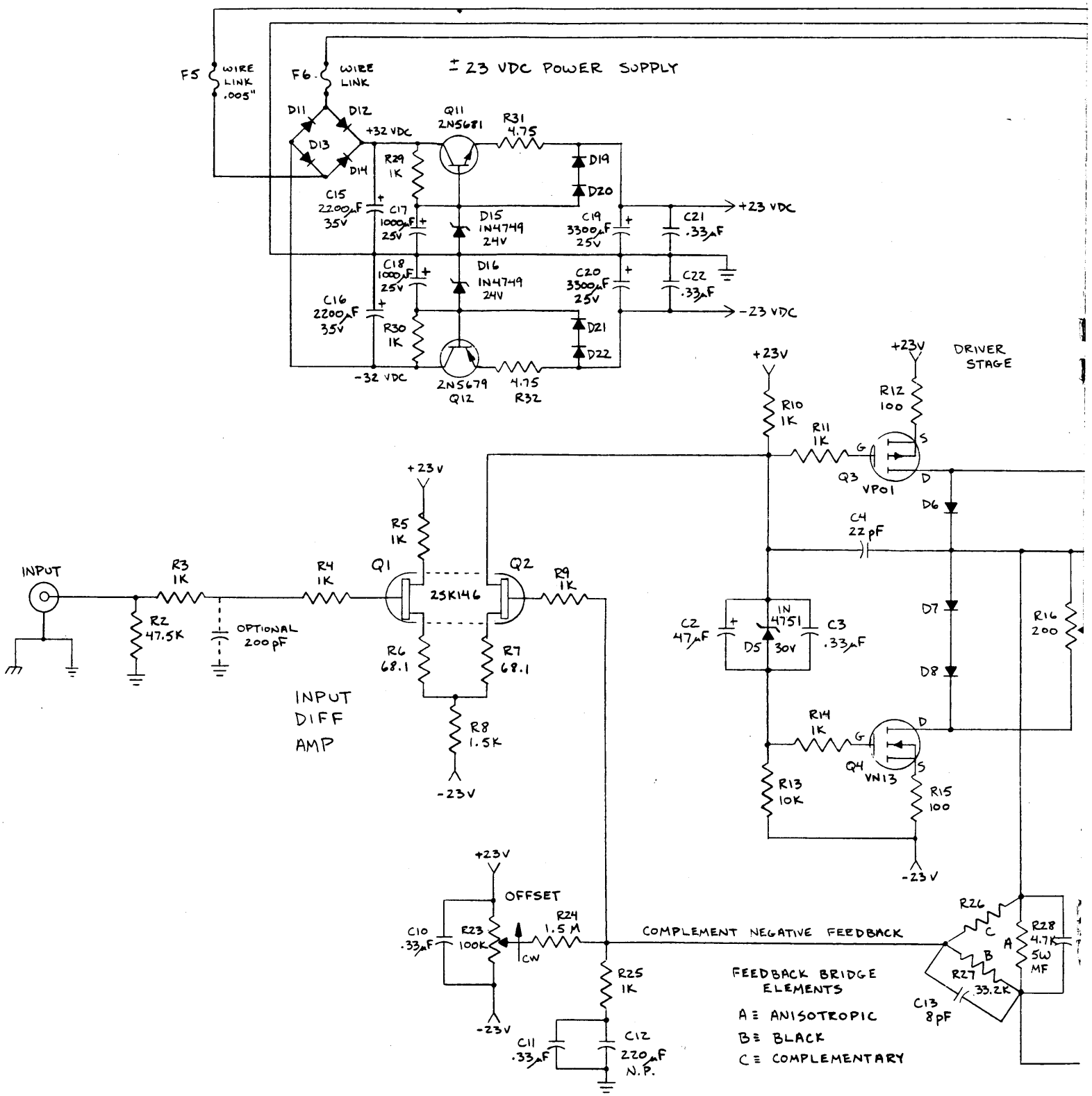
The Acoustat Trans-Nova Twin 200 amplifier is designed to provide years of trouble-free use.

If distorted, weak or no sound is heard first check all connections to the amplifier's inputs and outputs. Try switching the input and output cables of one channel with that of the other channel.

Once you are sure the problem originates within the amplifier, disconnect AC power and remove the top and bottom covers. Check all six fuses within the TNT-200 amplifier. We have found that a visual inspection of these fuses is hardly accurate, and recommend that each fuse be checked with an ohmeter.

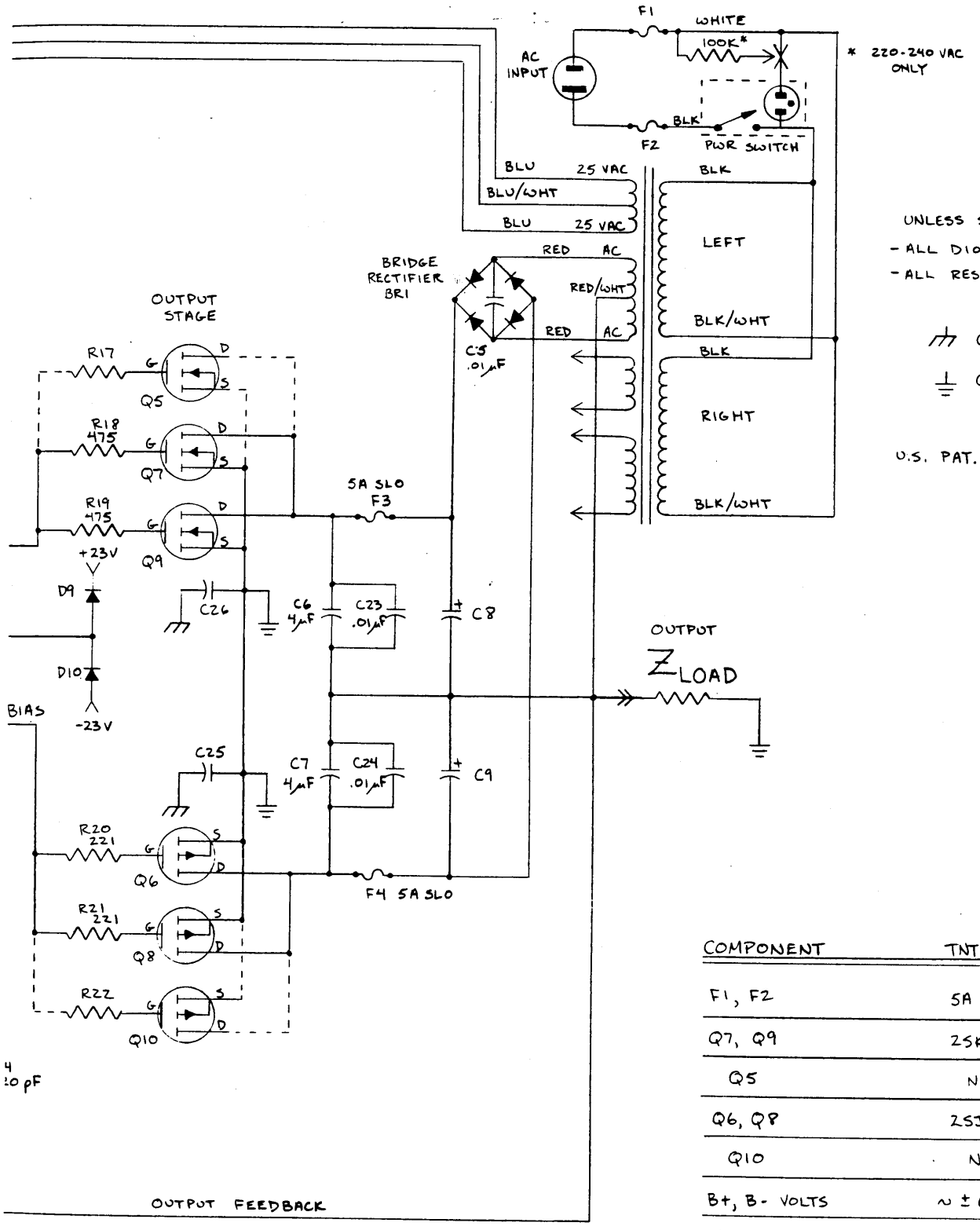
Note: There are two 7½ amp slo-blo AC line fuses located on the amplifier's center rail. There is one 5 amp slo-blo fuse on each PC board (TWO per channel).

IF ALL FUSES ARE FOUND TO BE INTACT — CALL ACOUSTAT SERVICE AT 305/462-6700.



ACOUSTAT
a div. of the david hafler company

TRANS-NOVA® TWIN



UNLESS SPECIFIED OTHERWISE:

- ALL DIODES IN4006
- ALL RESISTORS ½ WATT METAL FILM

⏚ CHASSIS GROUND

⏚ CIRCUIT GROUND

U.S. PAT. # 4,467,288

COMPONENT	TNT-120	TNT-200
F1, F2	5A SLO	7.5A SLO
Q7, Q9	2SK134	2SK135
Q5	NA	2SK135
Q6, Q8	2SJ49	2SJ50
Q10	NA	2SJ50
B+, B- VOLTS	~ ± 60 VDC	~ ± 70 VDC
C8, C9	15,000μF 63V	20,000μF 75V
C25, C26	NA	.1μF 50V
R22	NA	221Ω
R17	NA	475Ω
R26	150KΩ	316KΩ

NA = NOT APPLICABLE

CLEANING

The stainless steel faceplate and chassis of your new amplifier can be easily cleaned with any commercial stainless steel polish. To help prevent against fingerprints, we have found some spray-on furniture polishes (such as Pledge) will coat the faceplate with a clear film that resists fingerprinting.

RACK-MOUNTING

If you wish to rack-mount your amplifier, an adaptor bracket kit is available from your dealer at a small charge. This bracket is mounted in place of the two end-caps on the front corners of the amplifier. Complete instructions are included with the RM kit.

LIMITED WARRANTY FOR ACOUSTAT TNT-200 AMPLIFIER

ACOUSTAT warrants to the owner that the ACOUSTAT amplifier will perform as specified and that it will be free of defects in materials and workmanship for a period of FIVE YEARS from the date of original purchase.

ACOUSTAT will repair defective units without charge for labor or parts, subject to the following conditions:

a) The unit must not have been altered or damaged through misuse, abuse, negligence, accident, or improper operation.

b) The purchaser must provide the dealer's original dated bill of sale as proof of purchase; if unavailable, warranty period will be based on date of manufacture.

c) All repairs must be undertaken at the factory or other service center designated by ACOUSTAT. Units submitted for warranty repairs must be shipped in the factory packing carton to ACOUSTAT or its designated service center, freight and insurance prepaid by the owner, and will be returned to the owner freight and insurance prepaid by ACOUSTAT.

d) Normal wear and maintenance are not covered by this warranty.

ACOUSTAT SHALL NOT BE RESPONSIBLE IN ANY WAY FOR CONSEQUENTIAL OR INDIRECT DAMAGES OR LIABILITIES RESULTING FROM THE USE AND OPERATION OF THE PRODUCT COVERED HEREIN OR RESULTING FROM ANY BREACH OF THIS WARRANTY OR ANY IMPLIED WARRANTY RELATING TO THE SAID PRODUCT.

Some states do not allow exclusion or limitation of incidental or consequential damages so the above limitation or exclusion may not apply to you.

This warranty gives you specific legal rights and you may have other rights which vary from state to state.

SPECIFICATIONS

Power Output: 200 watts per channel into 8 ohms, both channels driven, from 20 to 20K Hz, at no more than .1% total harmonic distortion.
4 Ohm Power Output: 325 watts per channel, as above.
IM Distortion: No more than .1% at any output power from .01 watts to 200 watts.
Damping Factor: Greater than 1000 at all frequencies below 1000 Hz. Greater than 100 at 20K Hz.
Slew Rate: 165 v/us
Power Response: 20 Hz to 20K Hz ±0.1 dB at 200 watts/channel, +0, -3 dB from 2.0 Hz to 400K Hz.
Feedback Closure Ratio: 20 dB
Complement Feedback Ratio: 0.5 dB
Input Impedance: 47k ohms
Input Sensitivity: 1.4 volts for rated output
Forward Driven Output Impedance: ZERO to 1K Hz
40 milliohm @ 20K Hz
200 milliohm @ 50K Hz
Power Consumption: 100 watts @ idle.
750 watts @ full rated power output.

PARTS LIST (Refer to Schematic)

RESISTORS:

(resistors are ½ watt, metal film 1% tolerance, except where noted)

R31, R32 = 4.75 ohm
R3, R4, R5, R9, R10, R14, R25, R29, R30 = 1 k ohm
R12, R15 = 100 ohm
R6, R7 = 68.1 ohm
R8 = 1.5 k ohm
R13 = 10 k ohm
R16 = 200 ohm trimmer potentiometer
R17, R18, R19 = 475 ohm
R20, R21, R22 = 221 ohm
R23 = 100 k ohm trimmer potentiometer
R24 = 1.5 m ohm
R26 = see schematic
R27 = 33.2 k ohm
R28 = 4.7 k ohm 3 watt metal oxide film

CAPACITORS:

C25, C26 = .1uF 50v ceramic disc
C2 = 47 uF 35v low leakage lytic
C3, C10, C11, C21, C22 = .33 uF 160v polypropylene
C4 = 22 pF polystyrene
C5 = .01 uF 600v ceramic disc
C6, C7 = see schematic
C12 = 220 uF 25v non-polar lytic
C13 = 8 pF polystyrene
C14 = 620 pF polystyrene
C15, C16 = 2200 uF 35v lytic
C17, C18 = 1000 uF 25v lytic
C19, C20 = 3300 uF 25v lytic
C23, C24 = .01 uF 160v polystyrene

SEMICONDUCTORS:

Q1, Q2 = 2SK146 Toshiba
Q3 = VP01 (TO-5) (40-90v Supertex)
Q4 = VN13 (TO-5) (40-90v Supertex)
Q5, Q7, Q9 = Hitachi, see schematic
Q6, Q8, Q10 = Hitachi, see schematic
BR1 = 25 Amp 250v bridge rectifier
D5 = 1N4751A 30v Zener
D6 - D14, D19 - D22 = 1N4006
D15, D16 = 1N4749A 24v Zener
Q11 = 2N5681
Q12 = 2N5679

FUSES:

F1, F2 = see schematic
F3, F4 = 5 Amp Slo-Blo

ACOUSTAT

3101 Southwest First Terrace / Fort Lauderdale, Florida 33315
Phone: (305) 462-6700

Costruttore: Acoustat Corporation, 3101 Southwest Terrace, Fort Lauderdale, Florida 33315, USA
Distributore per l'Italia: International Sound, Corso di Porta Vittoria, 47, 20122, Milano. Tel. (02) 784405

Prezzo: L. 3.540.000

CARATTERISTICHE DICHIARATE DAL COSTRUTTORE
Potenza d'uscita: 200 W per canale su 8 ohm, due canali in funzione, da 20 a 20.000 Hz, a non più di 0,1% di dist. arm. totale.
Potenza d'uscita su 4 ohm: 325 W per canale, come sopra.
Distorsione di intermodulazione: non più di 0,1% ad ogni potenza d'uscita da 0,01 a 200 W.
Fattore di smorzamento: maggiore di 1000 a tutte le frequenze sotto i 1000 Hz; maggiore di 100 a 20 kHz.
Slew rate: 165 V/μs
Risposta in potenza: 20-20.000 Hz ±0,1 dB a 200 W/canale; +0, -3 dB da 2 Hz a 400 kHz.
Rapporto di controreazione: 20 dB
Impedenza di ingresso: 47 kohm
Sensibilità di ingresso: 1,4 V per l'uscita nominale
Impedenza d'uscita: 0 a 1 kHz; 40 mohm a 20 kHz; 200 mohm a 50 kHz

Parlando di Acoustat si pensa subito ai diffusori elettrostatici, di cui la casa americana è diventata nei suoi vent'anni di attività il maggior fabbricante mondiale. Per questi diffusori, come è noto, vengono anche prodotti speciali amplificatori incorporati; già nel '72, ad esempio, erano stati sviluppati dei finali ibridi (tubi + transistori) per pilotaggio diretto, ad alta tensione, delle celle elettrostatiche, mentre preamplificatori con pre-pre per bobina mobile sono da tempo in catalogo. Quindi, Acoustat è anche uno specialista in amplificatori e, aggiungiamo, in amplificatori non convenzionali, soprattutto a "valvole"; con il Twin-200 essa si cimenta, ancora una volta in maniera non convenzionale, anche nel campo dei finali di potenza per impiego universale.

