

Audio

The
Authoritative
Magazine
About
High Fidelity

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BONUS
Video Coverage

**SPECIAL
OPEN-REEL
RECORDER
ISSUE**

**INTERVIEW:
WILLI STUDER**

**MECHANISM
OF TAPE
ERASURE**



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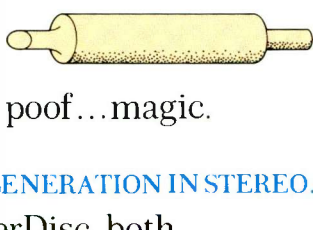
In hi-fi, up until now, sound was the whole picture.

Since the very beginning, hi-fi has appealed to one sense: your hearing. The rest was up to your imagination.

Now Pioneer brings you closer to the reality of performance than you've ever experienced at home: LaserDisc.™

Now you can hear and see a concert or a movie as easily as you can play a record. With sound that's pure hi-fi.

The Pioneer LaserDisc player is easy to hook up and easy to operate. One wire to your TV; two to your hi-fi. Then just place a disc on the player, and poof... magic.



THE SOUND: A NEW GENERATION IN STEREO.

With Pioneer LaserDisc, both channels are completely discrete from each other. It's stereo in its truest sense. And since the disc is read by a light beam rather than a video head or needle, with normal use, it doesn't wear out from play. In addition, unlike conventional records,



Concerts like Paul Simon.



New movies and classics like Dracula.



Sports like NFL Football.

you can handle the LaserDisc as much as you wish. Even minor surface scratches won't effect the superb audio and video fidelity. You can enjoy the disc forever.

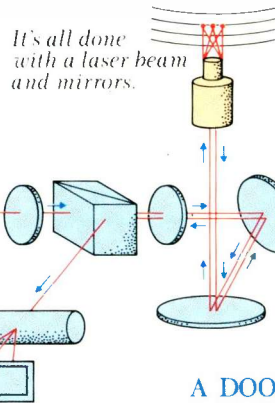
THE PICTURE: BETTER THAN HOME VIDEO TAPE.

The Pioneer LaserDisc player offers a picture with actually 40% better resolution than the picture delivered by a home video tape player. A picture of the highest broadcast quality. For the first time on your television set, video fidelity is matched by audio fidelity.

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Try to imagine what it would be like to sit down in front of your television and see whatever program you wished whenever you wished to see it. With a sense of performance, a feeling of "being there" never before experienced at home: Movies, concerts, sports.

Pioneer Artists and MCA/Discovision discs like Paul Simon, Liza Minelli, Loretta Lynn, Jaws, Animal House, The Blues Brothers, the NFL.



It's all done with a laser beam and mirrors.

A DOOR TO EDUCATION.

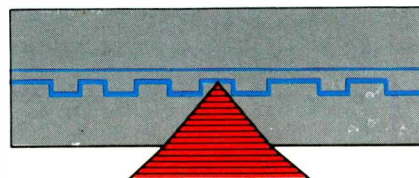
With standard-play discs, you can create your own instant sports replays at home, you can go in fast motion, slow motion, one frame at a time, even stop motion indefinitely. But LaserDisc offers something far more revolutionary. Everyone of the up to 108,000 frames on the disc is coded. And a built in micro-computer lets you access any individual frame at will. This means you can go to your favorite scene in a movie or song in a concert in seconds.

But that's merely the beginning. On one disc you can stroll through the National Gallery and study art masterpieces one masterpiece at a time.

And since play can't wear out the disc, they can be studied forever.

THE FUTURE IS IN REACH.

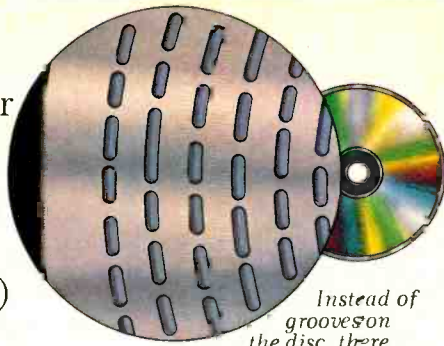
One of the most surprising parts of this new technology is that it's affordable.



A beam of light instead of a needle.

The Pioneer LaserDisc player has a suggested retail price of \$749* (Optional remote control just \$50* more.)

As surprising, a full length movie on LaserDisc can even cost less than taking your family out to the movies. And about half or a third of the price of that same movie on video tape.



Instead of grooves on the disc, there are microscopic pits.

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Irrespective of how much we say here, the true magic of LaserDisc can only be appreciated in person. So we've arranged for a personal demonstration in your area. Just call us at **800-621-5199**,** and we'll give you the names of the stores nearest you. Go by all means. You won't believe your eyes. Or your ears.

*Suggested retail price. Actual price set by dealer. ** (In Illinois 800-972-5855).

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Simulated TV picture from The Blues Brothers.



