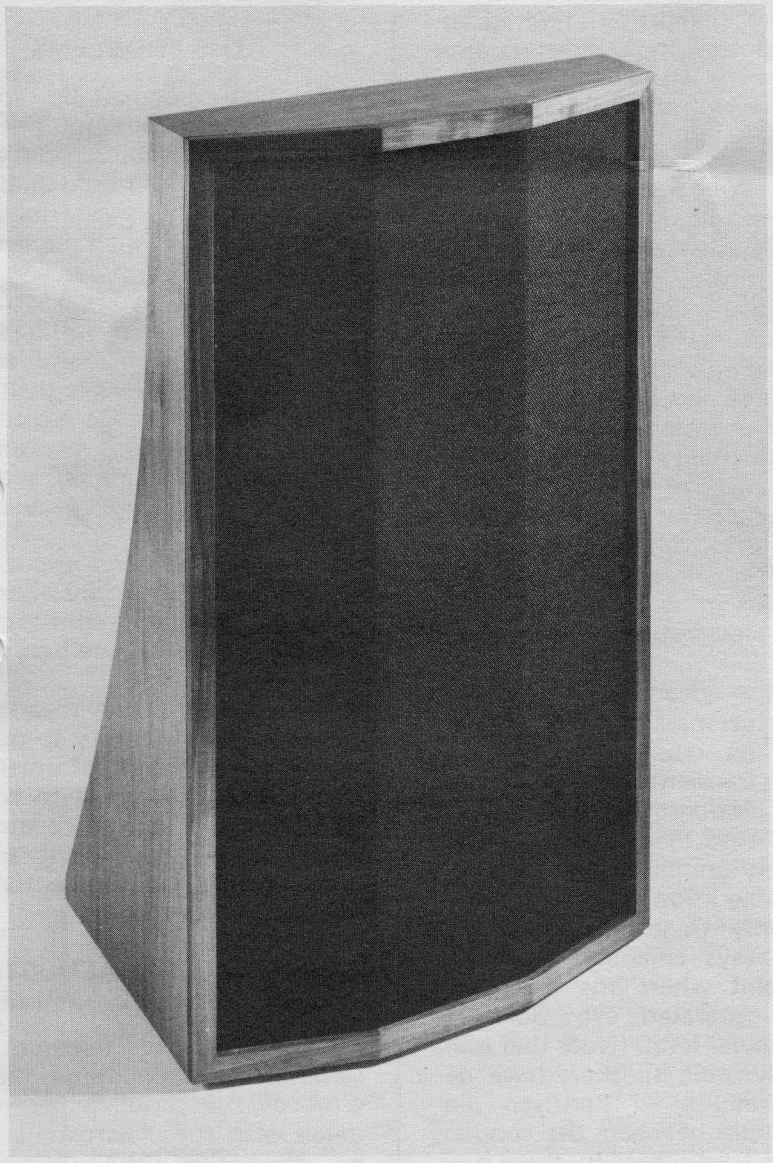
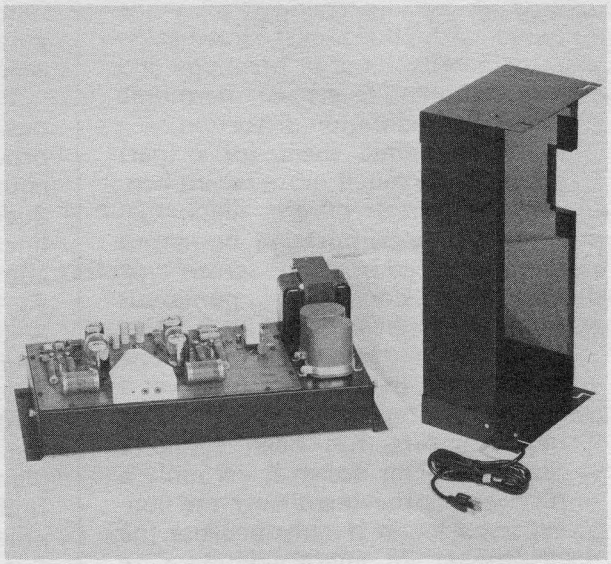
THE ACOUSTAT X

- 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 coherenc with no parasitic mechanica el ments between the drive an radiating element and for an ex cellent acoustic impedance matc to air. The electrostatic concept probably the closest thing ye devised to being able to tu a electrical signal directly into sound

THE PROBLEMS

Practical electrostatic speake made their debut in the ear 1950's with Arthur Janszen's sma tweeter array. This bold innovatio was enormously successful and still available in much the same fo mat today.

But, the *full-range* electrostat speaker that could fulfill all th obvious design goals was anoth story. There have more than a fe attempts at full range electrostat design *driven by conventional am plifiers* over the years, and the have all had three proble common:

1) inadequate sound output leve even when driven by exceedin ly high powered amplifiers.
2) generally inadequate bass r o se
3) distortion and non-linearity ca sed by the necessity to use hig voltage step-up transformers.