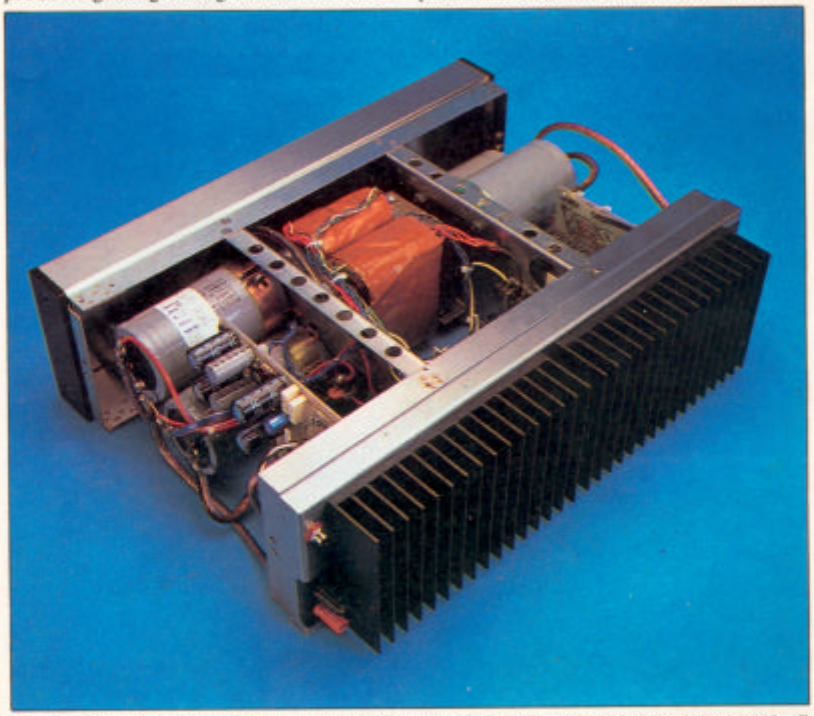
Filosofia costruttiva. J. C. Strickland, presidente della compagnia, afferma che i progettisti di amplificatori, formatisi nei trent'anni di vita dei transistori convenzionali, hanno acquisito una mentalità "bipolare", nel senso che continuano a progettare amplificatori con le stesse topologie circuitali messe a punto per i transistori bipolari, anche quando impiegano i moderni FET a giunzione e MOS-FET di alte prestazioni. In realtà, i transistori ad effetto di campo che sono disponibili dai primi anni '80 esibiscono interessanti caratteristiche, tra cui l'elevata transconduttanza (e quindi elevato guadagno, molto maggiore di quello dei tubi a vuoto), grande linearità, basso rumore, bassa conduttanza d'uscita (come nei pentodi), grande stabilità termica ed immunità da rottura secondaria e infine uniformità delle tensioni di gate, che consente una facile messsa in parallelo di più elementi. Insomma, i FET vengono letteralmente sprecati in circuitazioni inadeguate a sfruttare quelle caratteristiche peculiari che dovrebbero invece stimolare la creatività dei progettisti: impiegare i FET nelle consuete topologie è un po' come montare dei motori a getto su dei vecchi DC-3 ad eliche.

Ma questo, chiarisce Strickland, non significa che Acoustat vuole progettare ampli a transistori perché assomiglino sempre più agli ampli a tubi, ma solo che vuole sfruttare al massimo la grande esperienza acquisita lavorando con i tubi per applicarla ai moderni FET.

Tubi e FET. Un ampli a tubi è generalmente costituito da uno o più stadi di amplificazione di tensione, uno stadio di inversione di fase e uno stadio di uscita in controfase (quasi sempre con trasformatore) che fornisce sia guadagno in tensione che in corrente. Gli ampli a transistori, invece, sono nella stragrande maggioranza dei casi costituiti da una serie di stadi di guadagno di tensione e da uno stadio di uscita ("emitter follower") con solo guadagno in corrente. Questa topologia è stata adottata anche per fronteggiare alcuni tipici problemi dei transistori, soprattutto la non buona linearità tensione di base-corrente di collettore (transconduttanza), la bassa impedenza di ingresso, di "tipo-diodo", poco lineare, le limitazioni di "velocità", legate all'accumulo delle cariche.

Questi problemi non esistono nei FET, che non è quindi ragionevole usare in stadi di uscita senza guadagno in tensione. Inoltre, l'uso dei FET in emitter follower (anzi, in "source follower") causa ulteriori "sprechi". Il primo è legato al fatto che mentre i bipolari sono in piena conduzione con una tensione base-emettitore di meno di 1 volt, per i FET ne occorrono 10-15, quindi va persa una buona percentuale della tensione di alimentazione ed una ancor maggiore percentuale della potenza disponibile. Il secondo è legato alle caratteristiche di ingresso del MOS-FET (impedenza eminentemente capacitiva), che in configurazione a guadagno unitario perde gran parte delle sue eccellenti caratteristiche (che si sfrutterebbero in caso di sorgente a massa) di prodotto guadagno-larghezza di banda di potenza. Insomma, secondo Acoustat, i MOS-FET nelle consuete circuitazioni "sprecano", per i motivi di cui sopra, il 30% della potenza ed il 90% della velocità.

Realizzazione. La circuitazione con "sorgenti sulle alimentazioni" è stata scartata poiché, pur consentendo il guadagno in tensione, pone il problema del pilotaggio in parallelo di due gruppi di "gate" i cui potenziali differiscono di 100-150 V e le cui tensioni rispetto ai "source" sono critiche agli effetti della polarizzazione dei dispositivi. Perciò è stata impiegata una circuitazione che vede l'alimentazione flottante rispetto a massa: questa consente, come nel caso dei tubi, di porre le sorgenti a massa (con pieno guadagno in tensione e corrente, massimo sfruttamento della tensione di alimentazione e della velocità dei MOS-FET) e di controllare agevolmente i potenziali di gate ai fini del pilotaggio e della polarizzazione; ma, al contrario dei tubi,

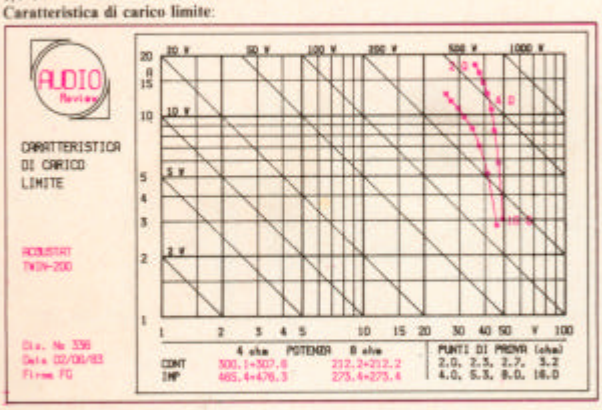


Il telaio del TWIN-200 è in acciaio inossidabile; si notano all'interno i condensatori da 20.000 μF, separati per i due canali.

Amplificatore finale: Acoustat TWIN-200
Numero di matricola: 302203

CARATTERISTICHE RILEVATE

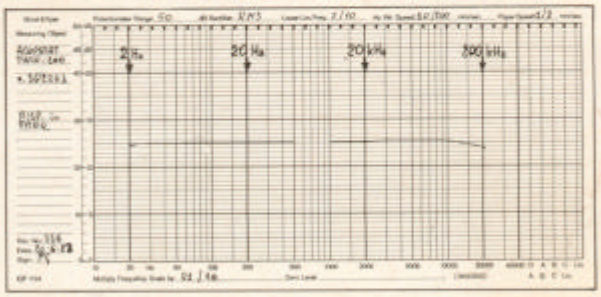
Impedenza di ingresso: 47 kΩ/20 pF
Tensione di rumore (pesata A) riportata all'ingresso:
Chiuso su 600 ohm: 6,9 µV
Sensibilità (per uscita nominale su 8 ohm)
1,4 V
Caratteristica di carico limite:



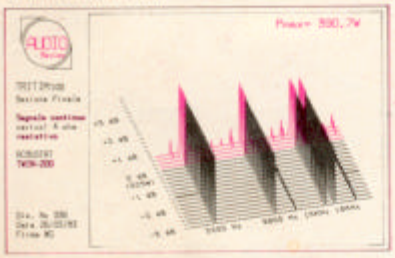
Fattore di smorzamento su 8 ohm:
a 100 Hz 370; a 1 kHz 370; a 10 kHz 286

Slew rate su 8 ohm:
Salita 120 V/µs; discesa 120 V/µs

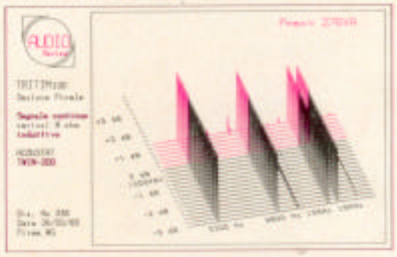
Risposta in frequenza (a 2,83 V su 8 ohm):
-1 dB a <2 Hz e 142 kHz
-3 dB a <2 Hz e >200 kHz



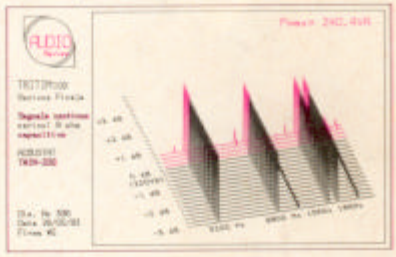
Tritim in regime continuo:
Carico resistivo 4 ohm



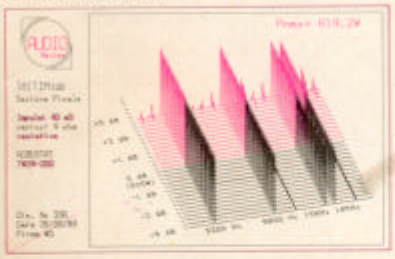
Carico induttivo 8 ohm/+ 60°



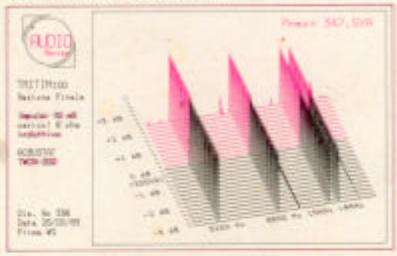
Carico capacitivo 8 ohm/- 60°



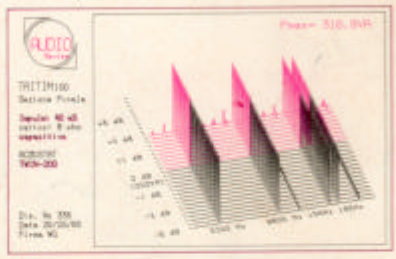
Tritim in regime impulsivo:
Carico resistivo 4 ohm



Carico induttivo 8 ohm/+ 60°



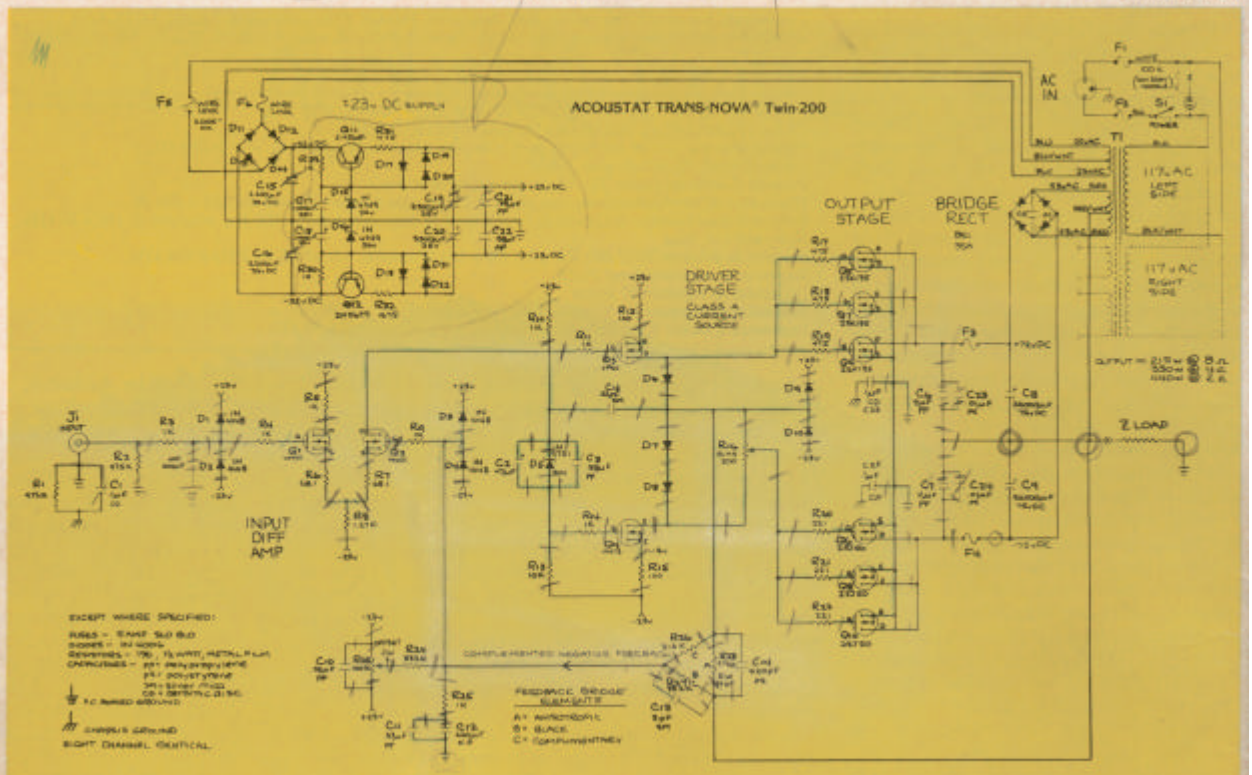
Carico capacitivo 8 ohm/- 60°



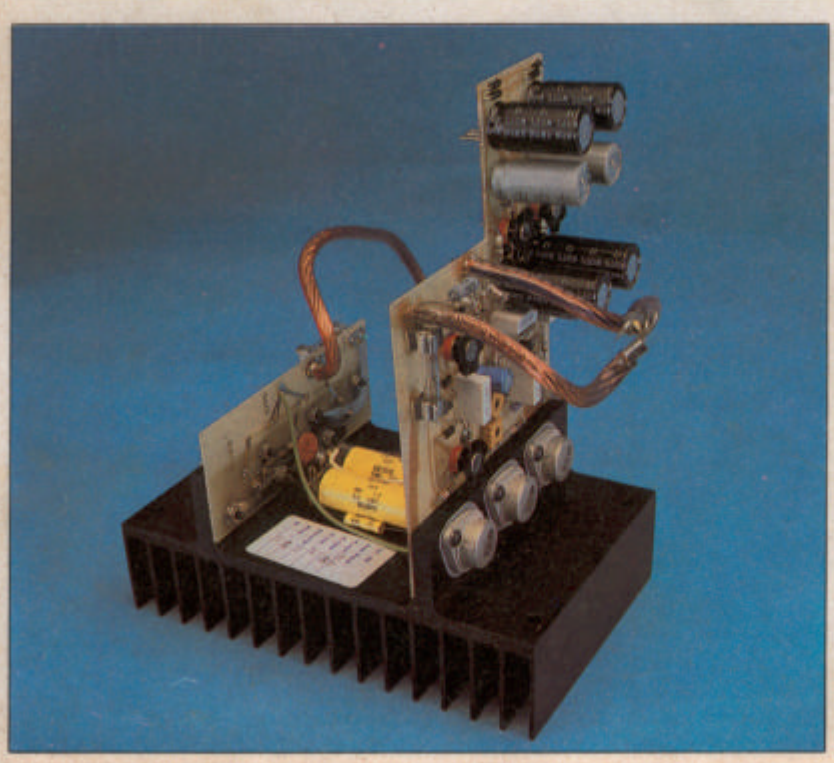
VA", significa "TRANSresistance-NOdal Voltage Amplifier".
La costruzione del TWIN-200 è notevole per i componenti impiegati e per la robustezza dell'insieme. Ciascun canale possiede una sua linea di alimentazione, dal secondario del trasformatore, al rettificatore, agli elettrolitici di livellamento in parallelo ai quali sono posti piccoli condensatori a polipropilene per ridurne l'impedenza alle alte frequenze; in assenza di qualsiasi tipo di limitazione di corrente (consentita dall'impiego di FET, intrinsecamente protetti), la sicurezza del dispositivo è affidata ad una coppia di fusibili ritardati da 5 A sulle alimentazioni, ma ancora "dentro" il loop di controreazione, per cui non riducono il fattore di smorzamento. Le connessioni di potenza sono realizzate mediante cavo a grande sezione, del tipo "speciale" per diffusori, mentre il telaio è in acciaio inossidabile (!).

Prestazioni. A conferma delle dichiarazioni del costruttore, il 200 è un ampli molto "veloce": lo slew rate è pari a 120 V/µs, misurati grazie all'assenza delle limitazioni della larghezza di banda; tuttavia è prevista la possibilità, accennata anche sullo schema elettrico, di inserire all'ingresso un condensatore che riduca la banda passante, per la sicurezza dell'ampli stesso e dei diffusori in caso di ingresso di spurie. Un'altra conferma viene dai dati di potenza d'uscita, ma ancora più importante è la notevole capacità di erogazione anche su carico bassissimo: la leggera flessione della curva di carico limite in regime continuo non è dovuta alle caratteristiche di auto-limitazione dei FET, ma solo al trasformatore: infatti la curva relativa al regime impulsivo è ben verticale, con il punto a 2 ohm oltre la linea dei 600 watt. La maxi-prova di interfacciamento (sul n. 17 di AUDIOREVIEW) ha confermato la notevole capacità del "200" di pilotare anche i diffusori più difficili.
In conclusione, un prodotto che al prezzo certo sostenuto contrappone una concezione originale, un'eccellente realizzazione e prestazioni allo stato dell'arte.

Franco Gatta



Il finale Acoustat impiega MOS-FET in tutti gli stadi del circuito; grazie all'alimentatore "floating", è stato possibile connettere i MOS-FET di uscita con "sorgente a massa", sfruttandone al meglio le caratteristiche. L'alimentazione di potenza è completamente separata per i due canali.