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Audio

APRIL 1981

VOL. 65, No. 4



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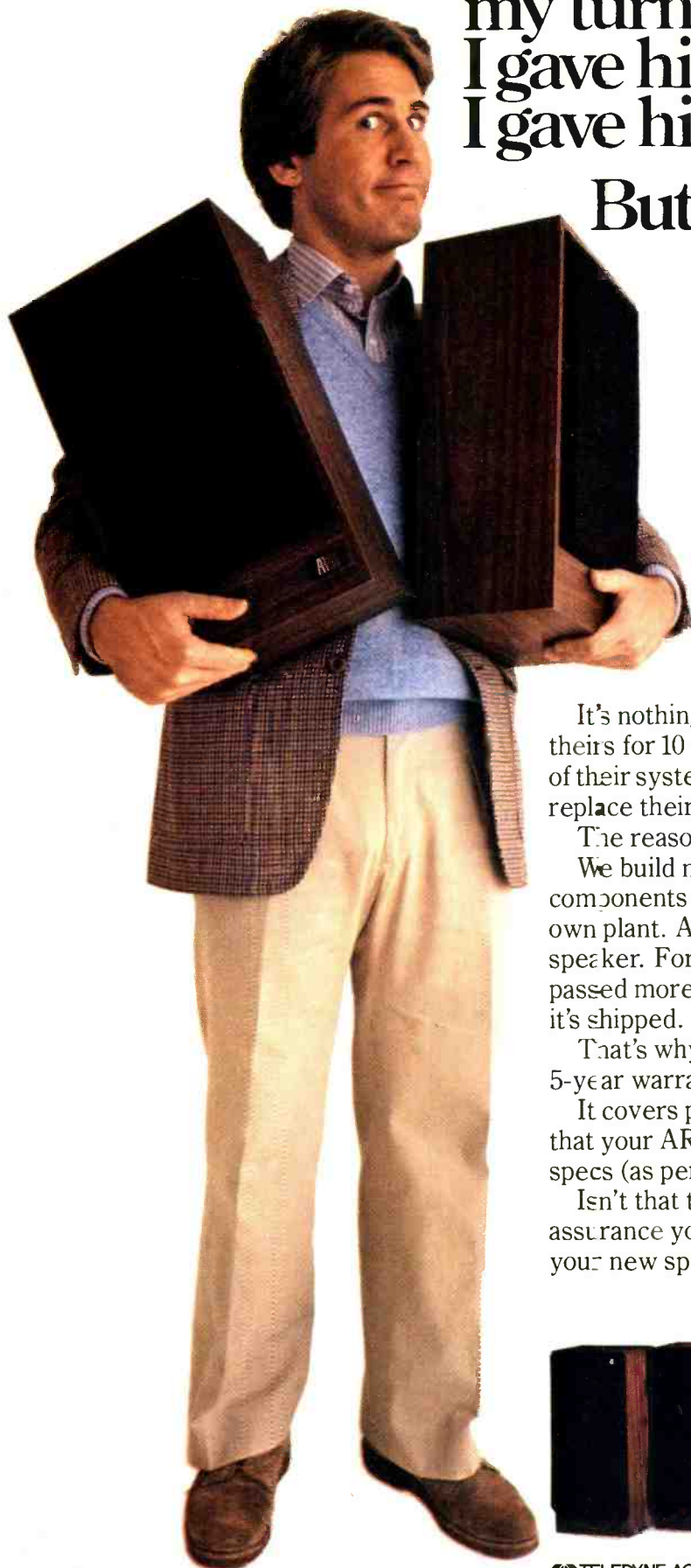


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"I gave my kid brother
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I gave him my tuner.
I gave him my tape deck.
But I kept my AR's."



Most good speakers sound fine when they're new.
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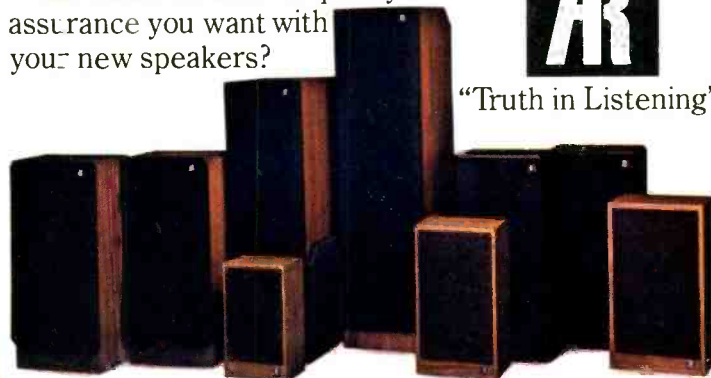
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TELEDYNE ACOUSTIC RESEARCH