In addition, by trying to squeez out more level with more and mo power in this inefficient arrang ment, panels are frequently ove driven and burned out.

THE SOLUTION: ACOUSTAT'S SERVO-CHARGE AMPLIFIER

The Acoustat research tea came to the conclusion that th crux of the problem lay not s much with the electrostatic spea ers themselves and their pane

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 pressure 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

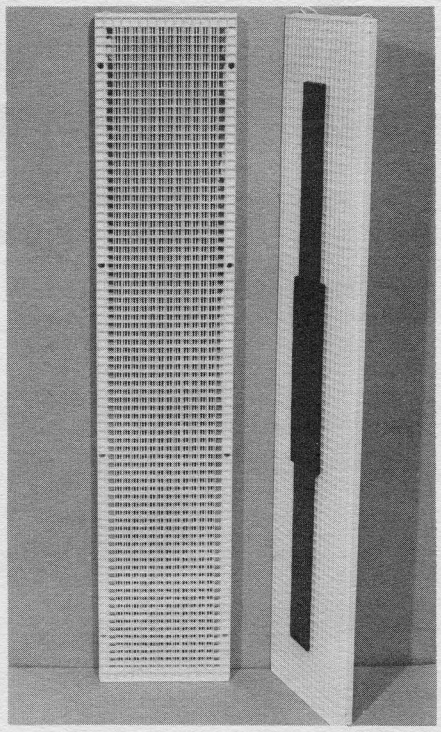
Acoustat has made some further contributions to electrostatic technology in the special design of its electrostatic panels. These panels are completely free of any arcing problems and further provide complete immunity from climate, temperature and humidity factors. And, most importantly, *they cannot 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

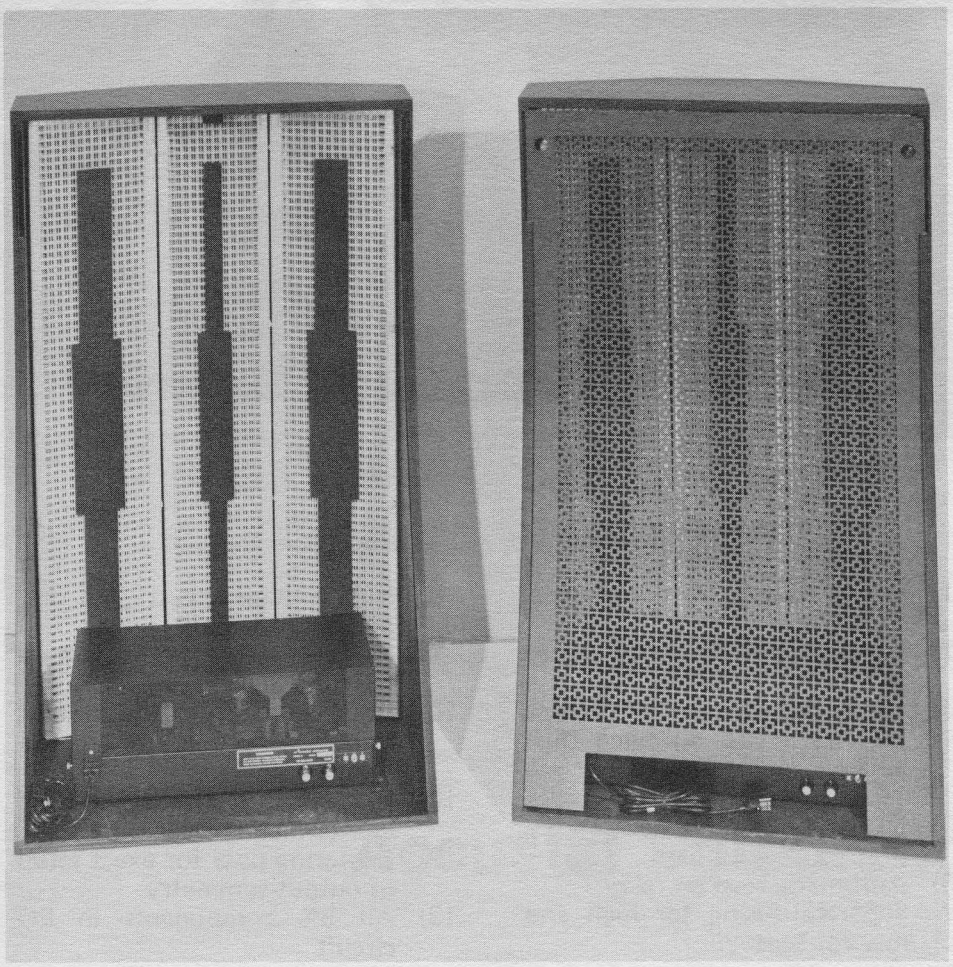
Because of the presence of dangerous high voltage at several points in the Servo-Charge Amplifier, the AC line cord is automatically disconnected when the protective cage is removed from the top of the chassis.

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.