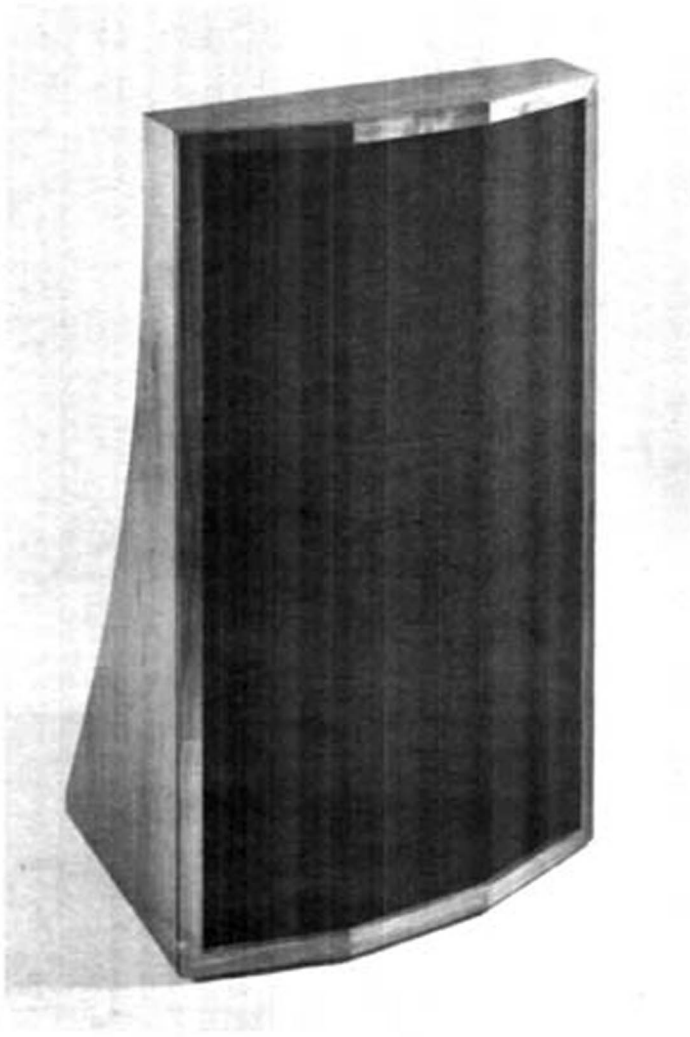
I moduli degli amplificatori, escluse le sezioni di alimentazione, possono essere facilmente distaccati; si notano i MOS-FET di potenza ed i grossi cavi relativi alle linee ad alta corrente.

non richiede trasformatori di uscita e si comporta in pratica come un push-pull, pur non richiedendo l'invertitore di fase caratteristico degli ampli a tubi; inoltre, con questa circuitazione, solo i dispositivi di uscita lavorano ad alta tensione (150 V picco-picco), mentre per gli altri stadi è sufficiente una tensione molto minore (circa 45 V p-p).

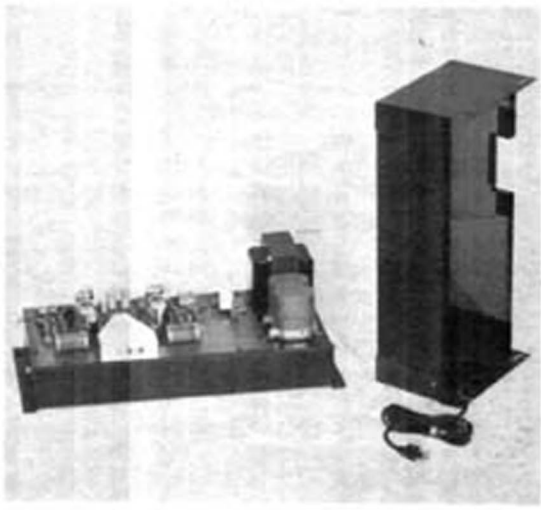
Ad onta della sua notevole originalità, il circuito è relativamente semplice ed impiega solo tre stadi, con un totale di 10 MOS-FET e pochi altri componenti; l'ingresso è un differenziale (Q1 e Q2) che pilota in tensione il successivo stadio pilota, convertitore tensione-corrente (Q3 e Q4), seguito dallo stadio finale (Q5-Q10), convertitore corrente-tensione; quest'ultimo possiede un suo loop di controreazione, interno al loop di controreazione totale, che dà luogo ad unn guadagno di circa 20 dB; il loop principale si chiude invece, come di consueto, al gate invertente del differenziale di ingresso e determina il guadagno complessivo dell'ampli, circa 30 dB. Il complesso acronimo coniato dal costruttore per designare questa circuitazione, "TRANS-NO-

THE ACOUSTAT X

- FULL RANGE
- DIRECT DRIVE
- ELECTROSTATIC SPEAKER SYSTEM



WITH:
INTEGRAL
SELF-CONTAINED
SERVO-CHARGE AMPLIFIER



Acoustat presents outstanding "State of the art" sound **electrostatically** at a conventional cone system price

WHY AN ELECTROSTATIC?

The electrostatic approach to sound reproduction has been called "the sound of the future," and at the risk of belaboring the obvious perhaps a brief review of the three different loudspeaker design concepts and their attendant faults and virtues is in order.

The dynamic cone (or dome) speaker has been around for a long time. Here the cone or vibrating structure (usually stiffened paper of relatively high mass) is energized at its apex by attachment to a voice coil placed in the gap of a magnet. The cone/voice-coil structure has high mass and thus significant inertia. Even if sufficient voice-coil drive and damping can keep it moving in an accurate replica of the electrical signal, there is a strong probability that the movement of the many portions of the cone will differ significantly from the signal due to the distance between the magnet/voice-coil energizing source and the cone's surface radiating area. A bit like trying to play the piano with chopsticks! Drawbacks: non-linearity, cone breakup and unacceptable levels of harmonic and intermodulation distortion.

The dynamic sheet (or planar) speaker is a much more recent concept. Here a plastic diaphragm physically incorporating numerous wires is placed in a large screen type enclosure containing numerous small magnets. In a sense the voice coil wire of the conventional cone speaker has been spread out over a large vibrating surface and the magnet structure has been similarly dispersed. This design is certainly a distinct improvement over the conventional cone if only because the diaphragm is energized close to the point where it radiates. Faults? Perhaps a few. The mass of the vibrating diaphragm is still relatively high because of the abundant wires and other structural considerations. In general, the higher the mass of the vibrating surface the poorer the transient and high frequency response. Also, because of diaphragm excursion limitations, bass response frequently requires augmentation with cone woofers.

The electrostatic design concept has a few similarities with the planar type, but it is fundamentally different. And it has been around a great deal longer. Here a very light plastic diaphragm is placed between a conductive grid structure (sorry, no magnets) placed front and back in relation to the diaphragm. The diaphragm is usually supplied a constant charge and is driven push-pull by other charges on the front and back grids going alternately positive and negative in response to the audio signal. But, in order to accomplish this, voltage requirements are much greater. Whereas a dynamic speaker system requires tens of volts the electrostatic requires thousands.

Potential advantages are numerous. The low mass of the diaphragm provides an opportunity for unequaled transient and high frequency response with excellent linearity. And there is an advantage completely unique to electrostatics. As far as we know, the electrostatic is the only transducer where the sound always emanates from the exact point where the energizing force is generated, even down to the molecular level. (Note that even planar dynamic speakers have definite stretches of undriven diaphragm area between the conductive wires.) Additionally, there is an opportunity for phase coherence with no parasitic mechanical elements between the drive and radiating element and for an excellent acoustic impedance match to air. The electrostatic concept is probably the closest thing yet devised to being able to turn an electrical signal directly into sound!

THE PROBLEMS

Practical electrostatic speakers made their debut in the early 1950's with Arthur Janszen's small tweeter array. This bold innovation was enormously successful and is still available in much the same format today.

But, the *full-range* electrostatic speaker that could fulfill all the obvious design goals was another story. There have more than a few attempts at full range electrostatic design *driven by conventional amplifiers* over the years, and they have all had three problems in common:

1) inadequate sound output levels even when driven by exceedingly high powered amplifiers.
2) generally inadequate bass response
3) distortion and non-linearity caused by the necessity to use high voltage step-up transformers.

In addition, by trying to squeeze out more level with more and more power in this inefficient arrangement, panels are frequently overdriven and burned out.

THE SOLUTION: ACOUSTAT'S SERVO-CHARGE AMPLIFIER

The Acoustat research team came to the conclusion that the crux of the problem lay not so much with the electrostatic speakers themselves and their panels

but rather with the amplifier that powers them. A *dynamic* speaker system (cone or planar) is essentially a *resistive* load in the range of 4-16 ohms. A full range electrostatic system, however, does not pose any significant resistive load but does provide an enormous *capacitative* load. Conventional amplifiers are designed for *resistive* loads. To give such an amplifier an 800-1000 pf capacitative load (faced through a 100:1 step-up transformer to obtain the required drive voltages) is to ask for marginal performance and poor reliability.

Acoustat researchers felt that by designing an amplifier ideally matched to the high capacitative load, the design goals of high sound presure level, excellent bass response, unrivaled linearity, low distortion and *reliability* could be easily met.

No step-up transformers in drive circuit

The Servo-Charge amplifiers contained in the Acoustat system employ a unique tube output section, four quadrant push-pull driving the speaker panel grids *directly* from the high voltage tube elements *without* itermediate step-up transformers.

We believe this concept to be especially important. In all prior attempts at a full-range electrostatic, these transformers are an absolute necessity to obtain the necessary high voltage levels to drive the speaker's grid structure.

The result of using a high voltage gain step-up transformer (besides the undesirable "ringing" and hysteresis effects) is relatively poor control and damping of the signal that finally reaches the electrostatic panel. An apt analogy would be to picture yourself holding one end of a 100 foot bamboo pole and imagine how well you could control the opposite end. The Acoustat X doesn't have a single "piece of iron" in the entire signal path!

In addition, a servo negative feedback loop deriving its information from the point where the panels are energized provides excellent waveform purity. The combination of the Acoustat panels and the Servo-Charge Amplifier provides extraordinary coupling efficiency.

How many watts?

An interesting if unanswerable question in this case. Unanswerable because a full range electrostatic is essentially a very large capacitor, and power output cannot be measured into a capacitative load. In the laboratory using a dummy resistive load the Servo-Charge Amplifier measures in the 100 watt range, a figure which is essentially meaningless.

Obviously we would like some yardstick to measure the "muscle" of this system and suggest the *sound pressure level* a system will produce in an average listening environment before either clipping the amplifier or exceeding 1% total harmonic distortion of the amplifier and speaker together. The Acoustat X system in this instance will produce 110 db 3 feet on axis (one speaker) and 105 db (a pair) at 20 feet!

Sound pressure levels such as these would generally require several hundred to a thousand watts per channel driving typical inefficient dynamic systems or older design transformer driven electrostatics. These levels are achieved in the Acoustat X through the markedly increased efficiency inherent in the direct drive design which eliminates transformer mismatch losses.

SYSTEM COMPONENTS

● Panels

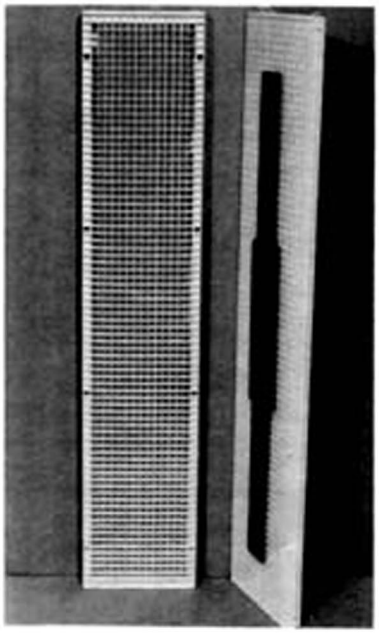
Acoustat has made some further contributions to electrostatic technology in the special design of its electrostatic panels. These panels are completely free of any arcing problems and further provide complete immunity from climate, temperature and humidity factors. And, most importantly, *they cannot be damaged by over-driving.* The panels are guaranteed in normal use for a period of five years. It should be pointed out that the Acoustat-X electrostatic panels and the Servo-Charge Amplifier are specifically designed for each other and are compatible *only* with each other.

The panels in the Acoustat-X are the result of years of research. Each single speaker contains 8.5 square feet of frontal radiating area. The total diaphragm front and back, considering the dipole radiation, of two speakers is 34 square feet. The Mylar diaphragm is of exceedingly low mass. Its thickness is .65 thousanths of an inch, and it is equivalent to the mass of only 7 mm of air.

Panel grid construction provides a far greater openness ratio than any prior design. Rather than the typical slot or "polka dot" perforations in sheet metal (where the diaphragm area energized is blocked by the structure) Acoustat has created an ingenious mil-spec. wire grid, bonded to a strong plastic matrix. Each pair of speakers contains more than 1500 feet of this wire because of the fine spacing required for optimum sound production.

NO woofer, mid-range, tweeter elements and NO crossover networks

A very significant difference between the Acoustat approach and that of some other electrostatics is the absence of any separate drivers, i.e. separate woofers, mid-range or tweeter units. Each speaker does contain three panels which are angled for horizontal dispersion, but electrically they are one and all are driven full range. The enormous advantage of this design is the complete elimination of cross-over networks and their attendant time delay and phase distortion characteristics.



● Servo-Charge Amplifier

These units are contained in the base of each cabinet enclosure and are of hybrid design employing solid state circuitry for all low level functions and the above described direct output coupling from high voltage tube elements for the speaker drive. They incorporate the following unique features:

"Instant On" Relay Circuitry

This feature which eliminates the need for any power umbilicals from the pre amplifier source consists of a unique audio triggered automatic turn-on circuit. The amplifier is left connected to its wall outlet at all times. A very low power is left on the four vacuum tube filaments when the amplifier is not in use. This facilitates instant turn on when an audio signal is supplied, provides a "damp-chaser" effect and because switching power surges are eliminated greatly extends tube life. The cost of this stand-by operation is less than 1¢ a day per speaker. After the audio signal has been removed for a period of five minutes the automatic circuitry will shut down the amplifier to the lower power stand-by mode.

Active equilization for elimination of low frequency response aberrations caused by interaction with the reflecting wall surface.

During extensive 1/3 octave frequency analysis in testing the response of this system, it was discovered that a phenomenon of quarter wave-length reinforcement and half wave-length cancellation takes place in the lower frequencies. This is true for *all* dipole radiators in the proximity of a reflecting wall. With a 3 feet diaphragm (2 feet cabinet) to wall distance the net effect of this reinforcement-cancelkation phenomenon is to produce a "hump" in the response at 90-100 Hz due to quarter wave-length reinforcement and a "dip" at 180-200 Hz because of have wave-length cancellation. The solution to this problem, which if left uncorrected causes a "voomy" sort of upper bass enhancement, and lower mid range "drop out" was to provide specific active equilization to correct the response.

Controls

1) High frequency balance control which adjusts over a plus or minus 5 db range the response in the upper mid-range and high frequency spectrum to compensate for room size, listening distance and phono cartridge idiosyncrasies.

2) Overall gain control for left-right channel balancing in the event that the preamplifier or other associated equipment does not have this capability.

Safety AC interconnect on chassis

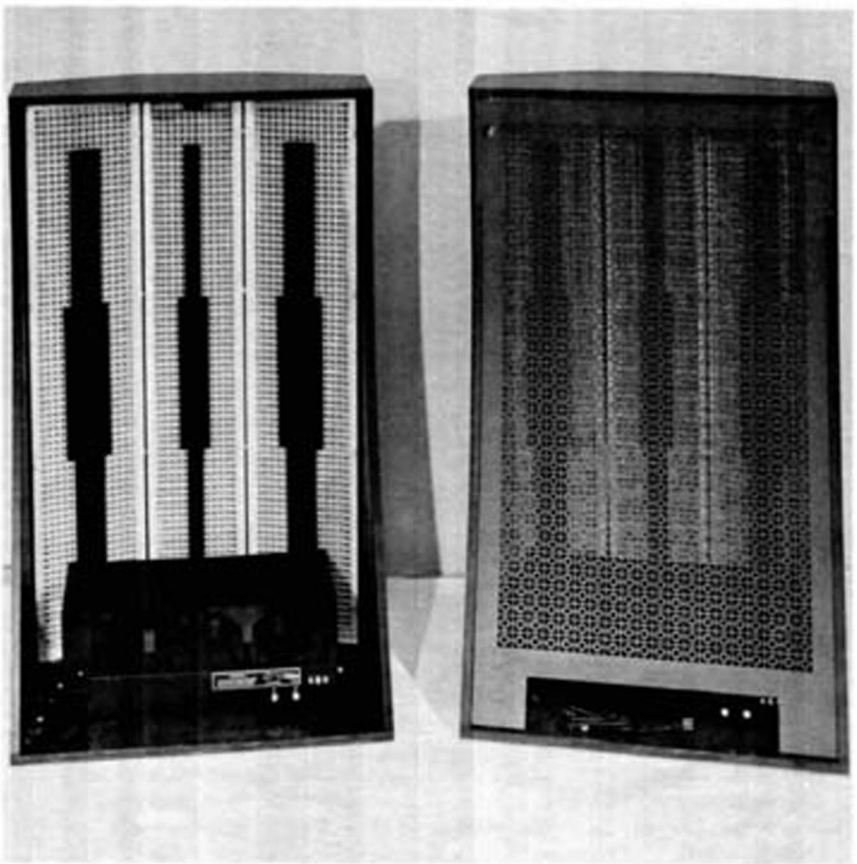
Because of the presence of dangerous high voltage at several points in the Servo-Charge Amplifier, the AC line cord is automatically disconnected when the protective cage is removed from the top of the chassis.