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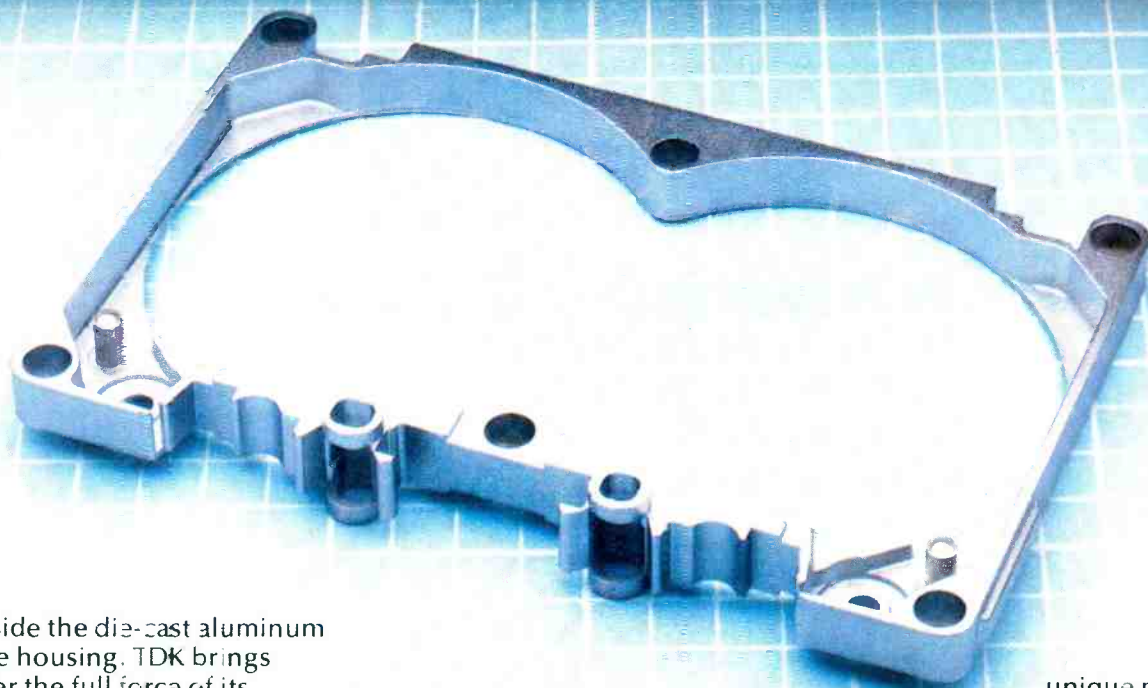
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To sharply define the difference between this cassette and any other, TDK encased it within two clear sheets of plastic. These sheets are thirty percent harder than the plastic used in ordinary cassettes. Die-cut, transparent liner sheets maintain a physical clarity that's matched by the crystal clarity of

sound. Six precision screws seal the shells and resist vibration. This state-of-the-art cassette is called MA-R. The effect is futuristic. But TDK does nothing merely for effect.

For example, *Part Ten* has the structural strength to withstand warpage, temperature, and humidity changes. In situations where stability and stress are critical factors, as in portables or car stereos, a bump in the road can throw a curve in the music. MA-R is warranted to perform uninterruptedly.

Because TDK has an unswerving commitment to music. It is the driving force behind every technological breakthrough. *Part Ten* plays as important a role in the MA-R's performance as its

unique metal tape. The added stability of structure and mechanism allows a more precise reproduction of music. TDK firmly believes a small cassette is governed by the same laws as a large orchestra. Music is the sum of its parts.



Assembled TDK MA-R cassette.

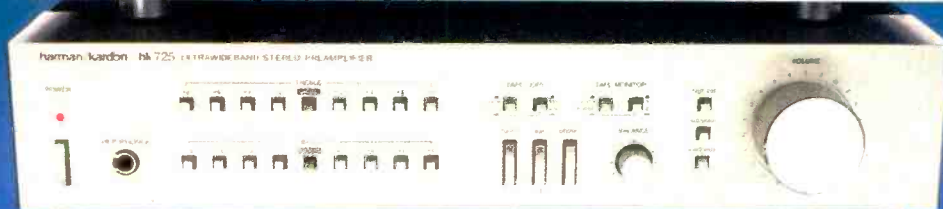


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The hk715 High Technology Quartz locked digital tuner.



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Last January, we introduced our 700 series High Technology Separates. The first moderately priced separates designed with low negative feedback.

Negative feedback?

It's a form of electronic compensation used in virtually every preamplifier, amplifier and receiver. Used judiciously, negative feedback can improve frequency response and THD

distortion characteristics. Unfortunately, most manufacturers try to reduce THD to lower and lower levels by adding more and more negative feedback – typically 60-80 dB. This excess negative feedback results in a new form of distortion called Transient Intermodulation Distortion (TIM), which does far more to degrade music than THD. In fact, according to a listening survey, TIM in music is detectable at

levels just 1/10 the detectable levels of THD.

By keeping negative feedback to 30 dB or less in all Harman Kardon electronics, we've eliminated the harsh, metallic, grating effects of TIM produced by conventional equipment with high negative feedback. You'll hear startlingly clean, clear, open sound.

