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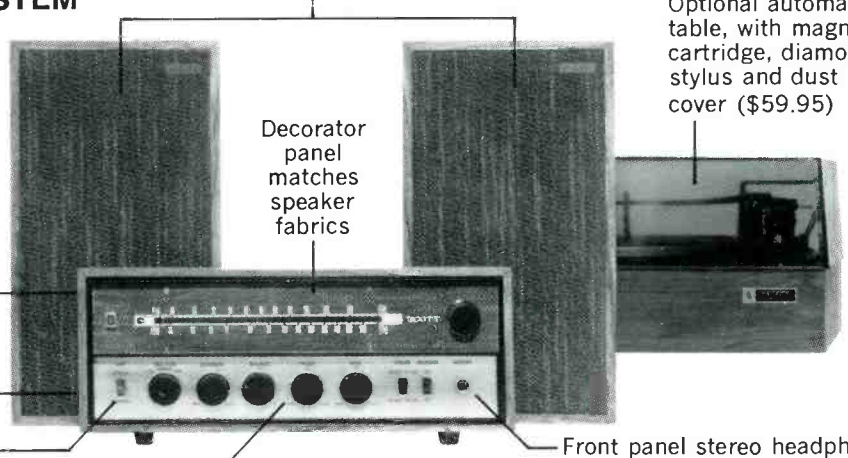

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FEATURE ARTICLES

ANNUAL PRODUCT PREVIEW

RECORD/TAPE REVIEWS

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Coming in September

S.C.A.—Private Music on Public FM Stereo—Leonard Feldman examines "background music" transmission and reception, detailing how the private channel(s) is hidden over FM stereo broadcasts and how it can be retrieved at the receiving end.

A Greek Theatre (Circa 1968)—Don Davis gives a step-by-step description of how a sound contractor planned an outdoor sound installation.

Electronic Organs, Part I—Norman H. Crowhurst starts a series on electronic organs, wedding music and electronics. He focuses on tone generators in this opening part.

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ABOUT THE COVER

Audio Magazine's annual product preview directory is depicted on the cover in type, with each product category identified. This yearlong guide to stereo hi-fi equipment begins on page 22.

Audioclinic

JOSEPH GIOVANELLI

If you have a problem or question on audio, write to Mr. Joseph Giovanelli at AUDIO, 134 North Thirteenth Street, Philadelphia, Pa. 19107. All letters are answered. Please enclose a stamped, self-addressed envelope.

"Clicks" in organ recordings

Q. My problem concerns the recording of "live" stereo organ music in church. My equipment consists of a stereo tape recorder and two omnidirectional mikes.

I get a pronounced "click" from the relays used to transport the signal from the organ console to its pipes. This problem has been observed in two different churches. A friend used a different brand of stereo deck and used the same type of microphones. He had no trouble.

First, can you tell me why I get a "click" in my tape recorder and why he did not get one on his recorder? This friend mentioned something to the effect that, when plugging the line cord into the outlet, there is a fifty-fifty chance for the proper ground. He said that when he recorded at the church, he also got a click. He then removed the plug for some reason. When he reinserted it, he got no click.—Richard C. Wagie, Mequon, Wisconsin

A. I would imagine that the clicks are transmitted by the power line and are entering your machine in the form of small, transient voltage changes, by way of the line cord. I would think that perhaps your friend's machine was free from the clicks because of a better power transformer's interwinding shield or a better layout, whereby important input leads are further removed from the power transformer than is true of your machine. Perhaps you can improve the situation by using a good line interference filter. You might also try grounding the tape recorder to the building ground and see if this eliminates the trouble.

It sometimes happens that merely by reversing the position of the plug in the wall socket, the machine is located at a better ground potential. You might try this to see if you can bring about improvement. If you obtain some gain, you should mark your plug so that you can always insert it into the socket in the same way. Of course, this will be true only for that particular wall outlet. It might not be true of another one.

Further, it is a good idea to connect your machine to a separate outlet from that supplying the switches in your organ's console. This will reduce the chance of receiving a large dose of the transients which are causing your trouble.

I do not know whether your mikes are high impedance, low impedance, or perhaps a combination type of microphone. If it can be adjusted for low impedance operation, do so. Then obtain a good line transformer to step the impedance up to the value required by your machine. Place this transformer as close to the tape recorder as possible so you will not run much cable at high impedance. (I can't emphasize enough that the transformer should be of good quality. The shielding against external fields should be excellent or you will pick up transients by induction into the transformer.) It is also possible that the clicks are entering via the mike cable. Run as little mike cable as possible. Unfortunately, organs are noted for producing transient clicks which are difficult to clean up.

Light Bulb as Dummy Load?

Q. What is your opinion of an ordinary incandescent light bulb for the load resistor of an amplifier under test? A 100 watt, 125 volt bulb measures almost exactly 16-ohms resistance on my VOM.—Harry C. Sutch, Seattle, Wash.

A. The resistance of a bulb changes dramatically with temperature. As the temperature of the bulb increases, its resistance increases. When the bulb is at normal operating temperature, its resistance will rise to a value over 100 ohms.

Therefore, you can see that as more and more power is applied from your amplifier to the bulb, the load applied to your amplifier will increase in value, making any tests meaningless.

If you want to prove this for yourself, work out the resistance and current needed for your bulb to operate. You will find that a bulb using 100 watts of power at 125 volts draws 0.8 ampere from the power line. Working this out further, you can see that the bulb will have a resistance of about 150 ohms at its proper operating point.

If you would like to see the resistance of a light bulb change with tempera-

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ture, obtain a small bulb (one of the Christmas tree types will suffice). Connect it to an ohmmeter and set the meter to a low scale. You will observe that the resistance increases during the time the meter is connected. This increase will continue until the bulb has reached a stable operating temperature —which will be much lower than the temperature of this same bulb when it is being supplied with its rated power.

Never attempt to measure the "hot" resistance of the bulb when it is still connected to the power line. I saw someone try that trick with the idea of making a direct measurement of the bulb's resistance under actual operating conditions. Naturally enough, this technician did not wish the bulb, or lamp as it is more technically correct to call this device, to cool off while he connected the ohmmeter into the circuit. Therefore, he made the connection of the ohmmeter before applying the power from the line. The ohmmeter was completely wrecked, of course. So *never* connect an ohmmeter to a circuit where voltage might be present.

Next Day (Almost)

Q. I understood all you said so far, but . . . Why does the varying resistance of a light bulb render amplifier tests meaningless when a speaker's impedance varies quite wildly with changes in frequency?—Harry C. Sutch, Seattle, Washington.

A. Well, it all comes down to the fact that the lamp does not vary with frequency; its impedance varies with the power applied to it. That is something else again.

Suppose we want to determine the power feeding the load at a given percentage of distortion. This is readily done when we know the value of the load resistor. However, we never really know its value when it is varying over a wide range of values. This variation is more than would be the case with a speaker's variations of impedance over the audio spectrum.

As you know, we often try to figure the speaker as having a constant impedance regardless of frequency. This makes for easy calculation if nothing else. It allows us to come up with some test results which can be verified by anyone who is conducting the same tests. In the case of your lamp, the results of your test could not readily be checked by other observers. I do not know if a lamp can be relied upon to have the same characteristics as another lamp with similar power rating.

If we can beat a higher price speaker, would you mind paying less for University?

Here's the "in" way to shop for the best sound at the best price: Compare one of our speakers to another that's the same price. Listen to both for a few minutes. Then compare ours to a speaker priced up a level. Then go up another level... and another level. When they begin to sound the same, compare the price. Now if getting the best speaker buy on the market is "in" for you, you'll know why University is "in" with sophisticated hi-fi enthusiasts everywhere.

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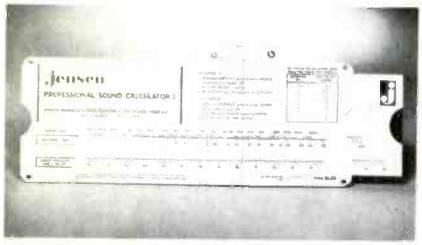
What's New In Audio

Sound Calculator

Jensen Manufacturing has made available a 7½-in., double-sided slide rule for quick computation of problems involving sound levels. Fixed and movable slider scales and a transparent sliding hairline indicator make it easy to convert sound pressure (dynes/sq. cm.) to sound pressure level (SPL in dB), and for computing SPL, distance



or power input to the loudspeaker for specified conditions such as loudspeaker sensitivity, required SPL, etc.

A "Range Extender" table shows SPL change for large ratios of distance and power, while an SPL "Summation" table illustrates total SPL for two known signal levels. Write Jensen Manufacturing Div., The Muter Co., 5655 W. 73rd St., Chicago, Ill. 60638. Price is $1.00.

Sound-Effects Console

The British "Mellotron" Sound-Effects Console uses 70 magnetic tapes (⅜-in.), each carrying three tracks. Tracks are divided into six sections of recorded information, providing 1260 different sound effects compiled from the British Broadcasting Corporation's (BBC) library. Any sound effect can be located within 20 seconds and injected directly into motion-picture films, television and sound broadcasting at either the dubbing or initial recording stages, or in direct transmission, according to the manufacturer.

The Console, which looks like an electronic organ, has 26 main sound groups, including industrial, traffic, animal, weather, and war sounds. Push-button switches above the keyboard select the range of effects, while the keys on the piano keyboard control individual sounds or related sequences. A sound effect can continue for eight seconds at a normal speed of 7½ ips, with speed variable ±20% to vary pitch.

Audio News

■ The first half of 1968 marked a great number of personnel changes in the audio industry, including the following: ☐ E. Peter Larmer was named vice president, marketing, for Ampex Corp.'s consumer and educational products division. ☐ George W. Tillett was appointed executive vice president of Audio Dynamics Corp. ☐ Stanley Grossman to vice president, sales and marketing, C/M Labs. ☐ Albert Kahn resigned as president of Electro-Voice, Inc., retaining his seat on the board of the parent company, Gulton Industries, Inc.; Wayne Beaverson was named the new E-V president. ☐ Elite Electronics Inc. has been appointed exclusive distributor in the United States of the Goodmans of England line of loudspeakers, speaker systems, and electronic components. P. Bert Groveman is president. ☐ Herbert F. Kuslow assumes responsibility for operations of the Jensen Manufacturing Div. as vice president and general manager. He continues as executive vice president of the parent company, Muter, and Herbert J. Rowe continues as president and chairman of the board. ☐ John Pacconi named vice president, marketing of University Sound.

■ Continuing a trend toward mergers, another hi-fi equipment manufacturer, Dyna Company (Dynaco, Inc.) has been acquired by Tyco Laboratories, Inc., a manufacturer of materials, electronics, and controls, it was announced recently. David Hafler, president of Dyna and Dynaco, will continue to manage the companies as divisions of Tyco.

Saul J. White, 64, acoustical engineer with Dyna Empire, Inc., passed away recently. He was on the board of governors of the Audio Engineering Society.

BEHIND THE SCENES

BERT WHYTE

"Stereo Eight"

The 8-track stereo cartridge and the stereo cassette are no longer considered novelties. Both have been firmly established as legitimate new formats of magnetic tape recordings. At present, both mediums seem to be in a state of "co-existence," but only the most optimistic of wishful thinkers can believe this "peaceful" status will be maintained.

The 8-track stereo cartridge and the stereo cassette have their boosters and their detractors in equal measure. Without declaring myself for either format, let us take a closer look at these fascinating concepts of magnetic recording, which have been categorized by some of their more enthusiastic supporters as "the wave of the future."

The 8-track stereo cartridge and its associated playback unit was developed by the Lear Jet Company with RCA Victor furnishing the musical material. As you know, the configuration is that of a plastic cartridge containing an endless loop of special back-lubricated quarter-inch magnetic tape, running at a speed of 3¾ ips, and with 4 pairs of stereo tracks. Each stereo pair is considered as a separate "sequence" or program. A magnetic head mounted on a cam plays a sequence. At the conclusion of the program a foil strip is encountered which "triggers" a switch that activates the cam mechanism which automatically shifts the head to the next sequence. The head shifts from sequence to sequence until the four pairs of stereo tracks are played and then the process will begin all over again, ad infinitum, as long as the cartridge remains inserted in the player.

Because we are dealing with an endless or "closed" loop of tape, each sequence is extremely critical as to timing and must be as equal in duration as possible. In practice, this means within one second. Believe me, since I have produced well over 100 classical 8-track stereo cartridges for RCA Victor, conforming to this tolerance is a difficult and oftentimes arduous task. At first glance, you might be puzzled why this matter of sequence timing is such a problem. It should be as simple as taking the total time of the music and dividing this by four. Unfortunately, this "brute force" method almost invariably results in cutting into the continuity of the music at awkward places. Couple this with the fact that there is a lag of several seconds when the head shifts from one sequence to the next. The abrupt cessation of sound, during a sustained note, for example, is a devastating affront to the ear and the aesthetics of music. With "Pop" music the timing problem isn't so formidable . . . each selection is of limited duration and there are pauses between each selection corresponding to the "cuts" on a stereo disc. By manipulating these pauses, sometimes adding and othertimes subtracting a certain number of seconds, it is usually possible to get four equal sequences without cutting into the music at all. With classical material, getting four sequences of equal duration without "butchering" the music can be one of the most frustrating and exasperating experiences imaginable. It goes without saying that composers did not write their works with the requirements of a stereo cartridge in mind.

Just for an example, let's consider a symphony that times out on the master tape to 48 minutes. Thus we must have four sequences, each 12 minutes in length. The usual symphony has four movements of variable length and a pause between each movement. Now follow this procedure: The specifications on the 8-track cartridge call for a minimum 10-second silent indent at the beginning of the first sequence. By sheer luck, the first movement of our symphony is exactly 11 minutes and 50 seconds, which with the ten-second indent, gives us the desired 12-minute sequence. The 2nd sequence begins with the 2nd movement, which we will assume is 8 minutes in duration. Allowing a ten-second pause, we need an additional 3 minutes and 50 seconds of music to complete the 12-minute sequence. We obtain this music by going into the third movement this length of time, cutting at that point. That's the rub . . . you just don't know what you will encounter at that cut point.

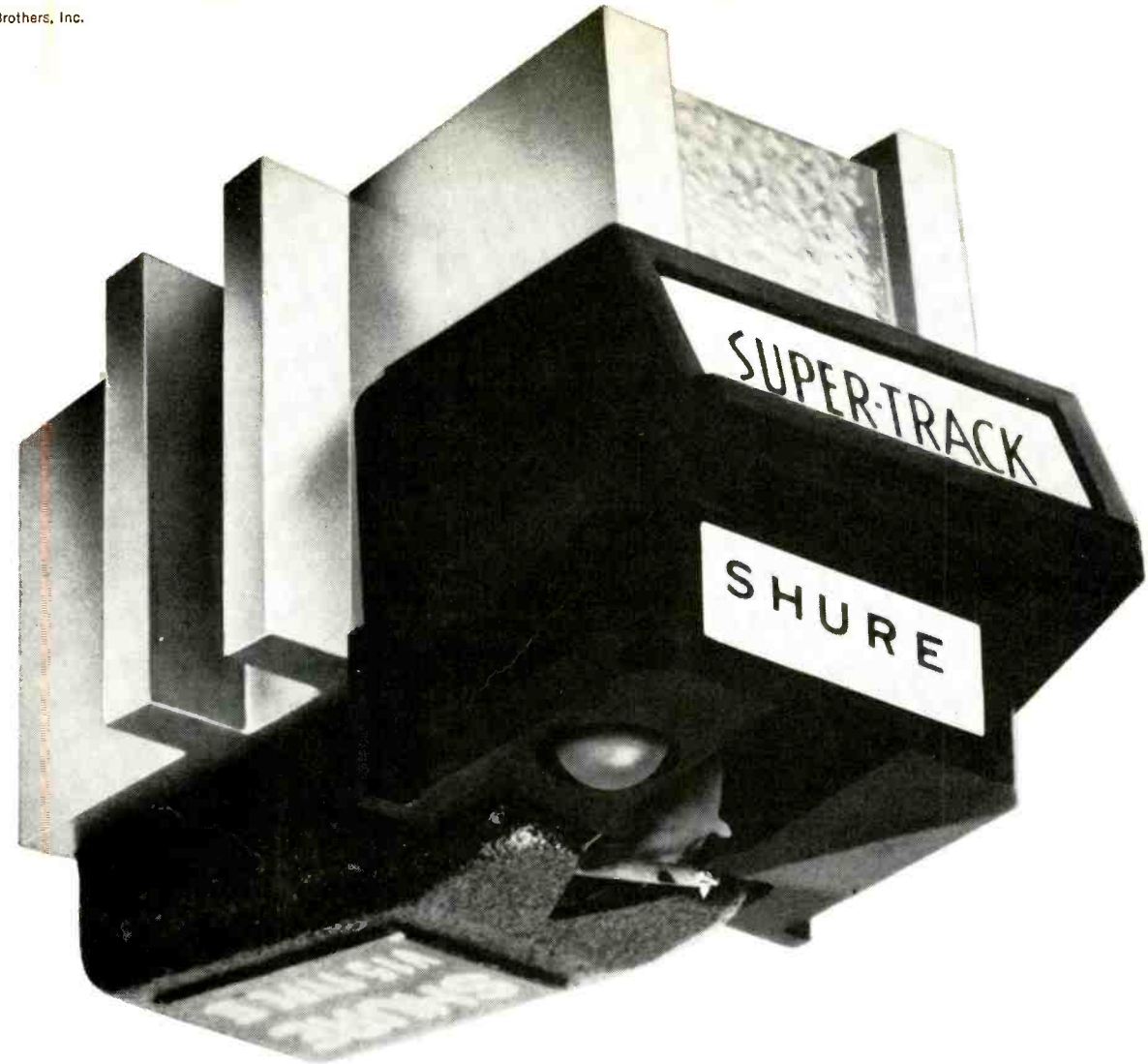
If we're in luck, we will be at a rest in the score and this tiny moment of silence will enable us to cut easily to the next sequence. If we land in the middle of a sustained note or chord we're in trouble. So you search for a more suitable cut point a few seconds before or after the original 3-min. 50-sec. cut point. Again you may find a rest; or it is possible to cut in on a sharp transient such as a tympani beat or cymbal clash; or you may not find any place to cut, necessitating more reshuffling in the shortening or extending of the pause between the movements. This whole procedure must be carried out with each sequence until they all tally out equally.

There are times when no amount of manipulation will result in satisfactory cuts in a given work. The only remedy to this is to combine the work with another score, perhaps an Overture or, if timing permits, a Symphony. This expediency will change the length of the sequences and, in this new configuration, the cuts may be acceptable. There are some very stringent requirements for this sequencing procedure. Although most mastering professional recorders do not have footage counters, fortunately there is one unit, the Studer (importer-distributor is Gotham Audio Corp., New York City), with an extremely accurate counter and such excellent motion that the one-second tolerance can be maintained. Without the use of the counter and fast forward and rewind, this "sequencing" would be far more tedious than it is and take an interminable amount of time. As you can imagine, the services of a splicing technician of absolutely expert attainments is a "must" in this work.

Once the matter of "sequencing" has been accomplished, the production of a dubbing master is comparatively straight-forward in the case of "Pop" music, but may entail other technical manipulation for Classical music. These techniques will be covered a little later in this article.

In spite of certain shortcomings, the 8-track stereo cartridge is well-suited to the automobile and other mobile environments. Not the least of its attractions is the closed-loop principle and the automatic switching of stereo tracks, which make no demands on the attention of the driver. The plastic cartridge is relatively compact and will stand a lot of abuse. Despite many predictions of trouble with the closed loop, the back-lubricated tape has worked well. The instructions packed with each cartridge sensibly admonish against subjecting them to extremes of temperature and humidity. Yet I have had them baking in my glove compartment in the summertime and they have endured 18-below-zero temperature without apparent harm. Once in awhile you will encounter the rubber pinch-roller binding in its bearing, rendering the cartridge inoperable. The conclusion is that, physically, the cartridges are quite sturdy.

In matters of sound quality, the best of the cartridges are quite good. In



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fact, I would say that the quality is a great deal better than many people realize, especially those whose experience with them has been confined to hearing them in an automobile. It is unfortunate that the speakers which are sold as part of the 8-track playback machines are, with rare exception, of exceedingly poor quality. It is also a sad fact that the usual 4-ohm output impedance of the amplifiers found in most 8-track machines will not permit effective use of the higher-quality hi-fi speakers.

In the top-quality cartridges, frequency response extends from 50 Hz to 10 kHz, distortion is quite low, signal-to-noise ratio is fairly good, crosstalk between tracks almost nil. Transient response is as good as it can be at the 3¾-ips speed, being subject to the same maladies caused by scrape flutter, and so on, as afflicts all slow-speed tape. (I explained all this in my recent article on open-reel tapes in the June issue of AUDIO.) On a cartridge of outstanding quality, such as "Without Her" by Jack Jones on RCA P8S1289, all the good qualities mentioned above are apparent even when played through a high-quality system in the home.

I emphasize this point because of the great difference in acoustic environment between the home and the automobile. As long as the 8-track cartridge is confined to the car, the attendant noises of motor, tire whine, wind roar, road rumble, squeaks, rattles, adjacent traffic, etc., effectively mask any deficiencies of quality. Even in the air-conditioned hush of a Rolls-Royce, there is enough residual noise to affect sound quality. Bringing the 8-track stereo cartridge to the home, the much quieter ambience and the better playback equipment spotlights the sonic deficiencies.

Another problem is that many companies have "tailored" their cartridges to the requirements of the car, as far as dynamic range and equalization are concerned. Pop music is rarely affected, but classical music is often compressed in dynamics, and bass and mid-range boosted. All, of course, in an attempt to cope with the acoustics and noise of the mobile environment. Naturally, the matter of economics dictates that there can't be a home and a car version of each cartridge. Thus, when the car-oriented cartridge is played in the home, many of the deficiencies and evidences of "sonic tampering" become glaringly obvious.

When the quality of a cartridge is poor, it can be most annoying in the car, but positively excruciating in the home. Excessive tape hiss and transient and saturation distortion are bad enough, but the main villain is crosstalk between tracks. On some cartridges it is so incredibly bad, two different programs are almost equally audible! When the 8-track specifications were published, many of the duplicating firms screamed loud and long about the problems of maintaining track alignment. While some of the complaints were no doubt sincere, in practice most were able to cope with the problem *provided they adhered to rigid quality control and utilized some remedial techniques*. One such technique which helps to reduce crosstalk and to an extent improve signal-to-noise ratio, is the use of a separate bias supply for each of the four pairs of stereo tracks, rather than a common bias supply. But believe it or not, the main cause of crosstalk is head wear on the duplicating machines. The tape is duplicated at high speed and gradually a "groove" is worn in the head. Then the tape has a tendency to "skew" . . . to shift alignment, and with the admittedly close tolerances crosstalk is easily produced. You can be almost certain that when you get a cartridge with very bad crosstalk, you received one from a batch made just prior to the heads being replaced with new units.

Understandably, head replacement is expensive and time-consuming; how often it is done is up to the conscientiousness of the quality-control engineer and company policy. Alternative to frequent head replacement is the use of Ferrite heads which are said to be much more wear-resistant . . . and presumably much more expensive. Some 8-track playback machines are equipped with so-called "synchro-track" controls, a vernier type of control to effect minute changes of head alignment to cancel out crosstalk when it is encountered. The trouble with these controls is that when you adjust it for one pair of tracks, it is necessary to reset the control when the head switches to the next sequence. Constant "diddling" with the control becomes necessary. This is not the safest activity while driving a car.

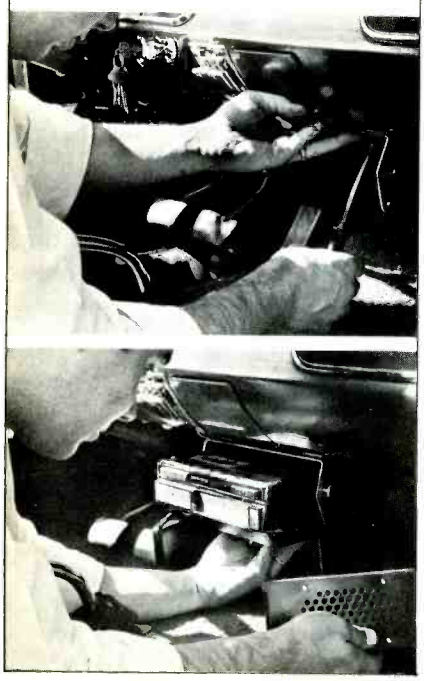
Opponents of the 8-track cartridge often cite the lack of fast forward and rewind and the absence of a footage counter to permit selectivity of program. Some units now have fast-forward facilities, although it would seem premature to comment on their efficiency. A magnetic "coding" device has also been developed, which used in conjunction with fast forward is said to permit selection of individual numbers. However, this is not presently on the market and I would venture a guess that it will not appear for some time.

Another charge leveled at the 8-track cartridge is the inability to record. This no longer is altogether true. While there are no car units that can record, as far as I know, there are several home units with recording facilities. The Roberts Company makes an open-reel machine with an additional built-in 8-track recorder. On this unit it is possible to playback an open-reel tape while recording its music on an 8-track blank cartridge. There is also a recorder made exclusively for 8-track cartridges manufactured by Sony, and another 8-track recorder known as the "Kinematic" which features selective erase facilities. I hope to have the use of some of these units before long, and form an opinion on their quality.

In summation, while there are problems with the 8-track stereo cartridge concept which must yet be resolved, under optimum conditions in the car and at home, they can be the source of much musical enjoyment. In any situation which demands a minimum of distraction (such as driving a car or hosting a cocktail party), the 8-track stereo cartridge would seem an admirable choice. In a following article, we will focus our attention on the stereo cassette. Æ

Installing an Auto Tape Cartridge Player

An Orrtronics 8-track stereo tape cartridge player is shown being installed. After drilling holes, gimbal brackets to hold the player are easily mounted with a screwdriver. Stereo twin speakers are attached to the sides of the players. Final installation requires that the 12-volt power lead be connected to the auto's fuse block or the ignition switch.



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LASTING QUALITY

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The quality of performance obtained with the FM-3 tuner, PAT-4 preamplifier, and the Stereo 120 power amplifier cannot be matched in any single package regardless of promotional claims. Other Dynaco units which can interchange with this system will also give similar results at lower power, or with a bit less control flexibility at still lower cost, depending on the units chosen.

Whether you compare Dynaco with others by listening or by laboratory test, you will find that Dynaco gives sound closest to the original—with lucid clarity, without murkiness, noise or distortion. Every unit—whether purchased as a kit or factory assembled, is assured of delivering the same specified quality, for our reputation has grown through directing our design efforts towards perfection rather than to the planned obsolescence of yearly model "face-lifts."

You may find that your dealer does not have some Dynaco equipment in stock, however, for the demand greatly exceeds our ability to produce for a rapidly growing audience. Quality is our first consideration, so we must ask your patience. We believe you will find it is worth the wait.

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Tape Guide

HERMAN BURSTEIN

If you have a problem or question on tape recording write to Mr. Herman Burstein at AUDIO, 134 North Thirteenth Street, Philadelphia, Pa. 19107. Please enclose a stamped, self-addressed envelope.

Reverberation Effect

Q. Many quality recorders incorporate the reverb effect, or so they say. My tape recorder, for one, has this effect, but to me it sounds more like just plain echo. I was under the impression that reverb was more of a hollow effect, as if singing or talking into a rain barrel. Please comment on this—B. S. Powell, APO, San Francisco, Calif.

A. Tape recorders of the home variety provide echo rather than reverb effect: a series of repeats rather than the blended quality of reverberation. The faster the tape speed, the more nearly one approaches reverb rather than echo. Professional tape units seeking to achieve the reverb effect may incorporate 3, 4, 5 or more playback heads lined up along the tape, all feeding their signals back to the record head at the beginning of the procession.

This and That

Q. What are your feelings about transistor versus tube preamps in tape systems? One well-known unit was introduced with tubes, went to transistors, and finally changed back to tubes. What is the argument usually used in strictly solenoid, partially solenoid, and joy-stick mechanical operation? What is the procedure for maintaining the electronics of a transistor tape deck with the usual four preamps? I am interested in bias voltage, channel balance, sensitivity. What equipment is needed, and are there any general books written to aid an experimental individual or somebody with technical background?—John E. Kimura, Potsdam, N. Y.

A. I think that transistors have finally reached the stage where they can give us quality as good as that of tubes, along with the advantages of cooler operation and saving of space.

Simplicity is a virtue in that there is less to go wrong. On the other hand, convenience and flexibility of operation may become uppermost considerations, for example when one runs a tape machine all day long and has much editing to do. Then a solenoid-operated transport becomes eminently desirable, even though its greater complexity may raise more problems of repair and maintenance, as well as adding to initial cost. On the other hand, at a price —and professional machines command that price—one can build a complex machine to stand up well under long and rigorous usage. For ordinary home use and the price the home user is ordinarily in a position to pay, I think that simplicity has the edge over convenience.

The procedures for maintaining tape electronics involve much too long a discussion for this column. I suggest that you read Chapters 14 and 15 of my book, "Getting the Most Out of Your Tape Recorder," John F. Rider Publisher, Inc.

Sound-on-Sound

Q. I purchased a specific tape recorder because it seemed to be the only "sub-professional" machine on the market that would do acceptable sound-on-sound recording. However, I found that the instruction manual wasn't very explicit, and despite 3 years of experience I still have one big difficulty, and that is volume balance between parts of a 3- or 4-part recording. I have written to the manufacturer two different times, but my letters have been ignored. Not only that, but I understand the recorder is not even made anymore. Specifically the trouble is this: In sound-on-sound recording, each successive recording loses just a little volume so that the first part has to be recorded louder than normal in order to come out right in the end. Then if a mistake is made on any part after the first part, the problem is compounded. Also, guitar rhythm versus the bass part and lead and harmony parts all seem to give different meter readings. In other words, different pitches seem to record at different volumes. This is where my balancing problem comes in; I can't seem to rely on the meter; I must rely more on what I monitor through my earphones.

This brings up another point. The manual says to monitor only the preceding part to properly bring about synchronization. If I did this, I never would get any balance between parts. Besides, I record with a patchcord connected ahead of my amplifier speakers and hooked directly to the auxiliary input of the recorder. For this reason I can't hear my guitar except through my earphones. I have never had any problem with synchronizing parts, even though the manual says I should—J. R. Lindley, Bartlesville, Okla.

A. In theory you should be able to achieve synchronization either by listening to playback of the previously recorded track or by listening to the mixture of sound going to the track presently being recorded.

I agree that your problem of balancing the levels of successive stages of sound-on-sound recording probably has to do with the fact that your meter gives different readings for different frequencies, with resultant misadjustment of recording gain. There are three possible reasons why your meter behaves this way:

1. The meter may be connected to a point after the treble boost employed in recording. If so, this exaggerates the apparent level of high frequency sounds and leads to *under*-recording.
2. If the meter is connected ahead of the treble boost circuit in recording, it will not necessarily produce apparent flat response. There is a tendency for the meter to understate sharp, brief sounds, which are high frequency in nature. This leads to *over*-recording of such sounds.
3. Even on steady signals, the meter simply may not have flat frequency response because it is not properly constructed.

All in all, with your present equipment, your best course is to use a systematic trial and error procedure to find the best settings of recording and playback gain for each stage of sound-on-sound recording. By listening to the *mixture* of sound presently being recorded, you should do well.

Chatter Problem

Q. My tape recorder, approximately three years old, has lately developed a machine-gun chatter that is heard in playback. The recorder has no monitor, but I assume that the signal entering is clear and at the proper level. However, on playback the chatter is heard along with the recorded music or voice. This chatter is not steady, but comes on occasionally, and is on the recorded tape. When the tape is played back on a second tape machine, the chatter shows up. I would like to know the reason for this chatter.—Frank Bizzak, Elgin, Ill.

A. A possible cause is oscillation in your record electronics, perhaps owing to feedback, which causes periodic blocking at a frequency corresponding to the chatter rate. Another possibility is mechanical "stutter" caused by excessive pressure of a pressure pad, or by a worn pad, or by other factors of a mechanical nature. Æ

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Letters

2-track vs. 4-track

• Your June 1968 article on state-of-the-art prerecorded tapes prompts me to re-enforce some of the comments on overall quality. The 4-track open reel format is excellent in principle. The duplicating process in many cases ruins the high frequencies at high levels. Apparently, the producer judges that hiss is more objectionable than lack of distortion. The only present alternative to provide good tapes is to re-record from selected records, and thus avoid the subsequent ticks and pops which constantly increase with use.

It is a disappointment to realize that although the original is recorded on tape, one must resort to a phonograph record as the only commercial source of highest quality music. In comparison with the price of the present 4-track tape, the original price of $18.95 for the first 2-track tape ("Also Sprach Zarathustra") was a bargain, but it is not available now.

JOHN K. HILLIARD
Director, LTV Research Division
Anaheim, Calif.

More batteries

• Thanks for the [May 1968] article, "Batteries for Tape Recorders." However, other rechargeable types which are currently available, although more expensive than the nickel-cadmium, were not discussed.

First is the more easily obtainable "semi-sealed" lead-acid type, what the author calls a "storage battery": the model I am familiar with (from Globe-Union/Centralab) uses a gelled electrolyte in a sealed plastic case and a special uni-directional vent system for protection. It is not necessary to add water as with conventional automotive batteries; however, a special charger is required. The second type is the silver-zinc system (available from Yardney Electric or Gould-National Battery): with a nominal cell voltage of 1.5 volts, it has extremely high capacity and a flat discharge curve, but the price, for the consumer, is decidedly prohibitive.

KIRK L. THOMPSON
Minneapolis, Minn.

FM "rock"—pro's and con's

• It is evident that AUDIO is an adversary of rock music (indeed, rock record reviews are infrequent and condescending) and it is with this in mind that I read your editorial comment, "FM Rock," in the May, 1968 issue. I do not advocate serious rock to the exclusion of other musical forms, but rather insist that it has a distinct place in the segment of American liberalism known as the college environment.

"Ugly radio," or AM "top forty" format, is dead in Boston. It is ironic that Boston's WBCN has assumed a Jekyll and Hyde character by offering 100,000 watts of stereo rock after 10:30 p.m. (which stands in sharp contrast to its "make no enemies" daytime format), and continues to make friends.

To answer your question, *Newsweek* reported the beginning of a trend; to allay your fear, serious rock will not become a parasite like its AM counterpart; to redirect your good intentions, please remember that good sound reproduction is necessary to enjoy *all* forms of entertainment.

BRUCE A. MARLOW
Tufts University
Medford, Mass.

• I noted with interest your "Editor's Review" column in the April issue of your magazine. You state that, "an 18 minute Guthrie folk song (I assume you mean 'Alice's Restaurant') is simply not palatable to most adults." While this may be true, there is an audience for this material. It is worthwhile to note that this type of programming at one time was not available in quantity from any broadcast source.

I must take strong issue with your next statement that, "good sound reproduction (is not) necessary to enjoy this form of entertainment." Why not say that good sound reproduction is not necessary to enjoy *any* form of entertainment? Why is it that total enjoyment of jazz or popular music requires good sound reproduction whereas folk music, or so-called 'underground' music, or plain rock and roll do not require good reproduction? I am old

(Continued on page 89)

Most of the features of this $89.50 Dual were designed for more expensive Duals.

You'd expect a big difference in performance between the $129.50 Dual, the $109.50 Dual, and the $89.50 Dual.

There isn't a big difference.

The higher-priced models have a few more features, but no more precision. Play all three through comparable hi-fi systems and we defy you to tell which is which, from the sound alone.

To achieve this similarity, Dual simply did what other manufacturers would get sued for doing. We copied the most expensive Dual.

We eliminated some things that weren't essential to the good performance. But we kept everything that was essential.

So, though we're about to describe the $89.50 Dual, the Model 1015, everything we say about it is also true of the more expensive Duals.

The 1015 has a low-mass, counterbalanced tonearm that tracks flawlessly with a force as low as half a gram. (Vertical bearing friction is .01 gram; horizontal bearing friction is .04 gram.)

The tonearm settings for balance, tracking force and anti-skating are continuously variable and dead-accurate.

The cue control is gentle and accurate, and works on both automatic and manual start. (Rate of descent is 0.5 cm/sec. The cueing is silicon-damped and piston-activated.)

The motor maintains constant speed within 0.1% even if line voltage varies from 80 to 135 volts.

Rumble, wow and flutter are inaudible, even at the highest volume levels.

If all we say about the $89.50 Dual is true, you may wonder why anyone would pay the extra $40 for the Dual 1019.

Perhaps there's something appealing about owning the very best there is.

United Audio Products, Inc., 535 Madison Avenue, New York, N.Y. 10022. Dual 1015

EDITOR'S REVIEW

Diamond Heat Sinks

Based on experiments at Bell Telephone Labs, diamonds may be a high-power semiconductor's best friend. According to a report, they enable some semiconductor devices to perform better if the heat-sink mounting is made of diamond instead of copper. Seems that, at room temperature, diamonds conduct heat about five times better than copper does. Practical result: Using a diamond heat sink instead of a copper heat sink allowed Bell Labs to increase power output of an experimental semiconductor device to four times its previous maximum power.

Absolute Pitch

The (alleged) ability of some people to name notes, with a high degree of accuracy, that are played has been put to the test at Toronto University. The tests, reported in *The Journal of the Acoustical Society of America*, May 1968, were made to determine if such ability is inborn, can be learned only at an early age, can be learned later in life, or that there is no such thing as absolute pitch.

One test showed that there was a correlation between past musical training and pitch judgment. Other tests showed that students could be trained to improve their judgment, but that one type of training was much more effective than another type.

The first test measured one's ability to judge piano tones and sine-wave tones. The former have a complex set of overtones, while the latter, generated by electronic oscillators, are near-perfect single-frequency tones. Piano students were clearly superior in their ability to judge piano tones; piano and non-piano students were superior to general students and essentially equal to one another in ability to identify sine-wave tones.

The second experiment used a single tone—the standard A_4, the 440-Hz fourth A on a piano keyboard—to see if training increased ability to determine a single tone. After training sessions, all students showed improvement in being able to identify the tone, but the music students displayed a greater improvement than others.

The end result was that, though not possible to conclude that "perfect pitch" is learned, it does appear that training with a reference tone does enhance the ability to judge pitch.

Sound Attenuation

Lives there a serious hi-fier who hasn't wished for a quieter music-listening room than he has? Many have installed acoustical tiling on the ceilings in this quest, with great success. Some new noise-control material, introduced by the Soundcoat Company, New York City, should therefore be of interest to readers.

A lead-foam sound barrier material, called Soundmat LF, has a sheet of lead sandwiched between two layers of polyurethane foam. Each foam layer has a specific function, says the manufacturer. The outside layer, the thicker of the two, provides sound absorption, while the thinner inside layer acts as a vibration isolator. In critical frequency bands, noise reduction is said to be a minimum of 20 decibels, or the difference between noise level in an average factory and that of a quiet private office. The flexible material can be formed to fit curved surfaces.

And for those music enthusiasts who combine a wood-working hobby with hi-fi, Soundcoat has a "Hum-Cap" which is claimed to convert the shriek of a buzzsaw into a hum, reducing noise generated by a 10-in. circular saw cutting through 1-in. pine wood by as much as 22 dB. A 7-in. "HUM-CAP" disc for 10-in. blades is priced at $3.25.

Details on the above sound control material are available from Soundcoat, 515 Madison Ave., New York, N. Y.

Redundant FM Broadcast Transmitters

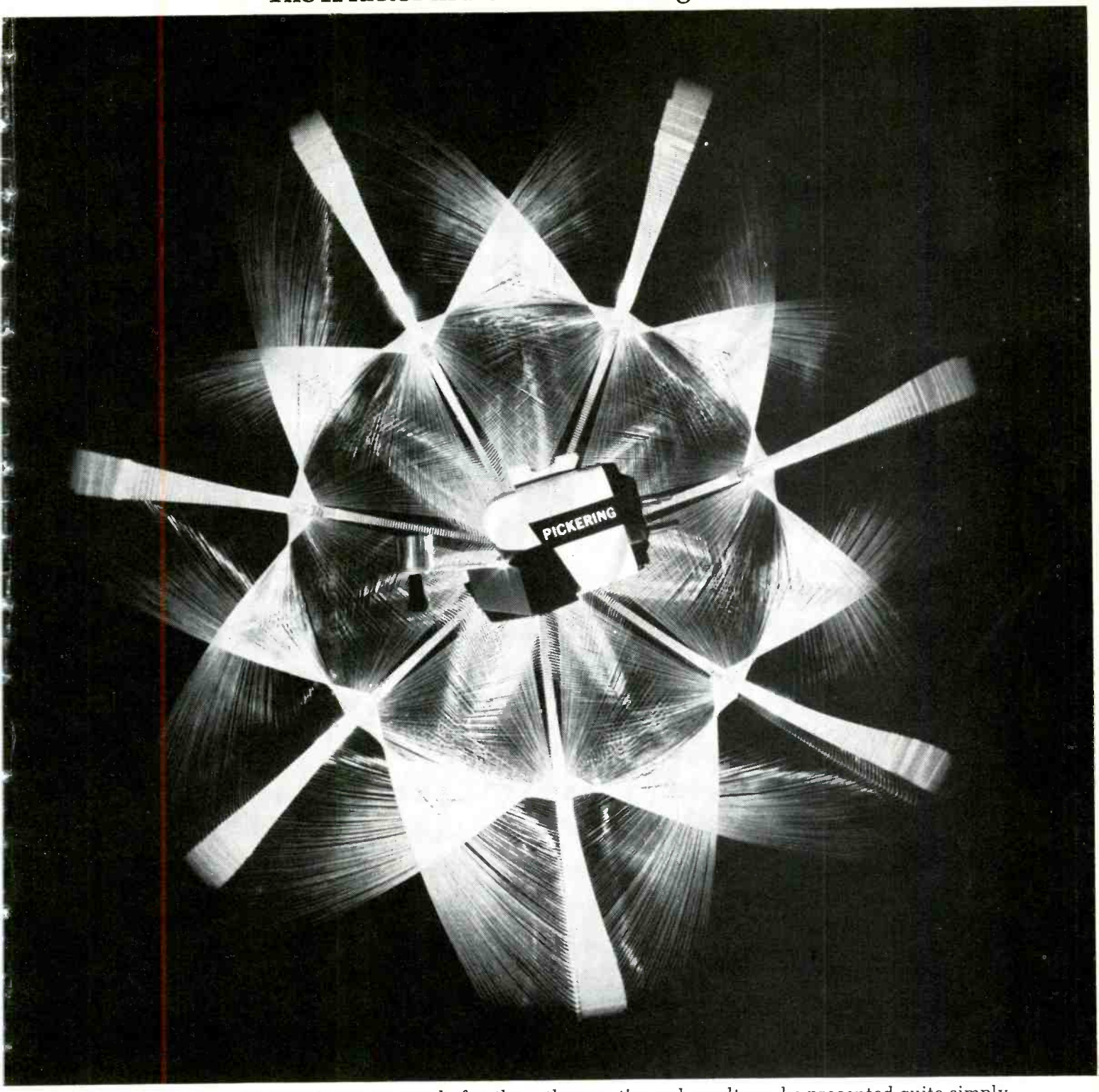
RCA has introduced the first FM "working standby" system for operating two broadcast transmitters in parallel. The station automatically switches to reduced power in the event that one of the two transmitters fails, allowing the broadcaster to remain on the air while repairs are made. This technique is used by several television broadcasters.