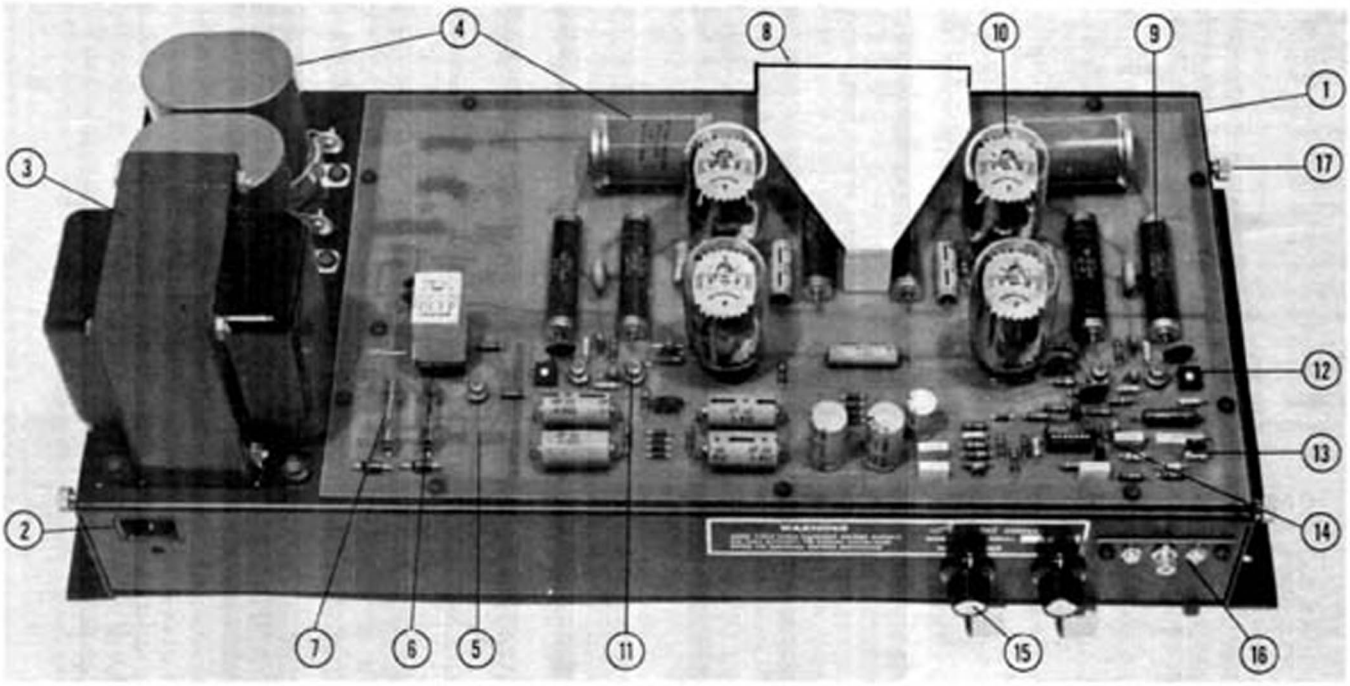
Dual input capability

We at Acoustat feel strongly that a speaker of this quality deserves the finest input sources available and for that reason urge the use of a high quality preamplifier. For those who wish, however, to use the output of an integrated receiver-amplifier, there is available on the input terminal strip, connecting terminals which when used will compensate for voltage and impedence differences. In this application the Servo-Charge Amplifier "sees" only the voltage from the receiver-amplifier, not the power.

● Cabinet

The cabinet enclosure of the Acoustat X has a handsome and pleasing design and its geometry has been tailored to provide optimum dispersion of sound. Construction is of selected walnut veneer and solid walnut. Other woods are available on special order.





1) Heavy duty 14 gauge steel chassis
2) International Standard three wire safety interlock (AC)
3) Heavy duty power transformer
4) Military grade oil filled high voltage and output coupling capacitors
5) Military grade glass-epoxy printed circuit board
6) Automatic turn on relay
7) Separate fusing for high and low voltages
8) High voltage guard with output jack assembly
9) Military grade high voltage resistors
10) Four quadrant tube output bridge using Schmitt connection
11) High voltage transistors used in intermediate stages
12) Centering pots for exact setup of output symmetry
13) All 5% components in EQ circuit
14) High performance, low distortion IC (same version currently used in "State of the art" professional mixing consoles
15) Controls for high frequency balance and gain
16) Dual input configuration for either preamplifier or receiver feed
17) Knurled thumbscrews facilitate easy access

All circuitry direct coupled up to final output coupling capacitors.

How do they sound?

The initial reaction of most listeners is that the Acoustat X system presents a new dimension of openness and transparent sound reproduction with transient response, definition, coherence and imaging that words alone cannot describe.

How about the low end, since this has been the Achilles heel of most prior full-range electrostatic attempts? The Acoustat X bass response not only goes down solidly to 30 Hz but is also remarkably clean and is able, in the worlds of one reviewer, "to shake a concrete floor!"

Audition a pair and let your ears decide!

SPECIFICATIONS

Frequency Response: 30-20 kHz ± 3 db

Sound Pressure Level: Program material:

110 db @ 3' - one speaker

105 db @ 20' - pair in 14' x 24' room

Harmonic Distortion: Less than 1% @ 3 db below full output 30-20 kHz

At average listening level: Close to instrumentation residual levels.

Input Impedence: 50 K-ohms

Provision for connection to a receiver is also provided on amplifier back panel.

Controls: High frequency balance ± 5 db

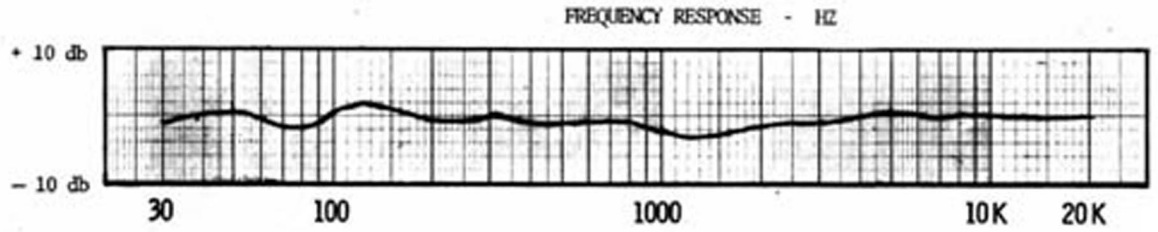
Gain ± 6 db

Input sensitivity: 0.7 volts for full output @ 1 kHz with gain control at calibration mark.

Size: 28" wide, 48" high, 19¼" deep at base, 7 5/8" deep at top.

WARRANTY

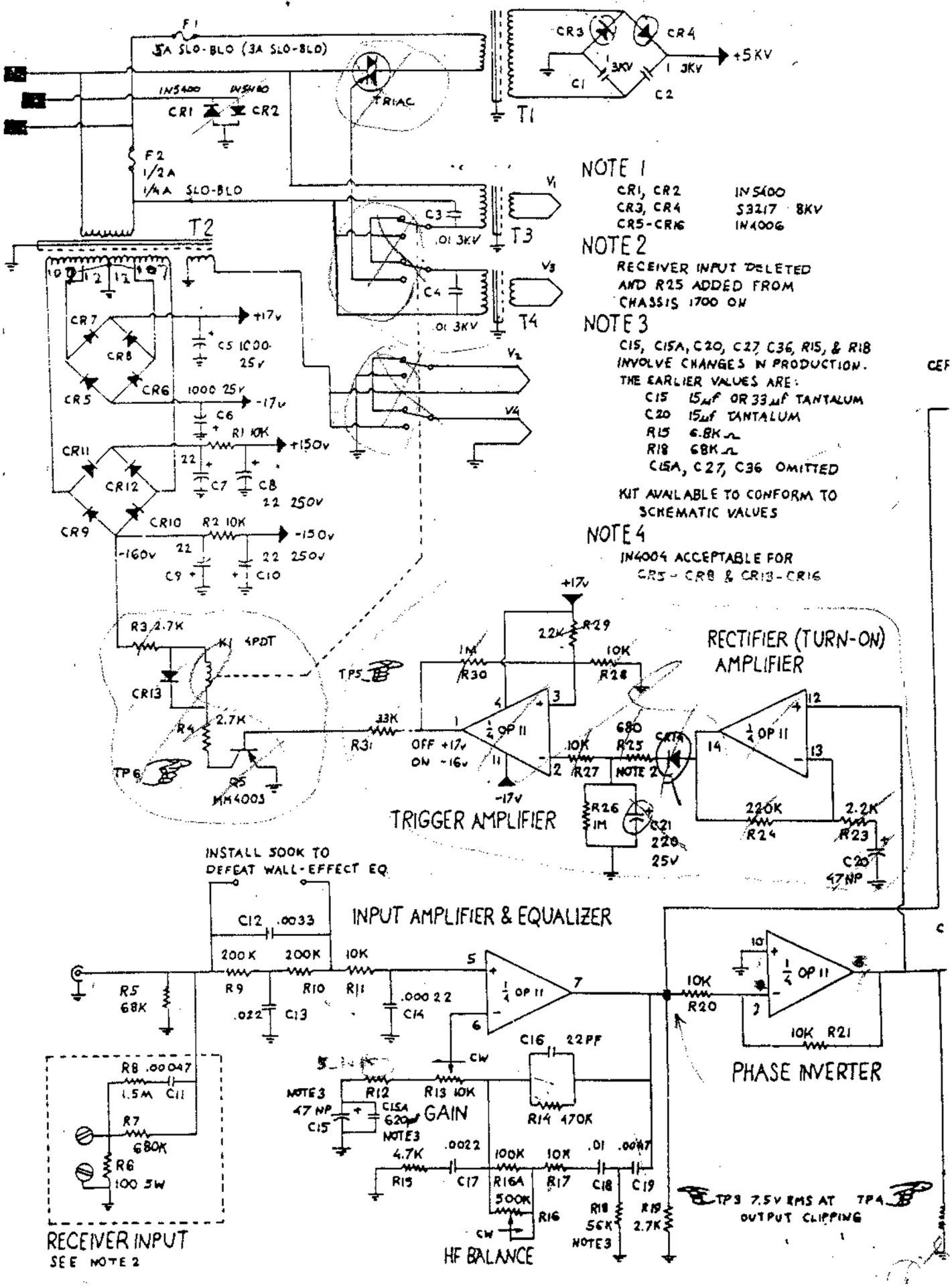
The Acoustat X system carries a five year complete warranty on the panels and a five year parts (2 years parts and labor) on the Servo-Charge Amplifier.

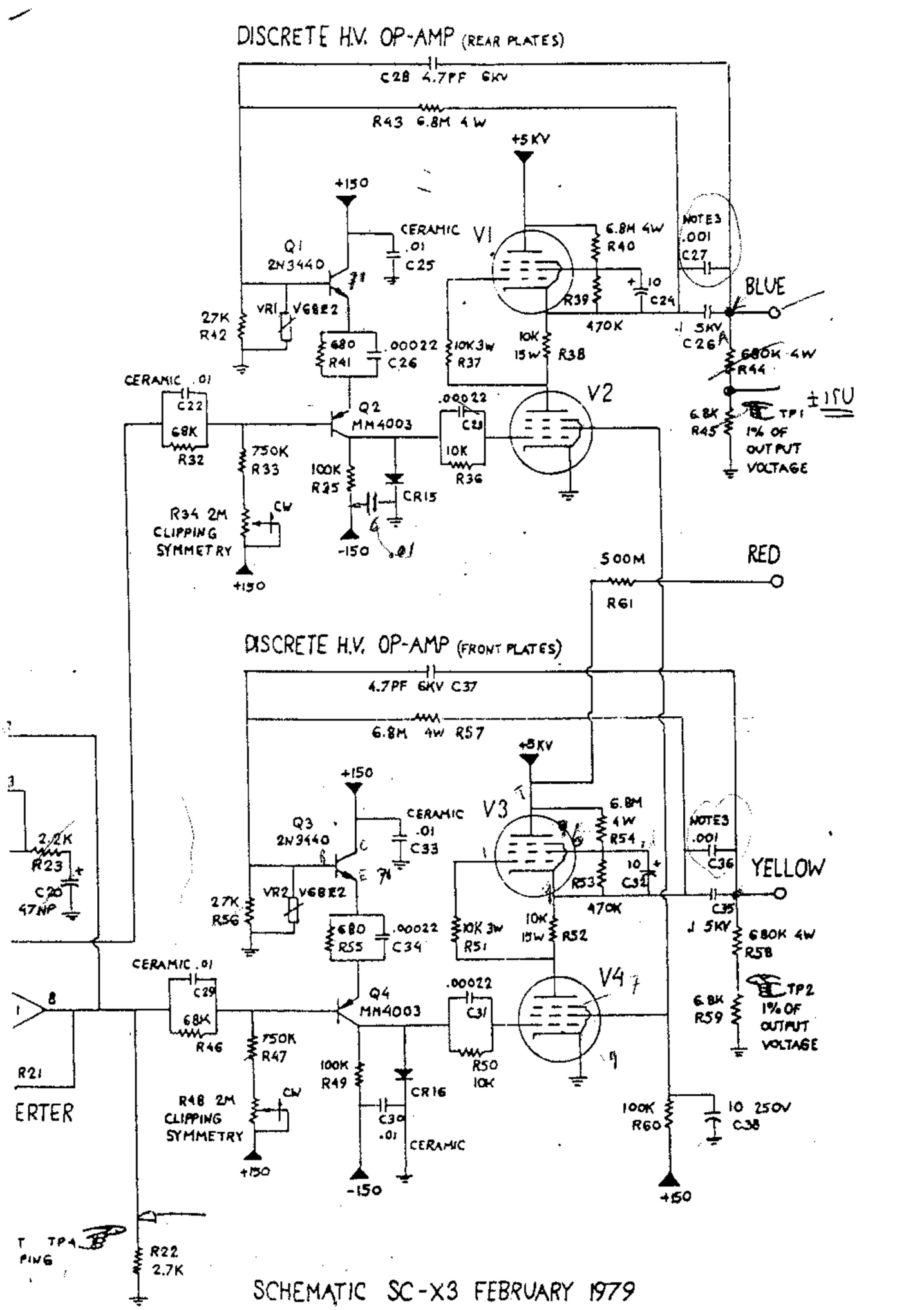


Measured using third-octave pink noise

Acoustat Corporation

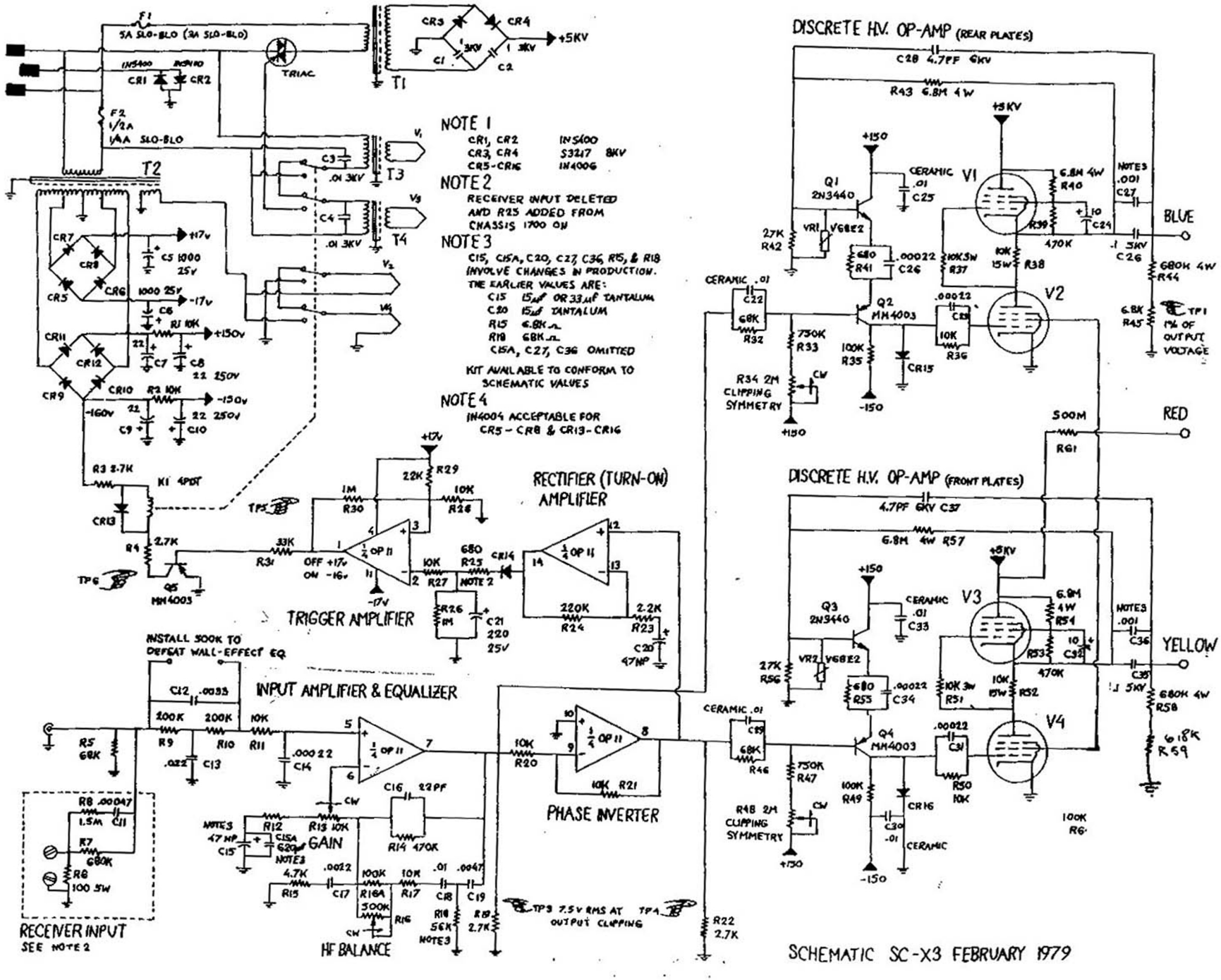
4020 N. 29th Avenue
Hollywood, Florida 33021