Now everyone can afford to be an audiophile.



The new hk350i
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20 watt per
channel receiver.

The new hk460i
High Technology
30 watt per
channel receiver.

The new hk570i
High Technology
45 watt per
channel receiver.

The new hk680i
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channel receiver.

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*20-20,000 Hz into 8 ohms @ 0.09% (or less) THD.

For all the technological advances you get with our low negative feedback components, you might expect to give up convenience features. Or pay a premium price. But you don't.

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Where in Heaven's name is big-time classical recording going these days? If you ask me, straight in the wrong direction by approximately 180 degrees. And this in spite of the huge roster of international greats who are under contract to produce recorded music.

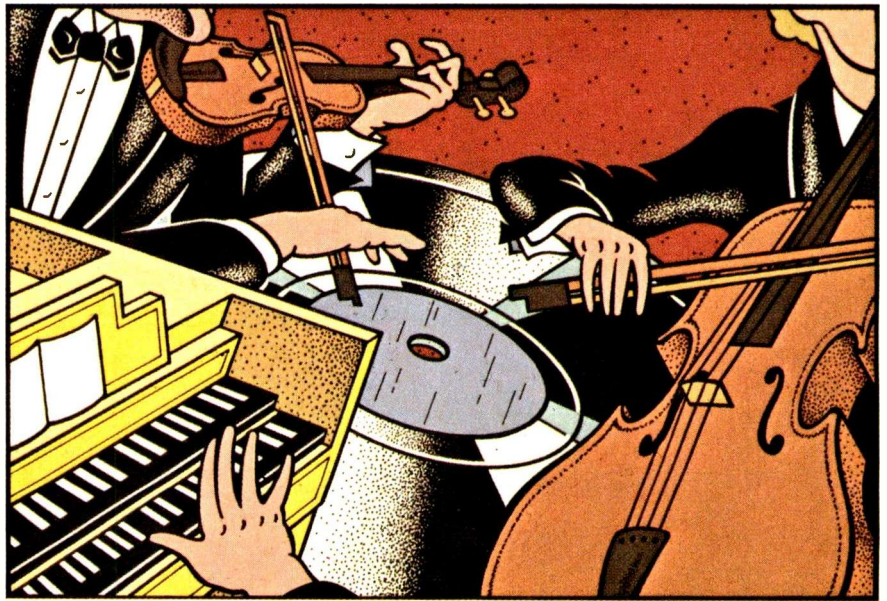
It isn't only the cost, which is predictably enormous. What bugs me, as they used to say, is that in the very face of our increasing knowledge of what recorded music can do and is good for, the big labels are tying themselves ever tighter and tighter to the LIVE music business.

That's crazy, I think. It's unnatural. Because LIVE music and recorded music are basically different media, in profound respects, for every type of music. Each medium has its own values — neither the one nor the other is "better." But those values are NOT the same. Folly, I say, to tie them together as though they were.

It's discouraging. Here I've been shouting this message for a good quarter century and more, and I might as well have kept my trap shut. At least as far as the Big Brass up there is concerned. They don't seem to be listening. And yet look at the mess they've got in lately! Near-total disintegration, wholly new teams brought in for rescue, drastic cuts and curtailments. And of course, "new" policies. That's where I groan.

Not just me, certainly. Over the decades, an ever-growing host of recording people have learned what recorded music can do, as DIFFERING from live music, and nowhere more obviously than in the pop field, though that is not my story. We have an immense accumulation of knowledge now, not merely of recording techniques and, of course, home playback techniques but, even more profoundly, of the very music we choose to record and its special effects via the recorded medium, contrasted to the live. The music that we choose to market, if you wish. We know what "works" in terms of home sound, home listening, not to mention listening in car and boat and so on. Utterly different from LIVE music! Does it really need to be said?

From the beginning of electrical recording, for instance, it has been increasingly obvious that *exploration into new musical territory* is the strongest thing records can do, with their peculiarly spaceless and timeless quality. Where



else do you suppose the popularity of Baroque music came from, and that old Baroque pro, Antonio Vivaldi! Definitely not from the famous concert artists and the major symphony orchestras. Those people haven't yet learned to play Baroque right, even with the proper "reduced" forces. The impetus for Baroque music has come from recordings, out of distant places mainly, by small groups of the type that *sound best in home reproduction* on anybody's equipment. Inherent. That's why good Baroque has been so widely popular.

It is also why there is so little of it — and so bad — among the great solo artists and the big symphony orchestras. It isn't their music. It's ours. No offense! Each to his own. That's what I mean.

So it has been with the whole enormous repertory of recorded classical that has grown up with us on LP since the 1960s and, even before that, on the limited old 78. The recorded medium has propagated all this music. Not the big-time concert world, which has latched onto it, late, mainly through OUR influence — the impact of *music on records*.