Pre-recorded Tape Sales Rise

The Record Industry Association of America (RIAA) announced that sales of pre-recorded tapes rose by 74 per cent in 1967 to $106.1 million at retail list-price value. The statistical study inaugurated by the RIAA included reel-to-reel, and 4- and 8-track cartridge tapes.

The largest increase, 148 per cent, was registered by 8-track pre-recorded tape cartridges. Four-track cartridges showed an increase of 51 per cent. In contrast, over-all reel-to-reel pre-recorded tapes increased only 2 per cent. Sales of 7½-ips tapes, however, declined 10 per cent, while 3¾-ips tapes increased 50 per cent. *A.P.S.*

The X factor in the new Pickering XV-15.



The X in the new Pickering XV-15 stands for the numerical solution for correct "Engineered Application." We call it the Dynamic Coupling Factor (DCF).[SM]

DCF is an index of maximum stylus performance when a cartridge is related to a particular type of playback equipment. This resultant number is derived from a Dimensional Analysis of all the parameters involved.

For an ordinary record changer, the DCF is 100. For a transcription quality tonearm the DCF is 400. Like other complex engineering problems, such as the egg, the end result can be presented quite simply. So can the superior performance of the XV-15 series. Its linear response assures 100% music power at all frequencies.

Lab measurements aside, this means all your favorite records, not just test records, will sound much cleaner and more open than ever before.

All five DCF-rated XV-15 models include the patented V-Guard stylus assembly and the Dustamatic brush.

For free literature, write to Pickering & Co., Plainview, L.I., N.Y.

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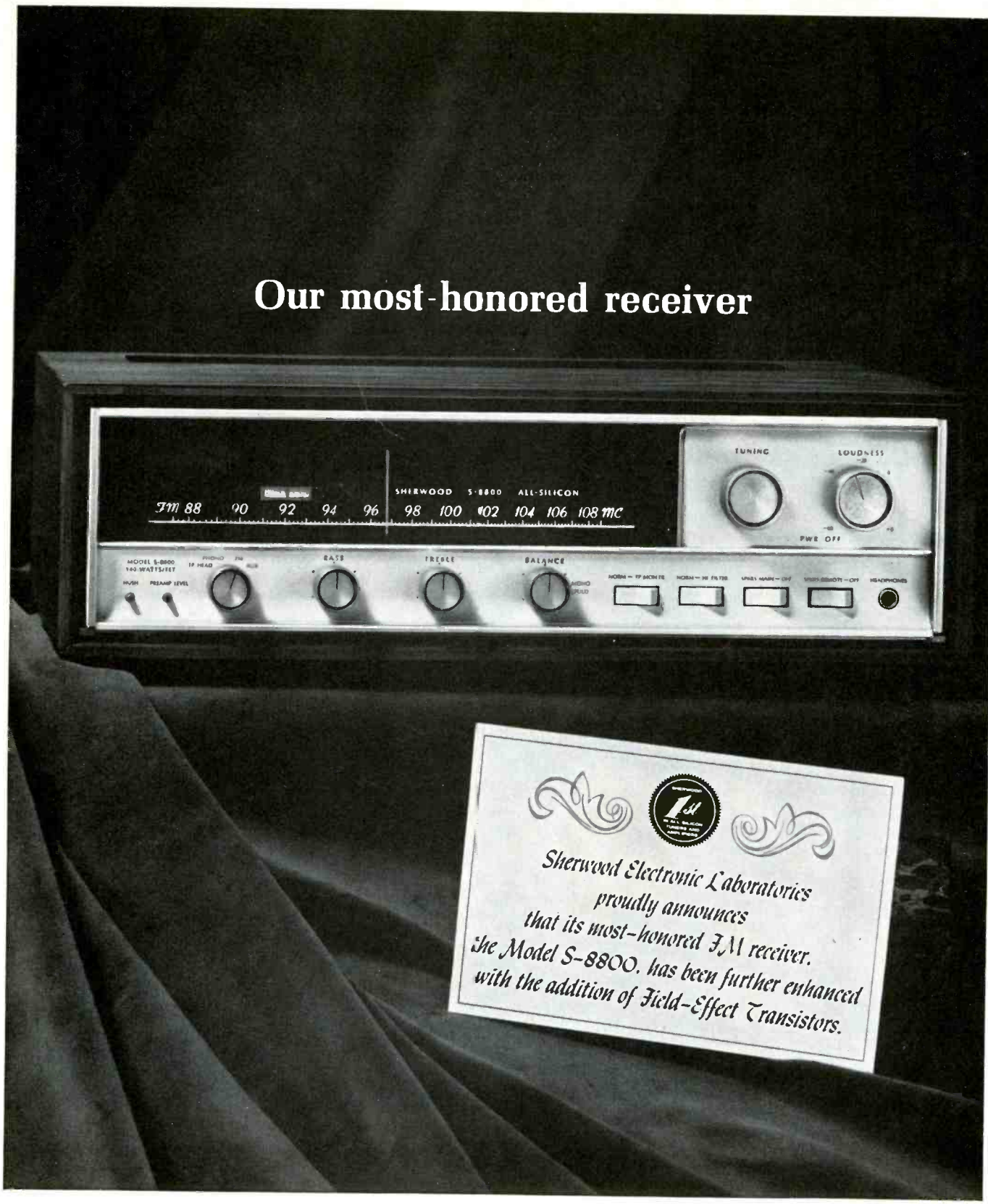

The highly-rated Sherwood S-8800 now features Field Effect Transistors (FET's) in the RF and Mixer stages to prevent multiple responses when used with strong FM signals. Among the Model S-8800's many useful features are two front-panel switches for independent or simultaneous operation of main and remote stereo speaker systems. Visit your Sherwood dealer now for a demonstration of those features which make Sherwood's new Model S-8800-FET receiver so outstanding. With Sherwood, you also get the industry's longest warranty—3 years, including transistors.

Compare these Model S-8800 specs: 140 watts music power (4 ohms) • Distortion: 0.1% (under 10W.) • FM sensitivity: 1.8 μv (IHF) • Cross-modulation rejection: -95db • FM hum & noise -70db.

Model S-8800 custom mounting $369.50
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Hand-rubbed walnut cabinet $397.50

Sherwood

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***New/Improved Hi-Fi Equipment Specifications!!!

Rennie Corb

A trenchant, tongue-in-cheek commentary on how manufacturers' hi-fi specifications evolve

ARE YOU TEYING to make up your mind about which model and make of stereo hi-fi equipment to buy? Are you troubled because you don't know how to interpret the esoteric data known as "manufacturer's specifications"? This article will tell you what they mean, while proposing entirely new standards of measurement and rating.

The proposed new standards follow the practice of some State Highway Departments in establishing speed limits. What they do is this: Over a given section of highway, a period of observation yields a set of figures for the speeds actually measured for the cars using the highway. These figures are averaged. This average is then set as the speed limit. The argument is that, if the accident rate due to speed is acceptable, this is really an acceptable limit. Besides, it is one that should not be too difficult to enforce because it represents essentially what people are doing even with a lower speed limit.

Let us see what current practices are for rating hi-fi equipment. First of all, it might be a good idea to take a look at how equipment is developed. The Sales Department starts by requesting a new product. They determine their requirements by observing the competition and asking for something which is better in every respect, more appealing in features and appearance, and manufacturable at lower cost, in small quantities, so that it can be sold at a competitive (lower) price by dealers who are given a larger-than-normal resale discount, greater inducements in the form of advertising allowances, and better credit terms, while leaving a large margin of profit for the manufacturer. In addition, the new product must contain some innovation—a breakthrough if possible—but well proven in the market.

After the agonized screams of the Engineering Department die down, a compromise is reached which begins to approach some semblance of feasibility—except, of course, in terms of the schedule, which calls for production to begin "yesterday."

Engineering proceeds to develop a product, the requirements for which are gradually forced back toward the original Sales requirements as competition brings out new models that "modify the market picture." Eventually, a product is designed and grudgingly approved by Sales, Production, Quality Control, Reliability, the Comptroller, and Management. Now . . . a performance specification must be issued.

Engineering makes careful measurements on a number of engineering models, averages them, and makes a summary. Are these the performance specs that will be met by units made in production? Not really, since components will vary in value, and adjustments will not be made quite as carefully as they are in the laboratory. To allow for this, Engineering applies safety factors. These may be arrived at by careful statistical analysis of past performance on similar units, or perhaps by seasoned intuition. The resulting specs are transmitted to Sales.

Meanwhile, Sales has been doing its own scientific research. It has been analyzing the advertisements and brochures of the competition. For each type of specification, it applies probability theory and statistical analysis. For example, take audio power output. The technique sometimes used is this: Add the power output of the equipment in the same price class made by the leading competitors and divide by the number of competitors. Then add 10%. If this yields a figure that is not more than 15% above the best laboratory measurements on the best of the lab models, it is used.

If this cannot be satisfied, Sales throws the entire project back to Engineering with the demand that they "wise up" and learn a few things from competition.

Of course, Engineering learns from this process. Consequently, they increase the safety factor. If they expect an amplifier to run 50 watts of power output in production, they rate it at 40 watts, knowing that Sales will call it 50 watts anyway. The trouble is that Sales is pretty smart, too. So knowing that Engineering will under-rate by 20%, they add 30% to the engineering figures instead of the originally intended 10%.

It is easily seen where this leads. Engineering refuses to provide any specifications and locks Sales out of the laboratory. Sales, in turn, writes whatever it pleases, unhampered by knowledge of the facts.

Now let's apply the methods of the Highway Departments: If this is the practice, legitimatize it. A new rating system is born: Not continuous or rms power; not IHF music power; not EIA music power; but SRP—Sales Rated Power!

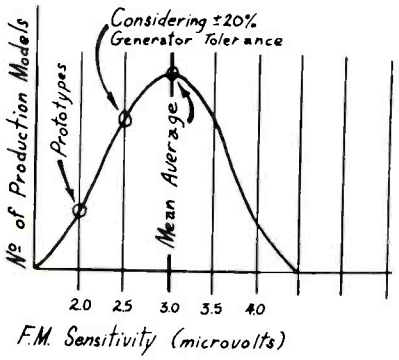
A similar process can be used to arrive at other ratings. It goes without saying that where a *lower* figure represents improved performance, as in tuner sensitivity or hum level, the average of the competitive figures should have 10% *subtracted* from it. For ratings expressed in dB, 10% can still be used. Remember, it is the psychological and not the physical meaning of the improvement that counts.

Some attention should be paid to inherent physical limitations to the specifications so derived. These are not serious. In the old days, one had to be more careful. For instance, with Class AB (tube) amplifiers it would have been rather embarrassing to claim power output greater

than the power consumed from the line, since that would have been implied that efficiency was over 100%. But with transistors in Class B, the amplifier just draws more power from the line as the drive goes up, so it is safe to quote idling (no signal) power consumption (SMALL) and power output at will (LARGE).

When it comes to FM sensitivity, several rating devices are available. One can write: 2.2 μV IHF SENSITIVITY; 1.3 MICROVOLTS for 20-dB quieting; or better still: 1.1 MICROVOLTS IHF SENSITIVITY for 72-ohm antenna.

One need not worry excessively about someone checking these figures. Many signal generators leak enough to make tuners start to limit even with the generator at-



The three faces of FM sensitivity ratings.

tenuator turned down nearly to zero. Fortunately, few of them leak signals that are out of phase with the output at the connecting cable, causing the readings to be too high!

Stereo separation. What user can check this? Measure the lab model at 1000 Hz and omit the frequency figure in the rating, implying that it is the separation over the whole audio band.

Capture ratio. For the values currently published, even a well-equipped laboratory cannot measure this reliably. So be brave! But do not quote 0 dB because this value makes it impossible to tell which is the stronger signal.

Now, of course, the procedures suggested lead to escalation. The power ratings will go UP-UP-UP, while the sensitivity figures go DOWN-DOWN-DOWN. Is this bad? By no means! When, at long last, the figures begin to tax consciences (and even the credulity of the buyer); when all audio amplifiers will be rated in kilowatts, all tuners in picovolts, and all speakers will ostensibly reproduce d.c. as well as microwave frequencies, people will perforce pay more attention to tone quality, station-getting ability, and freedom from interference and noise, among other attributes, as well as weighing manufacturers' specifications. Æ

Editor's Note: Though the author, an audio engineer, pointedly distorted measurement and rating procedures practiced by manufacturers of hi-fi equipment, using the Sales Department as his protagonist, there are some sobering thoughts beneath the humor: (1) Specifications can be exaggerated, though by and large most specs are reasonably accurate. (2) Judgements of equipment performance should be made through listening and operating tests, as well as by examining and comparing specifications. (3) Pressures from within a company and by competitive companies usually result in better values, with advances in performance capabilities, operating flexibility, and styling. The proof is both in the listening and in the specifications. You can check the latter in this issue's product directory.

How to build a low-voltage Remote On-Off Control

L. B. KEIM

ONE OF THE added pleasures of a fine home music system these days is being able to install more than one set of speakers. Since these additional sets of speakers are usually located at a considerable distance from the main equipment, it would be highly desirable to be able to turn on or shut off the whole system from the remote location. This is precisely what the simple-to-build project presented here enables one to do. Further, parts are inexpensive.

As designed, this remote-control system consists of a main unit (situated near the main equipment) and a control unit (located where remote speakers are placed). The remote control system simply controls the main power supply to the system, employing safe, low-voltage operation. The music system's power line is plugged into the remote's main unit; wiring of desired remote-control locations is accomplished by use of three-wire cabling. Thus, the remote-control system is simple and inexpensive, making it applicable for use with even modestly priced stereo installations. And since all control stations are wired in parallel, it is easy to add additional stations.

Design of the remote-control device centers around a "ratchet impulse relay." Some hi-fi enthusiasts may not be familiar with this component. Whereas a conventional relay has its coil energized continuously during the ON cycle (if it's a normally-off device), the impulse relay operates with only a momentary energization of the coil. Each pulse of current (effected by a pushbutton at the remote location) switches the relay contacts from ON to OFF (or vice versa).

ON/OFF status of the system is indicated at the remote location by a pilot light. Through use of a dropping resistor, the light glows softly. In addition, the resistor extends the lamp's life since voltage is well below its design center.

The main unit employs a so-called "signaling transformer" as a low-voltage transformer. These are designed for intermittent loading, which it receives since pilot-light drain is less than 40 milliamperes.

Construction

The Main Unit (Fig. 1) is built into a Minibox (8-in. x 6-in. x 3½-in.). The cover of this box is the section in which the closing holes have been completed by the factory, while the bottom is that section needing punch-out completion of the holes. The aluminum variety serves well and is easy to fabricate.

Construction convenience suggests the complete building of the Main Unit on the bottom side of the box, with the Ratchet Relay mounted on the left side of the 8-in. x 6-in. wall, and the transformer below it, to the right, on the 8-in. x 3½-in. fold. The opposite fold affords mounting space for the line cord and its strain-relief, toggle

switch, fuse post, outlet sockets and barrier strip. Examination of Fig. 1 shows the external appearance of a similar but larger control unit (this one incorporates two additional power sources for a special installation). The wiring is conventionally simple, as can be seen in Fig. 2.

Three one-in. diameter screen vents are installed, one on the bottom and two on top. Rubber feet are also used on the bottom to allow free ventilation to dissipate the slight warmth generated by the transformer. Other than this, no special precautions are needed in the building of the unit.

The relay specified in the parts list has sturdy contacts, rated at 5 amperes. One of its two poles controls the hi-fi system; the second operates the pilot-light indicator(s). Should your system be a high-powered one, it might be preferable to choose a 4-pole relay, paralleling two sets of contacts for the 120-volt power control. Adequate space exists for this change. When wiring these relays note that the contact systems are all form "C," meaning single-pole, single-throw contacts. They are alternately connected; in a 2-pole relay, one set is "top closed," the other "bottom closed" in a given relay position. They are reversed upon actuation of the mechanism. The two sets of contacts must be wired so that they are both closed or open at the same setting of the relay's operational mode.

In any device permitting remote operation, it is very desirable to eliminate this remote control should system servicing be necessary. That is the function of the toggle switch shown in the schematic.

The remote station is illustrated in Fig. 1. It is built on the cover of the tiny CU-2117 Minibox, with the cable entry hole and its grommet passing through a base fold. This is merely one possible way to construct the remote station. In a house under construction, the wiring could be pre-installed in the partitioning and solid switchbox plates could be used to mount the pushbutton and pilot-light assembly.

Since a pushbutton station is needed at the hi-fi equipment itself, I suggest it be wired to the 4-pin plug and inserted in its corresponding socket atop the Main Unit. All additional controls are paralleled to the barrier strip, which has enough room to accept many wires per terminal. The author found the conventional 3-wire twisted cabling sold for thermostat use (coded red, white, and blue) to be most handy for a permanent installation. Where portability and flexibility are desired, use of small-size audio cable is an ideal choice.

The actual connection of the Main Unit to your music system involves but the transfer of the system's power cord to this Unit, plugging the latter's line cord into the a.c. outlet. A short push of any button will start or stop your system, as well as indicate the mode established.

Complete construction of the Main Unit and several remotes can be accomplished in 2 or 3 evenings of most pleasant work. For those interested in the cost of such a device, the Main Unit and one Remote Station can be completed for around $20.00; each added remote, as shown, should cost about $3.50 to $4.00.

The convenience of being able to control the end of a listening period, or the commencement of a new one, cannot be really appreciated until such a device has been added to your stereo system. Æ

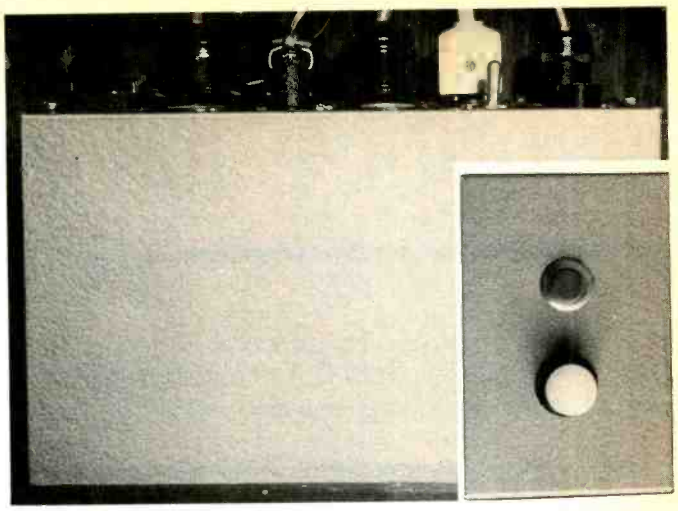
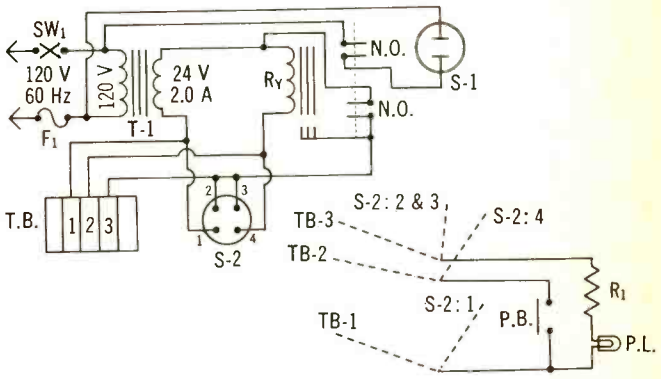


Fig. 1—The remote-control station is shown in the inset photograph. The main control unit, situated near the hi-fi system's amplifier, is also pictured above. **Fig. 2**—Below are schematic diagrams and a parts list.



PARTS LIST

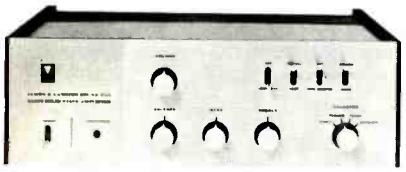
Quan.	Mfr.	Number	Description
			FOR THE MAIN UNIT
1	Bud	CU2109A	8" x 6" x 3½" aluminium Minibox
1	Potter-Brumfield	AP11A	Ratchet impulse relay with 24 Volt A.C. Coil, D PDT 5 Amp. Contacts.*
1	Triad	F102X	Signaling transformer, 120/24 Volt, 2 Amp.
1			DPST toggle switch, 5 Amp.
1			Extractor fuse post.
1		AGC	Fuse: rating to match equipment need.
1			#18 line cord.
1	Heyco		Strain relief for above.
3			1"-dia. vent-screen plugs.
1	Cinch-Jones	3-142	3-terminal barrier strip.
1	Amphenol	78RS4	4-pin socket.
1	Amphenol	86MP4	4-pin plug.
1	Amphenol	79CC4	Cable clamping cap for above.
1	Amphenol	61F1	A.C. outlet, female.
4	Bud		Rubber feet, 1" diam.
			Miscellaneous mounting hardware, wire, etc.
			FOR REMOTE CONTROL UNIT
1	Bud	CU2117A	Minibox, gray, aluminium
1	Switchcraft	903	SPDT pushbutton, wired "normally open".
1	Dialco	183-9830-14-604	Pilot-light assembly.**
1	Dialco	183-1475	Pilot-light assembly Cap.***
1	General Electric	327	28-volt, .04 amp. pilot light.
1	Ohmite		250-ohm, 0.5-watt resistor.
1			Cable entry grommet

* See text for possible subst.
** Avail. from Allied Radio, Chicago as #60B8856
*** Avail. from Allied Radio, Chicago as #60B8861

AMPLIFIERS (continued)

Kenwood "Supreme 1"

Marantz 15

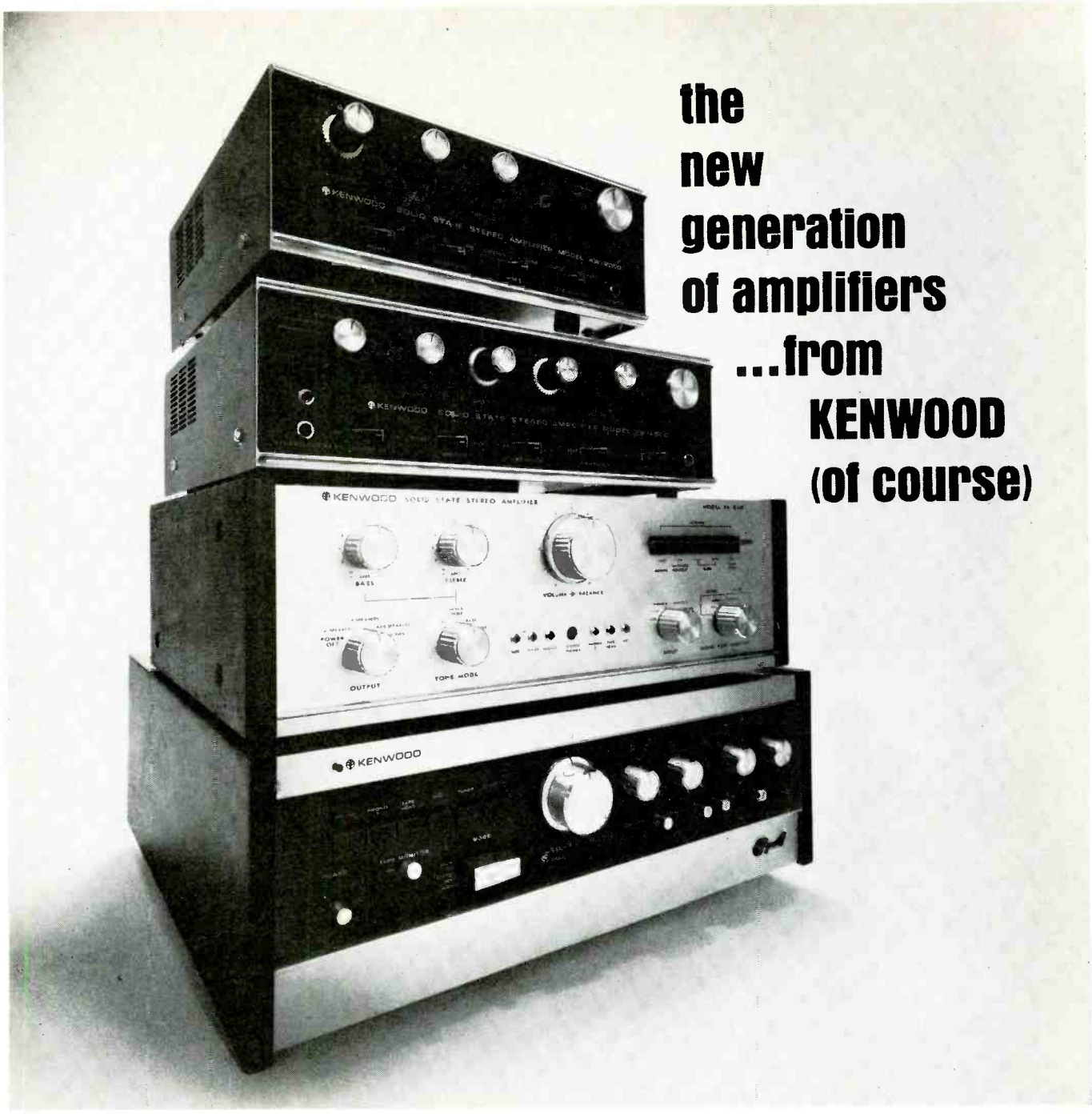


JBL SA600

NOTES – All models S/S except where model number is preceded by T
All models integrated except where model number is preceded by B
Y – Set by plug-in equallzer board to match speaker
K – Indicates Kit price W – Indicates wired price
z – Variable damping factor control

* Measured at 4 ohms
** Measured at 8 ohms
*** Measured at 16 ohms

MANUFACTURER (Circled numbers indicate adv. page) T=Tubed B=Basic	Model	IHF Pwr., /Chan., W	RMS Pwr./Chan., W	THD, Full Pwr., %	THD, 1 Watt, %	IM, Full Pwr., %	IM, 1 Watt, %	Pwr. Bandwidth, Hz	1-Watt Frequency Response, ± dB	S/N, dB	Input Sensitivity, Phono, mV	Input Overload, Phono, mV	Tape Head Input, mV	High Level Input, V	Damping Factor	Dimensions W x D x H, in.	Weight, Lbs.	Price	SPECIAL FEATURES
HEATH (46) (47)	AA-15	75	50	0.2	0.2	0.5	0.2	6-25K	6-40K ±1.0	65	2.2	155		0.2	45	16⅞ x 12½ x 4¾	21½	169.95K	Input level conts; short cct. protection rem. spkr. output; 2 phone jacks.
	AA-21D	50	35	0.5	0.5	1.0	1.0	13-25K	13-25K ±1.0	60	3.0		2.0	0.25		15½ x 14 x 5¼	25	137.00K	Secd'y. conts. concealed; opt cabs; preamp ccts prewired, epoxy sealed.
	AA-22	33	20	0.3	0.3	1.0	1.0	15-30K	15-30K ±1.0	65	6.0			0.25	20	12½ x 9⅝ x 3½	14	99.95K	5 stereo inputs; secondary controls concealed.
	AA-14	15	10	0.5	0.5	1.0	1.0	15-50K	12-60K ±1	63	4.0			0.3	50	12½ x 9⅝ x 3½	8½	59.95K	Edge lighted panel; fast 10-hr. const; opt. cabs.
JBL (LANSING)	SA-600		40	Too low to specify accurately				10-130K	10-130K ±1.5	85	4	250	2.0	0.25	27 Y	15 x 13¾ x 5	25	429.00	Integ. ampl; aural null bal. sys; dir-coup. "T" cct; phono sens. sw.
B	SE 408S		40					3-175K	3-175K ±1.5	90	–	–	–	0.8	27**	15¼ x 6¾ x 4⅝	20	276.00	As above, except mounts on spkr. enclosure.
B	SE 400S		40					3-175K	3-175K ±1.5	90	–	–	–	0.8	27 Y	15¼ x 7¾ x 4⅝	22	300.00	Free-standing pwr-amp "Energizer" matches spkr.
KENWOOD (25)	Supreme 1	71	82	0.3	0.1	0.3	0.1	10-100K	20-50K ±1.0	90	2.0	100	2.3	0.2	80*** 40**	16¾ x 12 x 6 5/32	36.3	695.00	3-chan. amps. w. elect. xover; flexible tone controls.
	KA-6000	85	45	0.5	0.1	0.5	0.1	20-20K	20-50K ±1.0	65	2.0	100	2.3	0.2	29**	16 5/16 x 11 1/32 x 5 5/32	24½	259.95	2 db/step tone conts; 2 sets spkr. terms; 20 db muting sw.
	KA-2500	35	20	0.8	0.2	0.8	0.2	20-30K	20-30K ±2.0	60	2.0	100	2.5	0.2	25	12½ x 9 5/16 x 4⅛	13	119.95	2 sets spkr. terms.
	KA-2000	20	12	0.8	0.2	0.8	0.5	20-30K	20-30K ±2.0	60	2.0	100	–	0.2	20	10¼ x 9⅜ x 4⅛	10	89.95	Compact size.
KNIGHT-KIT (63) (64)	KG-870	35	28	<0.5	0.3	<1.0	0.7	25-18K	20-25K ±1.0	80	3.0		2.0	1.0	12.5** 17.5***	13 x 11 x 2¾	15	99.95K	
	KG-865	25	17	1.0	0.25	1.0	0.7	20-20K	15-50K ±1.0	60	5.0	45	–	0.4	50	13 x 10 x 3½	10	69.95K	Comp. sym. output.
LAFAYETTE	LA-125T	62.5		0.8	0.15	1.0	0.3	20-40K	20-20K ±1	65	1.8, 7.0	35, 110	2.5	0.27	25	13 x 9 x 3⅞	13½	129.95	As LA 85T, but incls. front & rear rcdr terms, lo & Hi filters.
	LA-85T	42.5		0.8	0.15	1.0	0.3	20-40K	20-20K ±1.0	65	2.2	40	2.5	0.27	25	13 x 9 x 3⅞	11	99.95	Main/remote spkr. sw; incls case fused output.
	LA-450	18	12.5	0.22	0.2	0.1	0.1	50-28K	20-30K ±1.0	70	2.5	40	1.0	0.25	20	10 15/16 x 8 11/16 x 3⅞		74.95	
	LA-224T	15		1.0					30-20K ±2.0	65	3.0					10½ x 7 13/16 x 3 9/16	9	59.95	Headphone jack; dual-conc. conts; a.c. outlet.
LEAK	Stereo 70	45	35						30-20K ±1.0	86	2.0		2.0	0.2	60	13 x 9 x 4½	16	299.00	Integ. ampl.
B,T	Stereo 60	60	30						20-20K ±0.5	80	–	–	–	0.125	25	10⅝ x 13⅛ x 6⅞	29½	219.00	Basic stereo ampl.
B,T	TL/50 Plus	100* Mono	50* Mono						20-20K ±0.5	85	–	–	–	0.125	25	11½ x 9 x 6⅜	28	159.50	Basic mono ampl, can be paired for stereo.
B,T	TL/25 Plus	60* Mono	30* Mono						20-20K ±0.5	85	–	–	–	0.125	25	10 x 7⅞ x 6¾	17	119.50	As above.
MARANTZ B (29)	15	85	70	0.3	.015	.05	.03	8-60K	20-20K ±0.15	100	–	–	–	1.0	150	15⅜ x 8 x 5¾	30	395.00	Sep. & xtalk below noise level; separate swr. supplies.
MARTEL	RA 840	75							6-40K ±2.0		1.5			0.1					



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AMPLIFIERS (continued)

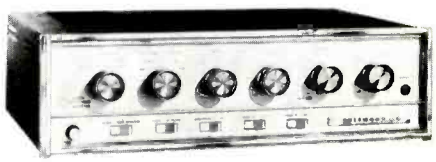
NOTES – All models S/S except where model number is preceded by T
All models integrated except where model number is preceded by B
Y – Set by plug-in equalizer board to match speaker
K – Indicates Kit price W – Indicates wired price
z – Variable damping factor control

* Measured at 4 ohms
** Measured at 8 ohms
*** Measured at 16 ohms

MANUFACTURER (Circled numbers indicate adv. page) T= Tubed B= Basic	Model	IHF Pwr./Chan., W	RMS Pwr./Chan., W	THD, Full Pwr., %	THD, 1 Watt, %	IM, Full Pwr., %	IM, 1 Watt, %	Pwr. Bandwidth, Hz	1-Watt Frequency Response, +, dB	S/N, dB	Input Sensitivity, Phono, mV	Input Overload, Phono, mV	Tape Head Input, mV	High Level Input, V	Damping Factor	Dimensions W x D x H, In.	Weight, Lbs.	Price	SPECIAL FEATURES
MC INTOSH (14) T	MC-2505		50	<0.2		<0.2		5-70K	10-100K +0,-1	>90	–	–	–	–	18-10	18 x 13 x 10	38	449.00	Front-panel pk. indicating mtrs. panel mtg; full pwr at all Z's.
T	MC-275		75	<0.5		<0.5		10-100K	10-100K +0,-1	>90	–	–	–	–	–	12¼ x 17¼ x 8	67½	444.00	Output Z's: 4, 8, 16, 600 stereo; 2, 4, 8, 16, 32, 62, 300 mono.
T	MC-250		50	<0.2		<0.2		10-100K	10-100K +0,-1	>90	–	–	–	–	25-11	7⅜ x 15⅝ x 7⅜	35	379.00	
T	MA-5100		45	<0.25		<0.25		12-80K		>75	2		2	0.2		16 x 13 x 5⅞	25	449.00	Integ. amp/preamp. output Z's- 4, 8, 16Ω
PIONEER (13) B	SM-100	105	90	0.5		0.5		10-30K	5-100K ±1.0	110	–	–	–	–	1.5-, Z 100	16½ x 11⅝ x 6¾	32		2 prs. in & out terminals.
	IS-80	55* x2	45* x 2	0.5		0.5		10-100K	10-60K +0.5	76	–	–	–	–	–	16 x 12½ x 28½	60	375.00	3-spkr. sys. in cabinet, elect. xover, 2 ampls, mono.
QUAD B	303		45	0.3	.03	<.01	<.01	20-20K	20-35K +0,-1	100	–	–	–	0.5	25	4¾ x 12¾ x 6¼	18	183.00	Pwr. ampl for use with mod. 30 control unit.
SANSUI	AU-777	30	25	0.1	0.1	0.8	0.8	20-50K	20-100K ±1.0	80	2.0	90	1.3, 1.5	0.14	24	17 x 13 x 6	27.1	279.95	2 ctr-chan outputs – flat & 200-Hz hi cut.
SCHOBER B	TR-Z	50* mono	40* mono	0.22	0.1	1.4	0.9	20-20K	10-30K ±1.0	83	–	–	–	0.1		5½ x 11¼ x 7½	14		Fan-cooled, heavy duty short-cct protection.
SCOTT Cover (2)	260 B	60	40	0.8	0.2	0.1	0.5	20-20K	15-30K ±1.0	55 (phono)	3, 5, 9	70, 90, 155	–	0.5	20	14¾ x 12 x 4⅛	16¼	319.95	Main, rem. or both spkr. oper. main may be stereo, rem. mono.
	299 F	32.5	18	0.8	0.2	0.1	0.5	25-20K	15-30K ±1.0	55 (phono)	4, 8	70, 140	–	0.5	20	14¾ x 12¾ x 4⅛	12½	199.95	
	LK-60B	60	40	0.8	0.2	0.1	0.5	20-20K	15-30K ±1.0	55 (phono)	3, 5, 9	70, 90, 155	0.2	0.5	20	14¾ x 13¾ x 4⅛	16¼	199.95K	Kit
SHERWOOD (18)	S-9000a	80	65	0.25	0.1	0.25	0.1	15-30K	12-25K ±1.0	80	1.6 adj	100	1.2	0.25	40	14 x 12½ x 4	24	309.50	Instant o'load protection Lo-filter.
	S-9900a	70	60	0.33	0.1	1.0	0.15	15-30K	12-25K ±1.0	80	1.6 adj	100	1.2	0.25	40	14 x 10½ x 4	19	229.50	Instant o'load protection; main & rem. spkr. sw.
	S-9500b	40	30	0.33	0.1	1.0	0.15	15-30K	12-25K ±1.0	80	1.6 adj	100	–	0.25	40	14 x 10½ x 4	16	189.50	Main & rem. spkr. sw.
SONY (31)	TA-1120 A	60	50	.05	.01	0.2	.02		6-200K +0, -0.15	90	1.2	100	1.2	0.15	360	15¾ x 12¼ x 5¾	24.3	449.50	Integ. ampl; jacks bet. pre-and pwr ampl.
	TA-1080	45	30	0.15	0.1	0.2	.06		20-60K +0,-1.0	80	2.3	100	0.7	0.12	80	15¾ x 12¼ x 5¾	24	299.50	Integ. ampl.
B	TA-3120	60	50	0.1	.05	0.3	.07		10-100K +0, -1.0	90	–	–	–	1.0	70	7⅛ x 17½ x 5¾	17.6	249.50	Stereo pwr. ampl.

McIntosh MC2505

Quad 303



Sherwood S-9900a

Scott 260B

Sony TA-1120

PREAMPLIFIERS

JBL SG520

Pioneer SC-100

CM Labs CC-1

Marantz 7T

Quad 33

Dynaco PAT-4

McIntosh C24

Sony TA-2000

MANUFACTURER (Circled numbers indicate adv. page) T=Tubed B=Basic	Model	Frequency Response, Hz	Rated Output, V	Rated Output THD, %	Rated Output IM, %	S/N, dB Below 10 mV. Phono S/N, dB Below H. L. Inputs	Phono Sens., mV.	Phono Overload, mV.	Tape Sens., mV.	High Level Sens., V.	Tape Mon. Z, Ohms	Dimensions — W x D x H, In.	Weight, Lbs.	Price	SPECIAL FEATURES
ACOUSTECH	VI	2-1 M	2	0.1	0.9	– 80	3.0	1.0	1.7	0.4	1000	15 x 8 x 5	14	249.00	Wired; stepped tone conts; output for Acoustech X sys.
C-M	CC-1	2-100K	2 8 max	0.1	0.1	– 80	1.5 5.0	150	2.0	0.2		15¾ x 12 x 5½	17	315.00	Mixing ability; stepped tone conts; blend cont; ctr. chan. out.
	CC-2	1-100K	2 10 max	< 0.25	< 0.25	– 80	3-8 var.	90-250 var.		0.1		12½ x 4 x 9	10	225.00	as above; simplified controls.
DYNACO (11)	PAT-4	5-100K	2	.03	.06	72 91	4	80-400	2.0	0.2	Source phono, 1000	13 x 8 x 4	10	129.95 W 79.95 K	Front panel guitar & tape jacks 600Ω phone jk, matches tuner.
T	PAS-3X	10-40K	2	< .05	.05	– 74	2	200	1.5	0.2	Source phono, 1000	13 x 8 x 4	11	109.95 W 69.95 K	Matches Dynatuner; blend cont., 7-kHz hi filter.
T	PAS-2X	10-40K	2	< .05	.05	– 74	2	200	1.5	0.2	Source phono, 1000	13 x 8 x 4	11	99.95 W 59.95 K	as PAS-3X, with different panel and knobs.
T	PAM-1	10-40K	2	< .05	.05	– 70	4	200-1.0V.		0.2	Source phono, 1000	12 x 6 x 3	7	59.95 W 34.95 K	Reqs. ext pwr. supply; mono preamp; 3 eq. pos; d.c. htrs.
JBL	SG 520	20-20K	3	*	*	90	2.0	110	1.0 **	0.15 **	40K	15½ x 13 x 6½	20	450.00	Aural null bal sys; linear conts; illum p.b. sws; *too low to specify accurately; **1.5V. out.
LEAK	Varislope-2 stereo	20-20K	0.125	0.1		60	3.5		3.0			10½ x 6½ x 3¾	6½	129.50	Takes req. pwr. from any Leak ampl.
MARANTZ (29)	7T	20-20K	10	.03	0.15	– 103	7 (10V. out)	100	7 (10V. out)	0.8	470	15⅜ x 8 x 5¾	11	325.00	Hi & Lo cut filters, 2 freq. ea.; 3 phono eq. settings, phone jk.
MC INTOSH (14)	C26	20-20K	2.5	< 0.1		– 85	2 (2.5V. out)			0.25 (2.5V. out)	Low	16 x 13 x 5 7/16	18	349.00	Tape rec. mon (2) rem front-pan. swtchg. Cab, 29.00
	C22	20-20K	2.5	< 0.1		– 85	2 (2.5V. out)		2 (2.5V. out)	0.25 (2.5V. out)	Low	16 x 13 x 5 7/16	16	279.00	cabinet, 29.00
	C24	20-20K	2.5	< 0.1		– 75	2 (2.5V. out)		2 (2.5V. out)	0.25 (2.5V. out)	Low	16x 11 x 5 7/16	17	249.00	as above.
PIONEER (13)	SC-100	5-50K	5	.04	.04	– 70	.08, 1.5	60	1.2	.08	150K	16½ x 11.6 x 6.7	21	375.00	Stepped v.c.; passive stepped tone conts.
QUAD	33	30-20K	0.5	< .02	< .03	70 85	2.0	120	2, 6, 100	0.1	200	10¼ x 6½ x 3⅝	6½	148.00	Var. rolloff cont., 3 freqs.; p.b. switching.
SONY (31)	TA-2000	12-150K	1.0	< .03	< .05	90	1.2 .06	100	1.2	0.120 adj		15¾ x 12¼ x 5¾	10.9	329.50	2 VU meters; 50 Hz lo filter; 9 kHz hi filter.