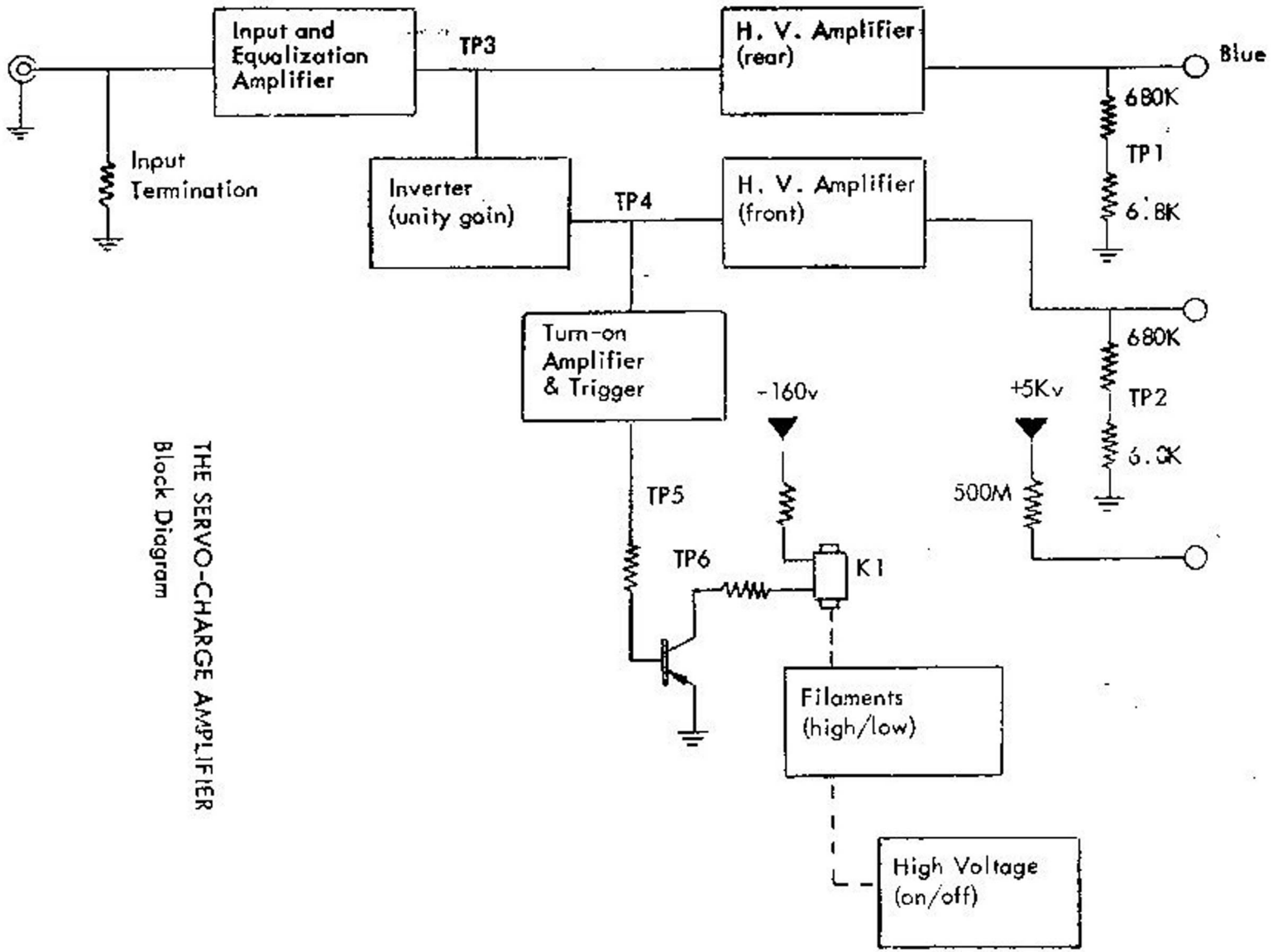

F1
3A SLO-BLO (3A SLO-BLO)
IN5400
IN5400
CR1
CR2
TRIAC
F2
1/2A
1/4A SLO-BLO
T2
T1
CR3
CR4
+5KV
3KV
C1
C2
V1
T3
C3
.01 3KV
V3
T4
C4
.01 3KV
V2
V4
CR7
CR8
+17v
C5 1000 25V
CR5
CR6
1000 25V
-17v
C6
R1 10K
+150v
CR11
CR12
22
C7
C8
22 250V
CR9
CR10
R2 10K
-150v
-160v
22
C9
22 250v
C10
NOTE 1
CR1, CR2 IN5400
CR3, CR4 S3217 8KV
CR5-CR16 IN4006
NOTE 2
RECEIVER INPUT DELETED AND R25 ADDED FROM CHASSIS 1700 ON
NOTE 3
C15, C15A, C20, C27 C36, R15, & R18 INVOLVE CHANGES IN PRODUCTION.
THE EARLIER VALUES ARE:
C15 15μf OR 33μf TANTALUM
C20 15μf TANTALUM
R15 6.8K
R18 68K
C15A, C27, C36 OMITTED
KIT AVAILABLE TO CONFORM TO SCHEMATIC VALUES
NOTE 4
IN4004 ACCEPTABLE FOR CR5 - CR8 & CR13 - CR16
R3 2.7K
K1 4PDT
CR13
R4 2.7K
TP6
Q5
MM4003
+17v
2.2K R29
1M R30
10K R28
TP5
33K R31
OFF +17v
ON -16v
1/4 OP 11
-17v
10K R27
680 R25
NOTE 2
CR14
R26 1M
C21 220 25V
TRIGGER AMPLIFIER
RECTIFIER (TURN-ON) AMPLIFIER
1/4 OP 11
220K R24
2.2K R23
C20 47NP
INSTALL 500K TO DEFEAT WALL-EFFECT EQ
C12 .0033
INPUT AMPLIFIER & EQUALIZER
200K R9
200K R10
10K R11
.022 C13
.00022 C14
R5 68K
1/4 OP 11
C16 22PF
R14 470K
CW
NOTE 3
R12
R13 10K
47 NP C15
C15A 620
GAIN
NOTE 3
4.7K R15
.0022 C17
100K R16A
500K R16
CW
HF BALANCE
10K R17
.01 C18
.0047 C19
R18 56K NOTE 3
R19 2.7K
10K R20
1/4 OP 11
10K R21
PHASE INVERTER
TP3 7.5V RMS AT OUTPUT CLIPPING
TP4
R8 .00047
1.5M C11
R7 680K
R6 100 5W
RECEIVER INPUT
SEE NOTE 2



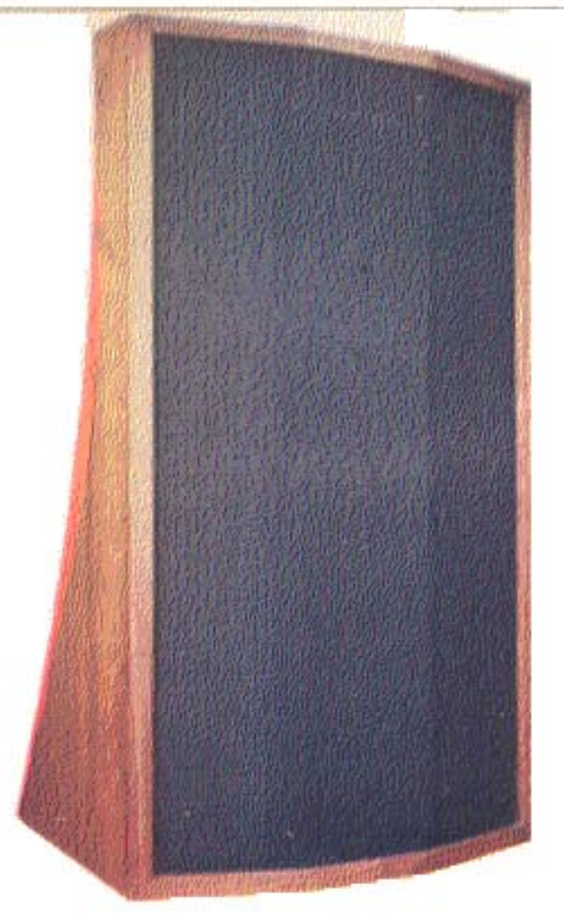
SCHEMATIC SC-X3 FEBRUARY 1979

Acoustat Monitor-X OTL


DISCRETE H.V. OP-AMP (REAR PLATES)
DISCRETE H.V. OP-AMP (FRONT PLATES)
RECTIFIER (TURN-ON) AMPLIFIER
TRIGGER AMPLIFIER
INPUT AMPLIFIER & EQUALIZER
PHASE INVERTER
HF BALANCE
GAIN
RECEIVER INPUT
SEE NOTE 2
INSTALL 500K TO DEFEAT WALL-EFFECT EQ
NOTE 1
CR1, CR2 IN5400
CR3, CR4 S3217 8KV
CR5-CR16 IN4006
NOTE 2
RECEIVER INPUT DELETED AND R25 ADDED FROM CHASSIS 1700 ON
NOTE 3
C15, C15A, C20, C27, C36, R15, & R18 INVOLVE CHANGES IN PRODUCTION. THE EARLIER VALUES ARE:
C15 15μF OR 33μF TANTALUM
C20 15μF TANTALUM
R15 6.8K Ω
R18 68K Ω
C15A, C27, C36 OMITTED
KIT AVAILABLE TO CONFORM TO SCHEMATIC VALUES
NOTE 4
IN4004 ACCEPTABLE FOR CR5 - CR8 & CR13 - CR16
TP1 1% OF OUTPUT VOLTAGE
TP3 7.5 V RMS AT OUTPUT CLIPPING
BLUE
RED
YELLOW
SCHEMATIC SC-X3 FEBRUARY 1979

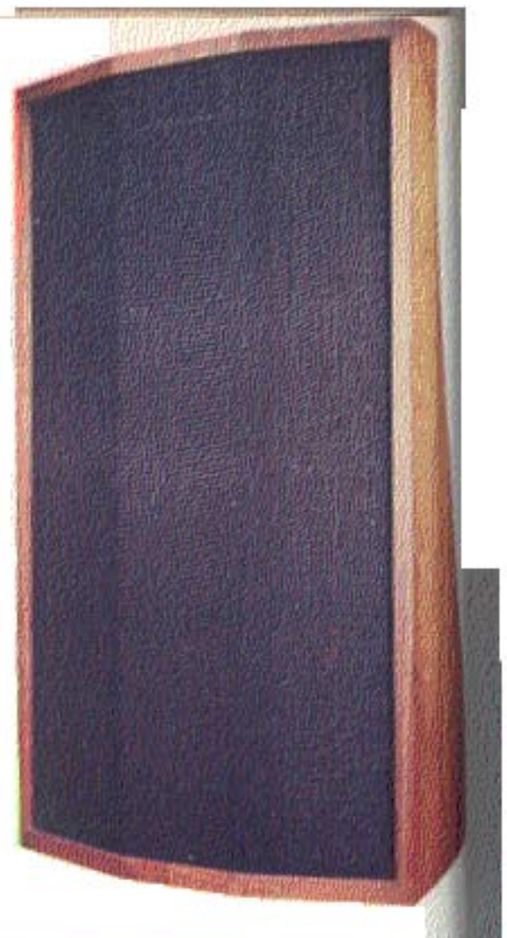


THE SERVO-CHARGE AMPLIFIER
Block Diagram



ACOUSTAT X
L.4.190.000 (la coppia)

magiche

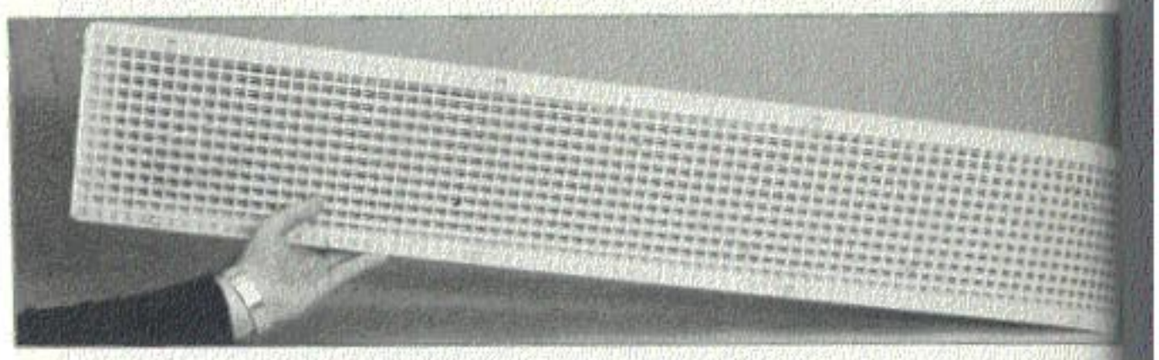


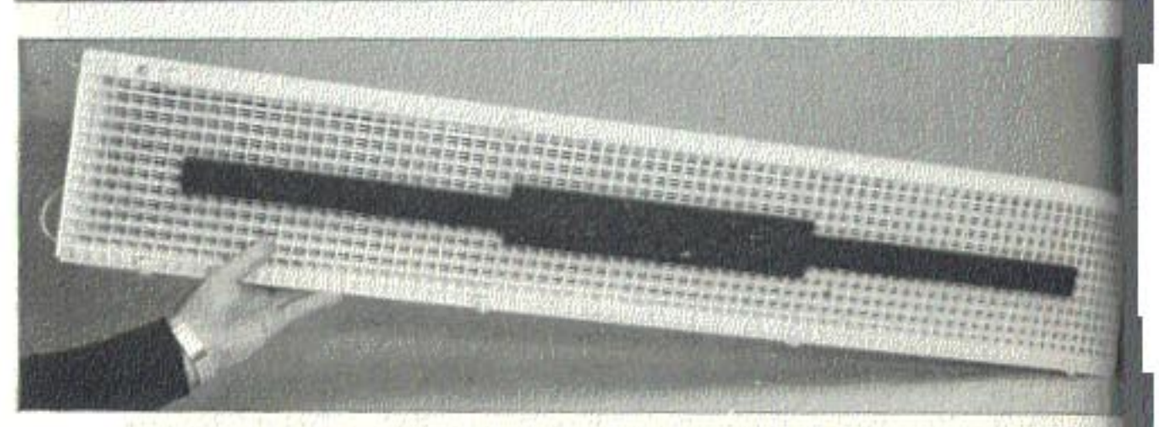
DIFFUSORE: ACOUSTAT X. **ALTOPARLANTI:** TRE ELETTROSTATICI; SUPERFICIE RADIANTE 110x15 CM. x 3. **DIMENSIONI:** 71x122x48 (L... CM. INGOMBRO MASSIMO. **MATRICOLA:** 775. **COSTRUTTORE:** ACOUSTAT CORPORATION, 4020 N. 29TH AVENUE - HOLLYWOOD, FLO... 33021. **IMPORTATORE:** INTERNATIONAL SOUND, C.SO DI PORTA VITTORIA, 47 - MILANO. **PREZZO MEDIO:** L. 4.190.000 LA COPPIA. R... **RIBILITA':** INIZIO DISTRIBUZIONE.

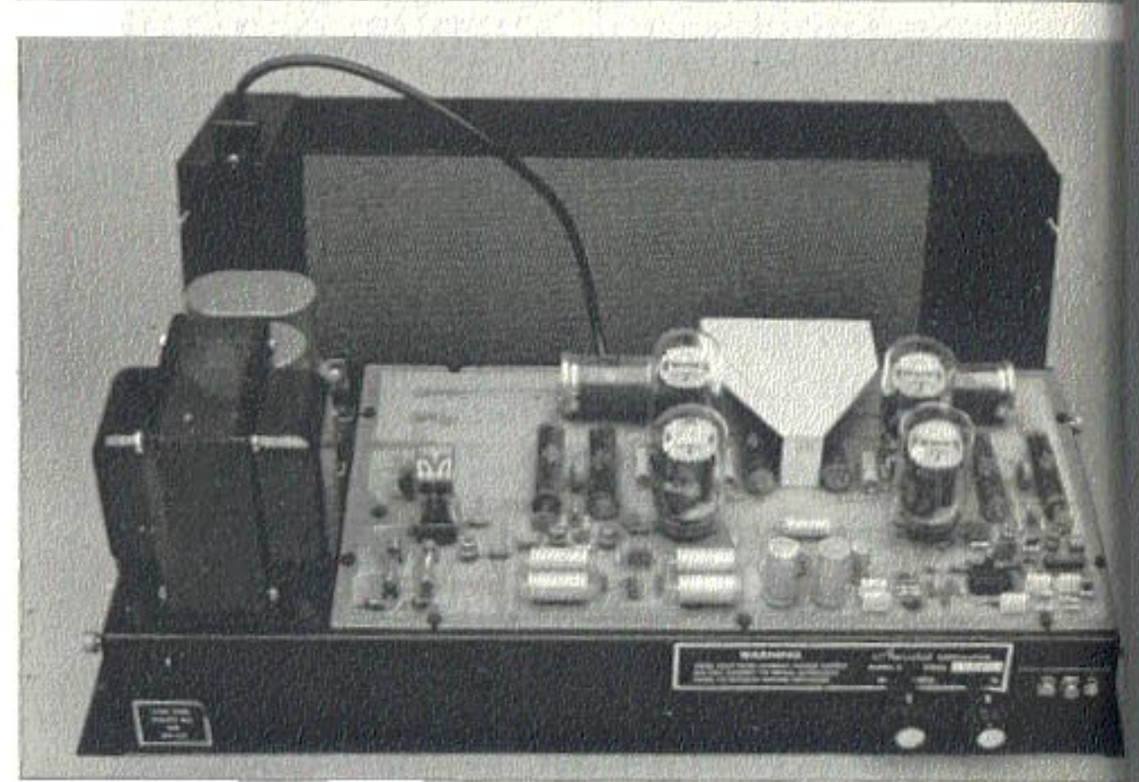
I diffusori Acoustat X utilizzano tre cellule elettrostatiche montate in un mobile « aperto » (rifinito in noce scuro), che contiene anche l'amplificatore. La orientazione è tale da migliorare la dispersione sul piano orizzontale, con in più una leggera inclinazione in alto, verso la più probabile posizione di ascolto. Le tre celle sono in parallelo e ricevono tutto il segnale audio, senza interposizione di filtri divisori, dall'apposito amplificatore a valvole che provvede anche alla tensione di polarizzazione. I diffusori necessitano quindi di un collegamento ad una presa di rete (220 Volt) e possono essere pilotati sia da un integrato (dai morsetti per gli altoparlanti) sia da un preamplificatore (sensibilità dichiarata: 1 Volt). L'amplificatore incorpora un circuito equalizzatore che corregge la risposta alle basse frequenze per prevenire le cancellazioni ed esaltazioni che intervengono sempre con i sistemi a dipolo acustico in prossimità di pareti riflettenti. Per la Acoustat X è prevista una posizione fissa di installazione a circa 90 cm. dalla parete posteriore.