The present-day big-time virtuoso music business is a creation of the 19th century, the pre-electronic era of the large public concert and the monumental grand opera, when volume meant sheer physical music power — LOUD voices, LOUD instruments, ever more enormous ensembles. That was the only

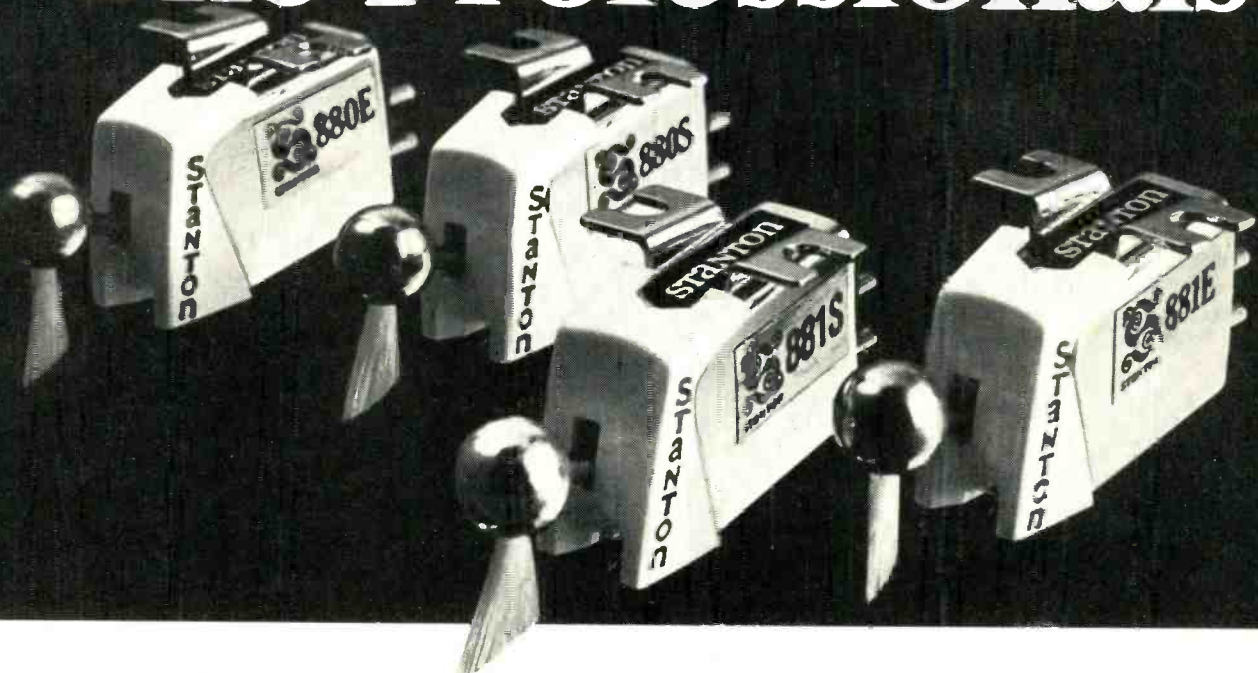
way to create bigness and it worked to perfection. That age is still with us and it still works, mikes or no mikes. Curious. The LIVE sound of a full symphony orchestra is a marvel to hear when the music is well designed for it, as plenty is. Those big voices, huge pianos, potent violins (rebuilt for volume in the early 19th century) fit remarkably well into our Carnegie Halls, Gewandhauses, Concertgebouws — even Avery Fisher. They match, they are built for one another. It's a glorious tradition. And so is the music. LIVE.

Yes, we can record this music. We do wonders. But the idea is not truly natural. For optimum recorded music, the best in sound, we need — and we use — smaller, clearer sounds. We have all the volume we need. In the living room, a string quartet is just as loud as a 100-piece orchestra, a rather important difference from LIVE music. This is our medium! We live with it, not in LIVE concert halls but in our own listening spaces.

Don't misunderstand me. We are doing, and have done, a noble job in the "translation" of big music into living-room terms. It is a mainstay of classical recording, obviously. Yet it is a fantasy job, too, a wonderfully imaginative adaptation of big music to a medium *inherently* not well suited to it. Big music was never intended for small spaces. It was never intended for recordings. Virtuoso performance absolutely demands big



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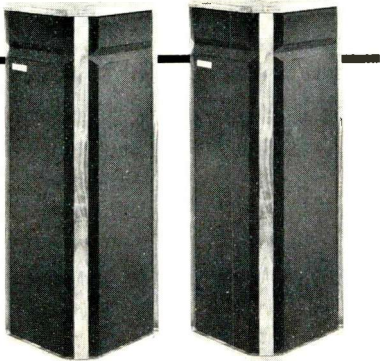
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Original.

original *n.*: that from which a copy, reproduction or translation is made. (Webster's Collegiate Dictionary)



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Live music and recorded music are basically different media, in profound respects, for every type of music. Each medium has its own values — neither one is "better."

audiences. Big audiences need big voices, potent violins, enormous pianos, high-power drama and what the actors call "projection" — out into vast spaces, to crowds of worshippers. That's the essence of big-time LIVE music.