RECEIVERS

ADC 1000

Electro-Voice E-V 1182

Allied 380

Bogen RX 150

Fisher 250-T

MANUFACTURER (Circled numbers indicate adv. pages)	Model	IHF Power/Chan., W	THD, Full Power, %	IM, Full Power, %	IM, 1 Watt	Power Bandwidth, Hz	1-W Freq. Resp., Hz	S/N, Rated Power, dB	Phono Sens, mV.	Phono Overload, mV.	IHF Usable Sens, μV.	THD, 100% Mod., %	Capture Ratio, dB	Stereo Sep., 1 kHz, dB	Tuning Indicator	Auto Switching?	Dimensions, in. W x D x H	Weight, Lbs.	Price	SPECIAL FEATURES
ALLIED (63) (64)	395	75	.05	.07	.05	15-40K	18-60K	79	2.5		1.6	0.5	2.2	38	Meter	Yes	16 x 12½ x 5	28	299.95	FM/AM; FETs & ICs; incls. metal case.
	380	46	1.0	.07	.05	20-40K	20-70K	76	2.5		1.6	0.8	2.4	34	Meter	Yes	16 x 12½ x 5	26	239.95	As above.
ALTEC (75)	714A	50	0.5	0.9	0.6	15-25K	15-30K	88	2.5	25	1.9	0.35	2.5	35	Meter	Yes	16⅜ x 12 x 5⅜	20	449.50	FM/AM; FETs both front ends; var. bandwidth on AM.
	711B	50	0.5	0.9	0.6	15-25K	15-30K	88	2.5	25	1.9	0.35	2.5	35	Meter	Yes	16⅜ x 12 x 5⅜	19	399.50	Same as above, except FM-only.
ADC	ADC-1200	50	0.2	0.8	0.3	8-30K	4-35K	75	2.0	200	0.5	0.5	3.0	35	Meter	Yes	17½ x 11 x 5½	23	429.95	Accs. 2 sets spkrs, together or independently 5-sta. p.b. sel.; AM/FM.
	ADC-1000	50	0.2	0.8	0.3	8-30K	4-35K	75	2.0	200	2.0	0.5	3.0	35	Meter	Yes	17 x 11 x 5½	23	379.95	As above, but FM only.
BOGEN (89)	RX 200	60	0.4	0.5	0.2	20-20K	10-35K	80	1.5	75	2.0	0.4	2.5	35	Meter	Yes	16 x 15 x 4⅝	28	369.95	Incls. text. wal metal enclosure.
	RX 150	35	0.3	0.3	0.2	20-20K	10-35K	80	2.0	50	2.5	0.5	3.0	35	Meter	Yes	16 x 11½ x 4½	13	299.95	As above.
EICO	Cortina 3770	70 (4Ω)	1.0	2.0	0.6	10-40K	10-50K	70	4.5	80	4.0	1.5	4.5	40	Meter	Yes	16 x 9 x 4	14	279.95 W 189.95 K	FM/AM; hi-lo filters; dual pwr. trans.; incls. cab.
	Cortina 3570	70 (4Ω)	0.75	2.0	0.6	10-40K	10-50K	60	4.2	90	2.4		4.5	40	Meter	Yes	16 x 9 x 4 1/16	14	259.95 W 169.95 K	As above; kits incl. wired & aligned r.f., i.f., mpx.
ELECTRO-VOICE Cover 4 (1)	EV-1282	40	0.8			20-20K	20-20K	70	2.7	70	2.5	<1.0	2.0	22	Meter	Yes	14¾ x 12 x 3¾	21	235.00	FM/AM; plug in const; FET frt. end; IC ifs; loudness & tape sws.
	EV-1281	40	0.8			20-20K	20-20K	70	2.7	70	2.5	<1.0	2.0	22	Meter	Yes	14¾ x 11 x 3¾	20	210.00	As above, less AM.
	EV-1181	20	0.8			20-20K	20-20K	70	2.7	70	2.5	<1.0	2.0	22	Meter	Yes	14¾ x 11 x 3¾	15	176.00	Plug-in const; FET front end; IC ifs.; EV-1182, same + AM, 199.00.
	EV-1180	15	1.0				20-20K	70	4.0	60	3.0	<1.0	2.5	22	Meter	Yes	15¾ x 8½ x 5	16	176.00	Incls. wal. case; die cast end panels; tape output jacks.
FISHER (43)	550-T	45	0.8	0.8	0.2	20-24K	22-30K	85	2.5, 9.0	40, 144	1.8	<0.5	2.0	>35	Meter	Yes	16¾ x 12¼ x 5⅛	29	449.95	FM/AM; FETs & ICs; 4 pos spkr. sel. sw. complete contrs, filters.
	250-T	40	0.5	1.0	0.2	20-25K	20-20K	90	2.5, 7.5	45, 135		0.5	2.8	38	Meter	Yes	15½ x 12¾ x 5¼	19	299.95	FM/AM; incls "Tune-O-Matic"® p.b. FM sta sel; 175T, FM only, 249.95
	200-T	35	0.8	1.0	0.2	22-30K	25-20K	80	3.5, 11	30, 94		0.5	2.5	>35	Meter	Yes	15⅛ x 11½ x 4 13/16	22	279.95	Same as 550T, less AM. o'load prot; tape mon, loudness sws.
	160-T	20	0.5	1.0	0.2	25-25K	25-20K	90	2.5, 9.5	45, 171		0.6	2.8	35		Yes	15¼ x 11¼ x 3⅛	15	199.95	FM only; "Tune-O-Matic;" FETs & ICs, complete conts, filters.
GROMMES	503	30	0.3	0.5	0.2	20-20K	15-50K	75	3.0	60	2.0	0.5	2.5	35	Meter	Yes	16 x 13 x 5¼	28	349.95	FM/AM; FETs & ICs; 15 A. sil. output; silent tuning.
	504	30	0.3	0.5	0.2	20-20K	15-50K	75	3.0	60	2.0	0.5	2.5	35	Meter	Yes	16 x 13 x 5¼	28	309.95	Same, but FM only.
HALLICRAFTERS	CR-3000	10	<3	<5	<5		30-15K	60	3.0		20			25	Meter	No	15⅛ x 12¼ x 5	22	269.95	6 bands; LW, AM bdcst, 3 SW bands from 2-18 MHz.

Check No. 29 on Reader Service Card →

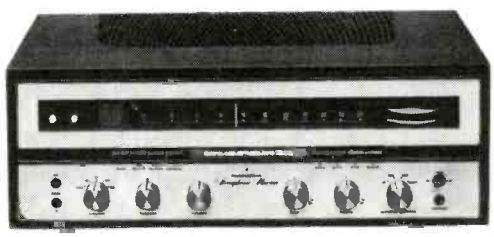
Our competition builds some pretty good stereo receivers.

(We just happen to build a great one!)

Let's not kid around. At 700 bucks plus tax, a Marantz Model 18 Receiver isn't for everyone.

But, if you'd like to own the best solid-state stereophonic receiver made anywhere in the world, this is it. Here are just a few of the reasons why.

The Marantz Model 18 is the only receiver in the world that contains its own built-in oscilloscope. That means you can tell a lot more about the signal a station is putting out besides its strength or whether or not it's stereo. Like if they're trying to put one over on you by broadcasting a monaural recording in stereo. Or causing distortion by overmodulating. (It's nice to know it's *their* fault.)



The Marantz Model 18 is the only stereo receiver in the world with a Butterworth filter. Let alone four of them. The result: Marantz IF stages *never* need realigning. Marantz station selectivity is superior so strong stations don't crowd our adjacent weaker stations. And stereo separation is so outstanding that for the first time you can enjoy true concert-hall realism at home. Moreover, distortion is virtually non-existent.

But there is much more that goes into making a Marantz a Marantz. That's why your local franchised Marantz dealer will be pleased to furnish you with complete details together with a demonstration. Then let your ears make up your mind.

marantz®

Designed to be number one in performance... not sales.

RECEIVERS (continued)

Kenwood TK-140

Marantz Eighteen

Harman-Kardon Five Twenty

KLH Twenty-Seven

Martel FAX-550

Heathkit AR-15

Lafayette LR-1500T

McIntosh Mac 1700

MANUFACTURER (Circled numbers indicate adv. pages)	Model	IHF Power/Chan., W	THD, Full Power, %	IM, Full Power, %	IM, 1 Watt	Power Bandwidth, Hz	1-W Freq. Resp., Hz	S/N, Rated Power, dB	Phono Sens., mV.	Phono Overload, mV.	IHF Usable Sens., μV.	THD, 100% Mod., %	Capture Ratio, dB	Stereo Sep., 1 kHz, dB	Tuning Indicator	Auto Switching?	Dimensions, In. W x D x H	Weight, Lbs.	Price	SPECIAL FEATURES
HARMAN-KARDON	720	40	0.3	0.4	.08	8-40K	5-60K	90			1.8	0.5		35	Meter	Yes	16¼ x 11¾ x 5	26	385.00	Opt wal encl., 29.95.
	530	70	0.3	0.3	.08	8-40K	5-60K	90			1.95	0.5		35	Meter	Yes	15 9/16 x 12½ x 4⅝	21	349.00	FM/AM; available as FM only, mod 520, 315.00.
	210	25	0.4	0.5	0.1	10-23K	8-25K	90			2.7	0.6		30	Meter	Yes	14¾ x 13¼ x 4½	20	285.00	FM/AM; 2 sets spkr switching; MOSFET front end; headphone jack.
	Citation 11	75	0.2	0.25	0.1	8-40K	3-100K	95	2.5, 5.0	70, 140	1.65	0.4	2.0	45	Meter	Yes	17 x 15 x 4⅝	35	595.00	3 FETs, xtal i.f.s & ICs; Sw tone conts; modular clip-in const.
HEATH (46) (47)	AR-15 ARW-15	75	0.2	0.5	0.2	6-25K	6-40K	65	2.2	155	1.8	0.5	1.5	40	Meter	Yes	16⅞ x 14½ x 4¾	28	339.95 K 499.50 W	FM/AM; FETs, 2 ICs; 2 xtal filters; o'load prot. opt wal cab 19.95.
	AR-13A	33	0.3	1.0	1.0	15-30K	12-60K	50	6		2.0	1.0	3.0	30	Meter	Yes	17 x 14¾ x 5½	24	184.00 K	FM/AM; filt. outputs for recdg; sec. conts. under hinged panel incls cab.
	AR-14	15	0.5	1.0	1.0	15-50K	12-60K	50	4		5.0	0.6	2.5	30		No	15¼ x 12 x 3⅞	14	99.95 K	FM only; filt. outputs for recdg; 20-hr. assbly; opt. cabs. met. 3.95; wal, 9.95.
	AR-17	7	1.0	2.0	0.7	40-60K	25-35K	55	5	30	5.0	1.0	3.0	30		No	12 x 10⅜ x 3	7	72.95 K	Compact model; incls. hdphn jk.
KENWOOD (25)	TK-140	65	0.8	0.8	< 0.3	20-30K	20-50K	60 (phono)	2.0	100	2.0	0.6	2.5	38	Meter	Yes	16½ x 14 x 5	31	339.95	FET front end; 2 sets spkr terms; piano key sws.
	TK-88	45	0.8	0.8	< 0.3	20-30K	20-50K	60	2.0	100	2.0	0.6	2.5	38	Meter	Yes	16½ x 12½ x 5	24	289.95	As above, except has rocker sws.
	TK-66	30	0.8	0.8	< 0.3	20-30K	20-50K	60	2.0	100	2.0	0.6	2.5	38	Meter	Yes	16½ x 12½ x 5	23	239.95	As above, but diff. styling.
	TK-55	30	0.8	0.8	< 0.3	20-30K	20-50K	60	2.0	100	2.5	0.6	2.5	38	Meter	Yes	16½ x 12½ x 5	20	199.95	As above.
KLH	27	50 (4Ω)	< 0.5	< 0.5	< 0.25	17-20K	6-25K	70	1.3	105	2.0	0.5	4.0	35	Meter	Yes	13¼ x 14¾ x 4½	20½	319.95	FM/AM; sep. plan. dials; FET's, 5-stg. i.f.; mx noise filtr.
KNIGHT-KIT (63) (64)	KG-980	25	1.0	1.0	0.7	20-20K	15-50K	65	5	45	3	1.0	3.0	30	Meter	Yes	15½ x 13½ x 4⅜	18	139.95 K	2 t.r.f. stgs; compl. sym. output stages.
LAFAYETTE	LR-1500T	85	0.8	0.8	0.3	12-40K	20-20K	68	1.8, 4.5, 12	30, 75, 200	1.5	0.3	1.25	40	Meter	Yes	16¾ x 14¼ x 4⅝	32	299.95	2 FETs, 4 ICs; main-rem. spkr. sw; front-rear tape jks.
	LR-500T	30	0.8	0.8	0.3	25-40K	22-20K	67	2.3	40	1.8	0.3	1.25	35	Meter	Yes	15⅛ x 10⅝ x 4⅜	15	179.95	As above.
MARANTZ (29)	18	40	0.15	0.2	b.r.*	10-40K	20-20K	80	1.0	80	2.5	0.15		45	Scope	Yes	18¼ x 16 x 6	40	695.00	*below resid; scope for multipath tuning ind.
MARTEL	FAX-550					20-25K			2.2 90*		3.2	2.0		37	Meter	Yes			299.50	*xtal. phono input; FET front end.
MC INTOSH (14)	MAC-1700	40	< 0.25	< 0.25		10-80K		75*	2.4		2.5	0.5	2.0	30	Meter	Yes	16 x 14½ x 5 1/16	34	599.00	*high level input, opt. cab. 29.50.

Check No. 31 on Reader Service Card →

You just can't compromise good design. It can't be rushed. You've been patient. We've been patient. Now we're both going to be rewarded. The new Sony 6060 receiver is a superb performer on FM stereo, FM and AM broadcasts; records and tapes.

On FM even the weakest, fuzziest stations sound like the strong ones. And they don't get clobbered by the strong ones. Stations you never knew existed suddenly appear.

FM stereo? Superb. All the separation necessary for full, rich stereo sound. And the 6060 automatically switches to stereo operation.

Sony engineering innovations made this possible: the front end combines three newly developed Sony field-effect transistors with a 5-gang variable capacitor to provide an unprecedented combination of low internal noise, high sensitivity (1.8μV) and low cross-modulation. The IF section uses six solid-state filters instead of conventional tuned circuits. Even AM broadcasts are better, because of the special care devoted to this portion of our receiver.

The powerful amplifier section delivers 110 watts IHF into 8 ohms without the slightest trace of distortion (0.2% at rated output). Plenty of power to drive any speaker system with plenty in reserve for difficult passages. A unique heat-sensing circuit protects the 6060 from overload.

Not only is the 6060 a pleasure to hear, but it is also a pleasure to use. It has a full complement of controls and conveniences: zero-center tuning meter; front-panel headphone jack; switches for tape monitoring, muting, speaker selection, tape head or Aux. input, loudness—the works.

At $399.50 (suggested list), it outperforms receivers selling for as much as $500. But don't take our word, hear for yourself at your hi-fi dealer.

Sony Corporation of America, 47-47 Van Dam St., L.I.C., N.Y. 11101.

Now, aren't you glad you waited?

SONY®

RECEIVERS (continued)

Sansui 5000

Nivico 5003M

Scott 388B

Sony STR-6060

Pioneer SX-1500T

Sherwood S-7800

University Studio Pro 120

MANUFACTURER (Circled numbers indicate adv. pages)	Model	IHF Power/Chan., W	THD, Full Power, %	IM, Full Power, %	IM, 1 Watt	Power Bandwidth, Hz	1-W Freq. Resp., Hz	S/N, Rated Power, dB	Phono Sens., mV.	Phono Overload, mV.	IHF Usable Sens., μV.	THD, 100% Mod., %	Capture Ratio, dB	Stereo Sep., 1 kHz, dB	Tuning Indicator	Auto Switching?	Dimensions, In. W x D x H	Weight, Lbs.	Price	SPECIAL FEATURES
NIVICO	5003 M	70	0.5	1.0		7-30K	5-35K	70	1.5 250*		1.8	0.5		35	Meter	Yes	20 x 13⅛ x 4⅘	30.8	329.95	5 i.f. stgs; FETs; sound effect ampl, spkr sys. sel. *xtal cartr.
NORDMENDE (87)	8001 ST	32	1.0	1.0			20-20K	65			4.0	1.0		32	Meter	Yes	19½ x 14 x 6		399.95	5 pre-set FM stas.;also AM, short & long waves.
PANASONIC (51)	SA-70	45	0.8	1.0	0.2	20-30K	18-60K	80	4, 18		1.8	0.5	2.0	35	Meter	Yes	19⅝ x 14 x 5⅛	28½	339.95	3 FETs, 4 ICs; cer. filters. Incls wal. cab; FM/AM.
	SA-60	30	0.8	1.0	0.2	20-26K	20-60K	77	3.5, 16		2.0	0.7	3.0	35	Meter	Yes	19⅝ x 14 x 5⅛	25.	279.95	3 FETs, cer. filters; incls. wal. cab; FM/AM.
PIONEER (13)	SX-1500T	85	0.5	0.5	0.3	15-70K	20-70K	65	2.4		1.7	0.5	1.0	37	Meter	Yes	15¾ x 13¾ x 5½	23	360.00	1 FET, 4 ICs; main. rem. spkr sw; 2 phono inputs; equalization for 2 tape speeds.
	SX-1000TD	65	0.5	0.5	0.3	15-50K	20-50K	65	2.4		1.7	0.5	1.7	38	Meter	Yes	16 x 13 13/16 x 5 7/16	25	315.00	As above.
	SX-700T	30	1.0	0.5	0.3	15-30K	25-50K	60	3.0		2.2	1.0	3.0	35	Meter	Yes	16 x 13 13/16 x 5 7/16	20	249.95	Main-rem. spkr. sw; 2 phono input sel; 2 tape sp. sel, incl. AM.
	SX-300T	20	1.0	1.0	0.5	15-30K	20-20K	55	2.6		3.0	1.0	3.5	35	Meter	Yes	16 x 12⅛ x 5 7/16		179.95	Incls. AM.
SANSUI (33)	5000	75	<0.5	1.0	1.0	15-30K	10-50K	>65	2.5		1.8	<0.8	1.5	>35	Meter	Yes	17 x 14 x 5	29	449.95	FET front end; 4 ICs in i.f. 75-300Ω ant; 3 prs spkr. outs.
	3000 A	48	0.8	1.0	1.0	20-40K	20-20K	65	2.5		1.8	1.0	2.7	>35	Meter	Yes	16 x 15 x 6	34.4	379.95	Incls. AM.
	2000	36	<0.8	1.0	1.0	20-40K	15-40K	>65	2.2		1.8	<0.8	2.5	>35	Meter	Yes	16 x 13 x 5	26½	299.95	
	400	25	<1.0	1.0	1.0	20-50K	15-40K	>60	2.2		2.5	<1.0		>35	Meter	Yes	16 x 12 x 5	22.8	239.95	
SCOTT Cover (2)	348-B	60	0.8	1.0	0.5	20 20K	15-30K	55*	3, 5, 9	70, 90, 155	1.7	0.8	1.9	40	Meter	Yes	17⅛ x 13½ x 5¼	21½	529.95	*phono; main-rem. spkr. sw; rems. may be mono; 388B W/AM.
	344 C	45	0.8	1.0	0.5	20-20K	15-30K	55*	4, 8	70, 140	1.9	0.8	2.2	36	Meter	Yes	17⅛ x 13 x 5¼	19¼	399.95	*phono; as above; avail. w/AM, mod 384.
	342 B	32.5	0.8	1.0	0.5	25-20K	15-30K	55*	4, 8	70, 140	2.2	0.8	2.5	36	Meter	Yes	14¾ x 12½ x 4⅛	14½	299.95	*phono; as above; avail. w/AM, mod. 382 B.
	341	25	0.8	1.0	0.5	25 20K	15-25K	55*	4	70	2.5	0.8	2.5	36	Meter	Yes	14¾ x 12½ x 4⅛	14¼	259.95	
SHERWOOD (18)	S-7800	70	0.6	1.0	0.1	12-30K	12-30K	70	1.5 6.2	22 100	1.8	0.15	2.0	40	Meter	Yes	16½ x 14 x 4½	27	419.50	FM/AM uses FETs and ICs.
	S-8800a	80	0.6	1.0	0.1	12-30K	12-30K	70	1.5 6.2	22 100	1.8	0.15	2.0	40	Meter	Yes	16½ x 14 x 4½	22	399.50	As above, FM only.
	S-7600	40	1.0	1.0	0.15	12-30K	12-30K	70	1.5 12.0	19 146	1.8	0.15	2.0	40	Meter	Yes	16½ x 14 x 4½	27	399.50	FM/AM, uses FETs and ICs.
	S-8600a	50	1.0	1.0	0.15	12-30K	12-30K	70	1.5 12.0	19 146	1.8	0.15	2.0	40	Meter	Yes	16½ x 14 x 4½	22	319.50	As above, FM only.
SONY (31)	STR-6060	55	0.2	0.2			20-60K	100	2.3	100	1.8	0.3	1.5	40	Meter	Yes	17⅛ x 13½ x 5⅞	29	399.50	Uses 3 new FETs; s/s i.f. filters repl. conv. transfs.
UNIVERSITY (5)	STUDIO PRO-120	60	0.8	<0.5	<0.5	10-40K	10-100K	83	4	50	2.3	<0.5	<1.0	40	Meter	Yes	16⅛ x 12 x 4½	17	379.50	MOSFETS, ICs; thermal cct brkrs; 2-yr warranty; encapsulated out. transistors.

Watt for Watt
Spec for Spec
Dollar for Dollar
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This is the new Sansuifidelity 2000. 100 watts (IHF) of music power... 36 watts/channel RMS... harmonic distortion of less than 0.8% at *all* rated outputs ... FET Front End... 1.8μV (IHF) FM Sensitivity... frequency response from 15-40,000 Hz. If you are an expert in audio equipment you will know what these specifications mean; if you are not, ask any sound engineer; he will tell you. He will also tell you that specifications alone do not make a great receiver. There is the perfection of every component, the most exacting quality control, the integrity and pride of the manufacturer, and that extra care and extra imagination that make a truly great product.

Your Franchised Sansui Sound Specialist invites you to see and listen to the Sansuifidelity 2000. Watch the exclusive Sansui blackout dial light up when you listen to AM or FM broadcasting and change when you switch the selector to phono or tape or auxiliary; notice the ease with which the controls let you choose exactly the blend of music you want to suit you and your personal taste. All this and much more at the unbelievable price of **$299.95.**

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TUNERS

EICO 3200 "Cortina"

Dynaco FM-3

Marantz 10B

MANUFACTURER (Circled number indicates ad page)	Model	IHF Sens. μV	THD, 100% mod, %	Capture Ratio, dB	Drift, kHz	Alt. Chan. Sel, dB	Freq. Resp. Hz ± dB	AFC ?	AM Suppression, dB	Stereo Sep. 1 kHz, dB	Stereo Sep. 10 kHz, dB	Stereo THD, %	Tuning Indicator	Stereo Indicator	Auto Switching?	Dimensions – In. W x D x H	Weight, Lbs.	Price	SPECIAL FEATURES
ACOUSTECH	VIII	2.0	0.3	2	10	55	30-15K ±1.0	No		35	20	1.0	Meter	Light	Yes	15 x 10 x 5	14	349.00	Incls ster phone ampl; see-thru panel; muting.
	VIII-K	2.0	0.3	2	10	55	30-15K ±1.0	No		35	20	1.0	Meter	Light	Yes	15 x 10 x 5	14	249.00	Kit of above; AM and phone modules can be added.
ALLIED (63) (64)	KHI-285	2.5	1.0	2.0	15	50	20-20K ±1.0	Yes	30	40		1.0	Meter	Light	Yes	13¾ x 9¾ x 4¾	18	79.95	FM/AM; 3 i.f. stages; includes metal case.
DYNACO (11)	FM-3	4.0	0.5	5	30	54	10-15K ±0.5	No	63	30	17	1.0	Eye	Eye	Yes	13 x 8 x 4	13	99.95K 154.95W	Front panel v.c., stereo defeat switch; TUBED
	FM-1	4.0	0.5	5	30	54	10-40K ±0.5	No	63	–	–	–	Eye	–	–	13 x 8 x 4	12	74.95K 109.95W	Mono; TUBED
EICO	Cortina 3200	2.4	0.5	4.5	12	45	20-15K ±1.0	Yes	40	40	30	0.75	Meter	Light	Yes	12 x 7¾ x 3⅛	7	89.95K 134.95W	Incl vinyl-clad metal cab. pre-wired r.f., i.f., mpx sects.
ELECTRO-VOICE Cover (4) (1)	EV-1255	2	1.0	2	20	40	30-15K ±1.0	Yes	40	25	15	1.0	Meter	Light	Yes	8⅜ x 10¼ x 3⅜	8	160.00	Sta. markers for favorite sta's. Incls case w/wal fin panels; matches 1244.
	EV-1256	2	1.0	2	20	40	30-15K ±1.0	Yes	40	25	15	1.0	Meter	Light	Yes	8⅜ x 10¼ x 3⅜	8	195.00	As above but with AM added; matches EV-1244 ampl.
	EV-1159	3	2.5	2.5	20	40	30-15K ±1.0	Yes	40	20	12	2.5	Meter	Light	Yes	15¾ x 8½ x 4¼	16	94.00	Matches EV-1122 ampl.; incls. wal case w/die cast end panels
FISHER (43)	R-200-B	1.8	0.4	2.5	10	50	20-15K ±1.0	No	50	35	30	1.5	Meter	Light	Yes	15⅛ x 12⅞ x 4 13/16	18½	299.95	5-band AM/FM, long, med, short wave; muting cont, AM bandwidth cont, whistle filt.
	TFM-1000	1.8	0.2	0.6	10	70	20-15K ±1.0	No	60	>40	35	1.5	Meter	Light	Yes	16¾ x 12⅜ x 5⅛	18	429.95	FET front end, 5 i.f. stgs, 4 limiters; counter det., 600Ω out, step atten.
	FMR-2	1.8	0.2	0.6	10	70	20-15K ±1.0	No	60	>40	35	1.5	Meter	Light	Yes	19 x 12⅜ x 5 7/32	18	449.95	Rack-mtg version of above. Sep- gain cents; fld. str. & VU meters.
GROMMES	108	2	0.5	2.5	10	50	20-20K ±1.0	No	50	35	25	0.75	Meter	Light	Yes	13½ x 10 x 4⅜	12	199.65	FET front end; IC i.f.; silent tuning; incls. AM
HEATH (46) (47)	AJ-15	1.8	0.5	1.5		70	20-15K ±1.0	No	50	40	25	1.0	2 Meters	Light	Yes	16⅞ x 12½ x 4¾	11½	189.95K	FET cascode, FET mixer, 2 xtal i.f. filters, 2 IC's; var squelch, ster thresh.
	AJ-43D	2	1.0	3.0			20-20K ±3.0	Yes	40	35	30	1.0	2 Meters	Light	Yes	15¾ x 14¾ x 5½	15	109.00K	Incls. AM; filtered outputs for recording: opt. wal cab. $12.95; metal, $6.95
	AJ-33A	3	1.0	4.0			20-20K ±3.0	Yes	40	30	25	1.0	Meter	Light	No	15⅜ x 11½ x 3¾	12	94.50K	As above, plus reg. pwr. supply, adj. squelch. incls wal cab.
	AJ-14	5	1.0	3.0			20-15K ±3.0	Yes	40	30				Light	No	12½ x 9⅝ x 3½	5	49.95K	FM only; 4 i.f.'s; phase cont; filt. outputs; opt. cabs - wal, $7.95; met, $3.50.
KLH	18	2	0.5	4.0	10	35	20-15K ±1.0	No	50	35	20	0.8	Meter	Light	Yes	9 x 5⅜ x 4¼	4	129.95	FET front end, 5 i.f.'s, 0-ctr meter, planetary tuning; incls cab.

McIntosh MR71

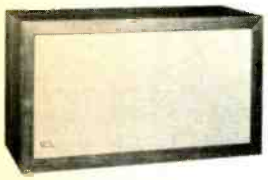
Sherwood S-3300

Scott 312D

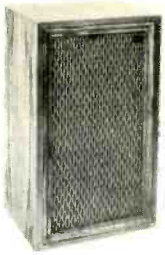
Sony ST-5000FW

MANUFACTURER (Circled number indicates ad page)	Model	IHF Sens. μV	THD, 100% mod, %	Capture Ratio, dB	Drift, kHz	Alt. Chan. Sel, dB	Freq. Resp. Hz ± dB	AFC ?	AM Suppression, dB	Stereo Sep. 1 kHz, dB	Stereo Sep. 10 kHz, dB	Stereo THD, %	Tuning Indicator	Stereo Indicator	Auto Switching?	Dimensions – In. W x D x H	Weight, Lbs.	Price	SPECIAL FEATURES
KNIGHT-KIT	KG-765A	2.5	<1.0	9		30	20-20K ±1.0	Yes	30	30	20	<1.0	Meter	Light	Yes	13 x 11 x 2 3/4	13	99.95	FM/AM
	KG-795	3.0	1.0	3	20	45	30-15K ±1.0	Yes	30	30	15	1.5	Meter	Light	Yes	13 x 10 x 3 5/16	7	59.95	2 t.r.f. stages
LAFAYETTE	LT-425	1.5	0.4	1.5	15	50	50-15K ±1.0	No	50	40	24	0.7	2 Meters	Light	Yes	13 x 9 x 3 7/8	9 1/2	119.95	AM/FM, 2 FETS in front end, 4 IC's, built-in ants; front & rear tape outs.
	LT-225T	3	1.0	3.0	20	50	50-15K ±1.0	No	50	30	20	1.5	Meter	Light	Yes	11 x 8 11/16 x 4 1/4	12	79.95	AM/FM, built-in ants, 2 rear panel outputs for tape & ampl.
LEAK	Trough-Line 3	2.	1.0		3		20-20K ±1.0	Yes	45	–	–	–	Eye	–	–	11 1/2 x 8 1/4 x 4 1/4	13	159.00	Mono only
	Trough-Line Stereo	2.5	1.0		3		20-20K ±1.0	Yes					Eye	No	No	11 1/2 x 8 1/4 x 4 1/4	13 1/2	199.00	Stereo
3-M (WOLLENSAK)	5810	10					40-12K Stereo		30	>25			Eye	Light				119.95	AM/FM; matches 5800 recorder
MARANTZ (29)	10 B	2	0.2	1.75	10	150	20-15K ±0.5	No	70	48	33	0.2	CRT	Light	Yes	15 3/8 x 15 x 5 1/4	36	750.00	Bal. diode 1st det; 6 if's coup. by passive filters; TUBED.
MC INTOSH (14)	MR-67	2.5	<0.5	1.5		60	20-20K ±0.5	No		>30		0.5	Meter	Light	No	16 x 13 x 5 7/16	24 1/2	299.00	Built-in multipath indicator; cab. $29.00
	MR-71	2.5	<0.5	1.5		60	20-20K ±0.5	Var.		>30		0.5	2 Meters	Light	Yes	16 x 13 x 5 7/16	27	399.00	As above
	MX-110	2.5	<0.5	1.7			20-20K ±0.5	No		>30		0.5	Eye	Light	No	16 x 13 x 5 7/16	27 1/2	399.00	Includes complete stereo preamp.
SCOTT	312 D	1.7	0.8	1 9	20	46	30-15K ±1.0	No	55	40	20	1.0	Meter	Light	Yes	14 3/4 x 12 1/2 x 4 1/8	11 1/8	329.95	Hi-Z & 600 Ω outputs, both W. level conts. 3-way meter sw.-m'path, ctr tuning, sig. strength.
Cover (2)	315 B	2.2	0.8	2.5	20	42	30-15K ±1.0	No	55	36	20	1.0	Meter	Light	Yes	14 3/4 x 13 x 4 1/8	11	212.95	
	LT-112-B	1.8	0.8	2.5	20	45	30-15K ±1.0	No	55	40	20	1.0	Meter	Light	Yes	14 3/4 x 12 1/2 x 4 1/8	11	199.95K	Kit; 4-way mtr sw-alignment, m-path, ctr tuning, signal strength
SHERWOOD (18)	S-3300	1.8	0.15	2.0	10	50	20-15K ±0.5	No	56	35	24	0.15	Meter	Light	Yes	14 x 10 1/2 x 4	10	197.50	FET front end; IC's; stereo noise filter does not affect freq resp; level control.
	S-2300	1.8	0.15	2.0	10	50	20-15K ±0.5	No	56	35	24	0.15	Meter	Light	Yes	14 x 10 1/2 x 4	13	224.50	As above, includes AM
	S-3500	1.8	0.25	2.4	10	50	20-20K ±0.5	Yes	56	–	–	–	Meter	–	Yes	14 x 10 1/2 x 4	9	129.50	FM mono; AFC tracks wireless mikes, and bio-telemetric Xmitters.
SONY (31)	ST-5000 F	1.5	0.2	1.0	20	90	20-15K ±0.5	No	65	40	30	0.35	2 Meters	Light	Yes	15 3/4 x 12 1/4 x 5 3/4	10.9	449.50	FET front end; 3 ceramic i.f. filters, 9 i.f. stages, 5 limiters, muting control.

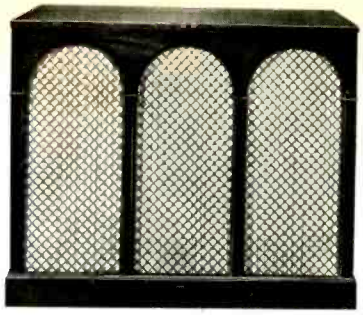
SPEAKER SYSTEMS



AR-3a



ADC-400



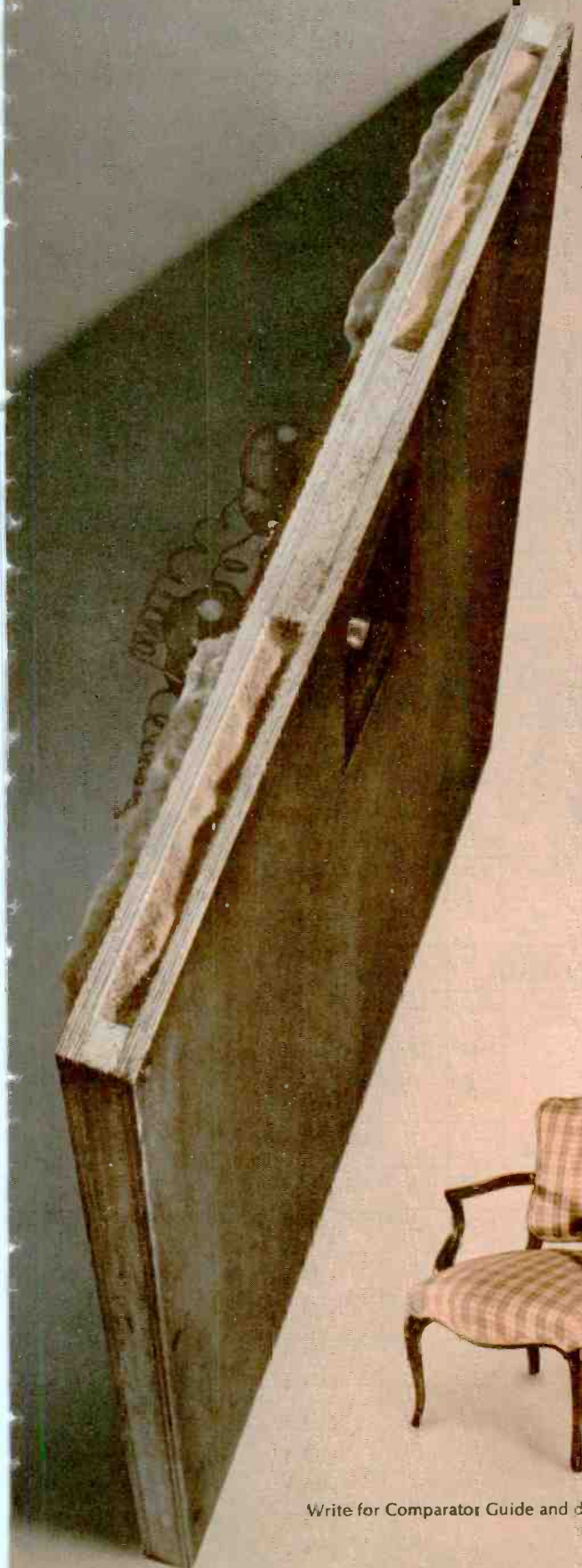
Bozak B-305

Electro-Voice E-V Four-A

MANUFACTURER (Circled numbers indicate adv. page)	Model	WOOFER Diameter, In.	WOOFER Resonance, Hz.	WOOFER Cone Material	MID-RANGE Diameter, In.	MID-RANGE Diaphragm Material	MID-RANGE Type	TWEETER Diameter, In.	TWEETER Diaphragm Material	Enclosure Dimensions W x D x H, In.	Wood Finish	Grille Material Color	Overall Freq. Response, Hz.	Crossover Freqs., kHz	Impedance, Ohms	Weight, Lbs.	Price	SPECIAL FEATURES
ACOUSTECH	X	All Electrostatic Stereo System								30 x 4 x 72	Wal.	Cloth Beige	30-30k	1300	–	175	1690.00	Incls. 4 ampls; 500 W. music power, elect. xover.
ACOUSTIC RESEARCH (55)	AR-3a	12	44	Paper	1½	Spec.	Dome Dyn.	¾ Dome	Spec.	25 x 11⅜ x 14	Var.	Burlap Beige		0.575 5	4			Price depends on finish; Wal. highest; unf. pine lowest.
	AR-3	12	44	Paper	2	Phen.	Dome Dyn.	1⅜ Dome	Phen.	25 x 11⅜ x 14	Var.	Saran Off Wht		1 7.5	4			As above.
	AR-2a[X]	10	56	Paper	3	Paper	Cone	1⅜ Dome	Phen.	24 x 11½ x 13½	Var.	Burlap Beige		1.75 7.5	8			As above.
	AR-4[X]	8	68	Paper	–	–	–	2½ Cone	Paper	19 x 9 x 10	Var.	Burlap Beige		1.2	8			As above.
ALLIED (63) (64)	2380	15		Paper			Horn	Dome		20½ x 14 x 30¾	Oil Wal.	Cane Straw	20 –Aud.	2 10	8	52	149.95	Sep. level conts for mid-range and tweeter.
	2260A 2260AK	12		Paper	8	Paper	Cone	Horn		25 x 8 x 17	Wal. Ven.	Cane Straw	30-20k	0.6 4	8	37	79.95 64.95K	Compr. tweeter; ducted port; high-compl. woofer.
ALTEC (75)	846A	15	25	Paper		Alum.	Horn	–	–	29¾ x 27½ x 19	Wal.	Fretwk Brown	32-22k	0.8	8-16	100	333.00	A7 "Voice of the Theatre" components; fretwork grille.
	A7-500 W-1	15	25	Paper		Alum.	Horn	–	–	42 x 32 x 25	Wal.	Fretwk Brown	30-22k	0.5	8-16	170	498.00	A7-500 "Voice of the Theatre" components; fretwork grille.
	847A	12	32	Paper	–	–	–	Horn	Mylar®	26 x 19 x 14	Wal.	Fretwk Brown	40-22k	3	8-16	60	237.00	Fretwork grille.
	890B	10	10	Paper	–	–	–	Horn	Mylar®	25¾ x 12 x 14½	Wal.	Cloth Neutral	40-22k	3	8	30	179.50	Incls. 10-in. phase inverter for low-end response.
AMPEX	830	8	62	Paper	–	–	–	3½ Cone	Paper	24 x 14 x 12	Wal.	Cloth Eggshell	45-15k	1.5	8	42 (pr)	99.95 pr	
ADC	ADC-19	16x* 12		Poly-styrene	–	–	–	1½** Dome	Mylar®	45½ x 16 x 32½	Oil Wal.	Cloth Light	20-20k	1 4	6		475.00	*Rect., 2 units. **4 units.
	ADC-18A	16x* 12	45	Poly-styrene	5	Paper	Cone	1½ Dome	Mylar®	39½ x 17 x 26½	Oil Wal.	Cloth Light	20-20k	0.4 4	8		275.00	*Rect.; h.f. level control.
	ADC-400	10	55	Paper	5½	Paper	Cone	1½ Dome	Mylar®	25 x 11⅞ x 14½	Oil Wal.	Cloth Light	30-20k	0.8 4	8		159.50	h.f. level cont.; removable frame for interchg. grille.
BOGEN (89)	LS-20	8	35-40	Comp.	–	–	–	5½	Comp.	19 x 9 x 10	Oil Wal.	Cloth	30-20k	1.05	8	17	59.95*	*List; h.f. level control.
BOWERS & WILKINS	DM-3	13½ x* 8½	25	Glass	1½	Fabric	Pressure	¾	Plas.	28½ x 11½ x 15¾	Teak, Wal.	Cloth	40-25k	0.8, 3,14	8	47	250.00	*Elliptical; small monitor spkr; min. coloration.
BOZAK	B-410	(4) 12	40	Felted Paper	(2) 8	Metal	Cone	(8) 2½	Metal Cone	52 x 19 x 36	Wal.	Cloth White	28-20k	0.4 2.5	8	225	862.00	Interchangeable grille cloth.
	B-4000 Classic	(2) 12	40	Felted Paper	8	Metal	Cone	(8) 2½	Metal Cone	26¼ x 15⅜ x 44½	Var.	Cloth Met. Gr.	35-20k	0.2 1.5	8	150	555.00	As above.
	B-305 Moorish	(2) 12	40	Felted Paper	8	Metal	Cone	(4) 2½	Metal Cone	28 x 36 x 20	Var.	Cloth	35-20k	0.8 1.5	16	140	475.00	As above.
	B-302A Century	12	40	Felted Paper	8	Metal	Cone	(2) 2½	Metal Cone	31 x 19 x 28	Var.	Cloth Met. Gr.	40-20k	0.8 2.5	8	100	280.00	As above.
ELECTRO-VOICE (1)	Patrician 800	30	15	Poly-styrene	12	Cone	Paper	4 x 8 horn 3¾ x 4½ horn	Metal Metal	51 x 28 x 33	Var.*	Cloth Dk. Bm	30-20k	0.1, 0.8 3.5	16	270	1095.00	*Walnut, mahogany, fruitwood; 4-way sys.
	Four-A	12	14	Paper	6	Cone	Paper	2½ cone	Paper	25 x 13½ x 14	Wal.	Cloth Dk. Bm	30-20k	0.4 2.5	8	45	155.00	Closed-cell half-roll woofer surround; sealed system.
	Four	12	17	Paper		Horn	Mylar®	5 Cone	Paper	25 x 13½ x 14	Wal.	Cane Neutral	30-20k	0.8 3.5	8	42	138.00	Etched-circuit xover; step-type level conts.
	Five-A	10	22	Paper	–	–	–	2½ Cone	Paper	21¾ x 10⅜ x 12¼	Wal.	Cloth White	30-20k	1	8	22	88.00	4-layer v.c. for better bass at lower cost.
Cover (4)	Seven-A	8	30	Paper	–	–	–	3½ Cone	Paper	19 x 8½ x 10	Wal.	Cane Neutral	50-20k	2	8	19	66.50	Caned-in grille; bril. cont.
	Eight	6	33	Paper	–	–	–	2½ Cone	Paper	15½ x 6½ x 8¾	Wal.	Cloth White	60-20k	2	8	16	47.00	Double-damped tweeter; bril. cont.

Check No. 37 on Reader Service Card →

Does WHARFEDALE still use sand in its speaker systems?



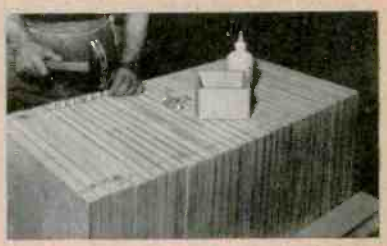
YOU BET WE DO! For example, you'll find over 7 pounds of fine, white sand densely packed between layers of hardwood in our W70D speaker system... even more in the W90D... a little less in the W60D. Why sand? Because to create the famous Wharfedale *Achromatic* sound, we know a speaker cabinet must remain absolutely inert. It must be more than just hardwood, for even the thickest wood baffles can resonate. The Wharfedale sand-filled construction damps all vibrations and eliminates spurious resonances, no matter how deep or intense the bass energy. The result is distortion-free, superior sound. Rap the back cover of a sand-filled Wharfedale and hear the low, dull "thud" in contrast to the resonant sound of equally large plywood panels normally used in other systems.

MORE COSTLY TO BUILD... AND WORTH IT!