In pratica abbiamo rilevato che tale equalizzazione è particolarmente spinta ed ottiene quindi di attenuare un poco la risposta in ambiente alle frequenze basse rispetto al livello medio di emissione del resto della gamma (allontanando peraltro pericoli di intermodulazione). L'amplificazione incorporata ottiene inoltre di proteggere il diffusore da eventuale sovrapilotaggio (che nel caso dei trasduttori elettrostatici può essere particolarmente dannoso); durante la prova di utilizzazione abbiamo apprezzato la assoluta insensibilità delle Acoustat a qualunque « tortura » (volontaria o involontaria) cui sono state assoggettate. L'amplificatore è dotato di un controllo di livello e di un regolatore degli alti, che agisce in modo simile ad un controllo di tono ed interessa anche buona parte della gamma media.

L'utilizzazione delle Acoustat X ha confermato i risultati delle misure, completando l'immagine di un diffusore in grado di porsi quale valida alternativa a certi sistemi « tradizionali » di alto livello. E' importante sottolineare comunque che un confronto diretto fra le prestazioni di questi diffusori e quelle di sistemi dinamici utilizzanti altoparlanti convenzionali presenta numerose difficoltà; nel caso delle Acoustat infatti il posizionamento e le caratteristiche dell'ambiente d'ascolto sono in grado di influenzare in modo meno facilmente prevedibile il risultato globale. La forte direttività sia verticale che orizzontale, compensata in parte dalle maggiori dimensioni della sorgente acustica, la timbrica caratteristica estremamente analitica e fortemente proiettata verso l'ascoltatore alle medie frequenze, la grande estensione della risposta alle basse frequenze (che in una delle installazioni provate ci ha fornito una sensazione d'ascolto del tutto eccezionale) contribuiscono a formare un quadro originale. I migliori risultati sono stati ottenuti con musica da camera e strumenti solisti, che vengono di volta in volta « trasportati nella stanza ». Con l'orchestra sinfonica, l'ascolto è emozionante, anche se sembra a volte di ascoltare attraverso due grandi finestre aperte su un altro ambiente; la posizione degli strumentisti è univocamente determinata grazie alla forte componente diretta del campo sonoro nel punto di ascolto. Ci teniamo a sottolineare che le Acoustat X sono i diffusori elettrostatici che hanno la più alta



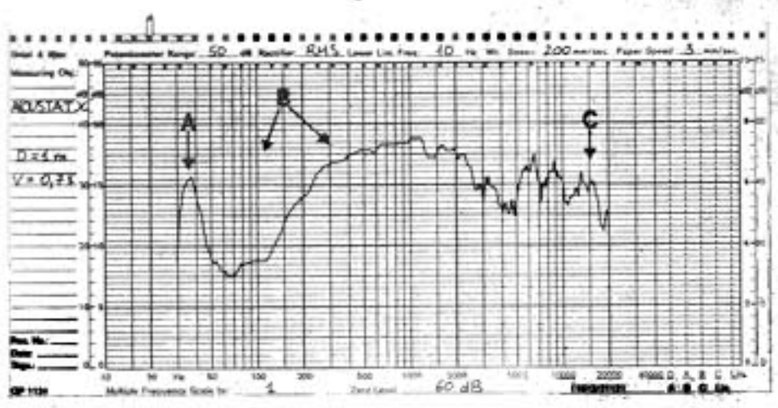




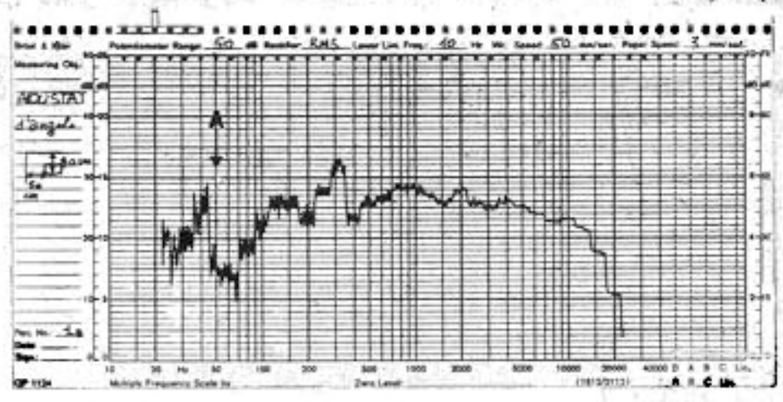
Le celle elettrostatiche dell'Acoustat X sono lunghe 110 cm e la... **14 cm, per favorire la dispersione orizzontale delle** medie frequ... **e sviluppare l'altezza della sorgente di emissione.** Posteriorme... **ciascun altoparlante è applicata una** striscia di feltro che limit... **emissione posteriore** in gamma media e alta. L'amplificatore utilizza ... **circuiti integrati e transistor che valvole** (finali video per TVColor) ... **il migliore accoppiamento ai trasduttori elettrostatici.**

dinamica fra tutti quelli che conosciamo (ottenuta con un... plificazione specifica, in grado di sfruttarli appieno), perfe... mente adeguata anche all'ascolto di brani jazz di una certa ... lenza. Ultima considerazione: il prezzo. Le Acoustat X va... valutate personalmente; la scelta potrebbe in una certa mis... prescindere dal costo, ma va ricordato che non obbligano ... acquisto di alcun amplificatore di potenza e quindi il confro... con sistemi « Top » completi di raffinata amplificazione è ... certi casi molto favorevole.

le misure

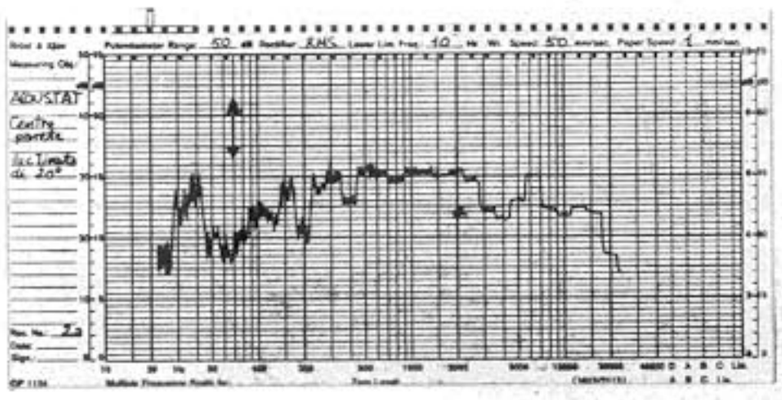


Risposta in frequenza sull'asse

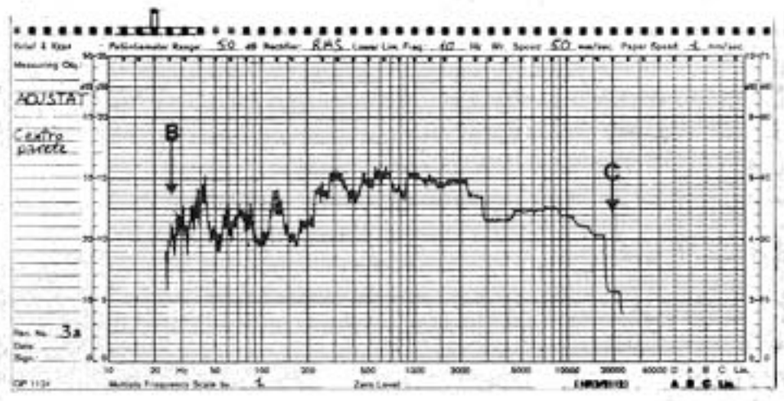


Risposta in frequenza in ambiente

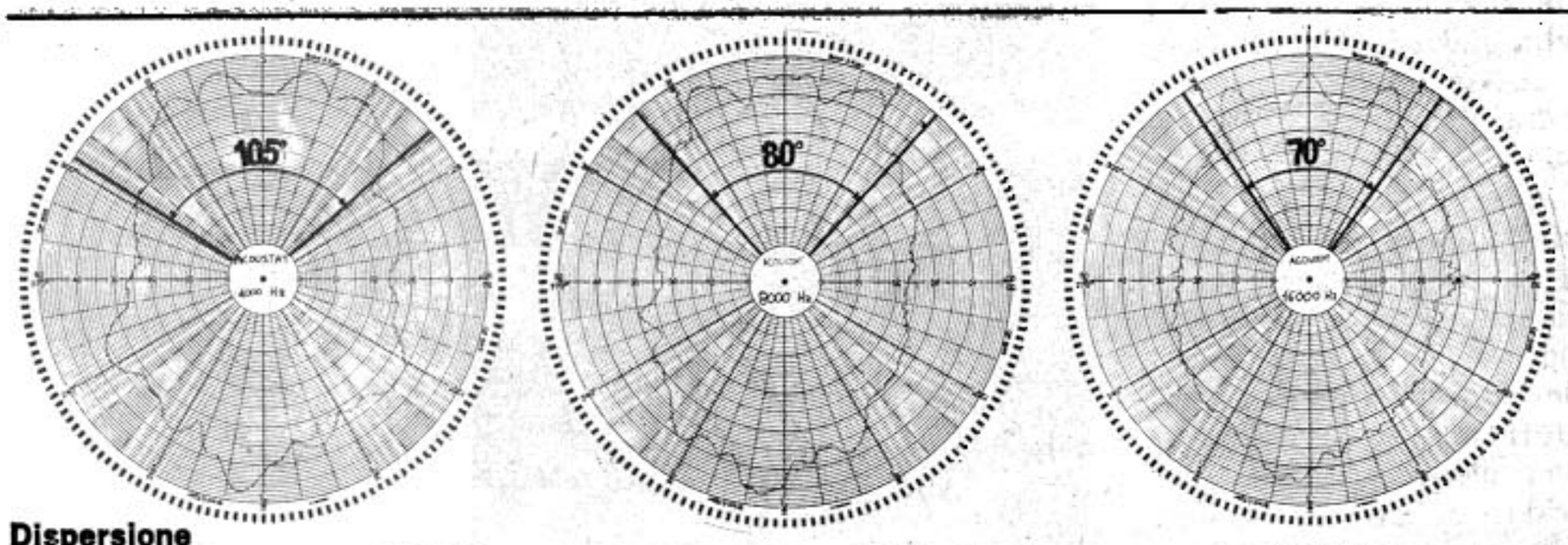
La risposta sull'asse mostra l'andamento caratteristico della equalizzazione (B) adottata per compensare le interazioni fra la emissione posteriore riflessa dalla parete di fondo e quella frontale. La rimanente parte della curva sull'asse è un poco tormentata dalle interazioni fra le emissioni dei tre pannelli. L'estensione è molto buona sia alle basse (circa 0 dB a 35 Hzl) (A) che alle alte frequenze (C).
Il primo grafico di risposta in ambiente (a lato di quella sull'asse) è stato rilevato con la cassa in posizione simile a quella utilizzata per tutti i diffusori in prova (a pavimento a 50 cm di distanza da due pareti d'angolo) aumentando a 90 cm la distanza dalla parete posteriore. Il secondo ponendo il diffusore (sempre a 90 cm) al centro di una parete molto lunga inclinato di circa 20°. Il terzo nella seconda posizione ma perfettamente parallela alla parete. Si nota che la equalizzazione introdotta è un po' eccessiva (A); la risposta è particolarmente estesa soprattutto alle basse frequenze (B), mentre il terzo d'ottava a 20 Kz è attenuato (C).



Risposta in frequenza in ambiente

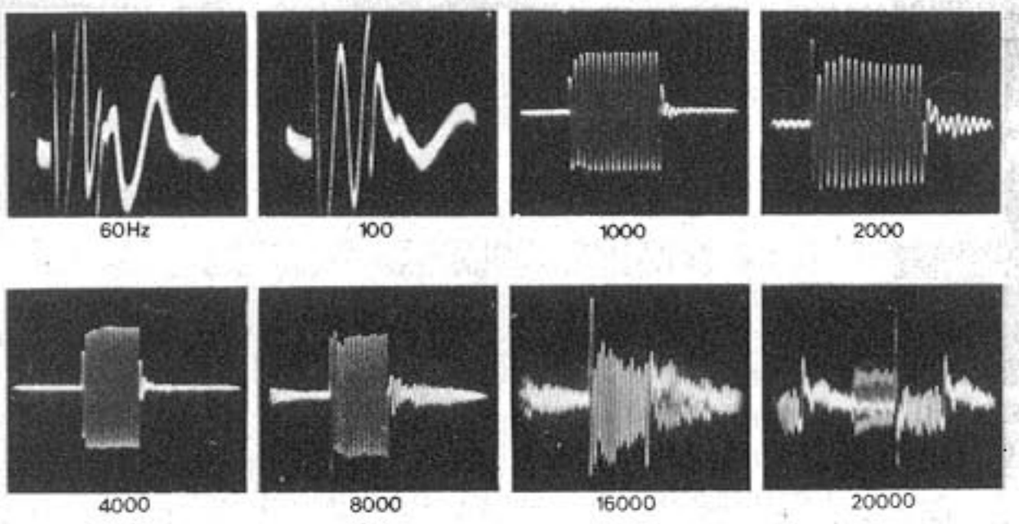


Risposta in frequenza in ambiente



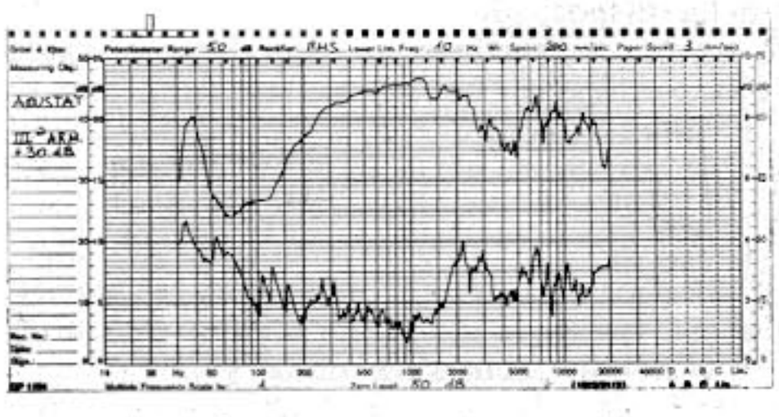
Dispersione orizzontale **4.000 Hz** **8.000 Hz** **16.000 Hz**

I diagrammi di dispersione alle alte frequenze mostrano la tipica conformazione a due lobi dei sistemi a dipolo acustico (emissione bidirezionale in controfase). Gli angoli di dispersione per 10 dB di attenuazione confermano le impressioni di ascolto: le Acoustat sono fatte per essere ascoltate con grande cura da uno, due ascoltatori.

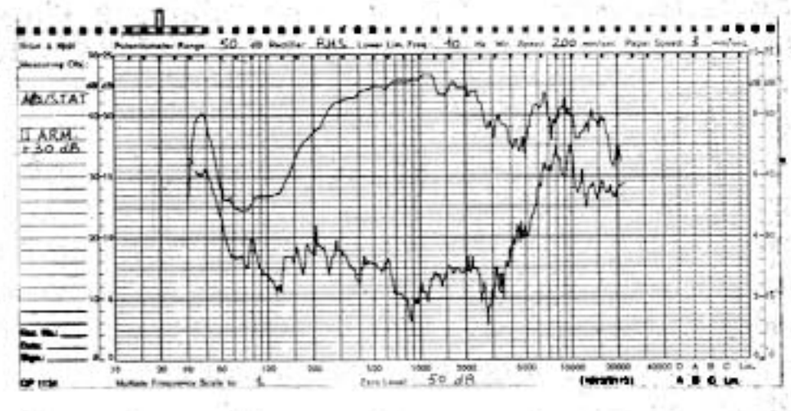


Risposta ai transienti

Tone burst accidentati alle basse frequenze, dove il comportamento dinamico risente anche degli sfasamenti introdotti dalla equalizzazione. Buona performance alle medie frequenze; alle alte si conferma invece la difficoltà ad ottenere una emissione coerente da una sorgente molto estesa studiata per un funzionamento a larga banda.



Distorsione di terza armonica



Distorsione di seconda armonica

La distorsione a 90 dB (un livello molto alto per un diffusore di questo tipo) è particolarmente ridotta. Alle basse frequenze si raggiunge solo l'1,5% di terza armonica a 60 Hz mentre a 35 Hz si è addirittura sullo 0,3%. Risultati eccellenti anche su tutta la gamma media, con un andamento particolarmente regolare tutto inferiore allo 0,1%!

Livello a 1 metro
1 Volt rumore rosa **87,2 dB**

Con 1 Volt (sensibilità nominale) si ottengono 87,2 dB). L'abbinamento è possibile quindi a qualsiasi preamplificatore.

UTILIZZAZIONE

a cura di Maurizio Ramaglia



acoustat X

Costruttore: Acoustat Corporation - **4020 N.** 29th Avenue Hollywood, Florida 33021 - **Distributore** per l'Italia: International Sound - Corso di Porta Vittoria, 47 - Milano - **Tel.** 02/784405

Prezzo corretto: L. 4.190.000 la coppia.

Verrebbe da pensare che la prova di utilizzazione di un diffusore acustico dovrebbe, con più** coerenza, **essere chiamata** prova **di ascolto; in generale ciò è senz'altro giusto: nel caso delle Acoustat « X » il discorso è** differente. Questi diffusori sono **assolutamente particolari; non possono, ad esempio, essere collegati, nei modi tradizionali, ad un amplificatore e** debbono, inoltre, **essere disposti nel locale di ascolto secondo alcuni accorgimenti. Vediamo il perché.