And so all this big-time razzle-dazzle of publicity we now experience is quite properly aimed at the LIVE music circuit. What else? It works! It still does. Nobody in his right mind complains about big-time LIVE music.

But recordings? In the big-time LIVE music context they are no more than a kind of after-effect or a before-effect, a branch of publicity, to boost up the ticket sales. Yes, they can do that. GO TO THE CONCERT! And PLAY THE RECORD! The all-out tie-in. Every piece that gets played LIVE on a big-time stage can be put out on a record too. But what a limitation on the recorded medium! It can do better, it can go further and wider, as we very well know.

Yet the big record labels (notably those that are American-based) have latched onto the international LIVE music biz, in all its ramifications, as if their life depended on it. Play up the virtuoso as never before, grab the latest "in" sensation (LIVE), and get him out on records fast, re-record all those same old concert works, the chestnuts, Virgil Thomson's famous "fifty pieces," with NEW, NEW artists. Plug them LIVE in a thousand cities, plug their concert records in the same.

It'll work, for the moment. But it is wrong, dismally misguided, if we consider what recordings are and can do. It's bad policy because it flatly denies the true usefulnesses of recorded music at its own best, which is not ever merely to record live music, but to present music itself in an alternative and DIFFERENT medium. Frankly, all this is demeaning to the highly developed art of recording, a not very subtle insult in the name of immediate rescue profits. I think most recording engineers will agree.

The little record labels tell a different story. They seldom have access to the big-name personalities (except in elderly reissues); they can't afford the tag. They are lucky. They save millions. Do not suppose, however, that the "name brand" musicians, as the LIVE music biz people would have you think, are the only good musicians around. The music world is crammed everywhere with ex-

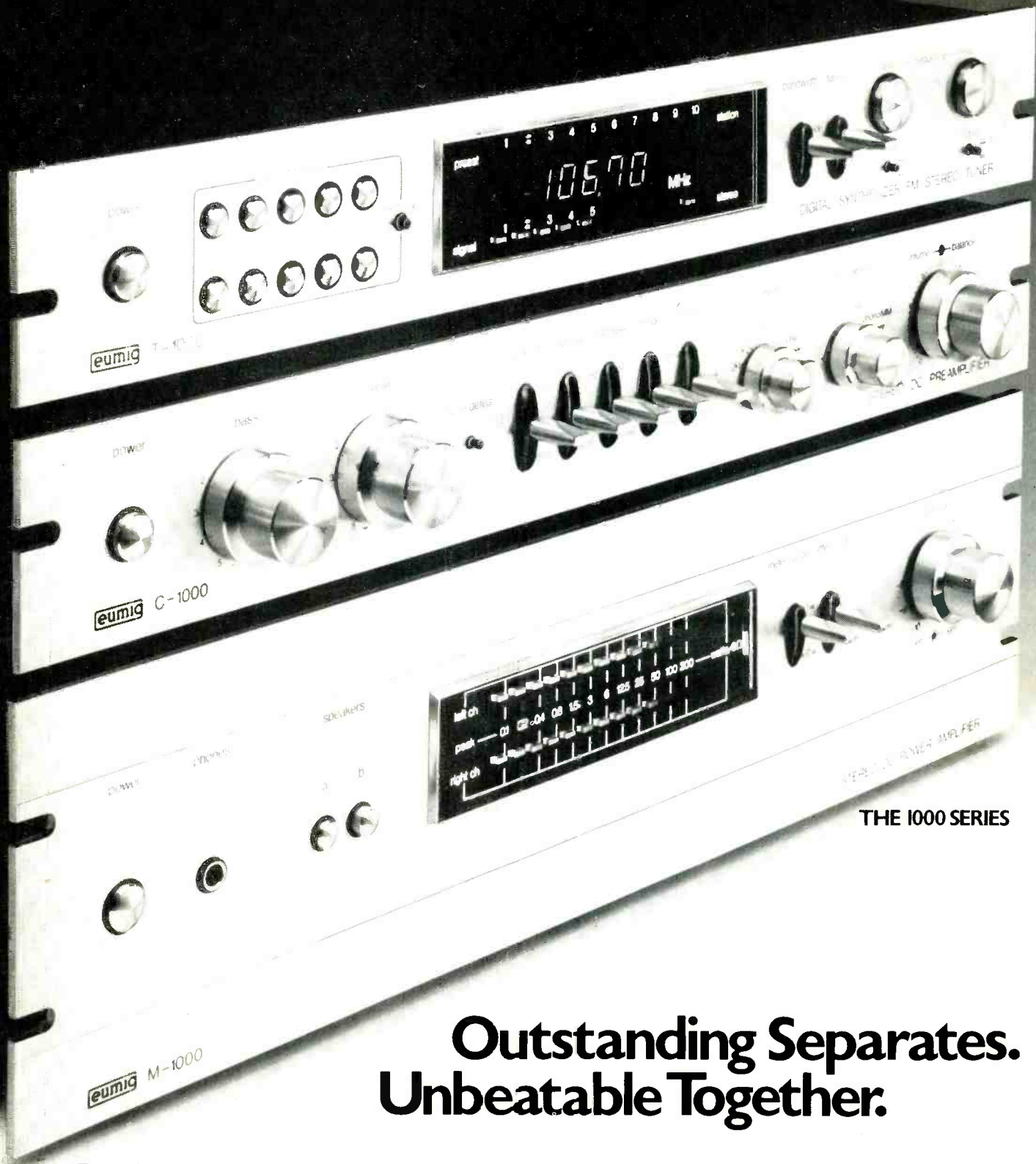
cellent performers, many of whom can do a better job on records than the overly-potent big virtuosi — who often simply cannot tone themselves down for the living room. The small labels, perforce, make use of this much greater pool of talent, and at a fraction of the cost of top artists. They have no choice — but they are right. The best of them know very well that they are onto something good, for records.