1. Cabinet back cover being assembled. Heavy plywood walls are further strengthened by thick wood braces, forming a strong, rigid panel with cavities.

2. Panels are stacked on specially designed vibrating machine. Note small, round openings on top edges, for fine-grain, cleansed white sand.

3. Sand is poured on, filtering slowly through small openings into panel cavities. Vibration machine eliminates air pockets, insures maximum compression.



4. Feed holes are sealed with wood plugs. Panel becomes totally inert to the back waves of sound which will be projected against it in the speaker enclosure.

HEARING... AND SEEING... IS BELIEVING. Once you hear the sound of Wharfedale *Achromatic* Speaker Systems, you will understand why Wharfedale has earned the loyalty of the most knowledgeable listeners in music and audiophile circles. Achromatic sound is rich, full, realistic sound reproduction, uncolored by extraneous modulations. The speakers and cabinet perform together as a single unit in correct acoustical balance to provide a truly faithful duplication of the original performance. It's the result of unique and exclusive construction features and techniques developed by Wharfedale.

What's more, you'll be delighted by Wharfedale cabinets: decor-conscious proportions; fine furniture finish; tasteful grille fabrics, removable at will; design that is a refreshing departure from conventional "boxy" shapes.

Wharfedale

ACHROMATIC SPEAKER SYSTEMS

Write for Comparator Guide and dealer list to: Wharfedale D..., British Industries Corp., Dept. HF-2, Westbury, N.Y. 11590.

SPEAKER SYSTEMS (continued)

Empire 7000

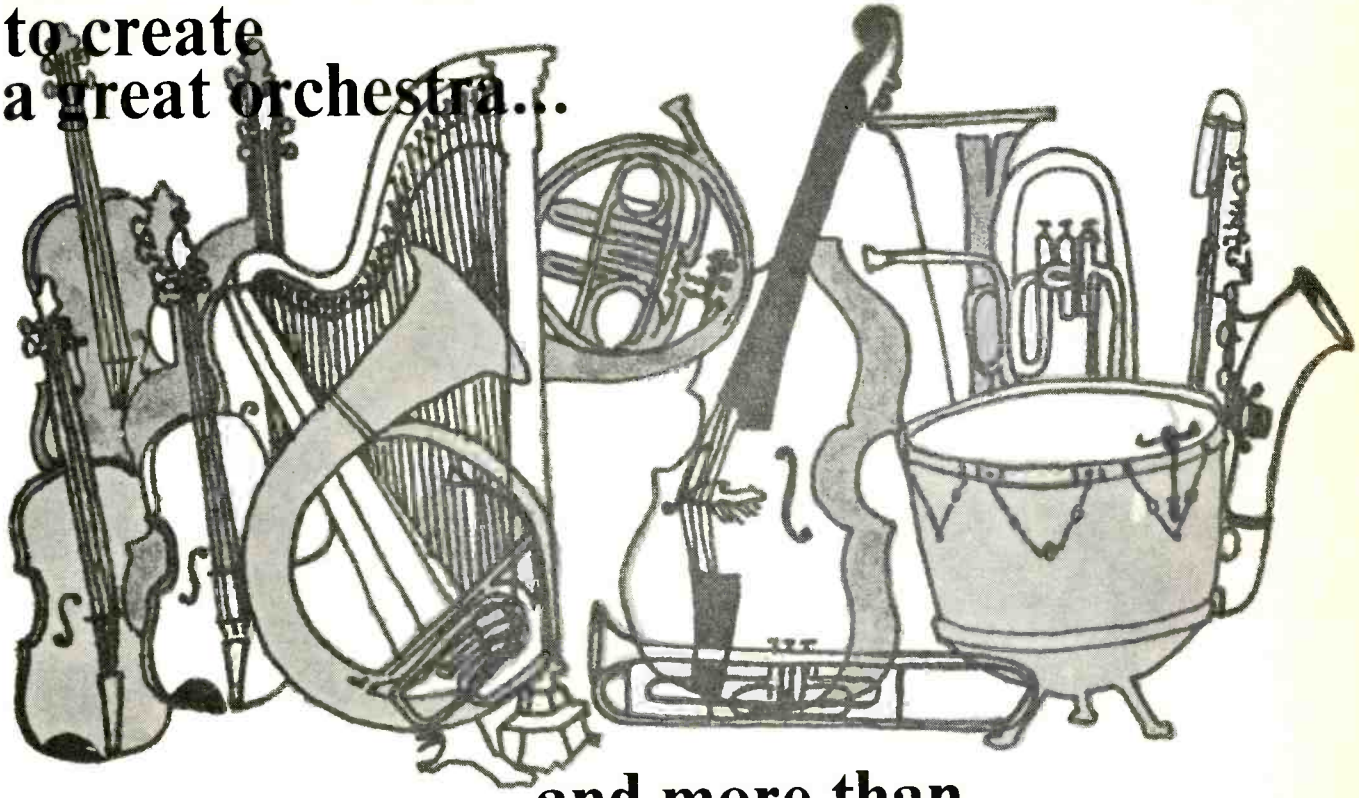
Erath LWE-I

Goodmans Maxim

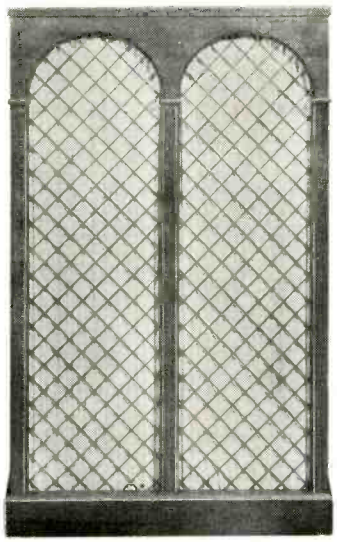
Fisher XP-18

MANUFACTURER (Circled numbers indicate adv. page)	Model	WOOFER Diameter, In.	WOOFER Resonance, Hz.	WOOFER Cone Material	MID-RANGE Diameter, In.	MID-RANGE Diaphragm Material	MID-RANGE Type	TWEETER Diameter, In.	TWEETER Diaphragm Material	Enclosure Dimensions W x D x H, In.	Wood Finish	Grille Material Color	Overall Freq. Response, Hz.	Crossover Freqs., kHz	Impedance, Ohms	Weight, Lbs.	Price	SPECIAL FEATURES
EMI	629	13½ x* 8½		Paper-Alum.	–	–	–	(2) 3⅜ Cone	Paper	13½ x 12¼ x 24½	Oil Wal.	Cloth	40-20k	4.5	8		164.50	Two-tweeter high-perf. sys. *Ellip.
	92	13½ x* 8½		Paper-Alum.	–	–	–	3⅜ Cone	Paper	11¾ x 10¾ x 23⅛	Oil Wal.	Cloth	50-20k	4.5	8		109.95	Co-ax, w/alum center. *Ellip.
	62	10¾ x* 6⅞		Paper-Alum.	–	–	–	3⅜ Cone	Paper	11⅛ x 10 x 20½	Oil Wal.	Cloth	60-20k	5	8		79.95	As above.
	52	–	–	–	–	–	–	3⅜ Cone	Paper	10¼ x 7½ x 18	Oil Wal.	Cloth	65-20k		8			New for '68.
EMPIRE	9000 M	15	20	Paper	4	Phen.	Compr.	1 Compr.	Phen.	22 dia. x 29 h.	Satin Wal.		20-20k	0.45 5	8	120	299.95	3-way; wide-angle lens; marble top.
	7000 M	12	25	Paper	4	Phen.	Compr.	1 Compr.	Phen.	19 dia. x 26½	Satin Wal.		25-20k	0.45 5	8	75	209.95	As above.
	5000 M	12	25	Paper	–	–	–	4 Compr.	Phen.		Satin Wal.		25-18k	0.45	8	70	179.95	
	2000 M	10	30	Paper	3 Cone	Paper	–	–	–	11⅞ x 11⅞ x 18¼	Satin Wal		30-18k	1.2	8	45	119.95	Marble top; "Kitten".
ERATH (41)	II	(2) 15	non-res	Paper	(2) 6	Paper	Cone	2 x 5 horn	Plas	34 x 16 x 24	Oil w. unf. bir	GFW Brn	20-20k	4	4	141	550.00 495.00	"Electronic suspension(TM) feedback; room gain cont."
	I	15	non-res	Paper	6	Paper	Cone	2 x 5 horn	Plas	17 x 12 x 25	Oil w. unf. bir	Linen Beige	20-20k	1 4	4	61	250.00 225.00	Same as above; bases available.
	III	12	non-res	Paper	6	Paper	Cone	3½ Cone	Paper	22½ x 9½ x 15	Oil w. unf. bir	Linen Beige	25-17k	1 4	4	35	175.00 157.50	Same as above.
FISHER (43)	XP-18	18	14	Plas-trtd Fiber	8 5¼	Fiber Fiber	Cone Cone	(2) 2 Dome	Mylar®	30½ x 16½ x 29½	Oil wal	Cloth wal	30-22k	0.15,1.5 3	8	105	329.95	4-way sys; high comp. woofer; sep. controls -lo-mid, hi-mid, tweeter.
	XP-15B	15	15	Paper	8	Paper	Cone	1½ Dome	Soft Cotton	27 x 14¾ x 27	Oil wal	Cloth Green	28-20k	0.4 2.5	8	80	269.95	High comp woofer, 12-lb. mag.; sep. conts.; 3-way sys.
	XP-55B	8	38	Paper	–	–	–	3 Cone	Paper	20 x 7½ x 10	Wal (vinyl)	Cloth Green	37-20k	1.5	8	18	49.95	Compact 2-way sys. high comp. woofer.
GELOSO	10/12	15		Paper	–	–	–	4 Cone	Paper	20 x 12 x 40	Brn Vinyl						151.25	Elec. mus. inst spkr; port. case, metal reinforced; 125W
GOODMANS	MAGNUM-K	12	20	Plas. ctd. Paper	4	Plas. ctd. paper	Cone	3½ Cone	Plas. ctd. paper	15 x 11¼ x 24	Teak or wal	Cloth Charcoal	30-20k	1.5 6	4-8	47	189.00	Var. conts for both mid range and tweeter.
	MEZZO-II	12	35	Plas. ctd. Paper	–	–	–	4 Cone	Plas. ctd. paper	12 x 9 x 19½	Teak or wal	Cloth Charcoal	40-20k	2	8	20	139.00	h.f. atten mtd. flush on back panel.
	MAXIM	4	35	Plas. ctd. Paper	–	–	–	3½ Cone	Plas. ctd. paper	10½ x 7¼ x 5½	Teak or wal	Cloth Wht & Brn	45-20k	2.2	15-16	8	59.95	Extremely compact.
GOTHAM	OY	10	28	Paper	4	Paper	Cone	Horn		19 x 9 x 12	Oil Wal. Gry Form.	Metal Silver	40-16k	0.5 8	<4700	44	520.00	Line level input; has 2 30-W Ampls; elect xover; level cont.
HARMAN-KARDON	40	10	26	Paper	–	–	–	3½ Cone	Phen.	13⅜ x 8 x 22⅞	Oil Wal.	Cloth White	30-18k	2.5	4	30	70.00	
	20	8	32	Paper	–	–	–	3 Cone	Paper	16½ x 11⅛ x 18	Oil Wal.	Cloth Brn	40-18k		8	28	65.00	
HARTLEY	V-A Conc. Mstr	24	8	Poly.	10	Poly.	Cone	7 Cone	Poly.	39 x 18 x 29	Oil Wal.	Cloth Brn-Gold	16-25k	0.3 3	16	110	730.00	All cones of same mtl. No. awareness of xover.
	Concert Jr.	10	28	Poly.	7	Poly.	Cone	2	Poly.	30 x 13 x 15	Oil Wal.	Plas. Beige	20-25k	1.5	8	45	325.00	Same as above.
HEATH (46) (47)	AS-10	10	58	Paper	–	–	–	(2) 3½ Cone	Paper	13½ x 11½ x 24	Unf. Wal.		30-15k	2.25	16	43	59.95K 64.95K	Acous. susp; 10-40 W.
	AS-16	8	31	Paper	–	–	–	3½ Cone	Paper	19 x 9 x 10	Wal.		45-20k	1.5	8	22	49.95K	As above; compact.
	AS-37	8	70	Paper	–	–	–	Horn		23 x 11⅛ x 11½	Wal. Vinyl	Cloth Brn	50-12k	1.6	8	22	39.95K	New model
JENSEN	1200-XLC	(4) 15	15	Paper	Horn		Comp.	Horn & Dome		40 x 22¾ x 30½	Oil Wal.	Cloth Blk-Brn	15-25k	0.5, 4, 10	8	243	895.00	7 spkrs total; tweeter is "Sono-Dome®"
	700-XL	12	20	"Flexair®"	Horn			Horn & Dome		25½ x 12 x 16¼	Oil Wal.	Cloth Brn	20-20k	0.6, 4, 10	8	60	275.00	4-way sys, hor. or vert. oper. opt. floor stand available.
	PR-200A	12	20	"Flexair®"	Dome			Dome		25 x 10⅜ x 14	Wal. Ven.	Cloth Blk-Sienna	25-20k	2, 9	8	43½	189.00	Uses "Sono-Domes®" for mid & hf ranges; sep. conts.
	TF3B	10	25	"Flexair®"	3½	Paper	Cone	Dome		23¾ x 11⅜ x 13½	Wal. Ven.	Cloth Dk. Olive	25-20k	2, 10	8	40	122.00	"Superflex® " enclosure, "Sono-Dome® " tweeter.

It takes more than violins to create a great orchestra...



and more than ordinary loudspeakers to reproduce it.



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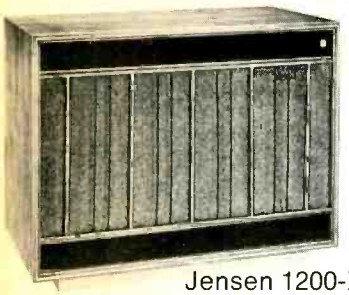
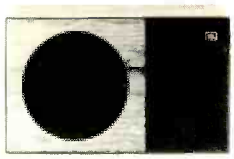
SPEAKER SYSTEMS (continued)



Jensen 1200-XLC



JBL Nova 88

KLH Six

Pioneer CS-88

Quad ESL

Sansui SP-30

MANUFACTURER (Circled numbers indicate adv. page)	Model	WOOFER Diameter, in.	WOOFER Resonance, Hz.	WOOFER Cone Material	MID-RANGE Diameter, in.	MID-RANGE Diaphragm Material	MID-RANGE Type	TWEETER Diameter, in.	TWEETER Diaphragm Material	Enclosure Dimensions W x D x H, in.	Wood Finish	Grille Material Color	Overall Freq. Response, Hz.	Crossover Freqs., kHz	Impedance, Ohms	Weight, Lbs.	Price	SPECIAL FEATURES
JBL	Olympus S7R	15	20	Paper	–	–		Horn	Acous. Lens	40 x 20 x 26½	Oil Wal.	Wal. Fretwork		0.5	8	165**	678.00	JBL passive radiator, slant-plate treble lens. **Shipping weight.
	Caprice	8		Pass. Rad.	8	Paper & Lans-a-plas	Full Range	–	–	22 x 10 x 22	Oil Wal.*	Perf. Alum.		1.5	8	88**	145.00 213.00*	Tilts for opt. coverage. *Rosewood.
	Lancer 77	10	20	Paper & Lans-a-plas	–	–	–	1.7 Cone	Paper	22½ x 11¾ x 14	Oil Wal.	Cloth Dk. Brn		2.5	8	42**	162.00	JBL passive radiator; 14-element h.f. lens
	88 Nova	12	28	Paper & Lans-a-plas	–	–	–	1.7 Cone	Paper	23½ x 11¾ x 14¼	Oil Wal.	Cloth Brn		2	8	46**	180.00	Avail. w/SE408S energizer.
KLH	9	20 10-in. sq. di-polar electrostatic radiators						2-di-polar E.S. radiators		23½ x 2⅞ x 70*	Var.	Boucle White	–	0.8-2 grad.	16	155	1140.00	Two panels for stereo. *Each panel.
	6	12	55	Paper	–	–	–	1¾	Stiff Paper	23½ x 11⅞ x 12⅜	Var.	Boucle White		1.5	8	34	122.00-134.00*	* Dep. on finish. - Unf. birch, mah, cherry, wal, oil wal. Fin 4 sides.
	17	10	60	Paper	–	–	–	1¾	Stiff Paper	23½ x 9 x 11¾	Oil Wal.	Cloth Off Wht		1.5	8	27	69.95	Fin. 4 sides, 3-pos twtr. cont., reqs. min. of 12W.
KLIPSCH	Klipschorn K-347	15 Horn		Paper	2 Horn	Phen.	Diaph.	1 Horn	Phen.	31¼ x 28½ x 52	Oil Wal., Mahog.	Sev.	30-19k	0.4 6	16	180	519.00-875.00*	*Depends on finish.
	Cornwall	15		Paper	2 Horn	Phen.	Diaph.	1 Horn	Phen.	24 x 18 x 36	Var.	Sev.	30-19k	0.6 6	16	105	311.00-* 415.00	*As above.
	Model H	12		Paper	2 Horn	Phen.	Diaph.	1 Horn	Phen.	15 x 13⅜ x 21½	Var.	Sev.	45-19k	0.7 6	16	47	188.00-* 225.00	*As above.
LAFAYETTE	Criterion 3X	12	30	Plas. Ctd. Paper	6½	Paper	Cone	3 Dome	Alum.	22½ x 11¾ x 13¼	Oil Wal.	Cloth White	20-25k	1.2 6	8		89.95	
	Criterion 200A	12	40	Foam Tr'td Paper	8	Paper	Cone	3 Dome	Alum.	24 x 12 x 14	Oil Wal.	Cloth	20-25k	0.7 5	8	30	69.95	
LEAK	Sandwich Mk. II	13	19	Poly. bet. Al. Skins	–	–	–	3½	Poly. bet. Al. Skins	15 x 12 x 26	Wal.	Boucle Brn	30-18k	0.9	15	49½	199.00	
	Mini-Sandwich	12 x 8 Ellip.	30	Poly. bet. Al. Skins	–	–	–	3½	Poly. bet. Al. Skins	18½ x 7 x 11	Teak	Woven Plas.	50-18	0.9	15	22	135.00	
MARTEL	VS-1200	12		Sty. Susp.	5		Sty. Susp.	3 Dome		26¼ x 11¾ x 15	Oil Wal.		35-20k	1.4 5	8	–	179.95	
NESHAMINY	Z600	11		Paper	–	–	–	2 Electrostatic		26⅝ x 13 x 20	Oil Wal.	Cloth	30-> 30k	1-2 Broad	8	50	298.95	Incls. pwr. sup. for electrostatic section.
PIONEER (13)	CS-63	15	15	Paper	6½	Paper	Cone + horn	2½ Cone	Paper	19¾ x 13¼ x 28⅞	Oil Wal.	Cloth Gold-Brn	25-20k	0.8, 3, 10	8	60	245.00	4-way bkshlf sys. 4-side, matched grain fin.
	CS-88	12	15	Paper	5	Paper	Cone	(2) 2½ Cone	Paper 1" Horn	14³⁄₁₆ x 13 x 24¹³⁄₁₆	Oil Wal.	Lat. Gr. Brn	25-20k		8	48	175.00	
	CS-24	8	70	Dual Cone	–	–	–	–	–	16¼ x 4¾ x 10⅝	Oil Wal.	Metal Blk	70-15k	2.5	8	7½	27.50	Slim-line design, spun metal grille.
QUAD	ESL	FULL-RANGE ELECTROSTATIC								34 x 10½ x 31		Metal Bronze	45-18k		15		223.00	
RECTILINEAR	VI	10	26	Paper	5	Paper	Cone	2½ Cone	Paper	14 x 11⅜ x 25	Nat. Wal.	Fiberglas Wht	26-18.5k	0.25, 3, 11	8	45	239.00	Light moving mass comps.
ROLA CELESTION	DITTON 25	12	20	Paper/ Plas.	(2) 1½	Phen.	Pressure	1½	Mylar®	32 x 11 x 14	Oil Teak*	Cloth Gld/Blk	20-40k	2.5 9	4-8	48		*and Walnut. 5 drive units, uses 12-in. aux. bass radiator.
	DITTON 15	8	8	Plas.	8	Paper/ Plas.	Cone	¾	Phen	21 x 9¼ x 9½	Teak Wal.	Cloth Gld-Blk	30-15k	0.6 3	4	20		Aux. bass radiator. Handles 30-W peaks at 30 Hz.
SANSUI (33)	SP-100	10		Paper	5	Paper	Cone	2 Horn	Mylar®	14 x 11 x 24	Oil Wal.	Fretwk Wal.	45-20k	1.5 5	8	34.8	139.95	Hand-carved grille, 3-pos. level control.
	SP-50	8		Paper	–	–	–	2 Horn	Mylar®	13 x 9 x 19	Oil Wal.	Fretwk Wal.	50-20k	7	8	19.8	79.95	
	SP-30	6½		Paper	–	–	–	2 Horn	Mylar®	10 x 7 x 16	Oil Wal.	Fretwk Wal.	50-20k	7	8	9.9	119.95 Pr.	
SCHOBER	LSS-10A	12	32	Paper	8	Paper	Cone	1 * Horn	Phen.	24 x 16 x 34	Wal.**	Cane Beige	30-13k	0.25 3.5*	8	80	175.00	*Tweeter optional. **Laq. or unf.

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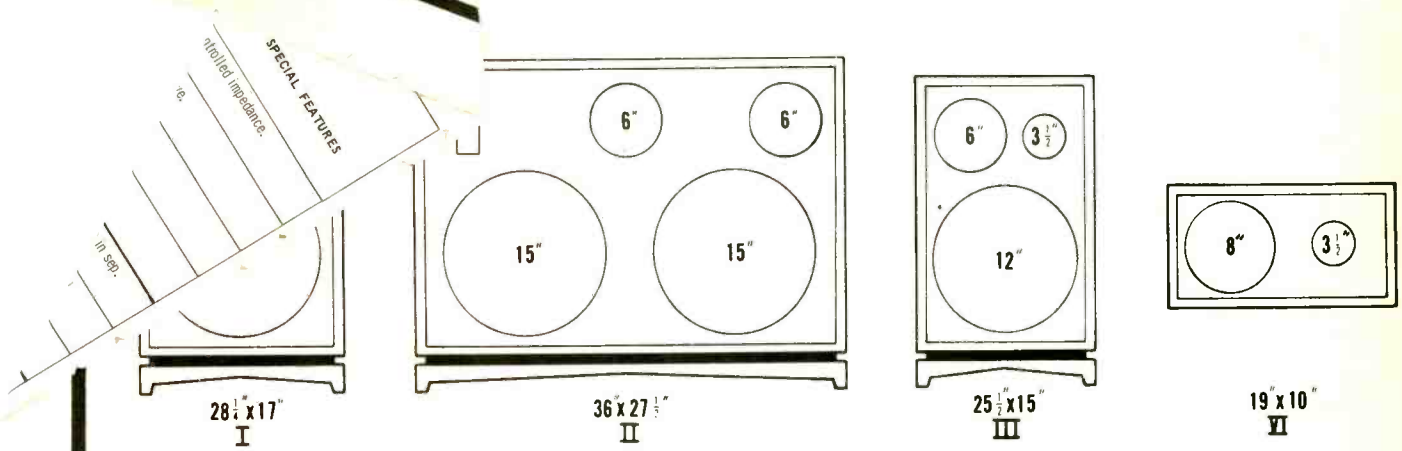

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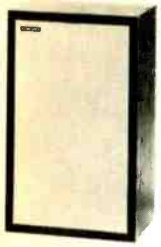


Scott S-14

Sony S-3300

Tannoy "Cadet"

University "Estoril"

MANUFACTURER (Circled numbers indicate adv. page)	Model	WOOFER Diameter, In.	WOOFER Resonance, Hz.	WOOFER Cone Material	MID-RANGE Diameter, In.	MID-RANGE Diaphragm Material	MID-RANGE Type	TWEETER Diameter, In.	TWEETER Diaphragm Material	Enclosure Dimensions W x D x H, In.	Wood Finish	Grille Material Color	Overall Freq. Response, Hz.	Crossover Freqs., kHz	Impedance, Ohms	Weight, Lbs.	Price	
SCOTT Cover (2)	S-12	15	20	Paper	5¼	Paper	Cone	3 Cone	Paper	27 x 16 x 21	Wal.	Cloth Tan	30-20k	0.75 3.5	8	68	274.95	Cl
	S-11	12	22	Paper	4¼	Paper	Cone	3 Cone	Paper	24 x 11¼ x 14	Wal.	Cloth Tan	35-20k	0.8 3	8	36	149.95	As abo
	S-15	10	26	Paper	4¼	Paper	Cone	3 Cone	Paper	23¼ x 9 x 11¾	Wal.	Cloth Brn	35-20k	0.75 3.8	8	24½	119.95	As above.
	S-10	10	26	Paper	–	–	–	3½ Cone	Paper	23½ x 9 x 11¾	Wal.	Cloth Tan	35-18k	1.2	8	21	79.95	As above.
SHERWOOD (18)	SR4 Tanglewood	(2) 10	19	Paper	5	Paper	Cone	3½ Cone	Paper	24 x 13 x 31½	Oil Wal. Unf. Bir.	Plas. Tan	38-18k	0.2, 0.6 3.5	8	73	219.50	Acous. susp.; woofer compartments.
	SR3 Ravinia	12	21	Paper	5	Paper	Cone	3½ Cone	Paper	26½ x 13¼ x 15	Oil Wal. Unf. Bir.	Plas. Tan	48-18k	0.6 3.5	8	55	139.50	Acous. susp.; utility mode available.
	SR2 Berkshire	10	23	Paper	5	Paper	Cone	3½ Cone	Paper	24 x 9½ x 13	Oil Wal. Unf. Bir.	Plas. Tan	53-17k	0.6 3.5	8	36	99.50	As above
SONY (31)	SS-3300	12	25	Paper	6½	Paper	Cone	2 Cone	Plas.	22⅞ x 14⅝ x 31½	Wal.	Cloth Blk	30-20k	0.5 3	16	90	349.50	Sep. sw. for multi-channel use.
	SS-3100	12	25	Paper	6½	Paper	Cone	2 Cone	Plas.	15¾ x 11 15/16 x 26¾	Wal.	Cloth Blk	30-20k	0.4 5	8	55	229.50	As above.
	SS-2800	10	30	Paper	6½	Paper	Cone	2 Cone	Plas.	13¾ x 9 1/16 x 23¼	Wal.	Cloth Blk	40-20k	0.6 6	16	35	124.50	
TANDBERG	114/ 116-8	10			–	–	–	2½		27½ x 10 x 10¼	Teak *	Teak	45-16k		4		106.50	*or Rosewood.
TANNOY (86)	GRF Windsor	15	26	Paper	–	–	–	2 Horn	Dural	25½ x 18½ x 41	Oil Wal.	Carved Wood	35-20k	1 0.35	8	120	440.00	Rear horn loaded. "Dual conc" dyn. bal. and rolloff conts.
	Cadet	10	30	Paper	–	–	–	2 Horn	Dural	23¾ x 11 x 13½	Oil Wal.	Plas. Nat	35-20k	1.8	8	43	194.00	Infinite baffle; "Dual conc." dyn bal and rolloff conts.
UNIVERSITY (5)	Sorrento II	12	20	Paper	8	Paper	Cone	Horn	Phen.	26⅛ x 16⅜ x 22½	Seville Blue	Cloth Eggsh.	20-[illegible]aud	0.8, 3, * 5	8	60	289.00	*Mech xover in mid-range cone; slate top; brass grille screen
	Mediter-ranean	12	18	Stiff Paper	8	Stiff Paper	Cone	Horn	Phen.	24⅜ dia. x 22½	Butternut	Cloth Beige	20-[illegible]aud	0.8 5	8	74	269.50	Commode doubles as end table. 3-way controls.
	Estoril	12	30	Paper	Diffusicone			Dome	Sphericon	12 x 12 x 26½	Oil Wal.	Cloth Brn	25-40k	1* 3	8	40	164.50	* Mech xover; aerodyn. bass energizer
	Senior III	12	25	Stiff Paper	8	Stiff Paper	Cone	Dome	Sphericon	23½ x 12¼ x 15¾	Oil Wal.	Cloth Bei, br	23-40k	0.6 4	8-16	40	145.00	Applique grille cloth; bril. and presence conts.
	Laredo	12	45	Paper	8	Paper	Cone	Dome	Sphericon	15 x 12 x 24	Oil Wal.	Cloth Brn	35-40k	0.6, 1.5,* 3	8	38	109.50	* Mech xover in mid-range cone
	Ultra D	10	16	Stiff Paper	4	Stiff Paper	Cone	3½ Cone	Stiff Paper	23 15/16 x 9¾ x 11⅞	Oil Wal.	Cloth Eggsh!.	30-[illegible]aud	1 5	8-16	24	76.90	Acous susp; bril-pres. cont. 5-yr warranty on all spkrs.
UTAH (76)	AS-1	10		Paper	–	–	–	3½ Cone	Paper	24 x 12 x 12	Wal. Ven	Cloth Gold	32-18.5k	4.5	8	41	24.95	
	SH8-W	8		Paper	–	–	–	3½ Cone	Paper	19 x 8½ x 11¼	Wal Ven	Cloth Off-wht	40-17k	4.5	8	19¼	39.95	
	PT4-C	8		Paper	Co-axial Cone			3½ Cone	Paper	18 x 3⅛ x 12	Wal. Plas	Cane		4.5	8	7	79.95	
VIKING (Telex)	4400	8	80	Paper	–	–	–	3½ Cone	Paper	16 x 5 x 14	Oil Wal	Cloth Brn. Cane	20-20k	2.5	8	25*	120.00*	* System – 2 encls. w/built-in pwr. amps, controls.
WHARFEDALE	W90D 4-way	12½ 12½	20 22	Poly Pap/cloth	(2) 5	Cloth Susp.	Phen.	(2) 3 Dome	Mylar®	30 x 13½ x 23¾	Oil Wal		20-aud	0.1, 1, 4	4-8	100	317.60	2 diff. des. woofers; ea. w/9¼-lb. magnet; sand filled; dioide bass
	W70D 4-way	12½	22	Pap/cloth Compound	8 5	Paper Phen.	Cone Cone	3 Dome	Mylar®	22⅝ x 13⅜ x 24	Oil Wal		25-20k	0.175, 1.25, 3.5	4-8	73	199.95	Dioided mid-range, 8" & 5". Sand filled
	W60D 3-way	12½	22	Pap/cloth Compound	5	Phen.	Cone	3 Dome	Mylar®	24 x 13 x 14¼	Oil Wal		30-20k	1 3.5	4-8	56	147.00	9½-lb. woofer magnet; omnidir-tweeter; sand filled
	W40D 3-way	10	30	Pap/cloth Compound	5	Phen.	Cone	3 Dome	Mylar®	23½ x 10⅜ x 12⅛	Oil Wal		35-20k	1.25 3.5	4-8	37	105.85	Long throw woofer, omnidir. tweeter, acous. susp
	W30D 2-way	8	30	Pap/cloth Compound	–	–	–	3 Dome	Mylar®	10 x 9¼ x 19	Oil Wal		40-18.5k	2	4-8	22	64.65	As above; tweeter level control
	W20D 2-way	8	35	Pap/cloth Compound	–	–	–	3 Dome	Mylar®	14 x 8½ x 9¾	Oil Wal		45-18k	1.6	4-8	14	52.95	As above

New developments in the great bass revival.

Last year, when we introduced the Fisher XP-18 four-way speaker system with its huge 18-inch woofer, we predicted a renewed interest in bass among serious audiophiles.

We pointed out that no bookshelf-size speaker, not even the top Fisher models that are famous for their bass, could push the low frequencies around a room with quite the same authority as a big brute like the XP-18.

This came as no surprise to those who remembered that a 40-cycle sound wave is more than 28 feet long. That's why it takes a double bass or a contrabassoon to sound a note that low. Bass and big dimensions go together.

But the sound of the big XP-18 did surprise a lot of people. They knew it had to be good at $330, but they weren't prepared for a completely new experience.

And then came the obvious request: Couldn't we make the XP-18 concept available in more moderately priced speakers?

The new XP-15B

The new XP-12

We could. And did: in the new Fisher XP-12 and XP-15B.

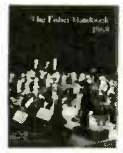
They're a little smaller (24″ x 22½″ x 13¾″ and 27″ x 27″ x 14¾″, respectively), but still twice as big as bookshelf speakers. They're three-way systems instead of four-way, but they have the same type of small cloth-dome tweeter and 8-inch midrange driver with molded rubber surround.

The main difference is in the woofers: a 12-inch unit with a 6-lb. magnet structure in the XP-12 and a 15-inch driver with a 12-lb. magnet structure in the XP-15B.

The prices justify the slight comedown in woof-inches; the XP-12 is listed at $199.95 and the XP-15B at $269.95.

How do they sound? Not quite like the XP-18. Just better than anything but the XP-18.

The Fisher®



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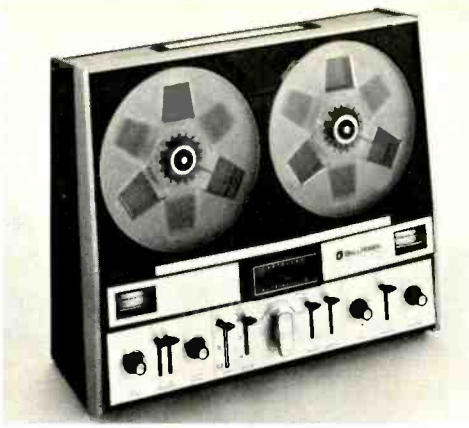

Bell & Howell 2295

Crown CX-822
(in YC floor console)

*** SPEEDS ARE INDICATED BY LETTERS**

A – 7½, 3¾, 1⅞
B – 7½, 3¾
C – 7½, 3¾, 1⅞, 15/16
D – 1⅞
E – 15, 7½, 3¾
F – 15, 7½
G – 15, 7½, 3¾, 1⅞
H – 3¾
J – 3¾, 1⅞
S/S – Sound on Sound
SWS – Sound With Sound

MANUFACTURER (Circled numbers indicate adv. page)	Model	Max. Reel Size, in.	Built-in Pwr Amps?	Speeds*	No. of Heads	Tracks	No. of Motors	Drive Motor Type	Drive to Capstan	Wow & Flutter, 7½ ips, %	Wow & Flutter, 3¾, %	THD Max Rec Level, %	Timing Accuracy, %	Rewind, 1200 Ft., Sec.	Mic Input Sens., mV.	Mic Input Imp., Ohms	High Level Imp., Ohms	Mixing Facility	Vol. ind. Type	Line Feed Output? Type	Dimensions, W x D x H, in.	Weight, Lbs.	Price	SPECIAL FEATURES
ALLIED (63) (64)	TD-130	7	No	A	2	4	1	4-p	belt	0.15	0.2	1.0	99.7	90	2	10K	600	No	2 VU	Yes	15½ x 13 x 7	24	129.95	Headphone output w/vol. cont.
	1070	7	No	A	4	4	1	Cap Start	belt	0.15	0.2	1.0	99.7	90	0.66	10K		S/S	2 VU	Yes	21 x 18 x 8	36	299.95	Auto record/playback reverse.
	1080	7	Yes	A	4	4	1	Cap Start	belt	0.15	0.2	1.0	99.7	90	0.66	10K		S/S	2 VU	Yes	21 x 19 x 8	42	349.95	As above.
AMPEX	AG-600	7	No	A opt F	3	opt	1	hys	belt	0.17	0.25	3.0	99.8	90	150	30-250	100K	Yes	VU	600Ω phone	14 x 9½ x 15	28	660.00	2 inputs/chan, sep. gain control; avail. ½ or ¼ tk.
	2161	7	Yes	A	4	4	1	hys	belt	.08	0.15		99	120	2-600	110K	200K	Yes	2 VU	1.5-7.5 V.	18½ x 13⅜ x 7⅞	42	499.95	Auto-thread; auto-rev. bi-dir. recdg.
	1450	7	No	A	4	4	1	hys	belt	0.15	0.2		98	150	1.2-30	150K	220K	No	2 VU		15¾ x 13 x 6½	29.5	299.95	Auto-thread; auto-rev; sws, tape monitor.
	750	7	No	A	3	4	1	4-p	belt	0.15	0.2		98	150	1.2-30	280K	220K	No	2 VU	2.5 V.	15¾ x 13 x 6½	23	199.95	s/s, sws, echo, tape monitor.
BELL & HOWELL	2291	7	No	C	2/4	4	1	4-p	idler/belt	.09	0.15	< 1.0	99.75	120	1.5	150K	240K	Yes	2 VU	Yes	15½ x 13¼ x 8½	22	349.95	Auto-load; auto rev.
	2295	7	Yes	C	2/4	4	1	4-p	idler/belt	.09	0.15	< 1.0	99.75	120	1.5	150K	240K	Yes	2 VU	Yes	15½ x 13¼ x 8½	25	399.95	As above, but incls. stereo pwr. ampl., 8.4 W/chan., 50-15 kHz.
	2297	7	Yes	C	2/4	4	1	4-p	idler/belt	.09	0.15	< 1.0	99.75	120	1.5	150K	240K	Yes	2 VU	Yes	15½ x 13¼ x 8½	25	449.95	As above, but ampl. is 15 W/chan. 50-20 kHz.
CONCERTONE	200S	cas.	Yes	D	2	4	1	4-p	belt		0.35 (1⅞)		99		-55 dB	50K	200K	Yes	2 VU	Yes	12½ x 5½ x 3½	12*	179.95	Tone & vol conts. *incls. 2 spkrs.
	302D	7½	No	A	2	4	1	sync	idler	0.15	0.25		99		-55 dB	50K	75K	No	2 VU	Yes			169.95	Auto shutoff, tape lifters; pause; cue.
	790	7½	Yes	C	3	4	1	d.c. gov.	idler	0.2	0.25		99		-55 dB	50K	75K	No	2 VU	Yes			239.95	Freq. resp. to 22K at 15 ips; AC, batt.
CONCORD	510-D	7	No	A	2	4			belt	< 0.17	< 0.22					Low		Yes	dual VU	Yes	14⅛ x 12¼ x 4¾	29½	< 150.00	Auto shutoff s/s recdg.
	776-D	7	No	B	3	4			belt	< 0.15	< 0.18					Low		Yes	dual VU	Yes	20 x 13½ x 7	20½	< 250.00	Auto-rev; auto shutoff.
	776	7	Yes	B	3	4			belt	< 0.15	< 0.18					Low		Yes	dual VU	Yes	20 x 13 x 13	40	< 350.00	Auto rev; auto shutoff.
CROWN (82)	SX 724	10½	No	B	3	4	3	hys	belt	09	0.18	1.5	99.8	45	0.4	350K	100K	Yes	dual VU	Yes 600	19 x 15½ x 9	45	995.00	Dual mixing, 2 tr. play opt; "X" case and 30-30 amp opt.
	SX 824	10½	No	B	3	4	3	hys	belt	.09	0.18	1.5	99.8	45	0.4	350K	100K	Yes	dual VU	Yes 600	19 x 15½ x 9	48	1495.00	Pro-800 transport; computer logic; electronics as above; rem cont opt.
	CX 724	10½	No	A	3	4	3	hys	belt	.09	0.18	1.5	99.8	45	.03 opt	350K opt	100K	Yes	dual VU	Yes 2000	19 x 17½ x 9	50	1295.00	Dual mixing, tone conts; echo; plug-in modules; Hi Z mikes.
	CX 822	10½	No	E	3	2	3	hys	belt	.09	0.18	1.5	99.8	45	.01	250 bal	100K	Yes	dual VU	600 bal	19 x 17½ x 9	53	2120.00	Pro-800 transport; CX-724 electronics, rem. cont opt.
DYNACO (11)	B & O 2000	7	Yes	A	3	4	1	hys	idler	.075	0.11		99.8	100	.05	200		Yes	2 VU	Yes	17⅝ x 13⅛ x 8¼	38	498.00	Slide-type mixing conts; plug-in ccts.

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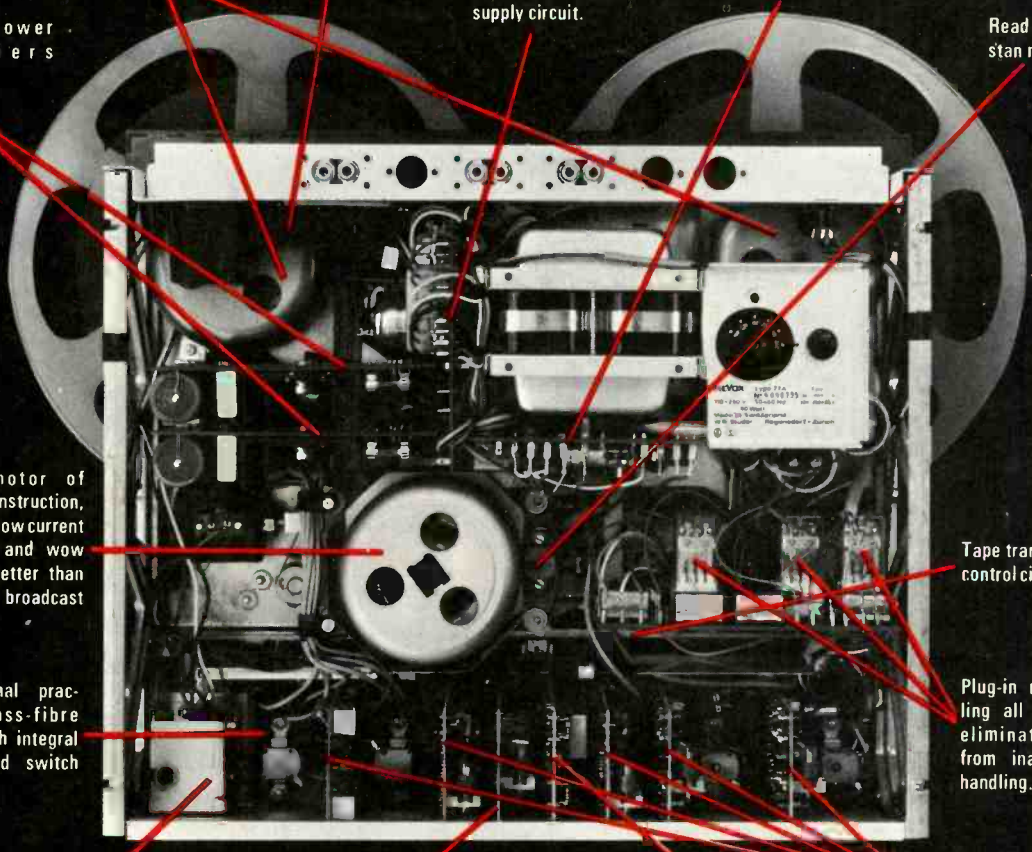

New from the Willi Studer Factory comes the revolutionary Model 77 incorporating design developments based on experience gained in the broadcast field with the 37 and 62 Series Studer machines. The 77 is a studio quality machine compactly presented and offering features unique in this price class including total indifference to fluctuations in mains supply periodicity. With a wow and flutter level below broadcast standard requirements plus a linear response from 20-20,000 Hz at 7½ ips. (±2 db) and an ultra low noise level, this new Revox now sets the standard by which the rest will be judged.