Che cosa sono e come funzionano

Affinché un diffusore elettrostatico in « push-pull », quali sono le Acoustat X, funzioni, oltre alla corretta tensione di polarizzazione, è necessario che il segnale venga applicato in controfase sulle armature esterne. Per far ciò, il segnale proveniente da un qualunque amplificatore di potenza, viene inviato sull'avvolgimento primario di un trasformatore elevatore di tensione, per essere nuovamente prelevato su di un secondario dotato di presa centrale: tra questa e gli estremi del secondario stesso si preleva una coppia di segnali in controfase. Questo sistema ha lo svantaggio di imporre, all'uscita di un amplificatore progettato per lavorare su di un carico resistivo, il collegamento di un trasformatore che è, viceversa, un carico di tutt'altra natura. La conseguenza consiste in tutta una serie di disfunzioni, tra cui, naturalmente, una buona percentuale di distorsione. D'altra parte, se si vuol realizzare un diffusore utilizzabile con qualunque amplificatore esistente in commercio, la soluzione, a tutt'oggi, non può essere che in questo tipo di compromesso.

La Acoustat ha escogitato una sua soluzione del problema: ciascun diffusore viene, quindi, fornito con un proprio amplificatore finale, progettato per funzionare esclusivamente su carico capacitivo (un diffusore elettrostatico si comporta, infatti, come un grande condensatore), ma che, però, può essere collegato all'uscita di un qualunque preamplificatore o amplificatore di potenza.

L'amplificatore « Servo-Charge »

Il finale di cui si parla è un amplificatore « ibrido », giacché utilizza sia elementi a stato solido (transistor, circuiti integrati), che tubi elettronici di tipo tradizionale. Gli elementi elettrostatici sono collegati direttamente ai quattro tubi della sezione di uscita, funzionanti in circuito a ponte e in controfase. Con questo si-

CARATTERISTICHE DICHIARATE DAL COSTRUTTORE

Risposta in frequenza: 30÷20.000 Hz

Livello di pressione acustica: 110 dB a 0,91 m (un diffusore) 105 dB a 6 m (un paio di diffusori in un ambiente di 4,2x7,2 m)

Distorsione armonica: 1% a 3 dB sotto l'uscita massima

Impedenza di ingresso: 50 Kohm

Controlli: bilanciamento delle alte frequenze: ±5 dB, guadagno: ±6 dB

Sensibilità ingresso: 0,7 V per l'uscita massima ad 1 KHz con il controllo di guadagno al segno di riferimento

Dimensioni: 71 (L) x 122 (H) x 49 (P alla base); 19,37 (P al sommo)

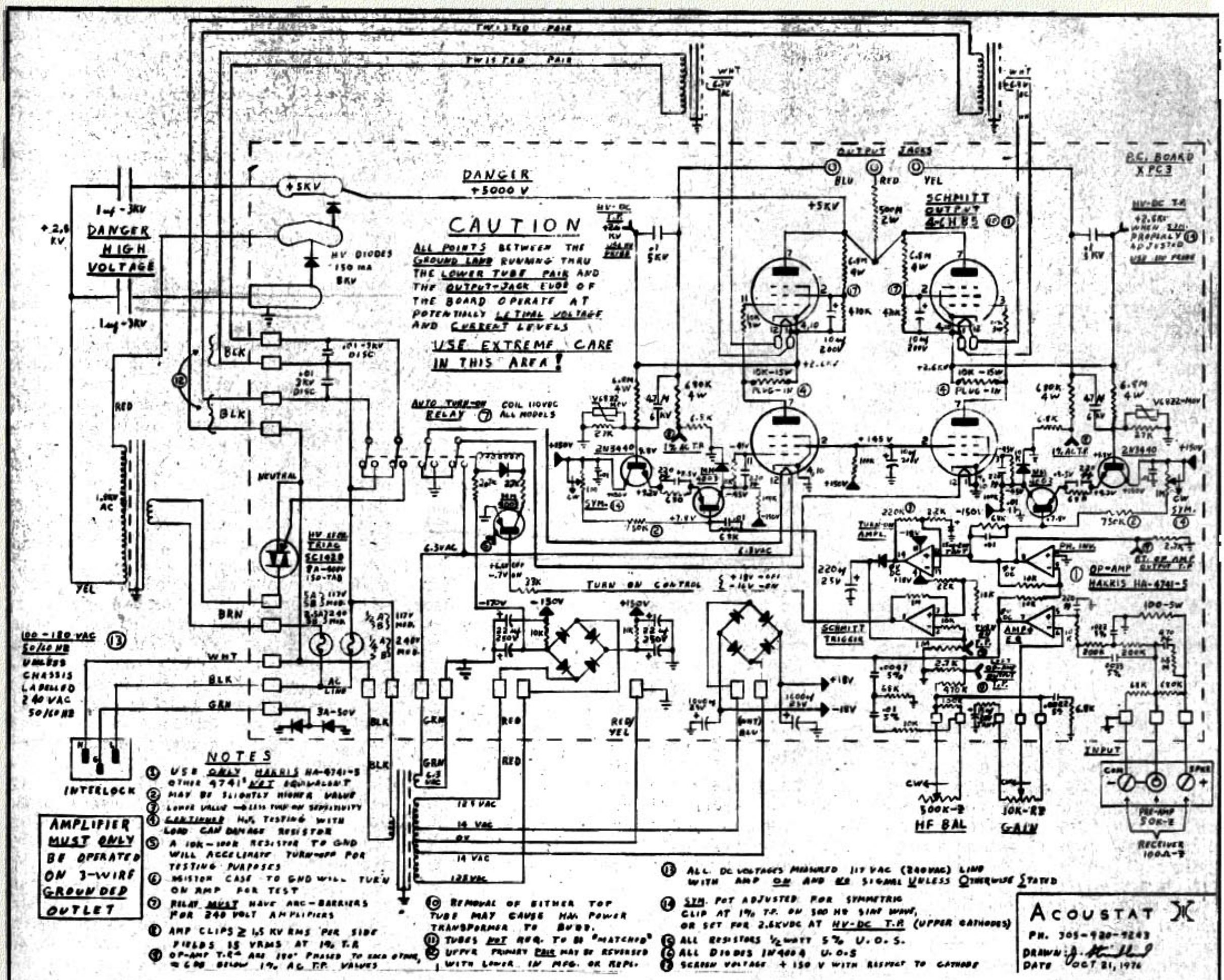


Il confronto con una figura umana rende perfettamente l'idea delle dimensioni di questi diffusori.

stema si è evitato l'impiego di trasformatori sul percorso del segnale; l'unico esistente, visibile nelle foto, è quello di alimentazione.
Il segnale da riprodurre può essere prelevato sia da un preamplificatore, che da un'uscita di potenza; sull'apparecchio, a tale scopo, sono stati predisposti due diversi tipi di ingresso. Naturalmente la soluzione migliore è quella di impiegare un preamplificatore, non fosse altro che per una questione economica. L'amplificatore è, inoltre, dotato di un circuito automatico di stand-by che, in assenza di segnale, dopo cinque minuti, provvede a spegnere l'apparecchio, mantenendo solo una limitata corrente sui filamenti dei tubi per tenerli pronti al funzionamento; inviando in circuito un qualunque segnale audio, l'amplificatore rientra immediatamente ed automaticamente in funzione.
I controlli del « Servo-Charge Amplifier » comprendono: un controllo della banda medio-alta che, secondo i dati dichiarati dalla Casa, fornisce esaltazione ed attenuazione per ±5 dB e la cui regolazione tipica è sulla posizione del « nove dell' orologio », ed un controllo di guadagno di ±6 dB attorno alla posizione tipica di « ore 11 ».
Tutto lo chassis è protetto da una grigliatura cui è fissato il cordone di alimentazione in modo che non sia possibile aprire la gabbia protettiva, senza prima disconnettere la tensione di alimentazione: ciò perché, in alcuni punti del circuito sono presenti tensioni dell'ordine dei 5.000 volt che possono far provare qualche spiacevole, quanto pericoloso, « brivido » ad un utilizzatore poco accorto.
A questo punto è lecito chiedersi quale potenza sviluppi questo amplificatore: la domanda è destinata, però, a rimanere senza risposta, infatti, per definire una potenza elettrica, è necessario ragionare su di un carico resistivo che nel caso di un altoparlante elettrostatico non sussiste. Al solo scopo di effettuare una misura, è comunque, possibile caricare l' uscita dell'amplificatore con una resistenza: il risultato, a detta della Casa, è qualcosa che si aggira sull'ordine dei 100 watt, ma che, sia ben chiaro, è assolutamente privo di significato.
Per quantificare, in qualche modo, la resa acustica che è possibile ottenere dal complesso amplificatore-diffusore, la Acoustat fornisce alcuni dati in SPL (Sound Pressure Level: livello di pressione acustica): 110 dB a 91 cm, per un solo diffusore e 105 dB per una coppia di diffusori a 6 m di distanza in un ambiente di 4,2x7,2 m. Questi dati vanno, però, considerati con una certa cautela, in quanto il livello sonoro che può essere ottenuto in un dato ambiente dipende, oltre che dalle dimensioni, anche dalle caratteristiche acustiche dell'ambiente stesso.

I diffusori

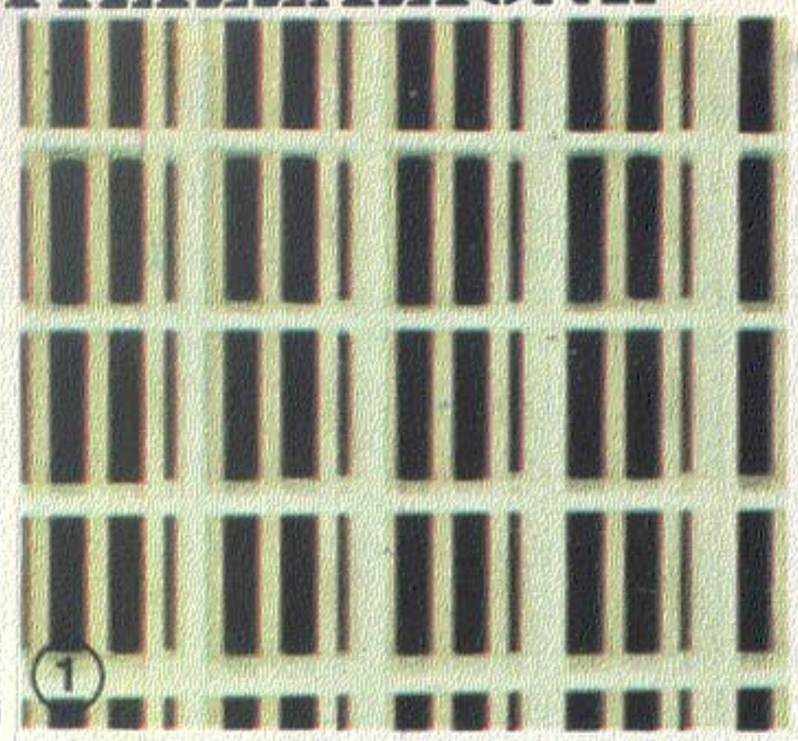
Le Acoustat « X » son due « sventole » alte un metro e ventidue, costruite e rivestite in noce o, a richiesta, in altri tipi di legno. Ciascuna di esse contiene tre identici « pannelli radianti » costituiti da una doppia struttura di plastica rigida formata da un insieme di celle quadrate, al centro della quale è teso il diaframma di mylar, con uno strato-deposito di materiale conduttore, che è praticamente « l'ugola » del sistema. Le due armature,

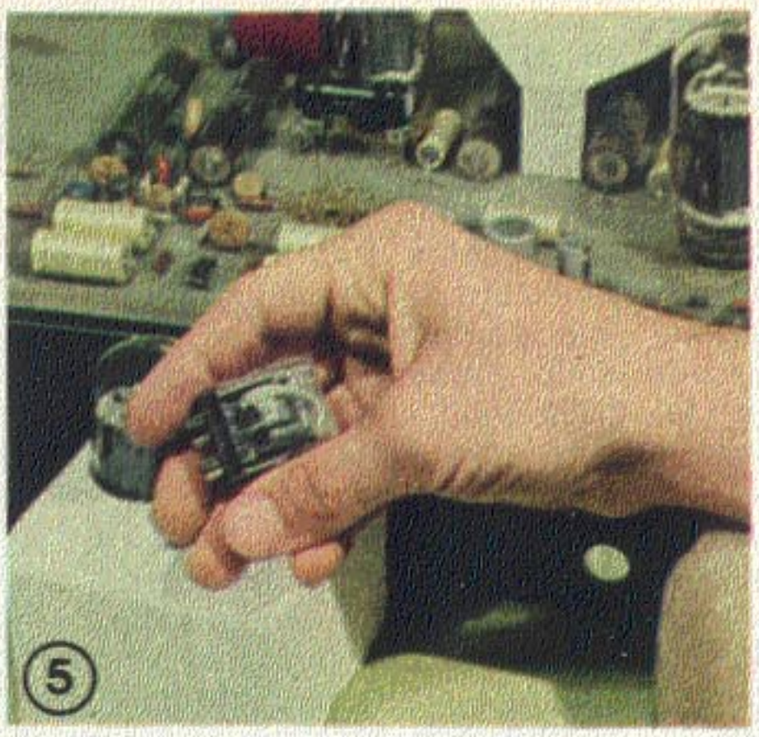


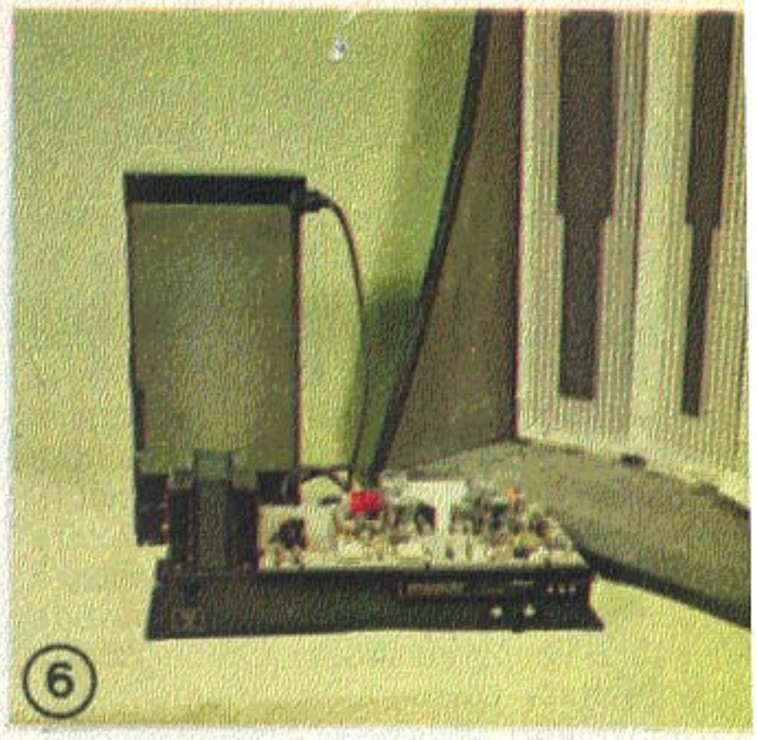
Una curiosità: lo schema dell'amplificatore del « Servo-Charge Amplifier ». Come si vede, in alcuni punti sono indicate delle tensioni piuttosto elevate, tanto da richiedere raccomandazioni di estrema cautela.

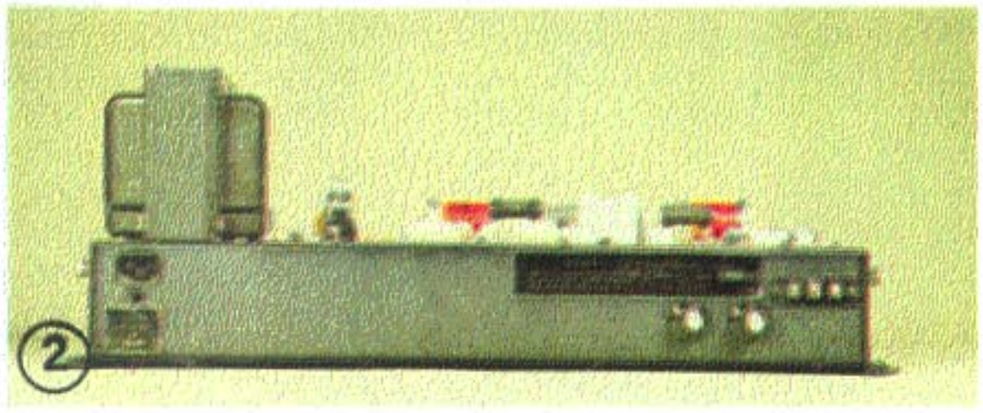
UTILIZZAZIONE

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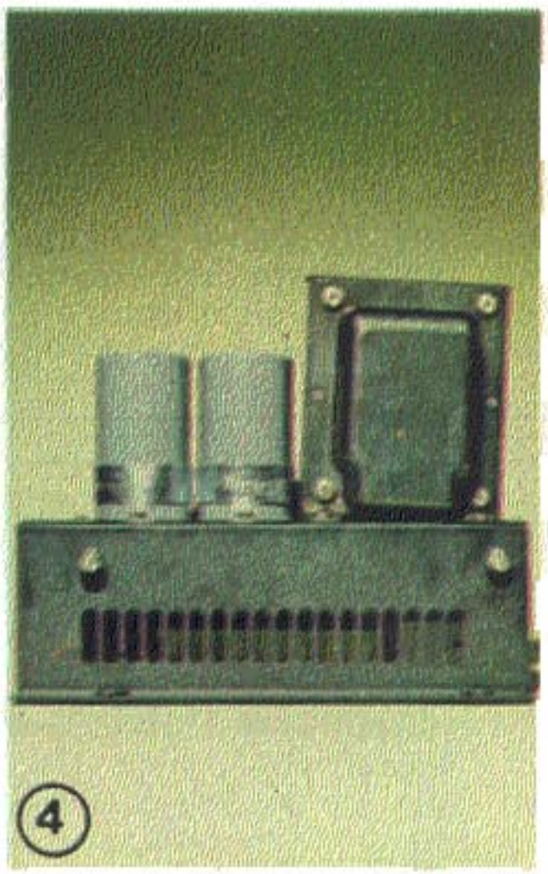












1) *In* ***questa foto è perfettamente visibi la struttura che sostiene il diaframma e i conduttori che costituiscono le armature fisse.***

2) *Visione laterale* ***dell'amplificatore: si n tano sul frontale i due controlli di to e guadagno e gli ingressi del segnale.***

3) *L'amplificatore* ***viaggia « disarmato »; quattro « valvoloni » vengono posti « opera » dall'utilizzatore medesimo.***

4) *Il trasformatore di alimentazione* ***con due surdimensionatissimi condensatori 1 µF, 3000 volt del raddrizzatore.***

5) *Il* ***particolare mostra il relé del circui di stand-by che provvede allo spegnime to parziale dell'amplificatore dopo 5 n nuti di inattività.***

6) ***Una vista d'insieme dell'amplificatore c i tubi in sito e la griglia di protezio rimossa.***
Normalmente esso è disposto nella ba del diffusore.