Similarly, the little companies seldom can afford big symphony orchestras and, again perforce, must feature many kinds of smaller ensembles for their music. Right! These are the sounds that are *inherently* best for the recorded medium. In the same way, these outfits also mostly avoid the standard concert works, already heavily recorded, to explore new music, new musical areas. Right again! And more often than not, these new areas provide better sonic material, *inherently*, than the powerhouse sounds of big-time concert music. Still right!

Much as we love the great artists (and who doesn't) in their own proper LIVE environment, we are bound to feel, I think, that the big record companies look rather foolish now, tying themselves so fiercely to this particular musical bandwagon for their current output. It puts them in such a secondary position, depending on the primary energy of the LIVE business.

I don't mean to imply that this is all we get from them. Nor that the actual recording is less than adequate. It does the job beautifully, for the most part. The European giants in particular still record big music, big artists, in terms of recording as an almost separate art. (If their publicity makes concert tie-ins, it isn't necessarily basic recording policy, after all.) I would hate to think that our own brand-new big-label classical execs didn't have at least SOME of this sense for recording in its own terms.

A word more about big-time classical. It's hardly new — it has an honorable tradition. Before the present jet age, moreover, big-time music had a special reasonableness, when famed performers were rare beings and their concerts were in the nature of unique events. To see and to hear a great pianist like, say, Paderewski (as I did when a child), or an operatic great like Caruso, in the flesh, right there before you, was an unbeat-



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able experience. People travelled great distances for the privilege. The trains and the ocean liners took these artists far, but slowly. Jenny Lind did it all back in the 1850s — imagine it! No wonder her concerts were big events.

Even in the 1930s, when classical recorded music first became mature via electrical recording, travel was not yet airborne and much of the old mystique remained; musical celebrities still were primarily in-person artists who took themselves, their actual bodies, to their audiences. The miracle of early recording, both acoustic and 78 electric, was

that it did indeed, at last, give us a sense of the actual music of these artists, right in our homes, and for the first time in history. That was a lot, as plenty of us remember. I don't know when Caruso went gold, but it must have been early.


Before that, you bought your ticket and you heard your music once, and that was that. To get to know the music better, you had to read a score. Or play the piano. Countless "piano reductions," often for four hands to divide the work, were issued in the 19th century of every kind of music from symphonies to grand opera — just to satisfy this need

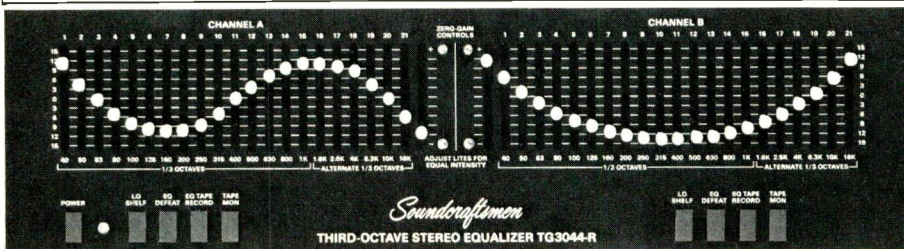
to get to know. But the sounds were mostly pretty feeble substitutes for the original. How enormously better, then, to have an early phono disc, a semi-reproduction of actual, real music. And later, the entire work, the whole concert, if in four-minute slices! This I can remember — I was there. And it was a real, legitimate "tie-in" between LIVE and recorded music, born of sheer necessity. We listeners ourselves made the tie-in, mostly, along with moderate efforts by the record companies themselves. But, mind you, they had learned that recorded music went far beyond LIVE tie-ins and should not be limited at all in that fashion. Are we forgetting?