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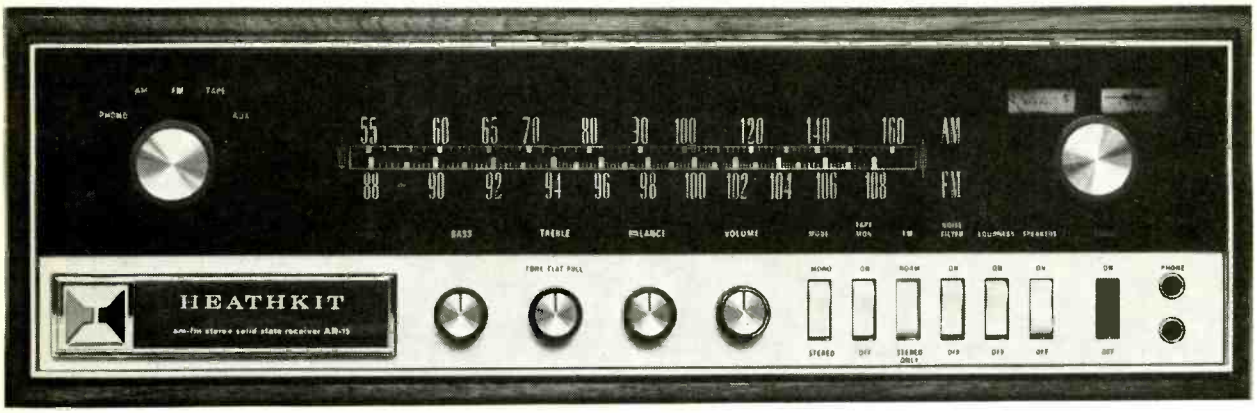
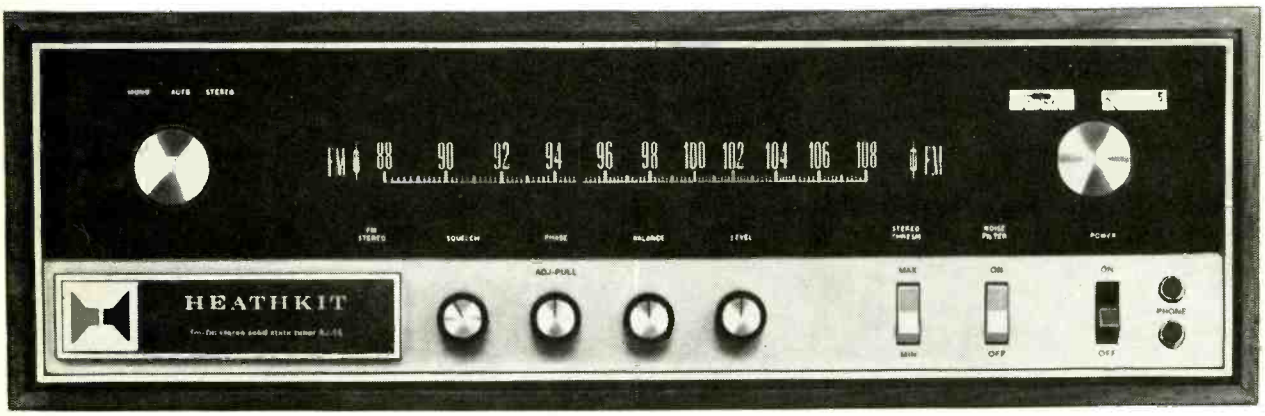
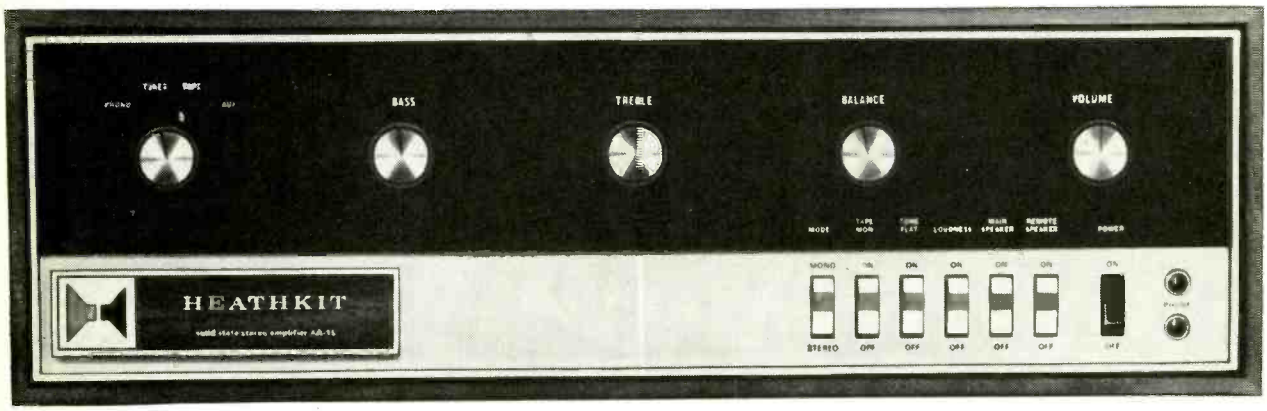


comes the world's finest stereo tuner...



and the world's finest stereo amplifier...



for the man who already owns a fine something or other.

Heathkit® AR-15

Every leading electronics magazine editor, every leading consumer testing organization, and thousands of owners agree the Heathkit AR-15 is the world's finest stereo receiver. All give it top rating for its advanced design concepts and superior performance . . . all give it rave reviews such as these:

. . . *"an audio Rolls Royce"* . . . *"engineered on an all-out, no compromise basis"* . . . *"cannot recall being so impressed by a receiver"* . . . *"it can form the heart of the finest stereo system"* . . . *"performs considerably better than published specifications"* . . . *"a new high in advanced performance and circuit concepts"* . . . *"not one that would match the superb overall performance of the Heath AR-15"* . . . *"top notch stereo receiver"* . . . *"its FM tuner ranks with the hottest available"* . . . *"it's hard to imagine any other amplifier, at any price, could produce significantly better sound"* . . . *"a remarkable musical instrument."*

The Heathkit AR-15 has these features: exclusive design FET FM tuner for best sensitivity; AM tuner; exclusive Crystal Filter IF for best selectivity; Integrated Circuit IF for best limiting; 150 watts music power; plus many more as shown below.

Kit AR-15, $339.95; Assembled ARW-15, $525; Walnut Cabinet AE-16, $24.95

New Heathkit® AJ-15

For the man who already owns a fine stereo amplifier, and in response to many requests, Heath now offers the superb FM stereo tuner section of the renowned AR-15 receiver as a separate unit . . . the new AJ-15 FM Stereo Tuner. It features the exclusive design FET FM tuner with two FET r.f. amplifiers and FET mixer for high sensitivity; two Crystal Filters in the IF strip for perfect response curve with no alignment ever needed; two Integrated Circuits in the IF strip for high gain and best limiting; elaborate Noise-Operated Squelch to hush between-station noise before you hear it; Stereo-Threshold switch to select the quality of stereo reception you will accept; Stereo-Only Switch rejects monophonic programs if you wish; Adjustable Multiplex Phase for cleanest FM stereo; Two Tuning Meters for center tuning, max. signal, and adjustment of 19 kHz pilot signal to max.; two variable output Stereo Phone jacks; one pair Variable Outputs plus two Fixed Outputs for amps., tape recorders, etc.; all controls front panel mounted; "Black Magic" Panel Lighting . . . no dial or scale markings when tuner is "off"; 120/240 VAC.

Kit AJ-15, $189.95; Walnut Cabinet AE-18, $19.95

New Heathkit® AA-15

For the man who already owns a fine stereo tuner, Heath now offers the famous stereo amplifier section of the AR-15 receiver as a separate unit . . . the new AA-15 Stereo Amplifier. It has the same deluxe circuitry and extra performance features: 150 Watts Music Power output . . . enormous reserves; Ultra-Low Harmonic & IM Distortion . . . less than 0.5% at full output; Ultra-Wide Frequency Response . . . ±1 dB, 8 to 40,000 Hz at 1 watt; Ultra-Wide Dynamic Range Preamp (98 dB) . . . no overload regardless of cartridge type; Tone-Flat Switch bypasses tone controls when desired; Front Panel Input Level Controls hidden by hinged door; Transformerless Amplifier for lowest phase shift and distortion; Capacitor Coupled Outputs protect speakers; Massive Power Supply, Electronically Filtered, for low heat, superior regulation . . . electrostatic and magnetic shielding; All-Silicon Transistor Circuitry; Positive Circuit Protection by current limiters and thermal circuit breakers; "Black Magic" Panel Lighting . . . no dial markings when unit is "off"; added features: Tuner Input Jack and Remote Speaker Switch for a second stereo speaker system; 120/240 VAC.

Kit AA-15, $169.95; Walnut Cabinet AE-18, $19.95

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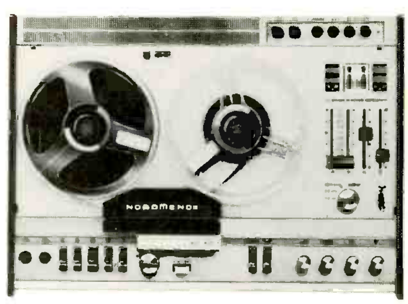
Wollensak 5740 (3M)



Nordmende 8001 T

Panasonic RS-766US

TAPE RECORDERS (continued)

Norelco 4408

*** SPEEDS ARE INDICATED BY LETTERS**

A – 7½, 3¾, 1⅞
B – 7½, 3¾
C – 7½, 3¾, 1⅞, 15/16
D – 1⅞
E – 15, 7½, 3¾
F – 15, 7½
G – 15, 7½, 3¾, 1⅞
H – 3¾
J – 3¾, 1⅞
S/S – Sound on Sound
SWS – Sound With Sound

MANUFACTURER (Circled numbers indicate adv. page)	Model	Max. Reel Size, In.	Built-in Pwr Amps?	Speeds *	No. of Heads	Tracks	No. of Motors	Drive Motor Type	Drive to Capstan	Wow & Flutter, 7½" %	Wow & Flutter, 3¾" %	THD Max Rec Level, %	Timing Accuracy, %	Rewind, 1200 Ft., Sec.	Mic Input Sens., mV.	Mic Input Imp., Ohms	High Level Imp., Ohms	Mixing Facility	Vol. Ind. Type	Line Feed Output? Type	Dimensions, W x D x H, In.	Weight, Lbs.	Price	SPECIAL FEATURES
FERROGRAPH	713	8¼	Yes	A	3	2 mono	3	hys	idler	< .08	< 0.15		99	< 60	0.15 - 15	10K	2 meg	Yes	VU	600	16¾ x 10 x 17½	49½	420.00	
	724	8¼	Yes	A	3	4	3	hys	idler	< .08	< 0.15		99	< 60	0.15 - 15	10K	2 meg	Yes	dual VU	600	16¾ x 10 x 17½	49½	595.00	Mod 722, ½ tr; speed A, $595.00 "722H, ½ tr; speed E, $625.00.
GELOSO	G 651	5¼	Yes	J	2	2 mono	1	d.c.	idler		< 0.5							No	meter	Yes			149.50	Batt, 12 V. d.c., 110-220 V. a.c. operation; piano key conts.; incls. mic.
HARMAN-KARDON	TD 2	7	No	A	2	4	1	ind	idler	0.1	0.12	1.0	99.8		0.5	10K	500K	Yes	dual VU	Yes em. fol.	11⅝ x 9⅜ x 6	16	149.50	
	TD 3	7	No	A	3	4	1	hys	idler	0.1	0.12	1.0	99.8		0.5	10K	500K	No	dual VU	Yes em. fol.	11⅝ x 9⅜ x 6	16	219.50	1-micron gap in pb head.
KNIGHT-KIT (63) (64)	KG-415	7	No	B	3	4	2	4-p	belt	< 0.2	< 0.3	< 1.5	98	90	1.5	3000	50K	Yes	2 VU	Yes em. fol.	14 x 9⅜ x 14½	30	249.95 K	Ster. hdphn. amp module; Viking transp; electronics, kit.
LAFAYETTE	RK-960	7	Yes	A	4	4	2	hys	belt		0.25		99			600			dual VU		22 x 15½ x x 8¼	44	299.95	3 auto. oper. modes, incl reverse.
	RK-920	7	No	A	4	4	2	hys	belt		0.2					600			dual VU		17 x 15½ x 8¼	38	199.95	As above,
	RK-845	7	Yes	A	2	4	1	4-p	belt	0.15						600			dual VU		15¾ x 14 x 7⅞	26	229.95	2 6 x 7 spkrs; hi & lo inputs; ext. spkr. output; auto shutoff.
3M (WOLLENSAK)	5800	7	Yes	A	2	4	1			< 0.25	< 0.3							No	VU		41 x 9 x 11	45	259.95	AM/FM tnr opt; incls spkrs.
	5740	7	Yes	A	2	4	1			< 0.25	< 0.3							No	VU		42 x 6⅜ x 10	27½	179.95	Vinyl trim.
	4200	cas.	Yes	D	1	1	1			< 0.4 (1⅞)											4½ x 2½ x 7⅞	4	109.95	Mono cassette rcdr.
MAGNECORD (TELEX)	1020	8¼	No	B	3	4	3	hys	belt	0.17	0.22	1.0	99	80	0.27	50K	hi	Yes	2 VU	Yes em. fol.	17 9/16 x 3 5/16 x 6⅝	35	570.00	
	1022	8¼	No	B	3	2	3	hys	belt	0.17	0.22	1.0	99.8	80	.038	150	hi	Yes	2 VU	Yes em. fol.	19 x 15¾ x 12	48	788.00	
	1024	8¼	No	B	3	4	3	hys	belt	0.17	0.22	1.0	99.8	80	0.32	50K	hi	Yes	2 VU	Yes em. fol.	19 x 15¾ x 12	48	648.00	
	1028	10½	No	F	3	2	3	hys	dir	0.1		< 1.0	99.8	50		50K	160K	No	2 VU	cath fol	17 9/16 x 13 1/16 x 6⅝	47	995.00	
NORDMENDE (87)	8001 T	7	Yes	A	3	4	3	hys	idler	0.1	0.15	1.0	99	48	0.2	500	10K	Yes	dual VU	Yes	19½ x 14 x 6	36	429.00	Built-in mixer
NEWCOMB	TX 10-4	10½	No	B	3	4	1	hys	belt	0.15	0.2	1.0	99	90	2.0		500K	Yes	2 VU	Yes Lo Z	12⅝ x 6¾ x 9½			"Joy-stick" oper; s/s.
NORELCO	2502	cas	No	D	1	4	1	sync	belt	0.1 (1⅞)										Yes 0.5V 20KΩ	15¼ x 9¼ x 4⅜	15½	129.95	Auto ster cassette deck changer; plays 6 cassettes automatically.
	2200	cas	Yes	D	1	2 mono	1	tr. reg. d.c.	belt												6¼ x 2½ x 10	2¼	29.95	Mono cassette port. player.
	150	cas	Yes	D	2	1 mono	1	tr. reg. d.c.	belt									No	meter		4½ x 2¼ x 7¾	3	64.50	Mono cassette port. "Carry Corder." Incls. spkr, mic.
	4408	7	Yes 2 x 6 W	A	2	4	1	ind	belt		0.2 peak		99.0	60	0.25	2000	500K	Yes	2 meters	Yes 1 V. 50K Ω	19 x 13 x 8½	28½	349.50	Duoplay, s/s, auto stop; hor or vert oper; ster mic.
PANASONIC (51)	RS 790S	7	Yes	A	4	4	1	4-p	idler	0.9	0.18			180	-67 dB	20K	100K	Yes	2 VU	Yes	17 5/16 x 9 x 16 13/16	38¼	329.95	Auto-tuning radio s/s.
	RS 761	7	Yes	A	2	4	1	4-p	idler	0.1	0.2			180	-74 dB	5600	100K	Yes	2 VU	Yes	17 5/16 x 11¾ x 6½	30	249.95	4-speaker sys; sep. rec & pb vol. conts.
	RS 760S	7	Yes	A	2	4	1	4-p	idler	0.1	0.2			180	-74 dB	10K	100K	Yes	2 VU	Yes	14 x 13½ x 7	22	179.95	Auto-rev; dual capstan s/s.
	RS 766OS	7	No	A	2	4	1	4-p	idler	0.1	0.2			180	-67 dB	10K	1.5M	No	2 VU	Yes	17⅛ x 11 x 5½	17	149.95	s/s; built in speakers.

TAPE RECORDERS (continued)

Sony TC 560-D

Tandberg 11

Teac A-6010

*** SPEEDS ARE INDICATED BY LETTERS**

A – 7½, 3¾, 1⅞
B – 7½, 3¾
C – 7½, 3¾, 1⅞, 15/16
D – 1⅞
E – 15, 7½, 3¾
F – 15, 7½
G – 15, 7½, 3¾, 1⅞
H – 3¾
J – 3¾, 1⅞
S/S – Sound on Sound
SWS – Sound With Sound

MANUFACTURER (Circled numbers indicate adv. page)	Model	Max. Reel Size, in.	Built-in Pwr Amps?	Speeds*	No. of Heads	Tracks	No. of Motors	Drive Motor Type	Drive to Capstan	Wow & Flutter, 7½ ips %	Wow & Flutter, 3¾ ips %	THD Max Rec Level, %	Timing Accuracy, %	Rewind, 1200 Ft., Sec.	Mic Input Sens., mV.	Mic Input Imp., Ohms	High Level Imp., Ohms	Mixing Facility	Vol. Ind. Type	Line Feed Output? Type	Dimensions, W x D x H, In.	Weight, Lbs.	Price	SPECIAL FEATURES
REVOX (45)	77 A	10½	opt	B	3	4	3	servo	dir	.08	0.1	2.0	99.8	75	0.15 2.0	200 hi	hi	Yes	2 VU	Yes, em. fol.	16¼ x 14¼ x 9	34	499.00	s/s; rem. cont opt. w/pwr amps, $569.50
ROBERTS	1725-III	7	Yes	A G opt	2	4	1	ind	belt	0.2	0.3	3.0	97	75	2.0	500K	500K	No	2 VU	Yes, Lo Z	14 x 13½ x 12	36	269.95	2 detach. spkrs.
	778X	7	Yes	A G opt	3 (2 cart)	4 8	1	hys	belt	0.18	0.3	2.0 3.0	98	75	0.5	50K	150K	No	2 VU	Yes, Lo Z	17 x 14 x 11	50	429.95	Compat. reel/8 tk cart. rcdr w/crossfield head.
	770 XSS	7	Yes	A G opt	3	4	1	hys	belt	0.15	0.2	2.0	98	75	0.5	50K	200K	No	2 VU	Yes, Lo Z	20 x 14 x 10	42	429.95	s/s.
SONY (SUPERSCOPE)	TC-100	cas	Yes	D	2	2 mono	1	d.c.	belt						.08	low	hi	No		Yes, hi Z	5 9/16 x 9 3/8 x 2 3/8	3.8	99.50	Tone control, agc. recdg cassette eject. button.
	TC-50	cas	Yes	D	1	2 mono	1	d.c.	belt						.08	low	hi	No		Yes, hi Z	3 9/16 x 1 15/32 x 5 1/16	14 oz	< 125.00	Built-in mic; agc. recdg.
(6)	TC-255	7	No	A	2	4	1	ind	idler	.09	0.12			150	0.19	low	hi	No	2 meters	Yes, hi Z	15 1/16 x 14 7/16	22	< 229.50	Scrape filter; noise suppr. Lo-Z head phone output, 160 kHz bias.
(7)	TC-230W	7	Yes	A	2	4	1	ind	idler	0.1	0.15			150	0.14	low	hi	No	2 meters	Yes, hi Z	17 x 14 x 9 3/8	29	< 249.50	Mag. phono cartr. input.
(83)	TC-560D	7	No	A	3	4	1	d.c. servo	belt	.07	0.1			140	0.19	low	hi	No	2 meters	Yes, hi Z	16 3/4 x 15 7/16 x 6 11/16	28.7	< 439.50	As above, plus auto reverse.
	TC-666D	7	No	B	4	4	3	hys	belt	.09	0.15			60	0.19	low	hi	No	2 meters	Yes, hi Z	17 5/16 x 16 3/4 x 8 5/16	48½		As above, plus solenoid rem. control.
TANDBERG	64 X	7	No	A	4	4	1	hys	idler	< 0.1	< 0.15	< 0.2	99.8	120	1.5	5 meg	1 meg	Yes	eye	Yes, cath foll.	15 1/8 x 11 5/8 7/8	23	549.00	Freq resp +2dB–7½, 30-20K; 3¾, 30-15K; 1⅞, 40-9K.
(48)	12	7	Yes	A	2	4	1	asyn	idler	< 0.1	< 0.15	< 0.5	99.8	120	0.15	200	1 meg	Yes	eye	pwr amp	15 3/8 x 11 13/16 x 6 7/8	23	449.50	7½, 40-16K; 3¾, 60-10K, 1⅞, 80-5K
	11-2	7 (5 w/cvr)	No	A	3	2 mono	1	9 V. d.c.	idler	< 0.1	< 0.15	< 0.5	99.8	120	0.1	200	200K	No	meter		13 x 4 x 10¼	9.5*	449.50	7½, 40-16K; 3¾, 50-9K *less batt; w/batt, 11½; case, 2.0
	15	7	Yes	A	2	2 mono	1	asyn.	idler	< 0.15	< 0.2	< 2	99.8	120	0.12	200	680K	No	meter	pwr amp		18	287.00	Same as mod 12.
TAPESONIC	70 TRSQ	10½	No	E	3	4	3	hys.	dir	0.12	0.23		99.8	45				Yes	2 VU	Yes, emit. foll.	21 x 19 x 8½	69*	615.00	*w/case, ($34.50 extra) VU mtrs are 4½ in.
TEAC	A-6010	7	No	B G opt	4	4	3	hys.	belt	.08	0.12	0.9	99.8	90	0.5	10K	300K	Yes	dual VU	Yes 1V, 10K Ω	17½ x 8¼ x 20 7/8	46	664.50	Auto rev. sys; rem. cont opt. this and above models avail ½ & full tr.
	A-4020	7	Yes	B	4	4	3	hys.	belt	0.12	0.15	1.2	99.5	100	0.5	10K	100K	Yes	dual VU	Yes 1V, 50K Ω	16¾ x 18¼ x 9	52	539.50	Comp. sys w/spkrs; recs. & plays fwd or rev.
(53)	A-4010S	7	No	B	4	4	3	hys.	belt	0.12	0.15	1.2	99.5	100	0.25	10K	100K	Yes	dual VU	Yes 1V, 100K Ω	17½ x 9¾ x 17¼	48	469.50	Foil sensing auto rev. Rem cont opt; tape tension cont.
	A-1200	7	No	B	3	4	3	hys.	belt	0.12	0.15	1.5	99.4	100	1.0	10K	100K	Yes	dual VU	Yes 1V, 10K Ω	15½ x 9¾ x 17	46	299.50	2-spd hys motor, s/s, sep. rec & pb amps; wal cab avail.

Check No. 51 on Reader Service Card →

This beautiful four-headed monster does away with amateurs.

Once you've met up with our monster with four heads, you're done for. Your amateur days are over. That's because the 4-track Solid State stereo RS-790S has just about everything you need to do a professional job of taping.

First, there's 3-speed Dual Capstan drive. It ends audible flutter and wow. And the sound is all the better for it.

Four heads are better for sound, too. And the Console-Aire delivers 30-18,000 cps and a signal-to-noise ratio of more than 52 db's. It all adds up to the greater fidelity the pros listen for.

Another great thing is continuous Automatic Reverse. Records and plays back in both directions. It means no more interruptions. And you'll never have to flip over a reel again. At any point on the tape you can manually punch up reverse, too. Of course, if you don't want it to run on forever, use the automatic shutoff.

Pause Control is another nice feature. It operates in forward and reverse, and locks down for easy editing.

It gets better.

There's headphone output for private listening. Makes it easier to record sound-*on*-sound and sound-*with*-sound.

If that sounds like a lot of sound, it should. You get 20-watt output through two 7" oval speakers with baffle boards.

There's more to come. Like two Dynamic Pencil Mikes with stands. Connecting cords and other extras.

That's not all. You get 2 precision VU meters, separate tone and volume controls, lighted directional indicators, and a 4-place digital counter. Top this with a smoked-glass dust cover, and you're on your way.

After all, it's what you'd expect from the world's largest manufacturer of tape recorders.

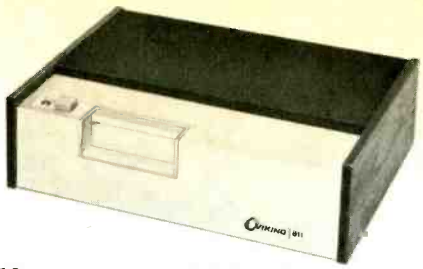
So go into any dealer's we permit to carry Panasonic. We have a feeling that once you come face-to-face with our beautiful four-headed monster, you'll lose your amateur standing forever. (And for just $329.95.*)

PANASONIC®

200 Park Avenue New York 10017

*Suggested list price. Canadian price higher.

TAPE RECORDERS (continued)



Viking 811

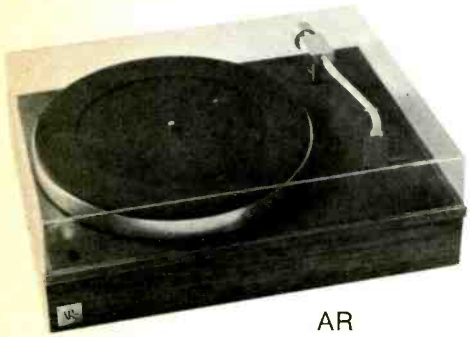
Uher 4400 "Report Stereo"

*** SPEEDS ARE INDICATED BY LETTERS**

A – 7½, 3¾, 1⅞
B – 7½, 3¾
C – 7½, 3¾, 1⅞, 15/16
D – 1⅞
E – 15, 7½, 3¾
F – 15, 7½
G – 15, 7½, 3¾, 1⅞
H – 3¾
J – 3¾, 1⅞
S/S – Sound on Sound
SWS – Sound With Sound

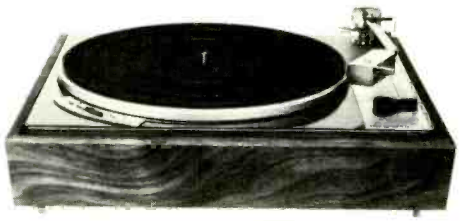
MANUFACTURER (Circled numbers indicate adv. page)	Model	Max. Reel Size, In.	Built-In Pwr Amps?	Speeds*	No. of Heads	Tracks	No. of Motors	Drive Motor Type	Drive to Capstan	Wow & Flutter, 7½ ips %	Wow & Flutter, 3¾ ips %	THD Max Rec Level, %	Timing Accuracy, %	Rewind, 1200 Ft., Sec.	Mic Input Sens., mV.	Mic Input Imp., Ohms	High Level Imp., Ohms	Mixing Facility	Vol. Ind. Type	Line Feed Output? Type	Dimensions, W x D x H, In.	Weight, Lbs.	Price	SPECIAL FEATURES
UHER	4400 Report Ster	5	Yes	C	2	4	1	Serv. cont. d.c.	belt	0.18	0.22	3.0	99.5	120	0.1	2000	47K 1 meg	No	meter	emit foll.	11 x 9 x 3½	8	600.00	Portable stereo. Freq resp-7½, 40-20K; 17K; 1⅞, 40-10K.
	4000L	5	Yes	C	2	2 mono	1	Serv. cont. d.c.	belt	0.18	0.22	3.0	99.5	120	0.1	2000	47K 1 meg	No	meter	emit foll.	11 x 9 x 3½	7	440.00	Portable, batt. oper.
	10,000 Royal	7	Yes	C	3	4	1	hys.	belt	.06	0.1	1.0	99.8	60	0.2	200	47K 1 meg	Yes	meter	emit foll.	18 x 14 x 7¾	38	550.00	7½, 20-20K; 3¾, 20-15K; tape tension comparator.
	7300	7	No	B	3	4	1	sync	idler	0.14	0.18	3.0	99	100	0.35	2000	47K 1 meg	No	meter	emit foll.	15 x 14 x 7	15	199.50	A-B monitor.
VIKING (TELEX)	433	7	No	A	3	4	3	ind	belt	0.2		1.0	99.5	70	0.55	hi	120K	Yes	dual meter	emit foll.	12⅝ x 8¾ x 15¾	31	369.95	
	88	7	No	B	3	2 & 4	2	ind	belt	0.2		1.0	99.5	90	1	hi	100K	No	dual meter	hi Z	13 x 13 x 6⅝	22	339.95	
	811 W	8-tr cart	Yes	H	1	8	1	ind	belt	0.3													149.95	As above, with two satellite spkrs.
	811	8-tr cart	No	H	1	8	1	ind	belt	0.3													99.95	Table-top unit; auto & p.b. track selector.

TURNTABLES & ARMS



AR

Empire 398A



Bogen B62

*** Speeds – A = 33-1/3, 45, 78**
B = 33-1/3, 45
C = 33-1/3
D = 16-2/3, 33-1/3, 45, 78
E = Cont Var

MANUFACTURER (Circled number indicates ad page)	Model	Speeds*	Wow, 33-1/3, %	Flutter, 33-1/3, %	Motor Type	Drive	Platter Dia., In.	Platter Wt., Lbs.	Platter Material	Arm Mounting Provision	Dimensions – W x D x H, In.	Weight, Lbs.	Model	Overall Length, In.	Pivot-Stylus Dist., In.	Type Cartr. Mtg.	Vert. Bearing	Lateral Bearing	Stylus Force Method	Max. Tkg. Error, Deg.	Cart. Wt. Range, Gms.	Arm Resonance, Hz.	Stylus Force Range, Gms.	Weight, (if Sep.) Oz.	Price	SPECIAL FEATURES
ACOUSTIC RESEARCH (55)	XA	B	0.1	0.5	24-p Sync	Belt	11¾	3.3	Al.	Integ.	16¾ x 12⅜ x 5¼	13	–	12	9	Std	Cone Point	Ball Sleeve	Adj. Ctrblnc	0.35 in.	–	10-15	0.5-8	13.5	78.00	Incls. Styl-frc. gauge, base, cover, oil, overhang gauge.
	TA	C	0.1	0.5	24-p Sync	Belt	11¾	3.3	Al.	Integ.	16¾ x 12⅜ x 5¼	13	–	12	9	Std	Cone Point	Ball Sleeve	Adj. Ctrblnc	0.35 in.	–	10-15	0.5-8	13.5	75.00	As above.
	XA Univ.	Same as XA, except for 120-220V., 50-60 Hz																							87.00	
AUDIO & DESIGN													M9BA	11½	9		Uni-Pivot		Bal.	1.2	2-18	10-20	0-3	–	120.00	Mercury contacts; magnetic bias.
BOGEN (89)	B-62	E	0.2	0.2	4p	Idler	12	7¾	–	Integ.	15 x 13 x 3½	23													67.95	Var. speeds, 29-86 rpm; Integral arm; incls base, cover.
	B-52	E	0.1	0.1	4p	Idler	12	3	Formid Steel	Integ.	14¾ x 11½ x 3½	12													49.95	As above.
EMPIRE	208	A	<.05		Hys.	Belt	12	6	Al.		16¹¹/₁₆ x 14¹³/₁₆ x 8¾					Std									75.00	Avail. gold fin, 208G. Base, 9.00.
	398A	A	<.05		Hys.	Belt	12	6	Al.	Integ.	17 x 15 x 8¾		980A	12⅜		Std				0.65	2-25	6		26½	114.00	Incls "dyna-lift," auto arm lifter.
	498A	A	<.05		Hys.	Belt	12	6	Al.	Integ			980A	12⅜		Std				0.65	2-25	6		26½		As above.

If your first tape deck measures up to this one, you're going to enjoy it a lot more.

The TEAC A-4010S: Four heads, 4 track, 2 channel. 7″ maximum reel size. Tape speeds 7½ and 3¾ ips (±0.5%). Dual speed hysteresis synchronous motor for capstan drive, 2 eddy current outer-rotor motors for reel drive. **Wow and flutter:** 7½ ips: 0.12%; 3¾ ips: 0.15%. **Frequency response:** 7½ ips: 30 to 20,000 Hz (±2 dB 50 to 15,000 Hz); 3¾ ips: 40 to 12,000 Hz (±3 dB 50 to 7,500 Hz). **Signal to noise ratio:** 50 dB. **Crosstalk:** 50 dB channel to channel at 1,000 Hz. 40 dB between adjacent tracks at 100 Hz. **Input:** (microphone): 10,000 ohms, 0.25 mV minimum. (line): 100,000 ohms, 0.14 V minimum. **Output:** 1 volt for load impedance 100,000 ohms or more. And these features, too: Automatic reverse for four hours of uninterrupted music on a single tape, symmetrical control system (fast-winding in both directions, playback and stop by a soft-touch push button system), TEAC-built hyperbolic type heads, four solid-state amplifiers, tape tension control switch, automatic shut off, 100 KHz bias-frequency, and independent LINE and MIC input controls to permit mixing signals from two recording sources. If your first tape deck measures up to these specifications, it's a TEAC. **See your TEAC dealer for a demonstration today.**

TEAC®

TEAC CORPORATION OF AMERICA
1547 18th St. Santa Monica, Calif. 90404

Check No. 53 on Reader Service Card

TURNTABLES & ARMS (continued)

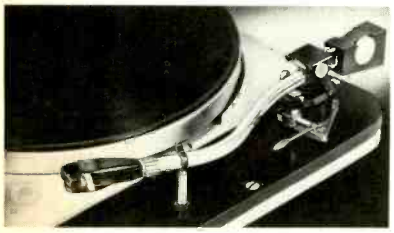
Shure-SME 3012

Marantz SLT-12U

Sony TTS-3000

Pioneer PL-41F

Thorens TD-150AB



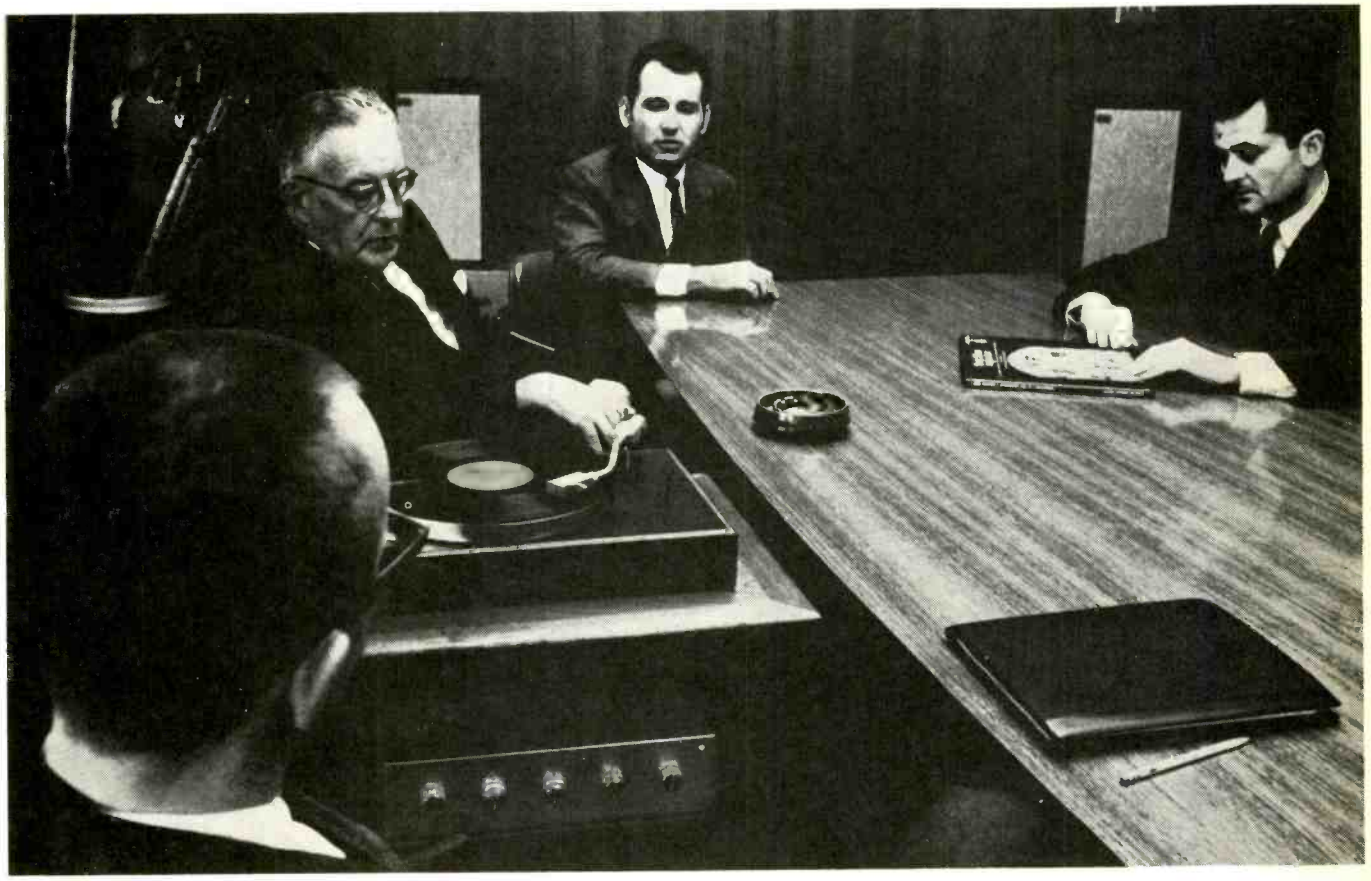
Ortofon RS-212

Rek-O-Kut B-12H

*** Speeds – A = 33-1/3, 45, 78**
B = 33-1/3, 45
C = 33-1/3
D = 16-2/3, 33-1/3, 45, 78
E = Cont Var

MANUFACTURER (Circled number indicates ad page)	Model	Speeds*	Wow, 33-1/3, %	Flutter, 33-1/3, %	Motor Type	Drive	Platter Dia., In.	Platter Wt., Lbs.	Platter Material	Arm Mounting Provision	Dimensions – W x D x H, in.	Weight, Lbs.	Model	Overall Length, In.	Pivot-Stylus Dist., In.	Type Cartr. Mtg.	Vert. Bearing	Lateral Bearing	Stylus Force Method	Max. Tkg. Error, Deg.	Cart. Wt. Range, Gms.	Arm Resonance, Hz.	Stylus Force Range, Gms.	Weight, (if Sep.) Oz.	Price	SPECIAL FEATURES
EUPHONICS													TA-15	12	8¼	Std	Ball	Damped Pivot	Spr. Bal.	0.75		12	0.5-1.5	12	32.50	Accepts Euph. cartr only – LS, w/cartr & pwr source, 87.50.
													TA-16	13½	11½	Std	Ball	Damped Pivot	Spr. Bal.	0.25		10		14	42.50	As above; – LS, w/cartr. H pwr source, 97.50
MARANTZ (29)	SLT-12U	B	0.04	0.04	Hys.	Belt	12	12	Al.	Integ.	18 x 14 x 6½	27					Ball Race	Ball Race								295.00	Straight-line trkg. arm; accepts most std. cartrs.
ORTOFON (57)													TP-14	12⅝	7½	Std	Ball Race	Ball Race	Bal. & Spg.	0.5		8	0-4		59.50	Lo-mass plug-in shell adjs. for 15° tkg angle.
													RS-212	11 13/16	8⅜	Std	–	–	Bal. & Spg.	1.19		8	0-4.5		90.00	Available on Thorens TD 12H mtg. board, 95.00
PIONEER (13)	PL-41F	B	0.08	0.08	Hys.	Belt	12⅛	4	Al.	Integ.	20 x 16 x 7¾	24½		13	9.6	Std	Ball Race	Ball Race	Rear Wt.	1		7	0-4		199.95	Combines base, hinged dust cover, cueing device
REK-O-KUT	B-16H	A	0.08	0.08	Hys.	Idler	16	9	Al.	Hole	20 x 19 x 8	34													275.00	
	B-12H	A	0.085	0.08	Hys.	Idler	12	5	Al.	Hole	18 x 16 x 10	19													175.00	Hi-torque motor for cueing.
	B-12GH	A	0.09	0.09	Hys.	Idler	12	5	Al.	Hole	18 x 16 x 10	17													124.95	
													S-320	12	9	Std	Ball	Ball	Bal & Spg.	1.0		9-12	0.2-5.0		44.95	
SHURE (9) (67)													3009 Ser		9	Std	Knife Edge	Ball	Rear Wts.		3-20		¼-5	1¾	106.50	Adj. anti-skat; viscous damping; cueing.
													3012 Ser		12	Std	Knife Edge	Ball	Rear Wts.		3-20		¼-5	2.1	106.50	Same as above.
SONY (31)	TTS-3000	B	0.05	0.03	d.c. Servo	Belt	12	3	Al.	–	14⅜ x 15 x 5⅛	14													149.50	Motor speed monitored by servo-cont. ampl.
													PUA-237	13⅜	9 11/32		Prec. Ball	Prec. Ball	Bal.			V-9 L-11			85.00	Integ. cueing dev., sil. damped; anti-skating device
													PUA-286	15⅜	11¼		Prec. Ball	Prec. Ball	Bal.			V-8 L-10			99.50	As above.
THORENS (57)	TD-124 Ser II	D	0.1	0.05	Sync	Belt, Idler	12	8½	Non-ferrous	Blank Board	16⅞ x 14 x 3½														149.50	Var. speed adj., ±3%; sep. al. shell cover on table.
	TD-150 AB	B	–	–	Sync	Belt	12	7½	Non-ferrous	Integ	15⅝ x 12⅞ x 2½	14¾	TP-13	12	8⅜	Std	Ball Race	Ball Race	Bal.	0.5		10	0-4		99.75	Integ. arm/table.
	TD-150	B	–	–	Sync.	Belt	12	7½	Non-ferrous	Blank Board	15⅝ x 12⅞ x 3¼														85.00	Allows use of arm of user's choice.

A new Angel Record is the sum of the creative efforts of many individuals. Orchestra, soloists and engineers must be scheduled many months in advance, and are frequently brought together over great distances to make the recording. Engineering at the recording session and during the transfer from tape to disc requires great care and precision. Each stage of the process, and the way in which it is carried out, influences the musical values in the recording finally released.



AR INC. components are used by executives at Angel Records to hear first pressings of new releases.

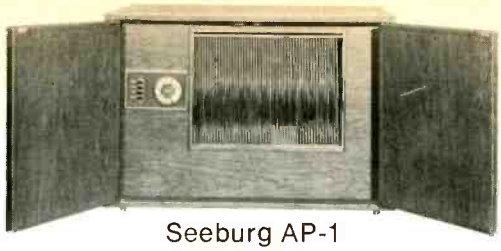
As responsible executives of one of the world's largest recording organizations, the men who conduct Angel's operations can afford any equipment except that which distorts or falsifies the quality and content of a recording. The executive conference room at Angel Records is equipped with AR high-fidelity components. Write for a catalog of AR products.