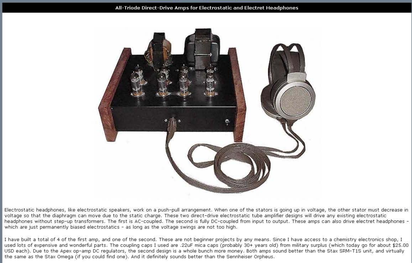
per realizzare la massima trasparenza acustica, sono realizzate mediante conduttori disposti a « cordiera » e, ai fini elettrostatici, sono assimilabili a piastre continue.
I tre pannelli sono angolati tra loro in modo da realizzare la massima ampiezza di fronte sonoro, senza produrre « zone d'ombra » nelle intersezioni dei fasci di emissione dei vari pannelli; questi sono collegati in parallelo senza interposizione di alcun circuito di crossover.

Utilizzazione

Qualunque diffusore dotato di emissione posteriore, se posto in vicinanza di una superficie riflettente (ad esempio un muro) dà luogo a fenomeni caratteristici di rinforzo e di attenuazione dovuti all'interferenza del fascio di emissione anteriore e di quello, riflesso, posteriore. Questi effetti sono maggiormente udibili sulle basse frequenze, in corrispondenza di lunghezze d'onda pari a quattro volte la distanza della sorgente sonora dalla superficie riflettente (rinforzo) e due volte la distanza stessa (attenuazione). Nel circuito di amplificazione della Acoustat X è stata prevista una equalizzazione attiva per ovviare a tale inconveniente; i parametri del circuito sono stati calcolati, però, in base ad una distanza, stabilita in sede di progetto, pari a 91 cm (3 feet) misurati tra diaframma e muro. A questa distanza corrisponde un rinforzo sui 90÷100 Hz ed una attenuazione sui 180÷200 Hz. Per tale motivo la Casa raccomanda di mantenere, tra muro posteriore e diffusori, una distanza pari a quella utilizzata per il calcolo del circuito di equalizzazione. Nel caso in cui le Acoustat dovessero essere utilizzate a grande distanza dalle pareti o, addirittura, all'aperto, si renderebbe necessaria la disattivazione di tale circuito secondo istruzioni da richiedere direttamente alla Casa. In questo tipo di utilizzazione di avrebbe, comunque, un moderato calo del livello massimo ottenibile.
Veniamo all'ascolto. Innanzitutto vogliamo avvertire che non è possibile rendere in poche righe l'impressione d'ascolto di questi diffusori. Il suono è particolarmente originale al primo impatto e consigliamo tutti di provare ad ascoltarle presso i rivenditori. Sarà un'esperienza inconsueta. Dopo un periodo di assuefazione, si scoprono cose ancora interessanti. Esempio: si ascolta una registrazione « Direct to disc » di un classico brano da discoteca e dopo un po' ci si accorge che tra gli altri strumenti di tipo elettronico o elettrico c'è un flauto e che questo strumento suona *esattamente come un flauto* e che sembra di ascoltare un unico vero strumento circondato da tanti altoparlanti. Un'impressione ancora più netta si è avuta ascoltando brani di pianoforte solista: facendo il confronto con diffusori di ottima reputazione, ma di tipo tradizionale, l'impressione nel passaggio dall'uno all'altro tipo è stata, a parità di livello di ascolto, quella di « vedere » lo strumento aumentare le proprie « dimensioni », sino a raggiungere quelle di uno strumento reale, la « presenza » insomma dello strumento acustico nella stanza, con tutte le sfumature del suo suono equilibrate in maniera corretta, senza innaturali « pompaggi » o « imbellimenti ».
Non si tratta di una coppia di diffusori c portare in una discoteca, in primo luog perché non verrebbero apprezzati ed noltre perché non reggono i sovracca chi cui in tali condizioni sarebbero sott posti non nel senso del danno, ma quello della distorsione: oltre un dete minato livello, sufficiente comunque far tremare le mura di qualunque appa tamento, queste casse distorcono in m niera abbastanza repentina. E' il loro m do di funzionare; non è detto che la d storsione debba obbligatoriamente cresc re lentamente, certo, sarebbe meglio. I ogni caso il livello massimo di funzion mento è determinato in maniera precis basta tenersi al disotto di questo perch non sorgano problemi; rimane solo quell dei vicini di casa, poiché, ripetiamo, livello cui questi diffusori distorcono ben al di sopra a quello di sopportazion del vicino « medio ».
Un'ultima parola sul prezzo: salato, m non così come può sembrare a prim vista, infatti esistono notissime casse gran pregio e di grandi dimensioni ch acquistate nella versione non rifinita ve rebbero a costare sopra il milione e me zo l'una: basta aggiungere un amplific tore adeguato per coprire la differenz « economica »; rimane da concludere discorso sulla differenza « acustica », m questo la proponiamo come piacevol test, per tutti gli audiofili. Gradiremmo anzi, ricevere qualche commento.

M. R

All-Triode Direct-Drive Amps for Electrostatic and Electret Headphones



Electrostatic headphones, like electrostatic speakers, work on a push-pull arrangement. When one of the stators is going up in voltage, the other stator must decrease in voltage so that the diaphragm can move due to the static charge. These two direct-drive electrostatic tube amplifier designs will drive any existing electrostatic headphones without step-up transformers. The first is AC-coupled. The second is fully DC-coupled from input to output. These amps can also drive electret headphones - which are just permanently biased electrostatics - as long as the voltage swings are not too high.

I have built a total of 4 of the first amp, and one of the second. These are not beginner projects by any means. Since I have access to a chemistry electronics shop, I can obtain the special components (1% resistors, 1% polypropylene caps, and military-grade tubes (NOS) from military surplus (which today go for about $25.00 USD each). Due to the Apex op-amp DC regulators, the second design is a whole bunch more money. Both amps sound better than the Stax SRM-T1S unit, and virtually the same as the Stax Omega (if you could find one). And it definitely sounds better than the Sennheiser Orpheus.

BACKGROUND

Why I decided to design and build these headphone amplifiers. There are lots of reasons. First let me say that there are some things transistors do better than tubes, like bass control and volume control, which works better with efficiency speakers like the Klipsch.

Then there are things that tubes do better than transistors. Like high voltage. Electrostatic headphones are very high-voltage devices. With a maximum voltage swing of 510 volts peak-to-peak, transistors or MOSFETS just are not good enough to do the job. The idea here was to design and build something good enough to make it into Stereophile's Class A category.

Here is what is available in electrostatic headphone/amplifier combo's:

Stax Omega and tube amp (approx. $10,000 a pair).
When the Omega headphone/tube system is no longer available, the amplifier in use is all tube DC-coupled unit. When it was available, it was absolutely the best thing in the world!

Stax Nova Signature and either SRM-T1S or SRM-T1W amp ($1500/$1700).
The SRM series amplifier has tube output, but MOSFET input and MOSFET gain stages. The sound is nowhere as good as the Omega, but strictly due to the amplifier used.

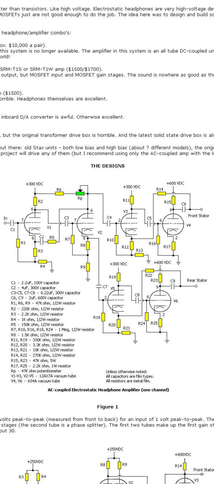
Sennheiser HV60/HEV70 combo ($1500).
The solid state drive amplifier is horrible. Headphones themselves are excellent.

Sennheiser Orpheus ($12,000).
A wonderful system, although the inboard D/A converter is awful. Otherwise excellent.

Koss 9500 (about $500).
The headphones are fairly decent, but the original transformer drive box is horrible. And the latest solid state drive box is also awful.

There are lots of good old headphones out there: old Stax units - both low bias and high bias (about 7 different models), the original koss headphones, and the Jecklin Floats. The tube amps described in this project will drive any of them (but I recommend using only the AC-coupled amp with the low-bias Stax phones - see below).

THE DESIGNS



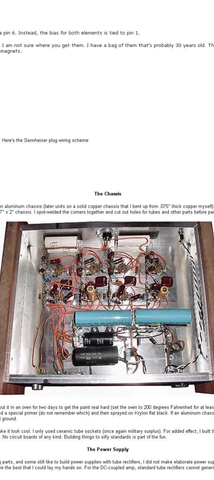
C1 - 2.2uF, 1000V capacitor
C2 - 4uF, 500V capacitor
C3-C5, C7-C9 - 0.22uF, 3000 capacitor
C6, C9 - 2uF, 500V capacitor
R1 - 100K ohm, 1/2W resistor
R2 - 220K ohm, 1/2W resistor
R3 - 2.2K ohm, 1/2W resistor
R4 - 470K ohm, 1/2W resistor
R5 - 330K ohm, 1/2W resistor
R7, R10, R16, R19, R24 - 1 Meg, 1/2W resistor
R6 - 1.5K ohm, 1/2W resistor
R11, R17 - 330K ohm, 1/2W resistor
R12, R18 - 2Meg, 1/2W resistor
R13, R22 - 10K ohm, 1/2W resistor
R14, R22 - 270K ohm, 1/2W resistor
R15 - 1K ohm, 1/2W resistor
R17, R20 - 2K ohm, 5W resistor
Rg - 47K ohm potentiometer
V1-V3, V5-V7 - 12AU7A vacuum tube
V4, V8 - 6SN7 vacuum tube

Unless otherwise noted:
All capacitors are film types.
All resistors are metal film.

AC-coupled Electrostatic Headphone Amplifier (one channel)

Figure 1

Both amps are OTL and will output 500 volts peak-to-peak (measured from front to back) for an input of 1 volt peak-to-peak. The AC-coupled amplifier (figure 1) uses a series of single-ended pure class a gain stages (the second tube is a phase splitter). The first two tubes make up the first gain stage with a gain of about 20 and the second two tubes make up a gain of about 30.



C1, C3, C5 - 33uF, 450V capacitor
C4, C6 - 2.2uF, 600V capacitor
C2 - C2 = R4C4 (turn high voltage opamp (see text))
R1, R2, R3, R10 - 47K ohm, 1/2W resistor
R3, R4 - 330K ohm, 1/2W resistor
R5, R11, R19 - 10K ohm, 1/2W resistor
R6, R12 - 1K ohm, 1/2W resistor
R8, R16, R17 - 100K ohm, 1/2W resistor
R13, R20 - 2Meg, 1/2W resistor
R15, R21 - 1Meg, 1/2W resistor
R14, R22 - 47K ohm, 5W resistor
R18, R23 - 1K ohm, 5W resistor
V1, V4 - 12AU7 vacuum tube
V3, V5 - 6SN7 vacuum tube

Unless otherwise noted:
All capacitors are film types.
All resistors are metal film.

DC-coupled Electrostatic Headphone Amplifier (one channel)

Figure 2

The DC-coupled amp (figure 2) uses two differential gain stages (the first stage is also a phase splitter). The output stage is single-ended pure class a. The first stage gain is about 7, the second stage gain is about 5 and the output stage has a gain of about 15. Decreasing the overall gain is easy - add an input pot. Increasing the gain is unnecessary as virtually any preamp can put out 1 volt, and that's quite loud (about 109dB).

The reason for a fully direct-coupled amp is that interstage coupling caps, regardless of quality (even the silver mica units I use), are not perfect. The transformers used in some electrostatic speakers and early Stax drive boxes are also far from perfect. So in this amp, from input to output, only tubes touch the audio signal. It's absolutely the best thing I have ever done.

I believe in feedback. Not a lot of feedback, but enough to fully stabilize the circuit. In both designs, the first two tube sections generate a stable pair of signals perfectly matched, but 180 degrees out of phase. Then each of these signals goes to a voltage booster once again with local feedback to drive the diaphragms. I have listened to these units for literally thousands of hours, trying various kinds of tubes, ranging from NOS Mullard, RCA, GE and Raytheon to current-made junk. The feedback makes all these tubes sound virtually alike. Not at all like some tube preamps that sound fantastically different depending on the tube you use.

The DC-coupled amp is also rather expensive. The 6 Apex op-amps alone are $240 in parts. It goes without saying that the build quality will ultimately effect the sound. I built several of these units on a pure copper chassis, with ceramic silver tie points, just like Tektronix used to do in their tube oscilloscopes (the prototype shown in the pictures used an aluminum chassis and standard tie points). It's insanely time consuming, but the result is worth it.

CONSTRUCTION

This project involves working with lethal high voltages, so be extremely careful! Keep one hand behind your back at all times. 600VDC across both arms might possibly stop your heart. **The author accepts no responsibility for any harm caused by the construction of this project**

An electrostatic element has one diaphragm in between two fixed stator elements. Each amp has front and rear stator outputs. Call the front and back whatever you want, so long as the left and right ear pieces are wired the same, so that they are in phase.

The PA42 is a 350-volt opamp from Apex Microtechnology Corp. (I use a lot of Apex products in research applications). It's a high voltage monolithic MOSFET unit. Since the opamps are strictly used for DC bias control, they do not influence the "TUBE" sound. They keep the output voltage at +300 volts. This is so that the output voltage can swing to zero and then to +600 volts. Note: the Burr-Brown 3583 high voltage opamp is not pin-for-pin substitute for the apex; however it should work.

The Headphone Cable Connectors

All of the low-bias Stax units use 6-pin plugs (amphenol microphone plug). All high-bias units are the same plug with 1 pin missing, and both diaphragms tied to the one wire. That way a high-bias headphone can plug into a low-bias driver, but the low-bias phones cannot plug into a high bias driver.

The Stax plug wiring scheme is as follows:

```
     left front: pin 2
     left rear: pin 5
     bias: pin 1
     right front: pin 3
     right rear: pin 4
     bias: pin 6
```

The high bias headphones do not have a pin 6. Instead, the bias for both elements is tied to pin 1.

The jack I used is an Amphenol 78-S6S. I am not sure where you get them. I have a bag of them that's probably 30 years old. The were used as speaker connectors when speakers did not have permanent magnets.

It looks like this from the pin end:

```
   _
  / \
 o   o
o     o
 \ _ /
```

except that it's not that regular.

```
 4 5 6
  1 2 3
```

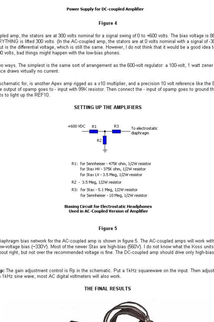
Above it is shown wired.

The Sennheiser HV60 uses a 6-pin inline plug. Here's the Sennheiser plug wiring scheme:

```
     pin 1 (the corner notch): left front
     pin 2: left diaphragm (bias)
     pin 3: left back
     pin 4: right back
     pin 5: right diaphragm (bias)
     pin 6: right front
```

The Chassis

I built the prototype shown in the pictures on an aluminum chassis (later units on a solid copper chassis that I beat up from .075" thick copper myself). The first amp is built on a 13" x 15" x 2" chassis. The second amp is built on a 15" x 17" x 2" chassis. I spot-welded the corners together and cut out holes for tubes and other parts before painting the chassis to avoid scratching it.



The outside of the chassis is painted black. I put it in an oven for two days to get the paint real hard (set the oven to 200 degrees Fahrenheit for at least 4 hours baked). The chassis should be degreased with alcohol before painting it. I used a special primer (do not remember which) and then sprayed on Krylon flat black. If an aluminum chassis used, have one copper sheet on the inside to make sure that everything has a really good ground.

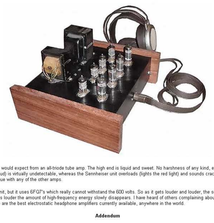
The 1 inch thick EBONY wood side panels make it look cool. I only used ceramic tube sockets (once again military surplus). For added effect, I built these units in a style similar to that of 40+ years ago. Everything is on ceramic tie points. No circuit boards of any kind. Building things to silly standards is part of the fun.

The Power Supply

Once the majority of people will be scrounging parts, and some still like to build power supplies with tube rectifiers, I did not make elaborate power supply schematics. For me, solid state power is just fine. The diodes and capacitors I used were the best that I could buy my hands on. For the DC-coupled amp, standard tube rectifiers cannot generate 850V without breaking down. Solid state fuse is definitely the way to go.

The 12AQ7 is either a 6-volt filament or a 12-volt filament, depending on how you wire it. In the schematic, I show it wired for 6-volts. The 6SA is strictly a 6-volt filament tube. I use AC for the filaments. You could certainly run DC for the filaments, if you wish. It might result in less hum, which is probably already unmeasurable if not inaudible.

The transformers: I have a lot of scrounged parts and actually used two transformers, one for the high voltage, and another dual coil for the filaments. I just looked through a bunch of catalogs for each element I made. It's no longer a hobby world. Allied Electronics (which still sells the old transformers - Model 6VCT2D is a 75-watt unit with 750 VCT and 6.3V. Model 6FS48F is a 25-watt unit with 12.6 VCT. The first unit is certainly overkill power-wise. The outputs run class A and are set at 4 watts, meaning 16 watts on the 600-volt line. The 300-volt line draws less than 2 watts.



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