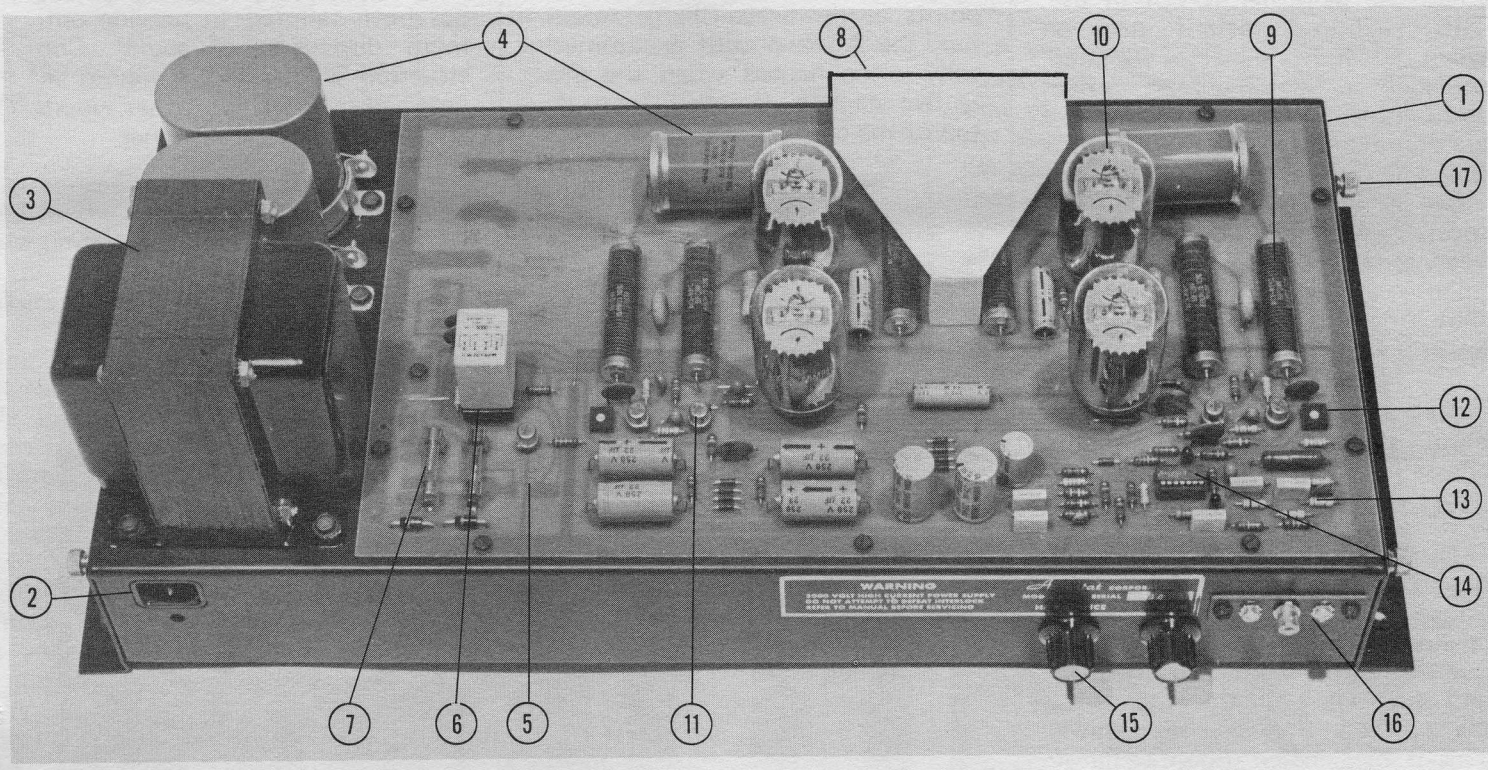
● Cabinet

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.



SERVO-CHARGE AMPLIFIER

PATENT PENDING



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

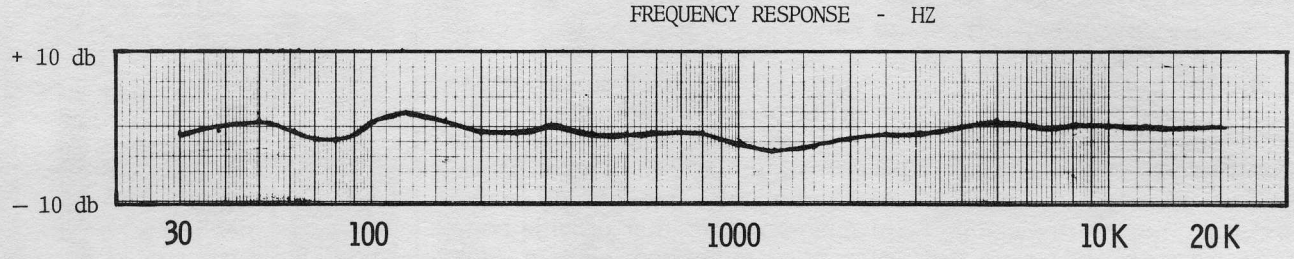
Gain ± 6 db

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

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