Suggested retail prices of AR components shown: AR amplifier, $225; AR turntable, $78; AR-3a speaker systems, $225-$250, depending on cabinet finish.

ACOUSTIC RESEARCH, INC., 24 Thorndike St., Cambridge, Mass. 02141

RECORD CHANGERS

Miracord 50H



Seeburg AP-1

Garrard SL-95

Dual 1212

BSR McDonald 500A

Elpa PE-2020

*Speeds – 4-78, 45, 33-1/3, 16-2/3
3-78, 45, 33-1/3
Others as marked

MANUFACTURER (Circled numbers indicate adv. page)	Model	Speeds*	Platter Diameter, in.	Wow at 33-1/3, %	Flutter at 33-1/3, %	Length, pivot/stylus, In.	Max. Tracking Error, Deg.	Arm Type	Cart. Weight Range, Gms.	Stylus Force Range, Gms.	Arm Resonance, Hz	Max. Stack Records	Change Cycle, 33-1/3, Secs.	Clearance Below Board, In.	Clearance Above Board, In.	Overall W x D, In.	Overall Height, In.	Weight, Lbs.	Price	SPECIAL FEATURES
BSR (81)	600	4	11	0.1	0.04	7.5	2	Balance	0-12	0-6	15	7	7	3	4	13⅛ x 11¼	6 19/64	9⅜	74.50	Anti-skating cont., self-locking arm rest; cast platter. Available as pkg w. cartr, base, cover.
	500A	4	11	0.12	0.05	7.5	2	Balance	0-12	0-6	15	7	7	3	4	13⅛ x 11¼	6 19/64	7½	59.50	As above.
	400	4	11	0.12	0.05	7.5	2	Lo-mass Spring	0-9	0-6	20	7	7	3	4	13⅛ x 11¼	6 19/64	7½	49.50	As above.
DUAL (15)	1019	4	10⅝	0.04	0.02	8	1.25	Balance		0.5	8	10	13	3	6	12¾ x 10½	9	16	129.50	Same as 1009F, but with 7-lb platter, rapid and fine-adjust counterbalance.
	1009F	3	10⅜	0.05	0.03	8	1.25	Balance		0-5	8	10	13	3	6	12¾ x 10½	9	10¼	109.50	Same as 1015F, but with rotating sgl. play spindle; fine adj. counterbalance.
	1015	3	10⅝	0.05	0.03	8	1.25	Balance		0-5	8	10	13	2⅝	6	12¾ x 10½	8⅝	12½	89.50	Cont. var. tkg force & anti-skate controls; 4-lb. platter; geared bal. adj. w/set screw.
	1212	3	10⅝	0.09	0.09	8	1.25	Balance		0-5	8	6	13	2¾	7⅝	13 x 10.8	7⅜	9.7	74.50	Anti-skating & tkg force varied by one control; cueing; 6% var. pitch control; fully automatic.
ELPA (57)	PE-2020	4	11¾	0.1	0.1	9	1.7	Dynamic Balance	4-18	0-6	8	8	21	3 37/64	4 37/64	14⅛ x 12	8 27/64		129.95	Vert. tkg angle adj; arm will not set down on empty platter, - simple "command control center" for easy operation.
GARRARD (3)	SL-95	3	11½	0.06	0.03	8¼	0.75	Balance	0-22	0-5	10	6	14	3	4⅜	16 1/16 x 14 9/16	7⅜	11	129.50	Sync. motor for correct speed; sliding weight anti-skate control; sgl. lever cont; auto-rise rec. platform.
	SL-75	3	11½	0.06	0.03	8¼	0.75	Balance	0-14	0-5	12	6	14	3	4⅜	15 13/16 x 14⅝	7⅜	11	109.50	Sync. motor; bal alum. platter, low-mass arm; sliding weight anti-skate control; auto-rise record platform.
	SL-65	4	10½	0.08	0.05	8½	0.85	Balance	0-18	0-5	15	8	10	2⅞	4	15⅜ x 13⅛	6⅞	11	79.50	Sync. motor; tubular, dyn. bal arm. auto anti-skate control.
	SL-55	4	10½	0.12	0.05	7½	0.85	Spring	1-12	*	15	8	10	2⅞	4	15⅜ x 13⅜	6⅞	9	59.50	Sync. motor; oversize platter. *depends on cartr. weight.
	40 Mk II	4	10½	0.14	0.05	7½	0.85	Spring	1-12	*	20	8	10	2⅞	4	14⅞ x 12½	6⅞	9	44.50	*depends on cartr. weight.
MIRACORD (61)	50H	4	12	0.06	0.02	8¾	0.5	Dynamic Balance	–	0-6½	8	10	12	3¾	5⅝	14½ x 12½	7¾	20	149.50	Push-button operation; adj. stylus overhang; hys-sync motor.
	630	4	10¼	0.06	0.025	8½	0.7	Dynamic Balance	–	0-6½	15	10	12	2⅝	5⅝	13⅜ x 11⅝	7¾	17	119.50	As above; but with ind motor.
	620	4	10¼	0.07	0.03	8½	0.7	Dynamic Balance	–	0-6½	15	10	12	2⅝	5⅜	13⅜ x 11⅝	7¾	15	89.50	Push-button operation.
SEEBURG	AP-1	1 (33)	–	0.15	0.03		0.8	Dynamic Balance	–	1.5 2.5	16	50	8	–	–	33 x 22½	21½	140	795.00	Chgr in cabinet; incls plug-in Pickering cartr., preamp, auto. cleaning brush; tel. dial selection of 100 sides.

Setting the record straight!

"The PE-2020 worked well in all modes of operation. It is gentle on records, simple to use, and highly flexible. The vertical stylus-angle adjustment does just what it was intended to do, and *the purist will find that this novel automatic turntable will meet his most exacting requirements . . .*"

**Excerpt, HiFi/Stereo Review, May, 1968*

"This clearly indicates the virtue of the adjustable vertical tracking angle in reducing distortion from the record, and in combination with the variable skating-angle compensation shows that the PE-2020 is well equipped to reduce distortion to a practical minimum. As a consequence, *the vertical tracking angle adjustment is not merely a gimmick . . .*" **Excerpt, Audio May, 1968*

The exclusive 15° Vertical Tracking Angle feature places the NEW ELPA PE-2020 ahead of all automatic turntables on the market.

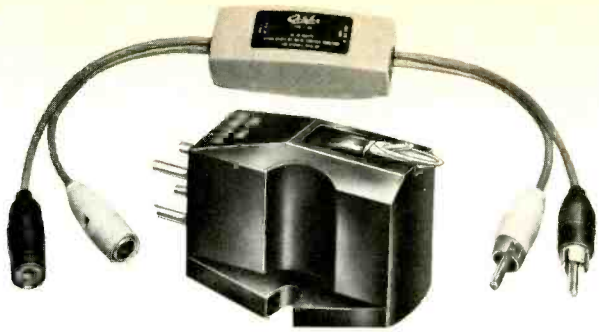
Don't be switched to yesterday's turntables. See and hear it yourself at any PE franchised dealer or write for complete specifications to:
ELPA MARKETING INDUSTRIES, INC. NEW HYDE PARK, N.Y. 11040.

*Complete reprints of articles available upon request.

PHONO CARTRIDGES

ADC 220

Empire 999VE



Ortofon SL 15 T

MANUFACTURER (Circled number indicates adv. page)	Model	IM Distortion, %	1-kHz Separation, dB	10-kHz Separation, dB	Output, 3.54 cm/sec., mV	Tracking Force, gms	Eff. Moving Mass, mg.	Lat. Compliance, x 10⁻⁶	Vert. Compliance, x 10⁻⁶	Stylus Radius, mils	Replacement	Max. Shunt Capacitance, pF	Weight, grams	Price	SPECIAL FEATURES
ADC	10E, MK II	<0.5	30	30	3.5	½-1½		35	35	0.3x0.7	user		7.0	59.50	"Induced magnet" principle, min. moving mass; 15-deg tkg.
	Point 4/E	<1.0	30	30 (8 kHz)	4.0	¾-1½		30	30	0.3x0.7	user		6.8	49.50	
	550 E	<1.0	20	20 (8 kHz)	4.0	¾-1½		28	28	0.3x0.7	user		6.7	49.50	
	660 E	<1.0	30	30 (8 kHz)	5.0	1½-3		20	20	0.3x0.7	user		6.8	39.50	
	770	<1.0	30	30 (8 kHz)	5.5	2-6		15	15	0.7	user		6.8	29.50	
ELAC (61)	444 E	<1.0	>26	17	3.5	¾-1½		33		0.2x0.9	user	220		69.50	
	444 R	<1.0	26	17	3.5	¾-1½		33		0.5	user	220		59.50	
	344 E	<1.0	24		3.5	1-2		25		0.2x0.9	user	220		49.50	
	344-17	<1.0	24		3.5	1-2		25		0.7	user	220		39.50	
	244-17	<1.0	22		5	1½x3		18		0.7	user	220		24.95	
EMPIRE	999 VE	<0.5	>30	>20	5.0	½-1½	<0.5	30	30	0.2x0.7	user	300	7	74.95	
	888 VE	<0.5	>30	>20	5.0	½-2	<0.5	30	30	0.2x0.7	user	300	7	59.95	
	888 TE	<0.5	>30	>20	5.0	½-3	<0.7	25	25	0.2x0.7	user	300	7	49.95	
	888 E	<0.5	>30	>20	5.0	¾-4	<0.7	15	15	0.4x0.9	user	300	7	39.95	888, w/0.7 sph stylus, 24.95.
	808 E	<0.5	>30	>20	5.5	1-4	<0.7	12	12	0.4x0.9	user	300	7	29.95	808, w/0.7 sph. stylus, 19.95.
EUPHONICS	CK-15-LS	1.0	30	20	8 or 0.5 V.	¾-2	0.6	25	25	0.2x0.7	user		1.5	55.00	Lab. std kit; cartr. & pwr. source; sil. semi-cond.
	CK-15-P	1.0	30	20	8 or 0.5 V.	1.3-3	0.7	15	15	0.5	user		1.5	30.00	Prof series kit; as above.
GOLDRING	A & D model	<2.0	25	20	3.0	¾-1¼	<1	30	30	0.3x0.8	user	400	7.5	60.00	
	800 E	<2.0	25	20	3.2	¾-1½	<1	30	30	0.3x0.8	user	400	7.5	34.50	
GRADO	BE	<1.0	>20	10	6.0	2.0				0.3x0.6	user		3.5	45.00	Available w/light mass stylus, BCR/LM, 30.00.
	BCE	<1.0	>20	10	6.0	2.0				0.3x0.6	user		3.5	35.00	
LEAK	MK IV		25	15	5.0	2.0	1	10	10	0.3x0.7	user	200	10	75.00	
ORTOFON (57)	S-15 T		25	25	6	1-2	0.9	10	10	0.3x0.7	factory		18.5	80.00	Avail as S-15MT, in Ortofon plug-in shell, 85.00
	S-15 SL-15 T		25	25	0.04 6 w/trans.	¾-1½	0.9	10	10	0.3x0.7	factory		7	60.00 75.00.	Des. for auto TTs. Incl. ext. stereo in-line xformers

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When Stanton engineers get together, they draw the line.

The frequency response curve of the new Stanton 681 Calibration Standard is virtually a straight line from 10-20,000 Hz.

That's a guarantee.

In addition, channel separation must be 35 dB or greater at 1,000 Hz. Output must be 0.8 mv/cm/sec minimum.

If a 681 doesn't match these specifications when first tested, it's meticulously adjusted until it does.

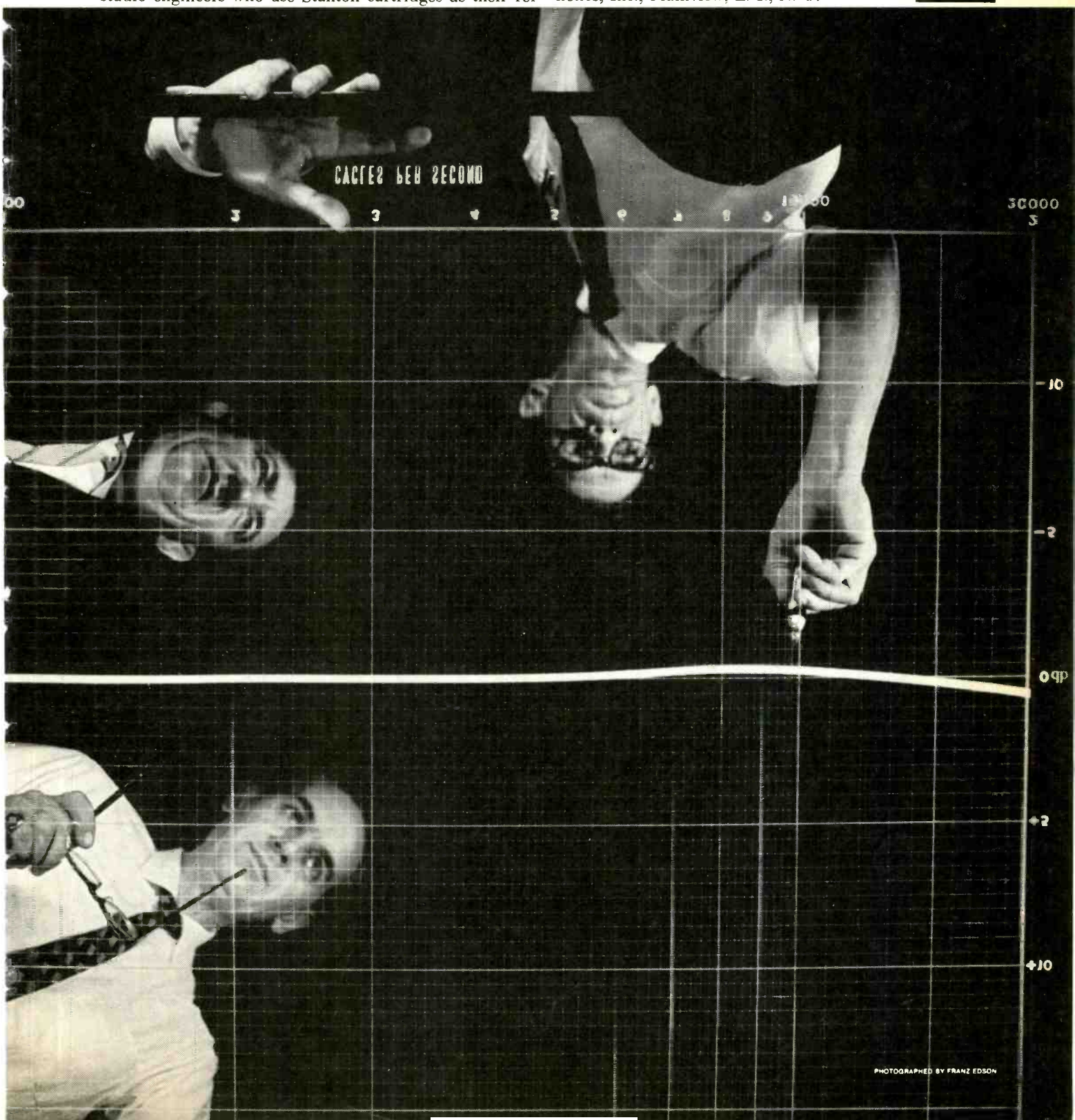
Each 681 includes hand-entered specifications that verify that your 681 matches the original laboratory standard in every respect.

Nothing less would meet the needs of the professional studio engineers who use Stanton cartridges as their reference to approve test pressings. They must hear exactly what has been cut into the grooves. No more. No less.

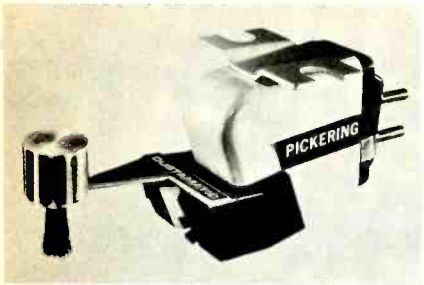
But you don't have to be a professional to hear the difference a Stanton 681 Calibration Standard will make, especially with the "Longhair" brush which provides the clean grooves so essential for clear reproduction. The improvement in performance is immediately audible, even to the unpracticed ear.

The 681 is completely new, from its slim-line configuration to the incredibly low-mass moving system. The 681A with conical stylus is $55.00, the 681EE with elliptical stylus, $60.00.

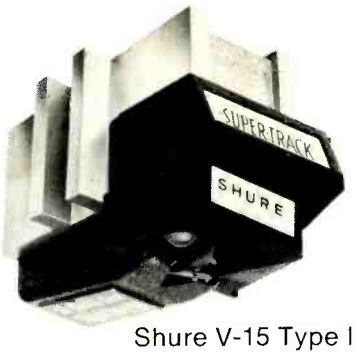
For free literature, write to Stanton Magnetics, Inc., Plainview, L. I., N. Y.



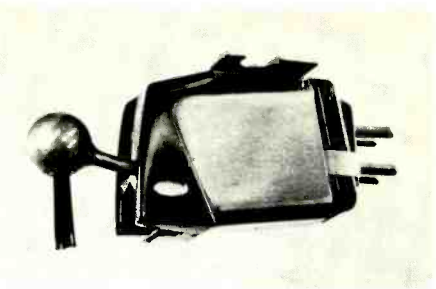
PHONO CARTRIDGES (continued)



Pickering XV-15



Shure V-15 Type II



Stanton 681EE

MANUFACTURER (Circled number indicates adv. page)	Model	IM Distortion, %	1-kHz Separation, dB	10-kHz Separation, dB	Output, 3.54 cm/sec., mV	Tracking Force, gms	Eff. Moving Mass, mg.	Lat. Compliance, x 10⁻⁶	Vert. Compliance, x 10⁻⁶	Stylus Radius, mils	Replacement	Max. Shunt Capacitance, pF	Weight, grams	Price	SPECIAL FEATURES
PICKERING (17)	XV-15/AME		35		4.0	¾ - 1½				0.2 x 0.9	user			49.95	DCF℠ series; for best auto & man. TTs. 10-30 kHz.
	XV-15/ATE		35		6.0	1-5				0.4 x 0.9	user			44.95	For good auto TTs, 10-25 kHz XV-15, 0.7 stylus, 34.95.
	V-15/AME-3		35		5.0	¾ - 1½				0.2 x 0.9	user		5	44.95	For best auto TTs, 20-25 kHz V-15/AM 3, w/0.7 stylus, 34.95.
	XV-15/AM		35		5.0	¾ - 3				0.7	user			39.95	For best auto TTs, 10-25 kHz.
	V-15/ATE-3		35		5.0	2-5				0.4 x 0.9	user		5	39.95	For good auto TTs, 20-25 kHz V-15/AT, 0.7 stylus, 29.95.
	V-15/ACE-3		30		6.9	3-5				0.4 x 0.9	user		5	29.95	For record changers. V-15/AC-3, 0.7 stylus, 24.95.
SHURE (9) (67)	V-15 Type II		> 25	> 20	3.5	¾ - 1½				0.2 x 0.7	user		6.8	67.50	Superior trackability; computer-designed for best TTs.
	M75E		> 25	> 20	5.7	¾ - 1½				0.2 x 0.7	user		6.0	39.50	High trackability for good auto & manual TTs.
	M55E		> 25	> 20	6.6	¾ - 1½		25	25	0.2 x 0.7	user		7.0	35.50	
	M44E		> 25	> 20	9.3	1¾ - 4		15	15	0.4 x 0.7	user		7.0	34.50	
	M31E		> 20	> 20	10.5	1-2				0.4 x 0.7	user		6.0	27.50	
	M3D		> 20	> 20	5.0	3-6		4	4	0.7	user		8.5	15.75	
SONOTONE	100TD7V MK. V	2	27	15	6.0	1½ - 3	1.8	15	15	0.7	user	1000	1.5	25.50	"Sono-Flex" stylus; avail. W/0.5 mil or ellip stylus, 26.50 or 28.50.
SONY (31)	VC-8E		30	20	3.0	½ - 2		30	30	0.2 x 0.8	user		15½	65.00	Moving-coil type; 15-deg. vert. tkg. angle.
STANTON (59)	681-EE		35		3.18	¾ - 1½				0.2 x 0.9	user	275	5½	60.00	For critical listening.
	681-A		35		3.18	1-3				0.7	user	275	5½	55.00	For recording-channel calibration.
	500E		35		2.83 min	2-5				0.4 x 0.9	user	275	5½	35.00	For critical auditioning.
	500AA		35		2.83 min	¾ - 3				0.5	user	275	5½	30.00	As above.
	500A		35		2.83 min	2-5				0.7	user	275	5½	25.00	For heavy-duty on-the-air use.

The most independent, independent testing laboratory announces its findings on the Elac 444-E

Fifty of the most knowledge and discerning high fidelity salesmen have just completed a thorough testing of the new Elac 444-E cartridge. They tried it with their home systems and compared it with the cartridge they are now using. Here are samples of their findings:

"*A great groove-tamer for the straight-from-the-studio sound lover! All of today's terms won't describe the utmost enjoyment I experienced. Fine response, clarity, were soon taken for granted.*"

"*This is probably one of the finest cartridges I've had the privilege to evaluate. I find it superior in all respects.*"

"*The over-all impression of this cartridge is more than delightful. It's tonal quality is probably the closest to the original sound. It should be a great asset to the better turntable.*"

"*This is about as good a cartridge as is presently available! Full, rich, clean sound.*"

More than half of these demanding critics rated the performance of the Elac 444-E as equal to or better than any cartridge they'd ever heard—regardless of price.

Why don't you put the 444-E through your own demanding test at your hi-fi dealer. Elac cartridges are priced from $69.50 for the 444-E to a modest $24.95. Benjamin Electronic Sound Corp., Farmingdale, New York 11735.

Elac 444-E
It may be the finest cartridge you ever heard

MODULAR SYSTEMS

Benjamin 1050

Harman-Kardon SC2520

Fisher 125

Scott 2503

*Shipping weights.

MANUFACTURER (Circled numbers indicates adv. page)	Model	AMPLIFIER: IHF Pwr/Chan., W	THD, Full Pwr., %	IM, Full Power, %	IM, 1 W, %	Power Bandwidth, Hz	1-W. Freq. Resp., Hz	Rated Output S/N, dB	IHF Sens., μV.	TUNER: THD, 100% Mod., %	Freq. Resp., dB	Stereo Sep., 1 KHz, dB	Stereo THD	Tuning Indicator	Auto Switching	Changer Type	SPEAKERS: Woofer Size	Woofer Type	Tweeter Type	Tweeter Size	Enclosure Type	Enclosure Size, In. W x D x H	System Weight, lbs.	Price	SPECIAL FEATURES
BENJAMIN	1050	42.5	<1			20-35k	15-35k	85	<3.0	<1.0		35		Meter	Yes	Miracord 50	8½ x 13½	Acous. Susp.	Paper	3⅜	Sealed Box	11¾ x 10¾ x 23⅜	110	549.50	CRB Cassette rcdr can be added.
(61)	1030	25	<1			20-35k	15-35k	82	<3.5	<1.0		30		Meter	Yes	Miracord 620B	6⅝ x 10¾	Acous. Susp.	Paper	3⅜	Sealed Box	11⅛ x 10 x 20½	92	439.50	As above.
	1040	25	<1			20-35k	15-35k	82	<3.5	<1.0		30		Meter	Yes	Miracord 40B	–	–	–	–	–	–	40	329.50	As above, but sold without spkrs.
	1020	12½	<1			N/A	N/A	80								Miracord 620B	5-in. Spec.	–	Plas. Cone	2½	Sealed Box				New for 1968; high-performance portable.
FISHER	120	20	0.5	1.0	0.2	25-25k	25-20k	85	2.0	0.6	25-15k	35	1.5	Meter	Yes	BSR 400	8	Acous. Susp.	Cone	3	Sealed Box	17½ x 15⅝ x 8¼	61	299.95	Spkrs are XP-55B.
(43)	125	20	0.5	1.0	0.2	25-25k	25-20k	85	2.0	0.6	25-15k	35	1.5	Meter	Yes	BSR 400	8	Acous. Susp.	Cone	3	Sealed Box	17½ x 15⅝ x 8¼	61	329.95	As above, plus AM.
HARMAN-KARDON	SC 2520	20	1.0	0.8	0.3		15-25k	65	2.9	1.0		35		Meter	Yes	Garrard 3000	8	Acous. Susp.	Phen. Cone	3	Sealed Box	16½ x 11⅛ x 18	48	479.00	Incls tape cassette rcdr and player.
	SC 2320	20	1.0	0.8	0.3		15-25k	65	2.9	1.0		35		Meter	Yes	Garrard 3000	8	Acous. Susp.	Phen. Cone	3	Sealed Box	16½ x 11⅛ x 18	47	429.00	AM sect. sens, 50μ V/mtr.
	SC 2020	15	1.0	0.8	0.3		15-25k	65	2.9	1.0		35		Meter	Yes	Garrard 3000	8	Acous. Susp.	Phen. Cone	3	Sealed Box	16½ x 11⅛ x 18	45	329.00	
KLH	20	25	–	–	–	–	–	–	3.0	0.5	20-15k	35	0.8	Meter	Yes	Garrard Custom	10	Acous. Susp.	Stiff Paper	1¾	Sealed Box	23⅛ x 9 x 11¾	81	399.95	Spkrs and ampl. crit. matched for opt. perf.; w/AM, 30.00 addl.
	24	17½	–	–	–	–	–	–	3.0	0.5	20-15k	35	0.8	Meter	Yes	Garrard Custom	8	Acous. Susp.	Stiff Paper	2	Sealed Box	18 x 10¼ x 7⅜	65	319.95	As above; includes molded plexi-glass cover.
	11W	17½	–	–	–	–	–	–	–	–	–	–	–	–	–	Garrard Custom	Single full-range 3-in. spkr w/⅜-in. cone excursion				Sealed Box	8 x 4 x 14	32	199.95	Spkrs and ampl. crit. matched; avail. as portable, same price.
MARTEL	Telmar 100W	20	1.5	1.0			15-32k							Meter	Yes	BSR Mini								169.95	W/o spkrs; avail. w/spkrs, 199.95
SCOTT	2505	20	0.8	2	1	30-20k	20-20k	60	2.2	0.8	30-15k	30		Meter	Yes	Garrard 3000	–	–	–	–	–	–	–	449.95	W/S-10 spkrs; available as 2504 w/S-14 spkrs, 349.95. FM only tuner.
Cover (2)	2503	20	0.8	2	1	30-20k	20-20k	60	2.2	0.8	30-15k	30		Meter	Yes	Garrard 3500								489.95	W/S-10 spkrs; available as 2502 w/S-14 spkrs, 399.95 FM and AM.
	2550						20-20k		2.5	0.8	30-15k	30			Yes	–	4-in. air susp. speaker				Sealed Box			229.95	Encls. available wal. or teak. Operates from 110V a.c. or 12V d.c.

MICROPHONES

AKG D1000E

Altec 681B

MANUFACTURER (Circled numbers indicate adv. page)	Model	Dir. Pattern	Oper. Principle	Diaphragm Material	Case Material	Ext. Finish	Impedance, Ohms	Freq. Resp., Hz	ASA Sensitivity, dB	Mic. Connection	Cable Length, Ft.	Cable Plug Type	Dimensions, In.	Weight, Oz.	Mfg. Method	Price	SPECIAL FEATURES
AKG	D-200E	Card	Dyn.	Mylar®	Metal	Satin	200	30-15k	-149	Can XLR	15	None	1⅝ dia. x 7 5/16	8.0	Std	69.00	Two-way, with network
	D-1000E	Card	Dyn.	Mylar®	Metal	Satin	200	40-16k	-147	Can XLR	15	None	1 7/16 dia. x 6	9½	Std	60.00	W/bass atten. sw.
(73)	D-19E/200	Card	Dyn.	Mylar®	Metal	Satin	200	40-16k	-147	Can XLR	15	None	1 7/16 dia. x 6	5.7	Std	58.00	With bass rolloff sw.
	D-108	Omni.	Dyn.	Mylar®	Metal	Satin	200	50-15k	-150	Attached Cable	30	None	5/8 dia. x 2¾	1½	None	48.00	Lavalier type.
	D-707E	Card	Dyn.	Mylar®	Metal	Satin	200	50-15k	-146	Can XLR	15	None	1 7/16 dia. x 6	5.7	Std	39.50	
ALLIED	3310	Uni.	Dyn.	Mylar®	D-C* Zinc	Satin Chrome	Hi	100-16k		3-Pin	5	Phone Plug	1 13/16 dia. x 7 27/32	13	Desk Stand	24.95	Avail. in stereo pairs; incls desk stand swivel holder
(63) (64)	3311	Omni.	Dyn.	Mylar®	D-C* Zinc	Dull Chr/Blk	Hi	45-15k		2-Pin	5	Phone Plug	1⅜ dia. x 10 1/8	13½	Desk Stand	19.95	As above. *Die Cast.
ALTEC	683B	Card.	Dyn.	Mylar®	D-C* Zinc	Grn. Enamel	150/200	45-15k	-148	Can XLR	15	Can XL	1½ dia. x 7¼	11	5/8-27	120.00	Ext. flat response. *Die cast.
(75)	650A	Card	Dyn.	Mylar®	Steel	Satin Chrome	200, 20k	50-15k	-150	Can XLR	15	Phone Plug	1¾ dia. x 6 13/16	10	5/8-27	75.00	Built-in wind/pop. screen, on-off sw. bass rolloff; pers. carrying case
	651AH	Card	Dyn.	Mylar®	Steel	Satin Chrome	20k	60-15k	-151	Attached Cable	15	Phone Plug	1¾ dia. x 6 13/16	11 incl. cable	5/8-27	62.50	Built-in wind/pop. screen; on-off sw.
	681B	Omni.	Dyn.	Mylar®	D-C* Zinc	Grn. Enamel	150/200	50-18k	-149	Attached Cable	15	None	1⅞ dia. x 7⅜	10 incl. cable	5/8-27		Ext. flat. respoqse. *Die cast.
AMPEX	2001	Omni.	Dyn.	Mylar®	Al. & Cycolac	Blk & Satin	40k	50-14k	-149		9	Molded Phone	1½ dia. x 7½	7½	Std* Pipe	29.95	Incls. stand adapter,* satin chr base.
BEYER	M-260E	Super Card	Dyn. Ribbon	Alum.	Steel	Enamel	200	50-18k	-158	DIN Plug	–	–	1 11/16 dia. x 6½	9	Clamp	75.00	
	M-808A	Card	Dyn	Alum.	Stnls Steel	Enamel	80k	50-16k	-146	Attached Cable	15	Phone	1¼ x 1¼ x 5⅛	10	Clamp	75.00	Incls 2 matched mics w/connecting bar.
DYNACO	200	Dual Fig. 8	Vel.	Rib.	Brass	Satin Chrome	200	30-13k	-156	DIN Plug	20	None	1¼ dia x 10	16	5/8-27 Adapt.	149.95	Stereo mic. w/adjust. sep. angle; sp-mus-off sw.
(11)	100	Fig. 8	Vel	Rib.	Brass	Satin Chrome	200	30-13k	-156	DIN Plug	20	None	1¼ dia x 6	10	5/8-27 Adapt.	89.95	Single unit; sp-mus-off sw.
ELECTRO-VOICE (General Purpose)	631	Omni.	Dyn.	Acoust-Alloy	D-C* Zinc	Chr. or Sat. Ni.	150 or Hi	80-13k	-149 -151	Amph.	15	None	Avail. w/phone plug (hi Z) add "P" to mod.; sl. addl. cost	1 25/64 dia. x 6 31/32	6	310 Std. Clamp	37.80	For hand-held ent. use; 4-stg pop filter; mag reed on-off sw, rem.
	627	Card (Sgl. D)	Dyn.	Acoust-Alloy	D-C* Zinc	Chr. or Sat. Ni.	150 or Hi	80-11k	-151 -153	Amph.	15	None		1 19/32 dia. x 6 7/16	6	310 Std. Clamp	37.80	For above use; bass resp. var. w/ dist–10dB incr. at 100Hz, 24" to 2".
(1)	664	Card (Var. D)	Dyn.	Acoust-Alloy	D-C* Zinc	Chr. Gray or Gold	Lo & Hi	60-15k	-149 -151	Amph. MC4M	15	None		1⅞ dia. x 7 3/16	28	5/8-27	53.40	Var-D card; resp. independent of dist.; on-off sw.
Cover (4)	674	Card (Var. D)	Dyn.	Acoust-Alloy	D-C* Zinc	Chr. Gray or Gold	Lo & Hi	60-15k	-151 -152	Amph. MC4M	15	None		1¼ dia. x 7⅞	14	5/8-27	53.40	As above, w/3-pos bass-tilt sw. for cont. of room rumble.
	676	Card (Var. D)	Dyn.	Acoust-Alloy	D-C* Zinc	Chr. Gray or Gold	Lo & Hi	60-15k	-151 -152	Amph. MC4M	15	None		1¼ dia. x 7⅝	12	300 Std. Clamp	53.40	As above, w/o on-off sw. *Die cast-all above mods.

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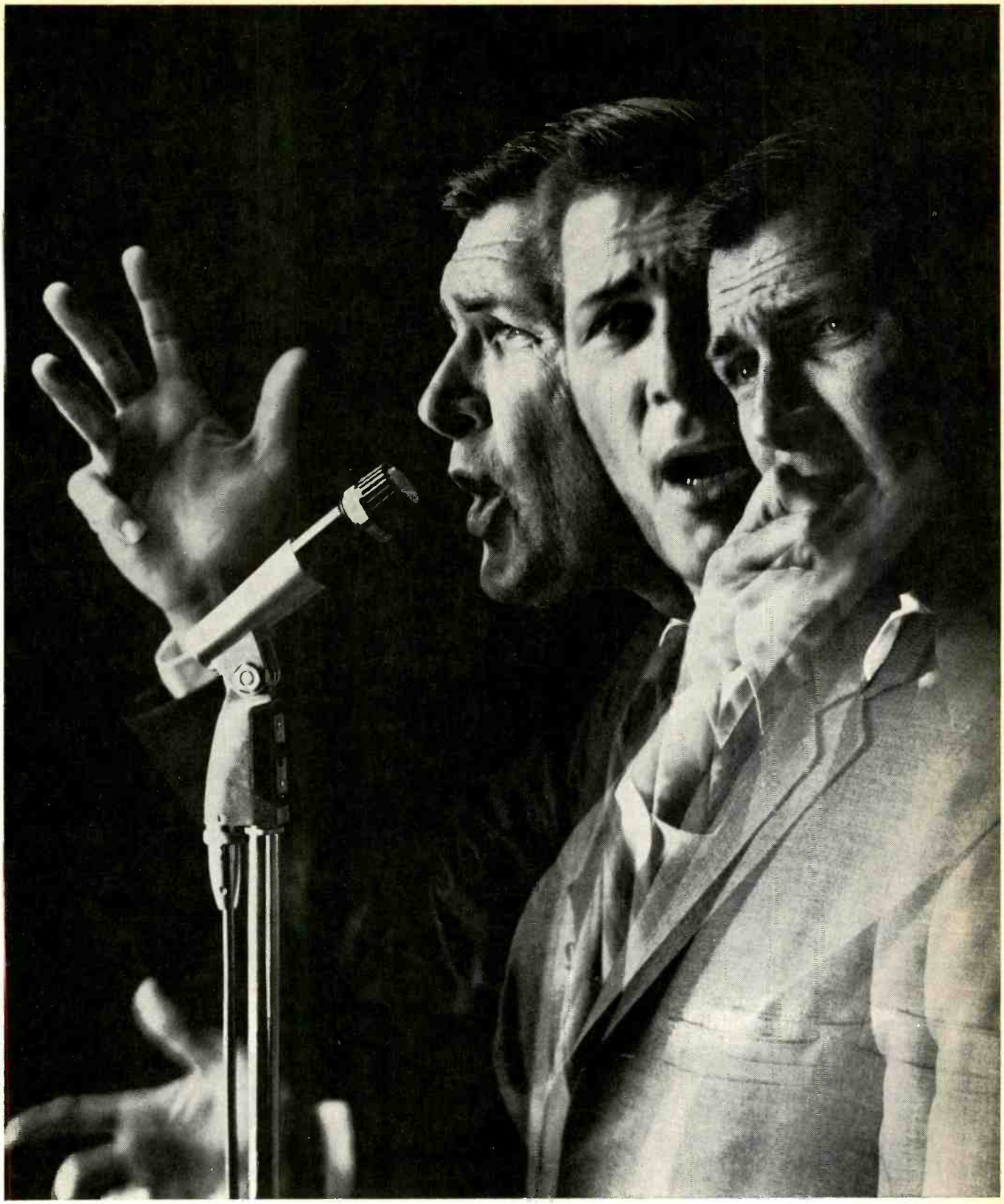
MICROPHONES (continued)

Electro-Voice RE15

Electro-Voice 649B

Hammond M-100

MANUFACTURER (Circled numbers indicate adv. page)	Model	Dir. Pattern	Oper. Principle	Diaphragm Material	Case Material	Ext. Finish	Impedance, Ohms	Freq. Resp., Hz	ASA Sensitivity, dB	Mic. Connection	Cable Length, Ft.	Cable Plug Type	Dimensions, In.	Weight, Oz.	Mtg. Method	Price	SPECIAL FEATURES
ELECTRO-VOICE (Professional)	RE-15	Super-Card	Dyn.	Acoust-Alloy	Steel	Satin Nickel	150	80-15k	-150	Cannon	18	None	¾ x 1⅜ x 6⁷/₁₆	6	310A Adapt.	153.00	Super-card; max rej. 150° off-axis; uniform resp at all angles.
	RE55	Omni.	Dyn.	Acoust. Alloy	Steel	Satin Nickel	150	40-20k	-149	Cannon	18	None	¾ x 1⁷/₃₂ x 10½	8½	310A Adapt.	126.00	Ext. smooth; suitable as sec dy calib. std.
(1)	635A	Omni.	Dyn.	Acoust-Alloy	Steel	Satin Nickel	150	80-13k	-149	Cannon	18	None	¾ x 1¹³/₁₆ x 5⁵/₁₆	6	310A Adapt.	49.20	Integ. 4-stg. pop filter; for hand held use.
	642	Card Line	Dyn.	Acoust-Alloy	Alum	Non-refl. Gray	50,150, 250	20-10k	-142	Cannon	20	None	3⁵/₁₆ dia. x 17⅞	3¼ lbs	356 Shk. Mt.	234.00	"Card-i-line," comb. card. w/ line mic; highly directional
Cover (4)	668	Card Line	Dyn.	Acoust-Alloy	Alum	Non-refl. Gray	50,150, 250	40-10k	-145	Cannon	20	None	3¼ dia. x 9⅝	27	Fl. Std. Adapt.	297.00	Boom mic w/integ. wind filtr; 36 vars. of resp. available.
	649B	Omni.	Dyn.	Acoust-Alloy	Alum	Non-refl. Gray	150	70-8k	-154	Attached Cable	30	None	¾ dia. x 2¼	1.1	Neck Cord 310 Adapt	66.00	Lavalier.
GELOSO	M-68	Card	Dyn.	Non-Met.		Satin Chrome	50-250	60-18k	-150	Spec. Gel.	25	None	1⁵/₁₆ dia. x 4½	5	⅝-27	25.60	Avail. hi Z, mod M-69, 27.30 incls cable, wind screen.
	M-14	Omni.	Dyn.	Non-Met.		Non-refl. Blk	50-250	60-14k		Attached Cable		None	¾ dia. x 2¼		Neck Cord	26.50	Lavalier type; incls. lea. pouch Hi Z, Mod M15.
HAMMOND (88)	M-100	Omni	Cond.	Gold Foil	Alum.	Anodized	50-200	20-20k	-157	Can XLR	15	Pin & Phone	1" dia. x 4	3	⅝-27 w. Adapt.	229.50* 149.50**	*Stereo pair; ** sgl unit. Nuvistor preamp, a.c. pwr. sup.
NEUMANN	LM-83	Omni.	Cond.	Gold on Mylar®	Metal	Satin Chrome	150/250	40-16k		Furn.	25	Cannon	0.83 dia. x 4	3	⅝-27	From 261.00*	*Incls cable & swivel; si-FET, bat. sply, 39.00; dual a.c. sply, 82.50; central pwr card for 30 + mics, 82.50; accessories available; 10-dB o'ld. protection.
	KM-84	Card	Cond.	Gold on Mylar®	Metal	Satin Chrome	150/250	40-16k		Furn.	25	Cannon	0.83 dia. x 4	3	⅝-27	From 276.00*	
	KM-86	8, Omni, Card	Cond.	Gold on Mylar®	Metal	Satin Chrome	150/250	40-16k		Furn.	25	Cannon	1.81 dia. x 6.9	7	⅝-27	From 330.00*	
	U-87	8, Omni, Card	Cond.	Gold on Mylar®	Metal	Satin Chrome	150/250	40-16k		Furn.	25	Cannon	2.25 dia. x 8.25	19.2	⅝-27	From 335.00*	As above; prof. effect corr. sw. clips for int. batts.
	SM-69	8, Omni, Card	Cond.	Gold on Mylar®	Metal	Satin Chrome	150/250	40-16k		Furn.	25	Cannon	1.89 dia. x 10.08	16	⅝-27	895.00 Sys.	Tubed; dbl cond. stereo mic. rem. cont. of patterns; price incls mic, pwr. splys intcntg cables. Matrix-ing x-former, 116.00
	M-249C	8, Omni, Card	Cond.	Gold on Mylar®	Metal	Satin Chrome	150/250	40-16k		Furn.	25	Cannon	3.15 dia. x 6.42	28	⅝-27	520.00 Sys.	
PML	EK-71	Omni.	Cond.	Poly.	Metal	Satin Chrome	30-50 200,600	40-18k	-164	Attached Cable	12+ 12 sig	None	11/16 dia. x 2 11/16	1¼	Adapt.	99.50	S/s, reqs. pwr sply; Mod EC-71, card, 100.50
RCA	BK-5B	Card	Ribbon			Gray	30,150, 250	50-15k	-150	Attached Cable	30	None	1¾ dia. x 7	27	Desk, Boom	158.00	
(4)	BK-12A	Omni	Dyn.			Bronze Gold	30 to 250	60-18k	-154	Attached Cable	30	None	¾ dia. x 1½	0.71	Clip, Lanyard	95.00	Lavalier type.
	HK-96	Card	Dyn.			Blk Chr.	200, 15k	50-15k	-154 -60*	5-pin**	20	None	1.6 dia. x 9¼	16		50.00	*Below 1V., hi Z. **Permits inst. Z switching



there's many a slip 'twixt the mike and the lip

SHURE'S LEVEL-LOC*AUDIO LEVEL CONTROLLER enables you to economically . . . easily . . . effectively improve audience communications by eliminating the following problems: "blasting" overload that occurs when the speaker shouts; fadeout caused by side-to-side or back-and-forth head motions; "roller-coaster" sound from a succession of widely divergent voices; the ear-splitting feedback build-up. How? The Level-Loc keeps electrical output from a microphone constant—even though the input signal varies considerably, so the sound is always smooth and evenly modulated. It's that simple—and it's only $90.00 List! Shure Brothers, Inc., 222 Hartrey Avenue, Evanston, Illinois 60204.

*TM

MICROPHONES (continued)

RCA HK-96

Sony
(Superscope) C37

Shure 548S

MANUFACTURER (Circled numbers indicate adv. page)	Model	Dir. Pattern	Oper. Principle	Diaphragm Material	Case Material	Ext. Finish	Impedance, Ohms	Freq. Resp., Hz	ASA Sensitivity, dB	Mic. Connection	Cable Length, Ft.	Cable Plug Type	Dimensions, in.	Weight, Oz.	Mtg. Method	Price	SPECIAL FEATURES
SENNHEISER	MD-321N	Omni.	Dyn.	Plas.	Metal	Satin Chr.	200 bal	50-15k	-158.7	Tuchel	None	None	1 5/16 dia. x 17	10	Hand Held	149.00	Probe type for sound measurements.
	MD 5-1	Card.	Dyn.	Plas.	Metal	Satin Chr.	200 bal	70-15k	-149.3	Attached Cable	22½	Phone	1 5/8 x 4 3/4 x 10 3/4	16.5	5/8-27	98.00	Stereo mic. dual system.
Cover (3)	MD-408	Card.	Dyn.	Plas.	Metal	Satin Chr.	200 bal	100-14k	-149.3	Tuchel	None	None	1 5/8 dia. x 12	10.5	5/8-27	58.00	Goose-neck, w/on-off sw.
	MD-411/MLH	Super Card	Dyn	Plas.	Plas. & Metal	Gray, Chr.	Lo, med, hi	50-12k	-150	Attached Cable	5	Phone Plug	1½ x 1½ x 8	8	Desk Stand	44.50	3 impedances, switchable.
SHURE	548S	Card	Dyn.	Poly	Steel	Satin Chr.	Hi & Low	40-15k	-149.5	Cannon	15	None	1 9/16 dia. x 5 7/16	16	5/8-27	105.00	New Unidyne 1V; shock mtd. cartr., on-off sw; swivel mt.
	565S	Card	Dyn.	Poly	Steel	Satin Chr.	Hi & Low	50-15k	-148.5	Amph. Type	15	None	2 dia. x 6 3/16	16	5/8-27	100.00	Unisphere I; ball type integ. filters, on-off sw, swivel.
	545	Card	Dyn.	Poly	Steel	Satin Chr.	Hi & Low	50-15k	-151.0	Amph. Type	15	None	1¼ dia. x 5 5/16	9	Adapt.	85.00	Unidyne III slim card. for hand or Stand use.
(67)	55 SW	Card	Dyn.	Poly	Steel	Satin Chr.	Hi & Low	50-15k	-151.5	Amph. Type	15	None	2 5/16 dia. x 3 5/16	26	5/8-27	85.00	Unidyne II; built in Z sel., on-off sw.
	585 SA	Card	Dyn.	Poly	Steel	Satin Chr.	High	50-13k	-153.5	Amph. Type	15	None	2 1/16 dia. x 6 3/4	13½	Adapt.	65.00	Unisphere A; integ. filters on-off sw. available.
	585SAV	Card	Dyn.	Poly	Steel	Satin Chr.	High	50-13k	-152.5	Amph. Type	15	None	2 1/16 dia. x 6 3/4	13½	Adapt.	72.50	As above, but with built-in vol. cont.
SONOTONE	DM 70-150B	Omni.	Dyn.	Poly	Die Cast	Brush Chr.	50k	40-15k	-156	Attached Cable	7	Phone Plug	1 13/16 dia. x 6	3¾		42.50	Ball style, w/sw. 200Ω, 10kΩ mods. avail.
SONY (Superscope) (6)(7)(83)	F-121	Card	Dyn.	Poly	Metal	Satin	50,250, 600,10k	70-12k	-151	Cannon	20	None	1" dia. x 7	7	Adapter	99.50	On-off sw; built-in wind screen.
TRUSONIC	C-3	Omni.	Cond.	Gold-Mylar®	Alum.	Anodized Enameled	cath. foll.	20-20k	-134	BNC	50		5/8 dia. x 7½	3	Adapter	200.00	T.r.f. wireless mic., no polar. voltages; long cable run to osc-mod
TURNER	S-500	Card	Dyn.	Mylar®	D.C.* Zinc	Satin Chr.	150, Hi	40-15k	-151	Swcrft 4-pin	20	4-pin	1 17/32 dia. x 6 13/16	12	Adapter	94.00	Rotary on-off sw. *Die cast.
UNIVERSITY	5020	Super Card	Dyn.	Unilar	Alum.	Satin Chr.	250, 20k	25-18k	-147	Amph.	15	None	2 5/16 dia. x 8 5/16	14	Adapter	56.95	Golf-ball type super-card; shock mtd; 5 yr. warranty.
	5050	Super Card	Dyn.	Unilar	Alum.	Satin Chr.	250, 20k	25-18k	-147	Amph.	15	None	2 5/16 dia. x 9 5/8	16	Adapter	59.95	As above, with swivel-stand adapter.
(5)	2040	Omni.	Dyn.	Unilar	Zamak 3	Sil. Gy. & Blk.	50, 20k	50-14k	-143	Cannon	15	None	1 5/32 dia. x 8 5/8	9	Adapter	30.60	On-off sw, 5-yr warranty.
	6000 Attache	Card	Dyn.	Unilar	Alum.	Chr. & Blk.	150	50-15k	-151	Attached Cable	15	None	1 1/16 dia. x 3 5/8	5	Lavalier	39.75	Incls. neck cord; spring-loaded cable ent; 5-yr. warranty.
	8100	Card	Dyn.	Unilar	Zamak 3	Chr. & Blk.	250, 20k	70-15k	-154	Cannon	15	None	1 23/32 dia. x 6 3/8	8	Adapter	37.95	Shock mtd; on-off sw. 5-yr. warranty.
VEGA	S10	Card	Cond.	Mylar®	Alum.	Beige	50, Hi Z	40-20k	-147	Cannon	20	None	7/8 dia. x 7 3/8	9	Adapter	260.00	s s, self-cont. batt.; a.c. sply avail. Mod. S10B, same, but w/omni pattern.
(91)	5	Omni	Dyn.	Mylar®	Alum.	Beige	50, Hi Z	40-20k	-147	Cannon	20	None	7/8 dia. x 7 3/8	9	Adapter	300.00	
	105	Omni	Dyn.	Mylar®	Alum.	Beige	50, Hi Z	40-20k	-147	Cannon	20	None	7/8 dia. x 7 3/8	9	Adapter	300.00	Wireless; incls rcvr.; available -H, hand-held; -L, lavalier; -P, pocket-trans.; -SH, Shure 565 w/wrls. trans.

LOUDSPEAKER MECHANISMS

Electro-Voice 12TRXB

Empire 9000/MHX

*Shipping weights.

MANUFACTURER (Circled number indicates adv. page)	Model	Diameter, in.	Freq. Response, Hz.	Resonance, Hz	Cone Material	Susp. Compliance	Type of Suspension	Magnet Type	Voice-Coil Type	Voice-Coil Diameters, in.	Max. Power Capacity, W.	Impedance, ohms. Depth, in.	Weight	EIA Efficiency	Price	SPECIAL FEATURES
ALLIED (63) (64)	615HC	15	20-20k	25	Paper	High	Cloth	Cer.	Cu. Rib. Al. Rib.	2½ 1	50	8 8¼	28	53	79.95	5-lb. magnet, cal. bril. cont. 100-w peak power.
	612HC	12	22-20k	40	Paper	High	Cloth	Cer.	Cu. Rib. Al. Rib.	2½ 1	35	8 7½	27	53	64.95	5-lb. magnet; level control.
	888HCA	12	25-19k	25	Paper	High	Cloth	Cer.	–	1½ 1	25	8 6⅜	11½	53	39.95	Tweeter level contr.; comp. type tweeter horn
ALTEC (75)	604E	15	20-22k	25	Paper	High	Cloth	Al-V	Copper Al. Rib.	3 ¾	50	8 11⅛	34	54	199.00	Duplex-coax types; incls 2-sect network, h.f. atten.
	605B	15	20-22k	25	Paper	Med.	Cloth	Al-V	Copper Al. Rib.	3 ¾	50	16 10	28	50	171.00	As above.
	601C	12	30-22k	39	Paper	Med.	Cloth	Al-V	Al. Rib.	3 ¾	30	8 5⅝	15	52	114.00	
	419A	12	30-15k	39	Paper	Med.	Cloth	Al-V	Al. Rib.	3	20	8 5⅝	15	49	67.00	Wide distribution; uses Biflex® principle.
BOZAK (39)	B-207B	12	40-20k	40	Felted Paper	Med.	Cloth	Al-V	Cu. Rib.	1½	25	8 7	15		97.50	Coaxial.
	B-199A	12	40-4.5k	40	Felted Paper	Med.	Cloth	Al-V	Cu. Rib.	1½	25	8 5⅞	9		57.00	Woofer only.
	B-209B	6	200-3.5k		Rigid Metal	Med.	Rubber	Al-V	Cu. Rib.	1½	25	8-16 3½	7		54.50	Mid-range.
	B-800	8	50-10k		Rigid Metal	Med.	Rubber	Al-V	Cu. Rib.	1½	25	8-16 3½	7		54.50	Wide-range.
	B-200Y	2½	1.5k-20k		Rigid Metal	Med.	Rubber	Al-V	Cu.	¾	25	8 2½	2½		36.50	Treble pair.
ELECTRO-VOICE Cover (4) (1)	30W	30	15-300	18	Foam-Polystyrene	High	Cloth	Cer.	Cu. Rib.	2½	100	16 13 13/32	34	54	250.00	Massive woofer, 9-lb., 4-oz. magnet.
	15TRX	15	25-20k	25	Paper Phen.	High	Cloth	Cer. Al. V		2½ 1	40	16 8¼	27	55	133.00	High-eff. 3-way for deluxe sys.
	12TRXB	12	35-20k	50	Paper Phen.	Med.	Cloth	Cer. Al. V	Al. Wire	2 1	30	16 7	14	52	70.00	As above, with Sono-phase tweeter and level cont.
	SP12B	12	35-15k	50	Paper	Med.	Cloth	Cer.	Al. Wire	2	30	16 6¼	11½	49	40.00	Full-range; radax dual-cone.
	SP8B	8	35-15k	60	Paper	Med.	Cloth	Cer.	Al. Wire	2	20	16 4¾	7	47	33.00	Compact; 1-lb. 6-oz.-magnet.
EMPIRE	9000/MHX	4½	450-20k		Phen.	High	Phen.	Al. V	Al.	4 1½	40	8 5½	12		94.95	Mid and high drivers w/acous. lens, x overs
	9000/15W	15	20-450	20	Paper	High	Cloth	Indox	Cu.	4	60	8 5½	23		89.95	15-in. woofer.
	8000/12W	12	25-450	25	Paper	High	Cloth	Indox	Cu.	4	60	8 3¼	21		74.95	12-in woofer.
GELOSO	SP480	19			Paper	Low	Trtd Paper	Cer.	Cu.	3	150				149.50	Des. for guitars and mus. insts. cast basket w/handle; wide range.
	SP325	12			Paper	Low	Trtd Paper	Cer.	Cu.	2½	50				84.00	Des. for mus. insts.; cast basket.
GOODMANS	AUDIOM 81	15	30-4000	30	Paper	Med.	Plastic	Cer.	Cu.	3	50	16 7 7/16	22½		109.95	Hvy. duty; hi fi or guitar use.
	AXIOM 201	12	30-16000	35	Plas. Ctd. Paper	Med.	Plastic	Cer.	Al.	1¾	30	16 5 27/32	10.8		59.95	Twin diaphragm.
	TWIN AXIETTE 8	8	40-18000	65	Plasticized Paper	Med.	Plasticized Paper	Cer.	Al.	1	12	16 3⅝	4		29.95	As above.

LOUDSPEAKER MECHANISMS (continued)

Hartley 218MS

JBL LE12C

Michigan MC12

*Shipping weights.

MANUFACTURER (Circled number indicates adv. page)	Model	Diameter, in.	Freq. Response, Hz.	Resonance, Hz	Cone Material	Susp. Compliance	Type of Suspension	Magnet Type	Voice-Coil Type	Voice-Coil Diameters, in.	Max. Power Capacity, W.	Impedance, ohms. Depth, in.	Weight	EIA Efficiency	Price	SPECIAL FEATURES
HARTLEY	218-MS	18	16-4000	17	Poly	Med.	Mag.	Al. III	Cu.	1½	60	16 8	18		195.00	Woofer; imperv. to humidity; cast al. frame; 14 lb. magnet.
	220MS	10	20-25k	28	Poly	Med.	Mag.	Al. II	Cu. Al.	1	50	8 5½	8		135.00	Full range coax; dual cone dual v.c., mag. susp; 6.1 lb. mag.
JENSEN	G-610B	15	<25 to >20k	50	Paper	Stiff	Paper	Al. V	Cu/Cu. Al.	3.2, 1	40	16 10¾	46	57	346.50	Triaxial®
	SG-300	12	20-20k	25	Paper	High	Flexair®	Syntox -6®	Cu/Cu. Al.	1½,1½ 1	25	8 8⅛	15*	48	125.00	Triax®
	SG-223	12	20-20k	25	Paper	High	Flexair®	Syntox -6®	Cu. Al.	1½ 1	25	8 6½	15*		88.75	Co-axial.
	SG-222	12	30-20k	50	Paper	Med.	Paper	Syntox -6®	Cu. Al.	1½ 1	25	8 7⅛	14*		80.50	Co-axial.
	DL-220	12	25-17k	25	Paper	High	Flexair®	Syntox -6®	Cu. Al.	1½ 1	20	8 5½	10*		44.50	3-element co-ax.
JBL	LE85	1 Throat	5000 up		Al.				Al. Rib.	2	60 w/network	8 3⅞	15*	55	150.00	H.F. driver; silver Z-contr. ring for smoothness.
	LE15A	15	1000 down	20	Paper Lans-a-plas	High	Lans-a-loy	Al. V	Cu. Rib.	4	60	8 5¾	26*	45	129.00	For use in 6-8 cu. ft. encls. with JBL PR-15 passive radiators
	LE12CHF	1.7	3000 up		Felted Paper			Al. V	Cu.	0.6	30	8 4¼	16	43	108.00	2-way sys; for use in encls. of 2.2 cu. ft. or more.
	LE12CLF	12	3000 down	35	Paper Lans-a-plas	High	Cloth	Al. V	Cu. Rib.	3					–	
	LE8T	8	Full	35	Paper Lans-a-plas	High	Lans-a-loy	Al. V	Al. Rib.	2	20	8 3⅞	11	40	72.00	Silver Z-contr. ring; linear cone travel at 20 kHz >0.5 in.
LAFAYETTE	SK-215	15	20-20k	25	Paper		Free Edge	Cer.		3 1	50	16 15¼	30		69.95	Co-ax. H.F. level cont.
	SK-216	12	20-20k	35	Paper		Free Edge	Cer.		3 1	50	16 12¼	25		59.95	As above.
	SK-500	12	25-20k	22-27	Paper		Free Edge (Rigid-flex)	Cer.		1¾ 1	30	8-16 6½	18		37.95	Co-ax. L-pad control.
MICHIGAN Cover 4 (1)	MT12	12	40-18k	60	Paper/ Phenolic	Med.	1 pc. cone	Al. V	Al. wire	2 1	20	8 5½	7	46	29. 50	Co-axial.
	MC12	12	40-14k	60	Paper	Med.	1 pc. cone	Al. V	Al. Wire	2	20	8 3½	5½	46	17.50	
	MC8	8	50-13k	75	Paper	Med.	1 pc. cone	Cer.	Al. Wire	1	12	8 3⅜	4	46	14.00	
PIONEER (13)	PAX-30F	12	23-16k	23-32	Paper & Mylar	High	Cloth	Al. V	Cu. Al.	3.0 0.95	35	8	9		72.50	Co-axial.
	PAX-30G	12	34-18k	34-50	Paper & Mylar	High	Cloth	Al. V	Cu. Al.		30	8	10		59.50	Co-axial.
	PAX-25F	10	25-16k	27-37	Paper & Mylar	High	Cloth	Al. V	Cu. Al.	2.0 0.95	20	8	11½		53.50	Co-axial.
	PAX-20F	8	35-20k	35-50	Paper & Mylar	High	Cloth	Al. V	Cu. Al.		15	8	4⅜		37.40	Co-axial.
ROLA CELESTION	CX2012	12	30-18k	35	Paper Phenolic	Med.	Plastic Roll	Cer.	Cu. Al.	1¾ 1	20	4,8,16 5½	16⅝			Full-range co-ax. w/h.f. control horn tweeter.
	CX1512	12	30-15k	35	Paper Phenolic			Cer.	Cu. Cu.	1¾ ¾	15	4,8,16 5½	12⅛			Full-range co-ax. w/wide treble dispersion.
TANNOY (86)	Monitor Gold 15"	15	23-20k	26	Paper Dural	Med.	Paper Plastic	Ticonal G	Cu. Al.	2 2	50	8 9	21		195.00	Co-ax.; dyn. bal. and roll-off controls.
	Monitor Gold-12"	12	25-20k	28	Paper Dural	Med.	Paper Plastic	Ticonal G	Cu. Al.	2 2	30	8 7½	10		147.00	As above.
	Monitor Gold-10"	10	27-20k	30	Paper Dural	Med.	Paper Plastic	Ticonal G	Cu. Al.	2½ 2	20	8 6½	9		127.00	As above.

LOUDSPEAKER MECHANISMS (continued)

*Shipping weights.

MANUFACTURER (Circled number indicates adv. page)	Model	Diameter, in.	Freq. Response, Hz.	Resonance, Hz	Cone Material	Susp. Compliance	Type of Suspension	Magnet Type	Voice-Coil Type	Voice-Coil Diameter, in.	Max. Power Capacity, W.	Impedance, ohms. Depth, in.	Weight	EIA Efficiency	Price	SPECIAL FEATURES
UNIVERSITY (5)	315C	15	25-20k	32	Pap/Pap. Phenolic	High	Cloth	Al. VB	Cu.	2 0.78	50	8-16 12	34½		179.50	3-way thru-axial; Diffusicone, horn tweeter, mid-r & bril conts.
	312	12	28-40k	30	Pap/pap. Phenolic	High	Cloth	Al. V	Cu. Al.	2 0.78	35	8-16 6⅝	10¼		84.50	As above except w/Sphericon tweeter.
	6201	12	28-18.5k	36	Paper Phenolic	High	Cloth	Al. V.	Cu.	2 0.78	35	8-16 6⅝	10¼		69.50	2-way thru-axial; horn tweeter, bril. cont.
	1212	12	35-30k	40	Pap/Pap. Phenolic	Med.	Cloth	Al. VB & Cer.	Cu.	2 0.78	30	8 8⅝	10		59.95	3-way, Diffusicone, Sphericon super tweeter.
	M12T	12	35-40k	45	Pap/Pap. Phenolic	Med.	Paper	Cer.	Cu.	2 0.78	30	8 3⅞	9	54.1	39.50	3-way, whizzer, Sphericon.
UTAH (76)	D15PXC-HF	15	30-20k	40	Paper	Med.	Self	Al. V		1½	45	8 —	12 lbs. 10 oz.		39.95	3-way; compression tweeter.
	C12PC-HF	12	25-20k	25	Paper	High	Cloth Roll	Cer.		1½	45	8 —	11¾		34.95	As above.
	C12-JC 2A	12	25-19k	25	Paper	High	Cloth Roll	Cer.		1½	45	8 —	10¾		26.50	2-way co-ax.
VITAVOX	K15-40	15	30-5000	30	Molded Paper	High	Chem. Trtd	Ticonal G	Cu.	2¼	50	15 8¼	23		135.00	Woofer, available in full-range model, $125.00.
	DU-121	12	30-16k	30	Paper Plastic	High Stiff	Chem. Trtd.	Feroba II Ticonal G	Cu.	¾ ¾	30	15 6	16		95.00	Compatible to both large and small enclosures.
WOLVERINE Cover (4) (1)	LT-12	12	40-18k	60	Paper Phenolic		1-pc. cone	Cer. Al. V	Al. Wire	2 1	20	8 5¼		47	40.00	Sonophase tweeter, var. brilliance control.
	LT-8	8	45-18k	65	Paper Plastic		1-pc. cone	Cer. Al. V	Al. Wire	2 1	20	8 3 15/16	6½	45	33.00	Tweeter has ring. dia.; var. brilliance control.
	LS-15	15	35-14k	50	Paper		1-pc. cone	Cer.	Al. Wire	2	20	8 6 11/32	9	47	31.00	15-in. woofer, converts to multi-sys with HF-1, MF-1 step-up kits.
	LS-12A	12	40-14k	60	Paper		1-pc. cone	Cer.	Al. Wire	2	20	8 3 1/16	6	46	23.00	Converts as above.
	LS-8	8	45-14k	75	Paper		1-pc. cone	Al. V	Al. Wire	2	20	8 3½	4	43	20.00	Shallow basket allows mtg in wall.

HEADPHONES

AKG K60

Koss PRO 4

MANUFACTURER (Circled numbers indicate adv. page)	Model	Type	Freq. Response, Hz	Impedance, Ohms	Sensitivity, mW	Max. Output, dBm	Max. Input, mW	Distortion, %	Plug Type	Cord Length, Ft.	Weight, Oz.	Price	SPECIAL FEATURES
AKG (73)	K-60	dyn	20-20K	600	100	125	20	1	Std 3-way	10	11	39.50	
	K-20	dyn	20-20K	600	100	115	20	1	Std 3-way	10	11	19.50	
ALLIED (63)	H-885	dyn	15-20K	4-16	105	120	750	0.5	Std 3-way	8	32	34.50	Vol & tone controls on each cup.
BEYER	DT-48S	dyn	16-18K	5+5	10		400	0.1	Std 3-way	9	12	85.00	Acc: TR 48/2 dual trans. for 600Ω line, 30.00; TR 48, sgl. trans for 600Ω line, 17.40
	DT-48SN	dyn	16-18K	50	20		400	0.1	Spec. NAGRA	9	12	85.00	For NAGRA tape recorder only; mono.

HEADPHONES (continued)

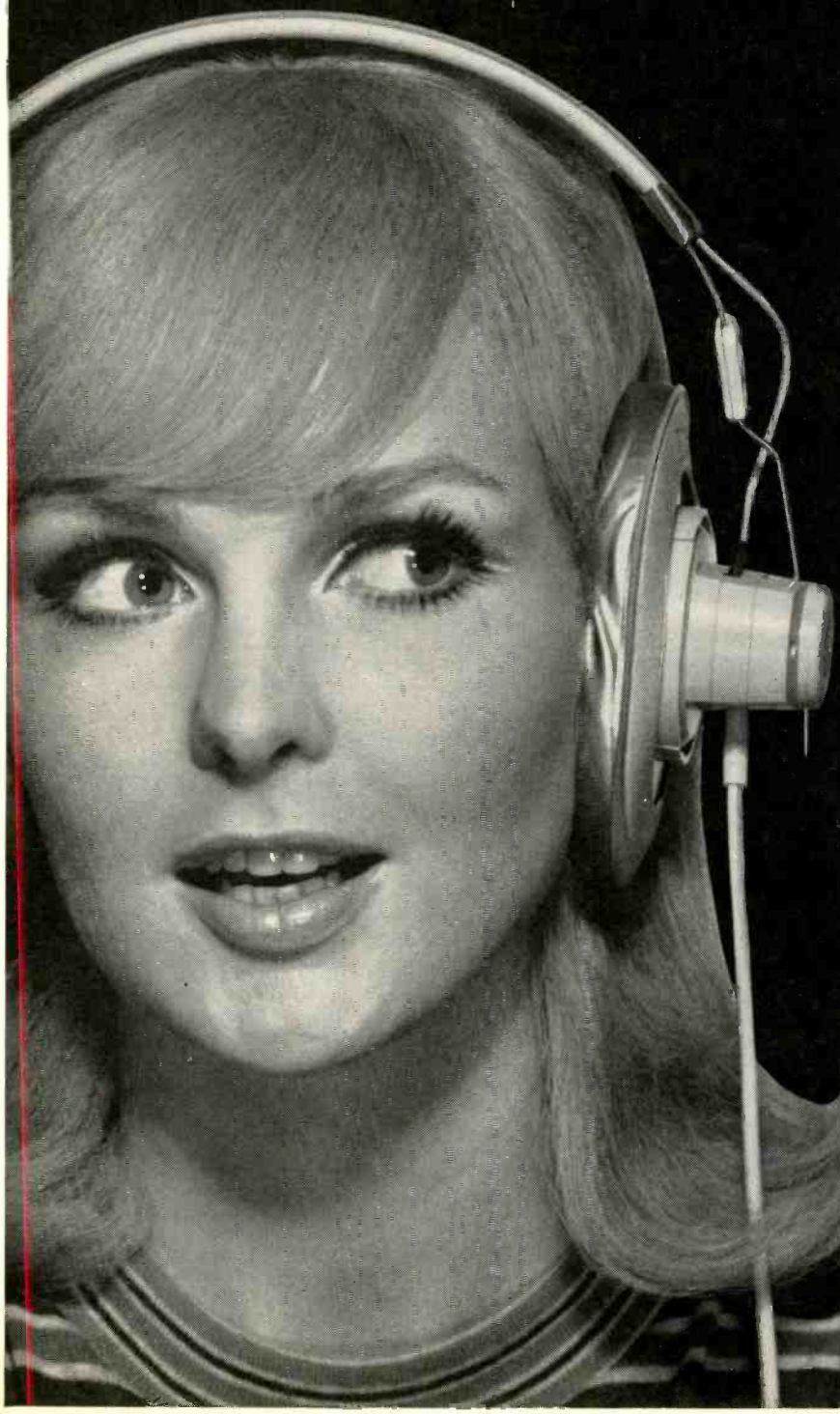
Pioneer SE-30

Superex ST-PRO

Telex Serenata II

MANUFACTURER (Circled numbers indicate adv..page)	Model	Type	Freq. Response, Hz	Impedance, Ohms	Sensitivity, mW	Max. Output, dBm	Max. Input, mW	Distortion, %	Plug Type	Cord Length, Ft.	Weight, Oz.	Price	SPECIAL FEATURES
DAVID CLARK	CL-1000	dyn	10-20K	50	1.0	110	2,000	< 0.5	Std 3-way	8	16	85.00	Wal. grain earpieces; gold plated hdw; sim. wal. carrying case.
	CL-100	dyn	10-20K	50	1.0	110	2,000	< 0.5	Std 3-way	8	16	39.50	CL-103, 300Ω, 39.50; CL-106, 600Ω, 44.50, CL-112, 1200Ω, 44.50
	CL-250	mag	20-17K	8	1.0	105	2,000		Std 3-way	6	17	32.00	R-L vol. cont.
	CL-300	mag	20-17K	8	1.0	105	2,000		Std 3-way	coiled	15	19.00	economy model
JENSEN	HS-2	dyn	20-17K	4	103			1.0	Std 3-way	8	16	24.95	
KOSS	PRO-4A	dyn	30-20K	50		120	1,000	< 1.0	Std 3-way	8	19	50.00	Fluid-filled cushions.
	KO-727	dyn	10-15K	4		143	10,000	< 1.0	Std 3-way	8 coiled	15	34.95	Fully adj; removable cushions.
	K-6	dyn	10-15K	4		143	10,000	< 1.0	Std 3-way	8	15	26.50	Foam-filled vinyl cushions.
	SP-3XC	dyn	10-15K	4		143	1,000	< 1.0	Std 3-way	8	15	24.95	
LAFAYETTE	F-880	dyn	25-15K	8			500		Std 3-way	5	12	17.95	Soft rubber foam cups; 2½" dyn. spkr for each ear.
PIONEER (13)	SE-30	dyn	20-20K	8			500	1.0	Std 3-way	8	14	29.95	Incls. storage case.
	SE-20	dyn	20-18K	8			500	1.0	Std 3-way	8	13	19.95	As above.
PML	D-42	dyn	30-20K	200÷200	0.3	100		2.0	unterm.	6	63	24.95	Ser. Z, 400 Ω; Par. Z, 100 Ω for mono use.
SENNHEISER Cover 3	HD-110	dyn	20-20K	*	$\frac{500\mu b}{\sqrt{VA}}$	120	160	1.0	Std 3-way or leads	6	10	64.00	*for hi-fi, 2x8Ω; also available 2x25Ω and 2x200Ω
SHARPE	HA-770 GP	dyn	15-35K	8 or 500	95 dB	110	1,000	< 0.8	Std 3-way	9 coiled	24	100.00	Calib. & matched drivers; individually fused; liquid-filled cushions, vol. conts.
	HA-660/PRO	dyn	15-35K	8 or 500	95 dB	110	1,000	< 0.8	Std 3-way	9 coiled	24	60.00	Individually fused; liquid-filled cushions.
	HA-10A	dyn	20-20K	8	115 dB	130	2,000	< 0.8	Std 3-way	6	23	32.95	
SONY (Superscope)	DR-3C	dyn		10,000	1				Std 3-way			27.50	
(6) (7) (83)	DR-3A	dyn		8	1				Std 3-way			22.50	
SUPEREX	ST-PRO-B	coax	18-22K	8-16			2,000	0.75	Std 3-way	7 coiled	14	50.00	Dyn woofer, cer. tweeter, crossover network. Available Hi Z; repl. vinyl foam cushions.
(87)	ST-M	coax	20-20K	8-16			2,000	1.0	Std 3-way	7	15	29.95	As above, plus tweeter controls.
	ST-S	dyn	20-16K	8-16			2,000	1.0	Std 3-way	7	12	24.95	Repl. vinyl cushions; avail. Hi Z; vol. conts.
	ST-C	dyn	25-15K	8-16			2,000	1.0	Std 3-way	7	10	19.95	Ear-formed vinyl cushions; dbl post & yoke headband; avail. 10,000Ω
TELEX	Serenata	dyn	20-20K	3-16	92 dB		2,000	0.5	Std 3-way	8	12	59.95	Tone cont; "comfort" cont; det. cord; liquid-filled cushions.
	ST-20	dyn	16-15K	3-16	95 dB		2,000	2.0	Std 3-way	8	12	34.95	Deep-cavity spkrs; vol. cont. each chan.
	Combo	dyn	10-15K	3-16	100 dB		10,000	1.0	Std 3-way	8	12	19.95	3½" spkr; vinyl cushions.
	Encore	dyn	20-18K	8	90 dB		1,000		Std 3-way	8	14	9.95	

AKG "HUMANIZED" HEADPHONES



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VIDEO TAPE RECORDERS

Panasonic
NV-8000

Ampex
VR-5000

Sony
DVK-2400

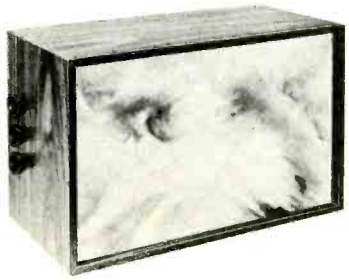
MANUFACTURER (Circled numbers indicate adv. page)	Model	Tape Width, In.	Tape Speed, IPS	Equiv. Tape Speed, IPS	Video Bandwidth, Hz	Lines Resolution, LPI	Audio Freq. Resp., Hz ±dB	Weight	Price	SPECIAL FEATURES
AMPEX	VR-5000	1	9.62	1000	30-2.5 M	250	90-9K 4	62	995.00	Lightest Ampex model; tapes interchangeable on any other 1" helical scan Ampex VTR.
	VR-7000	1	9.62	1000	30-3.5 M	350	50-12K 4	100	2500.00	Guar. tape interchangeability on other 1" hel scan Ampex VTRS. May be modified for color.
	VR-7500C	1	9.62	1000	30-4.2 M	350	50-12K 4	100	4850.00	NTSC color recdr; tape interchangeability; var. slow motion; rotary video head xformer; indefinite standby; cue track.
CONCORD	VTR-900	½	12	484	30-2.5 M	250	50-12K	52	995.00	Simple oper; p.b. controls; plays back thru std TV; portable.
	VTR-600	½	12	484	30-2.5 M	250	80-10K	52	1150.00	Built-in head cleaning; portable.
	VTR-620	½	12	484	30-2.5 M	250	50-12K	52	1050.00	p.b. elect. editing, audio dubbing; monitoring of audio & video; ferrite video heads; p.b. head cleaning.
	VTR-700	½	12	484	30-2.5 M	250	50-12K	60	1495.00	Rem. cont. oper; auto rem. activation; cont. rec. & p.b., auto rewind; auto shut off.
3-M	VTR-150	½	7½	180	50-2 M		50-10K	50	995.00	Simple function conts; spec. ferrite head, 1-yr warranty and promise of much longer life.
	VTR-150 ML	½	7½	180	50-2 M		50-10K	275	2495.00	Complete mobile sys. includes above recdr, camera, tripod, mon. receiver; switching control panel; mic; headphones, in convenient console.
PANASONIC (51)	NV-8000	½	12	484	to >2 M	>220	80-10K	54½	800.00	Audio dubbing; r.f. adaptable; video hd. auto clean.
	NV-8100	½	12	484	to >2 M	>220	80-10K	54½	950.00	as above.
	NV-8100D	½	12	484	to >2 M	>220	80-10K	54½	1050.00	as above, plus electronic editing.
	NV-204	½	12	484	10-3 M	350	50-12K	97	3750.00	Still/slow motion; r.f. adaptable, full remote control video head auto-clean.
SONY (31)	DVK-2400	½	7½	450	30-2 M	220	80-10K	10.8	1250.00	Batt. oper. Vidicorder/camera ensemble; zoom lens; reel size, 5 in. Incls. mic, batt. chgr.; camera has rem. cont. button, 1-in. monitor tube.
	TCV-2020	½	7½	450	30-2 M	220	80-10K	70	1150.00	Vidicorder, built in 8-in. monitor, timer, in walnut base TCV-2010, same, but in port case, without timer 995.00.
	TCV-2110	½	7½	450	30-2 M	220	80-10K	70	1050.00	Same as TCV-2010, with addition of automatic video & audio level cont. feature.
	CV-2100	½	7½	450	30-2 M	220	80-10K	49	795.00	Same as TCV-2110, except without monitor TV receiver.
	CV-2000D	½	7½	450	30-2 M	220	80-10K	42½	695.00	Same as TCV-2010, except without monitor TV receiver.

MISCELLANEOUS

Electronics

EICO

Cortina 3440 solid-state Color Organ. Using low-voltage, permanent-color lamps, the color organ works from any 3.2- to 50-ohm audio line, and is said to have no effect on the speaker circuit to which it is connected. The unit is furnished in a walnut-grain cabinet, with a shatterproof plastic front, and is provided with external color controls for precise selection of color balance. It is transformer operated, and is fused for safety.

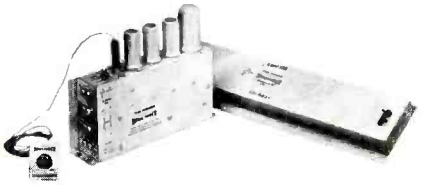


Since the user may select which color he wishes for each frequency band—0 to 250, 250 to 1500, and 1500 Hz up—any desired coloration may be obtained. Intensity of illumination is a function of the signal strength in each band, and

slight variations of signal level cause changes in the intensity of light. Available in kit form for 3-hour construction at $49.95, or factory wired at $79.95.

Fisher

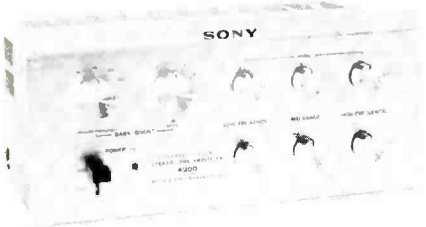
Model K-10 Dynamic Spacexpander is a reverberation device which may be used with records, radio, or tape, either mono or stereo, to create controlled



reverberation. Delay time is 33 milliseconds, and decay time is 2 seconds at 300 Hz. Front-panel control of the amount of reverberation is provided, and unit is self-powered. Price, $69.95.

Sony

TA-4300 3-Channel Electronic Crossover. This unit provides selection of both crossover frequencies, as well as the turnover frequencies of the woofers so as to permit compensation for the normal rolloff of the woofers in use. It also provides level controls in each



channel for woofer, midrange, and tweeter sections. In addition, it provides up to 8 dB of bass boost beginning at the selected woofer turnover frequency—70, 100, 150, 200, and 250 Hz.

Harmonic distortion is less than 0.1 per cent at the normal output of 2.1 V. in each of the three sections, rising to 0.5 per cent at an output of 3 V. Full control of the three-speaker system is thus available to the user without sacrifice of damping factor, and with consequent elimination of intermodulation because of the separation of the various bands of frequencies. Unit matches other Sony components, such as TA-1120A amplifier, ST-5000FW tuner, etc. Price, $199.50.

Tape Recording

Ampex

Ampex 404 series low-noise tape has a formulation consisting of small-particle oxide which, according to the manufacturer, meets or surpasses the most demanding low-noise specifications. This 404 Series is designed for mastering and duplicating. The 600 Series is designed for general-purpose professional recording, while the 681 Series is a lubricated tape for endless-loop cartridges.

All Series are available in the usual lengths and packaging for a wide variety of applications.

(Continued on page 76)

MISCELLANEOUS

(Continued from page 75)

Audio Devices

Cassette model AC-60 provides 60 min. of recording time at $2.65 list. These cassettes are packaged in sturdy mailable cartons.

BASF Computron

A complete line of BASF tensilized magnetic recording tape with polyvinyl chloride base and polyester base backing. Available in all popular reel sizes and tape thicknesses. Line includes C-60 cassettes with 60 min. recording time, $3.08; C-90 cassettes with 90 min. recording time, $5.08; and C-120 cassettes with 120 min. recording time, $6.25.

Individual plastic swivel boxes are included with all 4-in. through 7-in. reels at no additional charge.

Ercona PML

Three-channel mixer. Providing two low-level microphone inputs and one high-level input, this unit features six rim-operated controls covering on/off, bass cut, treble cut, and three gain controls (one for each channel). Price, $99.50.

EDITall

The EDITall KP-2 kit consists of the patented EDITall block, 30 EDITall splicing tapes, a demagnetized razor blade, grease pencil, instruction booklet, and tape guide. The EDITall block

is simply mounted on your tape recorder, or near it, using the adhesive back or with screws. Price, $3.50. EDITabs are available separately in packages of 50, $1.50.

Irish

Irish recording tape is available in all reel sizes from 3 in. to 10½ in., in ½-mil, 1-mil, and 1½-mil acetate or polyester bases. Color-coded leader and trailer, as well as metal reversing strips, are provided without extra cost.

Irish Video Recording tape ½-in. in width, is available in 600, 1200, 1800, and 2400-ft. reels for helical-scan video recorders. Prices range from $11.50 to $39.95 per reel — providing recording times from 15 minutes to 1 hour.

#4275 Tape-A-Letter is 1-mil tape packaged 275 ft. on a 3-in. reel, and is sold in a plastic self-mailer with two self-sticking labels. Each reel allows up to 1 hour of recording at 1⅞ ips. Price, $1.25 each.

3M Company

Recording Tape. A wide range of magnetic recording tapes is available in the "Scotch" brand, ranging from the old standard 111 acetate, which is a 1½-mil tape in the usual 1200 ft. on 7-in. reels to the low-noise "Dynarange" tape which is available as 201 on 1½-mil acetate, 202 on 1½-mil polyester, and 203 on 1-mil polyester, the latter appearing as 1800 ft. on 7-in. reels. Also available are the type 150 extra-length 1-mil polyester and the type 190 which is on a 1-mil acetate base. For battery-operated recorders, type 290, a ½-mil tensilized polyester provides 3600 ft. on a 7-in. reel or 1800 ft. on 5-in. reels, allowing "extra-length" recording on small machines.

Video tapes for helical VTRs are available in ½-in., 1-in. and 2-in. widths and all reel configurations.

Nortronics

Magnetic tape heads — Premium ¼-in. tape head replacements for over 1800 recorders, both foreign and domestic, in all track styles, are constructed with hyperbolic face for intimate tape-to-head-gap contact. These heads are made with laminated cores and deposited quartz gaps, and range in price from $18 to $105. Professional heads for ¼-in., ½-in., and 1-in. tape are available for Ampex, Crown, Magnecord, Presto, and Scully recorders, among others, and are priced from $18 to $350.

Reeves Soundcraft

Reeves Self-Threader Mylar® tabs are available color-coded red and blue to indicate side 1 or side 2, and aid in threading tape onto your reels. These tabs are packaged 30 to a sheet, with three sheets to a package, $1.00.

Tape Indx tabs are available in five colors to help identify selections on reels of tape. They are adhesive, and come with indexing labels for reel and box. Price, 30 tabs, with labels, $1.25.

Shure

Model M68 Microphone Mixer. Designed for the tape recordist who needs more flexibility than is usually available with the recorder alone, this unit accommodates four microphones of either low or high impedance, the selection being made by slide switches on the rear panel. In addition, it will accommodate a high-impedance auxiliary input. Separate level controls are provided for each input, and a master control which operates on the overall output, which may be at either low or high impedance at microphone level so as to feed the microphone input of the recorder, or at a high-impedance high-level output to feed the auxiliary input of the recorder or a power amplifier when used as a P.A. system mixer. Powered by a self-contained power supply operating from 117-V. a.c. lines, the unit provides a 28-V. d.c. output for other auxiliary equipment. Price, $125.00.

Superscope

Sony Video Recording Tape. Packaged in 15-minute, 30-minute, and 1-hour lengths, Sony ½-in. video tape is especially formulated for optimum results on helical-scan video recorders.

Sony Audio tapes are available in a number of lengths and reel sizes.

The Sony HE-2 head demagnetizer provides a quick means for keeping the noise level of recorded tapes to a minimum when it is due to magnetized heads. Narrow tips allow one to get

close to the head gaps. The HE-2 is a.c. line operated, and draws only 22 watts. Price, $12.95.

Switchcraft

Model 308TR Microphone Mixer. This unit is a.c. powered, and accepts from one to four mono input signals or up to two stereo inputs from any combination or type of program source, such as microphones, tape recorders, stereo or mono phono cartridges,

tuners, preamplifiers, and musical instruments. Any four inputs may be used simultaneously—all four for microphones if desired, or any combination of microphones and high-level sources. Similarly, two magnetic phono

(Continued on page 78)

MISCELLANEOUS

(Continued from page 77)

inputs are provided, and these may be used with two mikes or with two high-level inputs, or with one of each. Output is 4 V. rms maximum into a 600-ohm line input, and frequency response is within ±0.5 dB from 20 to 20 kHz at a maximum distortion of 1 per cent. Typical distortion is 0.5 per cent. S/N is 60 dB referred to 1 mV input. Price, $150.00 list.

Model 307TR is similar, but is battery operated, and provides a maximum output of 2 V. rms. Price, $145.00 list.

Cabinetry

Audio Originals

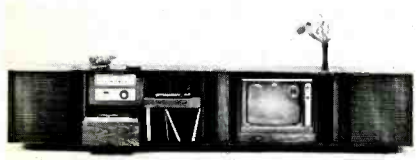
Audio Cabinetry. Many designs are planned to accommodate existing speaker systems, yet still give the im-

pression of a single-piece cabinet. Other models are designed solely to accommodate equipment, permitting use of existing speaker systems in their present locations. Still other models offer a form of shelving which combines accessibility with attractive design. Some models are shipped fully assembled, while others are shipped in knocked-down form to be assembled in minutes.

Barzilay

A wide variety of audio furniture is available in traditional and contemporary styles. Prices for consoles range from $219.50 for one model in kit form to a completely finished model at $575.00.

The Multispan system consists of a series of compatible units which can be assembled in a variety of forms to provide a "music wall" to accommodate



equipment of all types, as well as a bar, book shelves, magazine racks. Cabinets may be mounted on the wall, or on wood columns, as desired.

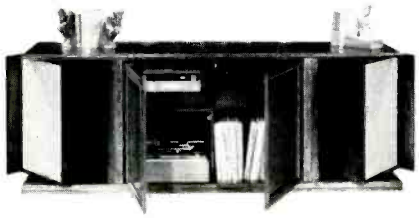
Kersting

Quick-See Record and Tape Files. These retractable files are available in seven models to fit any cabinet, enclosure, or shelf, and are priced from

$7.95 to $16.95. They feature front-drop gate for flip-through filing of record albums in a manner which offers immediate access to your preferred selection.

Toujay Designs

Sound-X-Pander Consoles permit "aiming" the sound direction, converging the direction, expanding the direction, and isolating the sound to eliminate any possibility of acoustic feedback. These consoles will accommodate comfortably all bookshelf speakers, such as AR, EMI, JBL. The unique design has solved the problem of opening and closing end speaker doors by



eliminating them. The model, measuring 85 x 30 x 21 in., is priced at $799.00 in oak.

A wide line of other high-quality cabinets to house stereo equipment, accessories, records and tapes is also available, including kits.

General

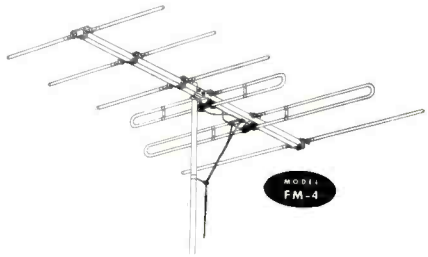
Elpa Marketing

The Parastat was introduced in its manual form as a substitute for the professional model which must be operated by experts. The Parastat re-

moves dust, grit, and residue from deep within the record groove. Price, $15.00. The Preener embodies similar principles, and is a simpler form for general use. The Preener has a specially formulated plush pile which penetrates every groove, and it may be kept in top condition by use of the "humid mop." This conditions the surface of the Preener and keeps it in condition for thorough cleaning of records. Price, $3.50.

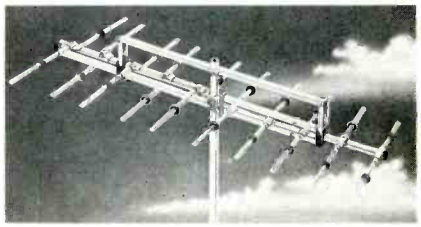
Finney

FM Antennas—Finney offers a line of broadband FM antennas, preassembled, and with snap-out self-aligning elements. Models include a six-element antenna, $24.90; 10-element, $36.35; 12-element, $44.95. An FM signal amplifier, model 65-7, provides 20 dB amplification. The high-gain low-noise transistor amplifier features outputs for one or two sets, $24.95.



JFD

FM/Stereo Log Periodic Antennas. Top suspension boom support of the far fringe model LPL-FM10A rigidizes antenna against sway or droop. Keeps



antenna pointed permanently in desired direction. 300-ohm impedance match results from log-periodic design on driven elements plus integrated twin-boom transformer.

Superscope

The Sony RK-66 Magnetic Phono Adapter is a passive device which provides RIAA equalization from a phono cartridge to feed into the microphone jack of a recorder to permit dubbing of phonograph records onto a standard tape recorder. It is designed to feed into a low-impedance mic input. Price, $2.95.

University Sound

Microphone Floor Stands. Two easy-adjust floor stands are capable of being adjusted with one hand and do not show finger marks, nor do they glare. FS-7 features a 7-lb. cast base, fluted stem, and a friction clutch. Available in aluminum, $10.77; and in either blue

or gold color at $11.37. FS-10 is similar except has a 10-lb. cast base, and is priced at $11.97 in aluminum, $12.57 in blue or gold colors.

AUDIO MUSIC REVIEW

Classical Record Reviews

EDWARD TATNALL CANBY

Organ Music

Franck: Grande Pièce Symphonique; Fantaisie in A; Pastorale. Marcel Dupré Organ of Saint-Sulpice, Paris

World Series PHC 9077 stereo $2.50

If you're going to record a Romantic organ, one of the big old-fashioned lion's roar sort, you might as well pick the best—for they are very good. The great French organs of the middle-19th century, especially Cavaillé-Coll. This is one of the finest. And if it is to be such an organ, pick the best music for it. César Franck. And as organist, one of the masters of the French tradition, now 82 years old, who goes straight back to Franck's time—Marcel Dupré. Unbeatable combination!

The organ is very difficult to record, of course, for it is not only huge but operates in a vast and reverberant church located in a large city. There is a steady, ambient noise level, the adding-up of countless small sounds in the stone space, that sounds like strong tape hiss. On the spot, the binaural ears tend to tune it out. On records it is always audible. And at edit points it tends to change in level suddenly, if mostly without too much intrusion.

The music is equally difficult, for it is enormous in dynamic range and depends greatly on what passes for silence —long passages at low level, numerous dramatic pauses. And the pace, in the late-Romantic fashion of Franck's day, is snail-slow.

Given such hurdles to get over, the engineers here did a very passable job and the organ sounds out in its true magnificence. So does the music of César Franck, as convincingly played by Dupré. But don't use this disc as hi-fi background. It needs serious listening and plenty of time.

Performance: A *Sound:* B—

The King of Instruments. Maurice and Marie-Madeleine Duruflé. Organ of Christ Church Cathedral, St. Louis. **Aeolian-Skinner AS 322 stereo** (Boston, Mass. 02127)

This is a pro record, an organ disc for organists, part of a long series put out by Aeolian-Skinner, the organs being the product of that firm. The French performers on the large St. Louis organ, M. et Mme Duruflé, have been touring the U.S. organ circuit recently.

Today's big organs are made to be suavely neutral in style—they have built-in facilities for all kinds of organ music, new or old. Though the idea, in a poly-instrument such as the organ, seems plausible enough, plenty of people think not. Not without unacceptable compromise, that is. But much depends on the organist's choice of registration and, of course, on the music.

Here we have mostly the kind of music that is the main fare for professional organists today, a late evolvement out of the late French Romantic style and almost totally unconnected with the outside modern world of music. It is full of icky harmonies, it tends to swell and die and take its own very long time, ad infinitum; it is also apt to be learned, in a heavyweight way, and very virtuoso for the player. For non-organist ears this all too often adds up to tedium. Tedium that seems to persist down through generation after generation—for Duruflé himself, whose works take up a large part of this disc, is only comfortably middle aged. I found the Prelude, Adagio and Chorale with Variations almost a caricature of past Romantic organ music, though in deadly earnest, and so too with the somewhat shorter Prelude in E Flat Minor. Vast expanses of moody noise, long passages of near-silence, a generally dour and uncompromising conservatism. Good music of its sort, I presume. But not for my ears. Nor the even more "advanced" semi-audible moodiness of an early (1934) work by Messiaen.

Two sprightly incongruities out of the 18th century by Clérambault, played by Marie-M., merely tend to prove the one-organ-for-all-music theory either way, depending on your viewpoint. I found one of them elephantine and the other overly cute.

There remain two minor but quite attractive items by Tournemire, with an interesting history. They are literal improvisations, directly recorded by Polydor in 1930; M. Duruflé, his pupil, has taken them down from the recording, by ear, and plays them from his own notations. They, at least, have a sprightly humor, if nothing else on this disc really does. Superb recording—as always with A-S, and no audible ambient noise background. Just silence. Too much of it.

Performance: B *Sound:* B—

Choral

Vivaldi: Juditha Triumphans. Soloists, Cho. Philh. Academy of Rome, Orch. Angelicum Mailand, Zedda. RCA Victrola VICS 6016 (2) stereo

Magnificent! In stereo sound, in the assembled soloists and instrumentalists (even if we have never heard of most) and in the music. Above all—this is one of those tremendous rediscovered works of Vivaldi that was totally unknown until just a few minutes ago, speaking in the long historical perspective.

RCA, canny as always, has quietly become in its Victrola department the extreme opposite of itself in the senior Victor label: a first-rate importer of unusual and well performed early-music recordings, mainly of the Baroque. It is done in modern stereo, featuring primarily the *music*, with scads of "unknown" performers. RCA always learns fast, if RCA's is seldom the first toe in the water.

This big oratorio is, like some of the recent Handel offerings, in effect a sacred opera, Baroque style, made up entirely of formal recitatives followed by arias, with a chorus or two thrown in to round out the large sections. Rigid format, yes—but what superb music! This is no skillful potboiler music, like so much Vivaldi; this is his very best. The story of Judith, who goes out to

the enemy camp and gives herself to the chief Holofernes, then cuts off his head, is treated with static grandeur. The music is curiously intense in view of the extreme lack of "action," even at the point of the blood-letting. It all builds up, in one splendid aria after another, each with its special instrumental color (even a mandolin!) and mood. As in Bach, the terraces of intensity are made cumulative by a sort of indirect means, the sheer impact of muscular, well made musical expression.

The characters are all sung by women, even the chorus of soldiers; but this bothers not in the least after five minutes of music. RCA doesn't say so but the work must have been for Vivaldi's usual performers, the young ladies of the *Pietà* orphanage and music conservatory in Venice where he was music director. The *very* buxom female voices in this recording are perhaps a bit out of character in this respect — Vivaldi's girls were decidedly youthful. But they sing so gloriously here that, again, it does not matter. Superb any way you listen, and our congrats to someone in RCA who has a keen ear for the good things in life. Snap up some more, please!

Performance: A— *Sound:* B+

Carissimi: Jephte; Judicium Extremum. Soloists, Amor Artis Chorale and Orch., Somary. **Decca DL 79430 stereo**

In the early-middle seventeenth century, long before Handel, the oratorio was Carissimi's Italian baby, so to speak. It was he who popularized this sacred semi-opera which told a biblical story with chorus, solo characters and, very often a "narrator" (at this early stage called *historicus* [a sort of historian or teller-of-the-story], the part divided up between several singers).

The two mature works on this record (out of sixteen) take you back to the time of Monteverdi, Schütz, Schein, the earliest Baroque. This New York performance is typical—full of energy and pep, never soggy, but tending towards a hard surface. Johannes Somary, Amor Artis founder, is a vigorous but not exactly subtle leader, stressing discipline rather than profundity. His many vocal soloists, no less than eight, vary wildly from sublime to decidedly unsublime, from semi-amateur (one lovely girl's voice) to wobbly pro. The chorus is extremely alert, the girls well blended, the men sounding like the familiar New York professional "pool" (maybe a few ringers were brought in), full of big opera vibrato, loud and competitive in tone, though always accurate.

The music moves, definitely. Its dramatic impact is definitely realized. But the level of that realization could be higher. Carissimi has still more to offer, though this is perhaps the best treatment he's had to date.

Performance: B— *Sound:* B

The Glory of Gabrieli (Music for multiple choirs, brass, and organ). Gregg Smith Singers, Texas Boys' Choir, E. Power Biggs, organ, Edward Tarr Brass Ensemble, Negri.

Columbia MS 7071 stereo

This is the first record from a heroic year-long project to record the music of Gabrieli in the great church where it was first heard (back at the turn of the seventeenth century, St. Mark's in Venice).

(But *which* Gabrieli? The record doesn't say! Andrea? Giovanni? Well, *some* of it is the younger man, Giovanni, anyhow; I know the music. Presumably, all of it.)

Indeed, the project was so heroic that most of the backliner notes are given over to a humorous account of the nearly insuperable mountains of bureaucracy that had to be overcome before the music could get underway. Teen-age choir girls swathed in white robes and veils, an Austrian organ virtually smuggled past customs, etc., etc. (the story has been wonderfully amplified in a recent article). But, alas, not a word about the music itself. Nor any texts. In this huge space, everybody mumbles, and the American feeling is that words don't matter much anyhow (a feeling I do *not* share). It would have been good to know more about the individual works and the "message" each celebrates, no matter how secular it may be in spirit beneath the religious surface.

The sounds are inspiring all right. It is vivid, energetic, in contrast to the dull exactitude of a German approach to such music, or the wildly inappropriate romanticizings of French and Italian approaches. But what *Columbia* only half realizes is that these performers, imported all the way to St. Mark's, bring with them a very American sound (which is not necessarily more nor less Gabrieli than others).

American vigor and enthusiasm—good. American purity of boychoir and girlchoir tone—also good. A peppy brass sound that also smacks of the U. S., though it comes via Austria, and a very Biggsy organ sound, similarly from Austria in the mechanical sense. (The irrepressible E. Power Biggs was the primary instigator of this affair.

Finally, a curious Americanism, two countertenors, one a soprano and the other an alto, who hoot and whinney their way solo through a number of Gabrieli works in a vocal style that has become inescapably American, in the *very* few years since the counter tenor voice became respectable in such outposts as Texas. Weird; but they are good — don't get me wrong. Maybe Gabrieli's men sounded the same way —who knows?

My one serious reservation in all this glorious sound is also characteristically American: a disregard for phrasing and accentuation that I find distressing, for it leads to a typical march-like beat and syncopation that is not good for such music. *ChrisTAY EleiSON,* sing the singers, and play the brass, swinging and swaying to the beat. Wrong! Not only unsubtle, accentuating the wrong syllah-bles, but wrongly shaping the melodic lines, too—accenting the high notes, à la Verdi, blurring the strong independence of cross rhythms that is so beautiful in music of this very early Baroque era, still half Renaissance.

So I hear it, but don't be overly worried. A technical fault and the over-all musical effect is still immense. So is the St. Mark's stereo.

Performance: B *Sound:* A—

Plainsong to Polyphony—an anthology of choral music. Choir of the Carmelite Priory, McCarthy

Everest 3174/3 (3) stereo

Another of Everest's monumental mystery snappings-up, this one out of EMI's august British vaults. In characteristic fashion, Everest offsets the original booklet of texts and commentary without bothering to change the side and band indications and the original "volume" designations — result is utter confusion, since, as anybody might guess, Everest's and EMI's layouts do not coincide at numerous points as to record sides, band numbers and even the order and content!

Ah well. Can't have everything. The choral music is very nicely sung by a large British choir in a somewhat old fashioned style (but how old fashioned is the actual recording itself?) with excellent pitch, blend, and expression, all

unaccompanied. The sound is plenty adequate if probably elderly; at a guess it is good middle-period 78 electrical. No highs, but no grating harshness either. Stereo? The usual synthetic, after the fact. Well after the fact, no doubt.

Too many works to list in detail; there's music by the stalwarts of the Golden Age, Palestrina, Lassus, Victoria, Morales, Byrd, Tallis, Josquin and a few others less well known.

Performance: B+ *Sound:* C+

CAPSULE COMMENTS

Arthur Friedheim Plays Liszt (Duo-Art piano roll). Everest X-925 stereo.
Myra Hess Concert. (Duo-Art piano roll). Everest X-917 stereo.

Everest's new Duo-Art piano roll performances seem a lot better technically than the first series—more convincing, fewer obvious mechanical faults. Friedheim's Liszt, direct from the master, comes through well, in olden style. Myra Hess plays her favorites, including Bach, Scarlatti, etc., in transcription for piano.

Sylvia Marlowe, harpsichord: Henry Purcell Suites and Misc. Pieces. Decca DL 710149 stereo.

A first rate harpsichord disc by a lady who has worked long and hard to achieve the smooth polish of execution in these Purcell works, many of them transcriptions from Purcell's theater incidental music.

Light Listening

STUART TRIFF

John Gary on Broadway—John Gary, vocal.; arr. & cond. by Dick Grove, Henri René and others.
RCA Victor LSP-3928 ($4.79)

This is the first John Gary album devoted exclusively to show tunes. It is done so well that the singer almost almost pulls off the impossible feat of convincing us that his material is as good as his performances of it. Familiar songs are ignored, while he explores lesser-known songs from eleven shows of the 1960's. Unfortunately, most of the stepchildren he gives shelter do little to earn their keep; for weak offspring from anemic shows do not an exciting program make.

When singer and song *do* meet on equal ground, the results are most rewarding. John Gary has an easy, relaxed way with a song and he never pushes his warmly-produced high baritone beyond its natural limits. The best tracks are, expectedly, the best songs, and include "Small World" from "Gypsy," a latin-tinged arrangement of "She Wasn't You" from "On a Clear Day," and a bright, up-tempo rendition of "A Certain Girl" from "The Happy Time."

The arrangements are excellent throughout and RCA provides very good sound.

Performance: B+ *Sound:* B+

Spanish Masters—The Swingle Singers
Philips PHS 200-261 ($4.79)

This is the seventh album by The Swingle Singers, featuring their unique, wordless vocal renderings of the classics, in the contemporary jazz idiom. The present collection is devoted to Spanish composers of the 19th and 20th centuries, whereas heretofore the group had confined its repertoire principally to the music of Bach, Vivaldi, Telemann and Mozart. This fine octette and their leader-arranger, Ward Swingle, deserve the highest praise. Though each singer is a worthy soloist in his or her own right, it is their closely-knit ensemble work for which they've become justly famous.

In a program that maintains a consistently high level of musicianship throughout, the performance of the slow movement from Rodrigo's "Concierto de Aranjuez" for guitar is particularly outstanding. Ward Swingle performs as a soloist for the first time on this disc in "Rondalla Aragonesa," from Granados' set of Spanish Dances, and is joined by Christine LeGrand's limpid soprano in the traditional "Spanish Romance" — the haunting theme used so effectively in the movie, "Forbidden Games."

Compositions by Isaac Albéniz dominate the collection (surprisingly, Falla is not represented at all), with the "Granada" and "Sevilla" sections of his "Suite Española" and two tangos, the familiar one in D and the lesser-known in A minor. Included as a reminder of their forte in baroque music, there's a condensation of the D Major Sonata by Padre Antonio Soler, a contemporary of Bach.

In all of the selections, the group is supported by complimentary and unobtrusive rhythm accompaniments. The contrapuntal writing in the arrangements and constant interplay of voices make The Swingle Singers a natural for stereo and Philips' engineers have accordingly, produced a record notable for sharply-defined channel separation.

Performance: A *Sound:* A

Recorded Tapes

BERT WHYTE

Open-Reel Classical

Khachaturian: Violin Concerto in D Minor. David Oistrakh, violin.

Sibelius: Violin Concerto in D Minor, Humoresques, Op. 87b. D. Oistrakh, vio. Aram Khachaturian & Gennady Rozhdestvensky cond. the Moscow Radio Symphony Orchestra. Angel Y2S3715, **open-reel 4 tr.,** 3¾ ips ($8.95)

David Oistrakh has had an enduring association with the Khachaturian violin concerto. His early monophonic recording on Mercury popularized the work in this country. In the ensuing years he has lost none of his interpretive powers and is one of the few who perform this work in a totally convincing manner.

There has been a tendency among music critics to dismiss this concerto as a tawdry vehicle of little substance. It is a "showy" piece and its melodies may cloy some palates, but this hasn't lessened its popularity with the concert-going public. Oistrakh treats us to a dazzling display of violinistic gymnastics, but does not forget the lyric aspects of the score. His tone is as lovely as ever, although it seems somewhat heavier than in his playing of a few years ago. Khachaturian's conducting seems more deliberate and his overall approach slower-paced and quite different from that of other conductors. Nonetheless, his performance is interesting and effective. Contrary to what you might expect, most composers are not the best interpreters of their own works. Stravinsky is a somewhat controversial exception to this and the same may be said for Aaron Copland and Carlos Chavez.

In the Sibelius concerto, Oistrakh gives us a very assertive and aggressive performance, darker in tone than most other violinists. His emphasis is on the more dramatic aspects of the work, somewhat at the expense of the lyric elements. Rozhdestvensky's accompaniment is quite serviceable, and he elicits good but not exceptional playing from the Moscow Radio orchestra. The woodwinds and strings are a bit ragged at times.

In matters of sound, we have the combination of great broad acoustics and a mike placement that blunts orchestral definition and gives too much projection and prominence to Oistrakh's violin. So much so that at times the violin covers the orchestra. The violin does have plenty of presence and is quite clean-sounding. The stereo is generally good, although the directional qualities may be somewhat less than usual. Oistrakh evidently sways a lot when he plays, thus you will notice the sound of his violin occasionally shifts back and forth between center and left. Dynamic range was moderately wide and hiss fairly low in level for a 3¾-ips tape. Little crosstalk was noted, nor was there much print-through. I find the hall acoustics quite interesting. If someone were to apply the proper techniques of orchestra placement and mike pick-up they could make some excellent-sounding recordings.

Open-Reel Pop

Music from Thoroughly Modern Millie: Let the Good Times In. Performed by The Ragtimers. **RCA Camden TC3-5008,** 4 tr.-3¾ ips, open reel ($6.95)

One of the big advantages of 3¾ ips tape is the large amount of music that can be obtained on one reel. This can have its drawbacks, too . . . as witness this recording. Like two full albums of ricky-ticky "23 skidoo" music can be a bit hard on the ear, unless you dig this sort of thing. Even benumbed from bathtub gin, I don't think I could survive the auditory assault of 23 consecutive examples of this breed of music. I got through "Thoroughly Modern Millie," "Poor Butterfly," "Jimmy" and "Rose of Washington Square," and I threw in the towel and just spot-checked the rest. But you know what? The stuff is beautifully recorded. Lots of punch and presence, a typical high-quality studio job.

Brass has plenty of bite, percussion and other elements clean and crisp. Directional effects not overdone, nor is reverb excessive. Like most pop recordings, dynamics are limited and the recorded level was fairly high. Thus tape hiss was quite low. There was very little crosstalk and some occasional print-through. For the record (no pun intended), like the music or not, it is well-played and in addition to the music from "Millie," the other album contains such diverse numbers as "Bye Bye Blackbird," "When the Red Red Robin, etc.," "In Old New York" and others. For those seeking music for an "Old Timers Night" or a Charleston party, this tape is a "darb." (ouch!).

Jazz, etc.

BERTRAM STANLEIGH

Bill Evans: Live at the Village Vanguard.
Riverside Stereo RS 3006

Performance: A *Sound:* A

Bill Evans: Polka Dots and Moonbeams.
Riverside Stereo RS 3001

Performance: A *Sound:* A

In resurrecting these two fine Evans sets, ABC salvages some of the most valuable of Riverside's treasures. Neither disc is very old, but their unavailability for even a short span of time has been a matter of concern to Evans fanciers.

Barney Kessel's Swingin' Party
Contemporary CYX 7613
(4-track stereo tape)

This 3¾-ips tape compares very well with the disc version issued in 1963; it's just a shade less brilliant when the cymbals are struck by brushes. Kessel was in top form, in a specially created warm ambiance when this set was recorded. The results richly deserve this new tape presentation.

Performance: A *Sound:* B+

Jim Kweskin: Jump for Joy
Vanguard VGX 9243 (4-track stereo tape)

A collection of oldies sung in proper Twenties fashion by the leader of that well-remembered jug band. Here he's accompanied by the Neo-Passe Jazz Band, a delicious group whose tongue-in-cheek arrangements include such delights as a pizzicato violin and banjo duet.

Performance: A *Sound:* A

THE SKYE'S THE LIMIT

Cal Tjader: Solar Heat
Skye Stereo SK-1

This is the first release of an enterprising new label produced by Cal Tjader, Gabor Szabo and Gary McFarland.

In the liner notes, Tjader is quoted as saying, "I've never said it before, but I really feel this is the best album I've ever done." It's a strong statement for an artist who has to his credit several dozen fine sets, made with top-flight musicians and recorded by labels who devote serious attention to quality engineering. Strong though the statement is, it is matched by results that absolutely bowl one over. The arrangements are by McFarland, and Tjader is backed by Joao Donato, organ, Bobby Rodriguez or Chuck Rainey, bass, Ray Baretto and Orestes Villato, Latin percussion, Mike Abene, electric piano and harpsichord, and Grady Tate, drums. In addition, McFarland sat in on a couple of numbers where Tjader thought a second set of vibes would be exciting. The results are free, relaxed, and up spirited. But this a far cry from the kind of shirt sleeves performance where happy, under-rehearsed musicians drop clinkers right and left and have a tendency to step on each others toes at entrances. Everyone here plays scrupulously, seriously, but without any heaviness or hesitation. It is the sort of exalted collaboration that occurs seldom and gets onto discs with even less frequency. Here, it is matched by meticulous engineering that very realistically reproduces a room-sized group in one's own living room.

Performance: A *Sound:* A

Gabor Szabo: Bacchanal
Skye Stereo SK-3

That Gabor Szabo is a subtle and refined guitarist capable of a broad range of rhythmic, dynamic, and textural effects is brought out clearly on his first appearance on the Skye label. This is not only a superior example of the talent and musicianship of Szabo, it is also a recording of exceptional technical quality. It has a super-silent background from which myriad subtle gradations of timbre and dynamics emerge with remarkable clarity. And, above all, it has a consistently high level of performance that makes the disc a pleasure from beginning to end. Working with his regular group: Jim Stewart, guitar, Hal Gordon, percussion, Jimmy Keltner, drums, and Louis Kabok, bass, Gabor offers a balanced recital that includes his own *Bacchanal* and *Divided City, Love Is Blue,* Donovan's *Three King Fishers* and *Sunshine Superman,* the theme from *Valley of the Dolls, Some Velvet Morning,* and *The Look of Love.*

Performance: A *Sound:* A

ABZs of FM

LEONARD FELDMAN

Local Oscillators & Mixers

FM superheterodyne receivers, like their AM counterparts, require conversion of the incoming signal to a lower intermediate frequency (i.f.). The i.f. almost universally used is 10.7 MHz. The signal received at the antenna terminals of the receiver is either amplified by means of a radio-frequency (r.f.) stage, as discussed in previous articles, or is fed directly to a mixer or converter stage (a practice employed only in very inexpensive sets).

The terms "mixer" and "converter" are not synonymous, even though they are often used interchangeably. A converter will involve the use of a tube or transistor which produces an oscillator voltage *and* mixes this voltage with the incoming r.f. signal. A mixer, on the other hand, fulfills only one of the above functions—the beating together of the incoming signal with a separately produced oscillator voltage. At the relatively low AM band frequencies it has become almost standard practice to use a converter stage. At signal frequencies of the FM band, however, operation of the local oscillator stage becomes more critical. Stability of output voltage is more difficult to achieve and interaction between oscillator and incoming signal voltage is more likely to occur with converters. While this does not rule out the use of "converters" in FM receivers (see Fig. 1), all but the most inexpensive units will separate the mixer and oscillator functions by using individual devices (tubes or transistors) for each.

Tubes vs Transistors

In examining the various circuits which comprise an FM tuner or receiver, it is our practice to examine performance of these circuits in terms of relative advantages and disadvantages as the state of the art advanced from tubes to solid-state circuitry. Accordingly, we shall first examine a high-quality tube-type oscillator circuit, followed by a modern transistorized local oscillator.

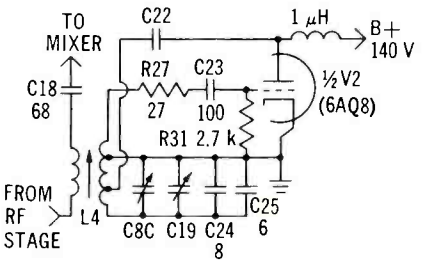
The first of these circuits is shown in Fig. 2. It is the local oscillator circuit of a Fisher Radio Model 500-C. Oscillation is achieved by the feedback circuit involving C22 (plate to grid circuit); resonant frequency is determined by the tank circuit consisting of L4, C8c, C19, C24 and C25. The variable capacitor section (C8c), along with its r.f. sections, is used to vary the oscillator frequency so that it is always 10.7 MHz removed from the received incoming signal. Trimmer capacitor C19 permits optimization of frequency tracking across the FM band.

Frequency Stability

Frequency conversion and the whole superheterodyne concept depends upon beating an incoming frequency against an accurately maintained local oscillator frequency to produce an accurate i.f. frequency. Transmitter channel accuracy is maintained and safeguarded by many electronic techniques (not to mention the surveillance of the FCC). At the receiving end, therefore, the accuracy of the i.f. frequency will depend primarily upon the frequency stability of the local oscillator. A drift of only 1% at 100 MHz represents a shift of 100 kHz, enough to shift the converted signal partially or completely outside the range of the tuned i.f. stages which follow.

Heat that is generated in a tube-type receiver (from tubes, transformers and even resistors) is largely responsible for oscillator drift, and 1% or even 2% is the magnitude of drift you might typically expect if certain design precautions were not taken. Increased temperature causes an increase in *both* coil inductance and capacitor capacitance. It is for this reason that drift in an FM tuner will always be *downward* in frequency, since resonant frequency varies inversely with the square root of both inductance and capacitance.

Fig. 2–Local oscillator circuit (Fisher 500-C tube-type receiver).



Proper precautions, such as careful layout of components which permits air to circulate and positions heat-producing elements far away from critical inductances and capacitances, will partly reduce drift in the local oscillator. Additional, final compensation is usually achieved by the use of small, fixed capacitors having a *negative* temperature coefficient. This means that these capacitors actually exhibit a *decrease* in capacitance with increase in surrounding temperature.

As an example (referring again to Fig. 2), C22 and C23 are shown as having an N1500 temperature coefficient, while C24 is listed at N330, and C25 is an "NPO" type. N1500 means that the particular capacitor will decrease by 1500 parts per *million* for every degree centigrade *increase* in ambient temperature. Similarly, N330 means a decrease in 330 parts per million (of capacitance) for each degree centigrade increase in temperature. "NPO" means negative-positive-zero — or, a temperature-stable capacitor that neither increases or decreases in capacitance with temperature changes. Less expensive sets would have attempted

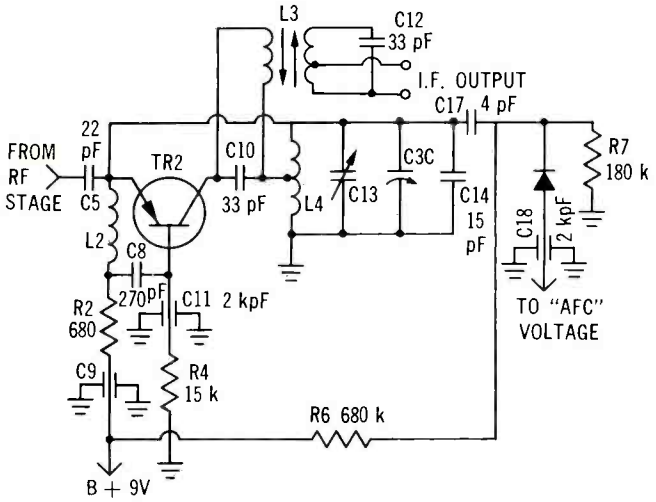


Fig. 1–Example of low-cost FM r.f. front-end "converter."

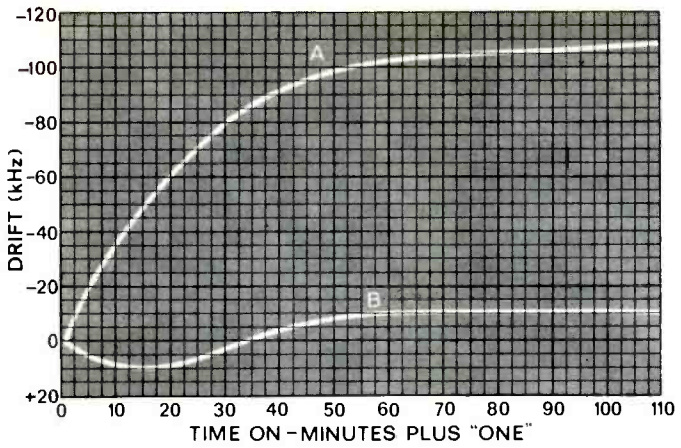


Fig. 3—Uncompensated (A) and heat-compensated drift of FM local oscillators.

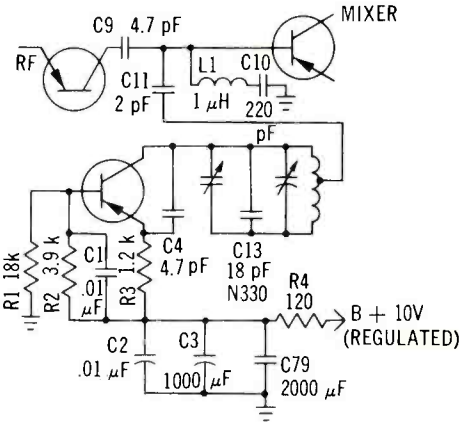


Fig. 4—Local oscillator used in the Harman-Kardon SR-900 FM section.

to stabilize frequency with only *one* temperature-compensating capacitor in the resonant circuit. By using both an N330 and an NPO type for C24 and C25, the circuit achieves precisely the compensation desired during the short-term and long-term drift time period.

Figure 3 illustrates typical drift conditions for compensated and uncompensated oscillator designs. Other measures taken to provide frequency stability include regulation of power supply voltage (oscillator frequency will vary with change of supply voltage) and designing resonant circuits in such a way that internal tube capacitances are a negligible percentage of the total capacitance present across the tuning circuit. This last requirement is necessary because, during tube warm-up, the internal capacitance of a tube changes. Oscillator voltage coupling to the mixer tube (the other half of the 6AQ8 tube) is accomplished inductively, by means of a secondary winding on coil L4. In many other designs (both transistorized and tube), coupling is achieved by means of a very small capacitor (often just a few pF in value).

Solid-State Oscillators

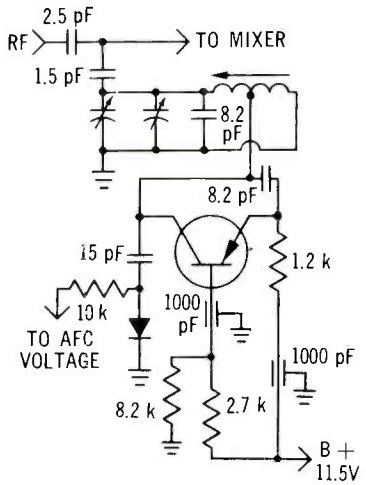
Not very long ago, the designers of FM receivers were not so much concerned with *which* transistor to use as a local oscillator in FM sets, but rather with the problem of getting *any* transistors which would oscillate at frequencies in the vicinity of 100 MHz. Today, of course, many types are available for the purpose, each with minimal input and output capacitances and with sufficiently high cut-off frequency to permit oscillation at the required frequencies. Furthermore, the battle against drift is much simplified because the amount of heat produced by all-transistor FM tuners is so very much less than that associated with tube sets.

Lest you get the notion that *all* precautions can be abandoned, however, consider the design shown in Fig. 4, the oscillator used in the Harman-Kardon SR900 solid-state receiver. In this "grounded base" circuit, the feedback which sustains oscillation is accomplished from collector to emitter by means of C4, while coupling to the mixer stage is through a 2-pF capacitor, C11. Note, however, that at least one temperature-compensating capacitor, C13, is still used since there is still some increase in chassis temperature with warm-up of output transistor heat-sinks and other components in the chassis.

Though it is not shown in the diagram of Fig. 4, examination of the power supply section of this receiver discloses that the 10-volt (positive) supply required by the oscillator stage is Zener-diode regulated to prevent variations in line voltage from affecting oscillator frequency.

In AM receivers intended for the broadcast band and utilizing an i.f. frequency of 455 kHz, positioning of the oscillator frequency *above* the incoming signal was dictated from practical design considerations. Since the broadcast band extends from 535-1605 kHz, placing the local oscillator frequency *below* the incoming signal would mean having an oscillator frequency range from 80 kHz to 1150 kHz. This represents a tuning ratio of nearly 15.1 and, therefore, a variable capacitance end-to-end capacitance ratio of nearly 225.1. This is hardly practical, physically.

Fig. 5—Local oscillator section of EICO 3200 tuner shows application of afc voltage by means of voltage-tuned diode FECR2.



In the case of FM, however, the case is not so one sided. With the FM frequency band extending from 88 to 108 MHz and the i.f. frequency desired set to 10.7 MHz, oscillator frequency range could have been set either from 77.3 to 97.3 MHz or from 98.7 to 118.7 MHz. Either range is practical from a design point of view. If the lower frequencies had been selected, as a matter of fact, design would be somewhat simpler in terms of attaining frequency stability, ease of construction and the use of somewhat less critical components. Unfortunately, TV channels 5 (76-82 MHz) and 6 (82-88 MHz) fall right in the range of the lower frequency alternative and, although shielding of local oscillators to prevent excessive radiation is a requirement of the FCC, it would not take much such radiation to interfere with one's own TV set (particularly if a common antenna is used). For this reason, nearly all FM sets produced today utilize a local oscillator tuned to the *higher* set of frequencies. An indirect advantage of this choice is the somewhat reduced tuning ratio this requires.

AFC & Oscillator Stability

While we shall deal in much greater detail with AFC (automatic frequency control) in a future installment, there is one point on the subject that needs to be made here. To those unfamiliar

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ABZs of FM

(Continued from page 85)

with AFC and how it works, a brief explanation of Fig. 5 will suffice. In this schematic, the oscillator section of the Eico Model 3200 FM Tuner is shown. The diode component identified as FECR2, in series with a 15-pF capacitor, is effectively in shunt with part of the frequency-determining tuned circuit of the local oscillator stage. This diode acts like a small variable capacitor when varying d.c. voltages are applied to it.

Both popular forms of detector circuit used for FM demodulation (the ratio detector and the Foster-Seeley discriminator) produce negative and positive d.c. voltages as stations are detuned above or below center frequency. These voltages are used as "error-correcting voltages" by causing a corrective shift in local oscillator frequency. This corrective scheme may be thought of as a "first order servo loop" and, as such, cannot be expected to offer total correction since some finite amount of error must be present for the corrective frequency shift to occur.

The real purpose of the AFC is to make it somewhat easier for the user to tune in stations. With AFC, stations "pop in" and stay fairly well tuned (though not perfectly so). Notwithstanding the advertising slogans, AFC does not, of itself, provide "drift-free tuning." It is *not* a substitute for a frequency-stable oscillator design. On the contrary, AFC often shows up a drifting oscillator even more. The user often thinks he is tuned to center of channel (in the absence of a good tuning meter) and actually may be on the edge of "drop-out" of the desired channel. Most instruction manuals prescribe tuning-in desired stations with the AFC turned off (if it is defeatable). Only after center-of-channel has been tuned in properly should AFC be introduced.

Many manufacturers have eliminated AFC altogether, claiming (and rightly so, in our opinion) that equally "smooth" tuning action can be obtained through the use of wideband i.f. designs. They further maintain that all but the most carefully designed AFC schemes contribute a measure of distortion to the output and that, since AFC is really no true substitute for oscillator stability, it serves little or no purpose in modern, stable, solid-state FM designs. Ten years ago, absence of AFC circuitry was a mark of "skimping" in design. Today, it is fast becoming a mark of distinction when accompanied by good wide-band design. Æ

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Acoustech, Inc. (see Koss Electronics)

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Acoustical Mfg. Co.
Huntingdon, Hants., England

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Chicago, Ill. 60680

Altec Lansing Corp.
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Anaheim, Calif. 92803

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Concertone, Inc.
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Delmonico International Corp.
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Dynaco, Inc.
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EdiTall (see Elpa Marketing)

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Elac (see Benjamin Electronic)

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Plainview, N. Y. 11803

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Erath, The L. W., Company
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Ercona Corp.
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Euphonics Marketing
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Hartley Products Corp.
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Manufacturer's List

(Continued from page 87)

IMF Products
7616 City Line Ave.
Philadelphia, Pa. 19151

Irish Tape (see Morhan National Sales Co.)

JBL (see James B. Lansing Sound, Inc.)

JFD Electronics Corp.
15th Ave. at 62nd St.
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Chicago, Ill. 60638

KLH Research & Development Corp.
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Los Angeles, Calif. 90007
6941 Calamus Ave.
Elmhurst, N. Y. 11377

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Koss Electronics, Inc.
2227 N. 31st Street
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Lafayette Radio
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Lansing, James B. Sound, Inc.
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Leak (see Ercona Corp.)

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St. Paul, Minn. 55119

Magnecord (see Telex)

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Martel Electronic Corp.
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Matsushita Electric Corp. of America
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Michigan (see Electro-Voice)

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Miracord (see Benjamin Electronic)

Morhan National Sales Co.
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Multicore (see British Industries)

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Norelco (see North American Philips Co.)

Nordmende (see Sterling)

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Panasonic (see Matsushita Electric)

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Quad (see Acoustical Mfg.)

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Ferry Works
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Maynard, Mass. 01754

Seeburg Corporation, The
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Chicago, Ill. 60618

Shure Brothers, Incorporated
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Elmsford, N. Y. 10523

Sony Corp. of America
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Stanton Magnetics
Terminal Drive
Plainview, N. Y. 11803

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Superex Electronics Corp.
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Syncron (see Vega Electronics)

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Tandberg of America, Inc.
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Toujay Designs, Inc.
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Transtech
Top-O-Hill Rd.
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Pasadena, Calif. 91103

Turner Comptny, The
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Cedar Rapids, Iowa 52402

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COMING IN SEPTEMBER AUDIO
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Letters

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enough that I no longer enjoy the "hard" rock and roll, but I do enjoy much of the folk and popular music and to say that FM radio is "too good" for rock is absurd. (I am 21.) Having a large investment in stereo components, I enjoy listening to several types of music, and when I wish to listen to any one type of music, I want to hear it with the best possible fidelity available and to me this means FM stereo and certainly not AM. In conclusion, why deny someone the quality of FM stereo just because the music does not agree with your taste?

WILLIAM D. PELLERRIN
Houston, Texas

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Letters

(continued from page 89)

cational FM stations with their limited hours of broadcasting, we must rely almost exclusively on our only "Classical Music" station for good music of uncompromised quality.

R. HAMMELL
W. Collingswood, N. J

• With some commercial FM stations switching from "good music" to other formats, it is quite possible the educational FM station will remain the sole source for this type of programming in many locales.

GLEN BISHOP
Manager, WMUK (FM)
Kalamazoo, Mich.

No, we're not adversaries of rock music per se. In fact, AUDIO *has published some favorable reviews of such recordings, though admittedly not many. Much of this music, in our staff's view, consists of trite lyrics, inferior music, and wretched performances. Certainly there are gems to be found, but the percentage of meaningful recordings (for adults) is woefully small.*

We agree that good sound reproduction can enhance a recording. Unfortunately, though, most of the so-called rock recordings are made for single-play records. And if you doubt that few exhibit good sound, try some of these 45's on a wide-range system. Since the 45-rpm records are the real big sellers for this type of music, can we not assume that sound for much of the rock-music audience is unimportant

Judging from correspondence around the country, FM Rock is spreading. WABC-FM (95.5 MHz), for example, has introduced a new program called, "Now Music."—Ed.

ADVERTISING INDEX