Now look at things today. The jet has made hash of that whole aura of rarity which once surrounded a virtuoso live performance and fueled its mystique. Now, the great artists are everywhere, and the result is almost TV-like, though live. The same artists, the same music, wherever you are, from Calgary to Sydney, New York to Tokyo. It's remarkably like TV and the movies. And every city or town has to have its semi-identical Performing Arts Program, complete with vast Cultural Center (as vast as funds allow, anyhow) — inhabited by exactly the same artists and music as every other city on the map. How much of this meets a true musical demand, how much is sheer civic boosterism? In all truth, the concert biz is much like TV, and probably it should be, that being what's important in our day.

So this is what we live with in big-time music. And it is this LIVE music, the same wherever you go, onto which our big record labels have latched themselves. OK! Nothing wrong from the LIVE viewpoint. And maybe Pavarotti & Co. and all the others will help our record companies (our record divisions, I should say, in deference to the implacable holding companies up above) turn a satisfactory financial corner before it is too late.

Too late? I should say so! There is every reason to think that the big-time classical recording might simply vanish, and not too far from now. Why? What about the big-time "TV disc," in all its formats? The TV disc, if it catches on, is going to be better. It is *inherently* big-time and it will do a far better job at publicizing live music (among other things) than any mere "audio disc" will do. I can see this sword of Damocles hanging right up there, in every audio big-label front office.

If so, then our enterprising small record companies (audio only) are in for a field day. A new era! They'll take over. They're on their way already. And on the RIGHT track. Absolutely. 

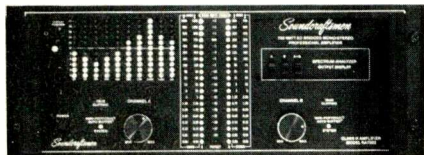


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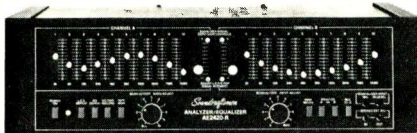
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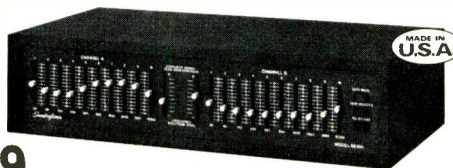


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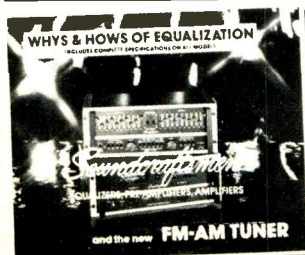
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"S" Me No Questions...

Q. My new tuner sounded fine for several weeks. Now it has a strange type of distortion. Music consisting of low fundamentals with few overtones sounds fine. However, on higher pitched musical tones, especially those having many higher harmonics, the tuning indicator shows mistuning. Interstation hiss is present, and there is considerable distortion, particularly with the letter "S" during spoken broadcasts.

Can you make any kind of diagnosis from such a short list of symptoms? — Name withheld.

A. Since your problem is one which I have not had the "pleasure" of tackling, I can only conjecture as to its cause.

My first guess is that there is instability in the i.f. amplifier stages. Assume that the i.f. stages oscillate when no signal is present; assume also that when a signal does appear, the gain of the i.f. stages is reduced because of a.g.c. and that the oscillation or tendency to oscillate is minimized. When modulation is low, all is well. When modulation is near 100 percent, however, the tuner is not always tuned to the center of the channel because the signal itself is moving ± 75 kHz. This is the same as saying that the tuning dial is moving rapidly over this 150-kHz bandwidth. Since the tuner is on the verge of oscillation, it is obvious that the i.f. stages are regenerative and that the tuner is sharp in terms of selectivity — sharper than it should be for the i.f. system to accept the full bandwidth of a well-modulated FM signal. The momentary extremes of carrier deviation which bring the carrier 75 kHz to one side or the other are sufficient to result in a weakening of the signal presented to the i.f. stages; as a consequence, they start to oscillate. Further, this oscillatory condition sharpens the i.f. stages still more, with the result that the signal completely disappears from the i.f. bandpass for an instant. This, in turn, causes the hiss you mention. If I am correct, the hiss is not steady and is interrupted by the modulation, but so rapidly as not to be noticed.

The cause of such i.f. instability can result from bad grounding of a component or shield partition or possibly a defective bypass capacitor.

My second guess is that it has something to do with the power supply. Assuming that the regulator in the power

supply has failed, the power supply voltage will increase, and this increase could result in the situation you describe. There could, however, be another consequence of an unregulated power supply. If, for some reason, modulation peaks result in a change of load on the supply, these changes could result in changes of power supply voltage. Such voltage changes would affect the frequency of the tuner's local oscillator, and these momentary oscillator frequency shifts could result in temporary mistuning, as shown by your indicator. Obviously, this too would result in a tremendous amount of distortion.

A quick voltage check should reveal whether the power supply is, indeed, supplying a voltage which is considerably higher than that called for in the service manual.

AM I on Your Wavelength?

Q. I read with interest your discussion of FM and AM signals in "Audioclinic," March, 1980. One point puzzles me, however; you stated that for FM reception, the receiving antenna must be in the "line of sight" of the transmitter, implying that the reverse is true for AM reception.

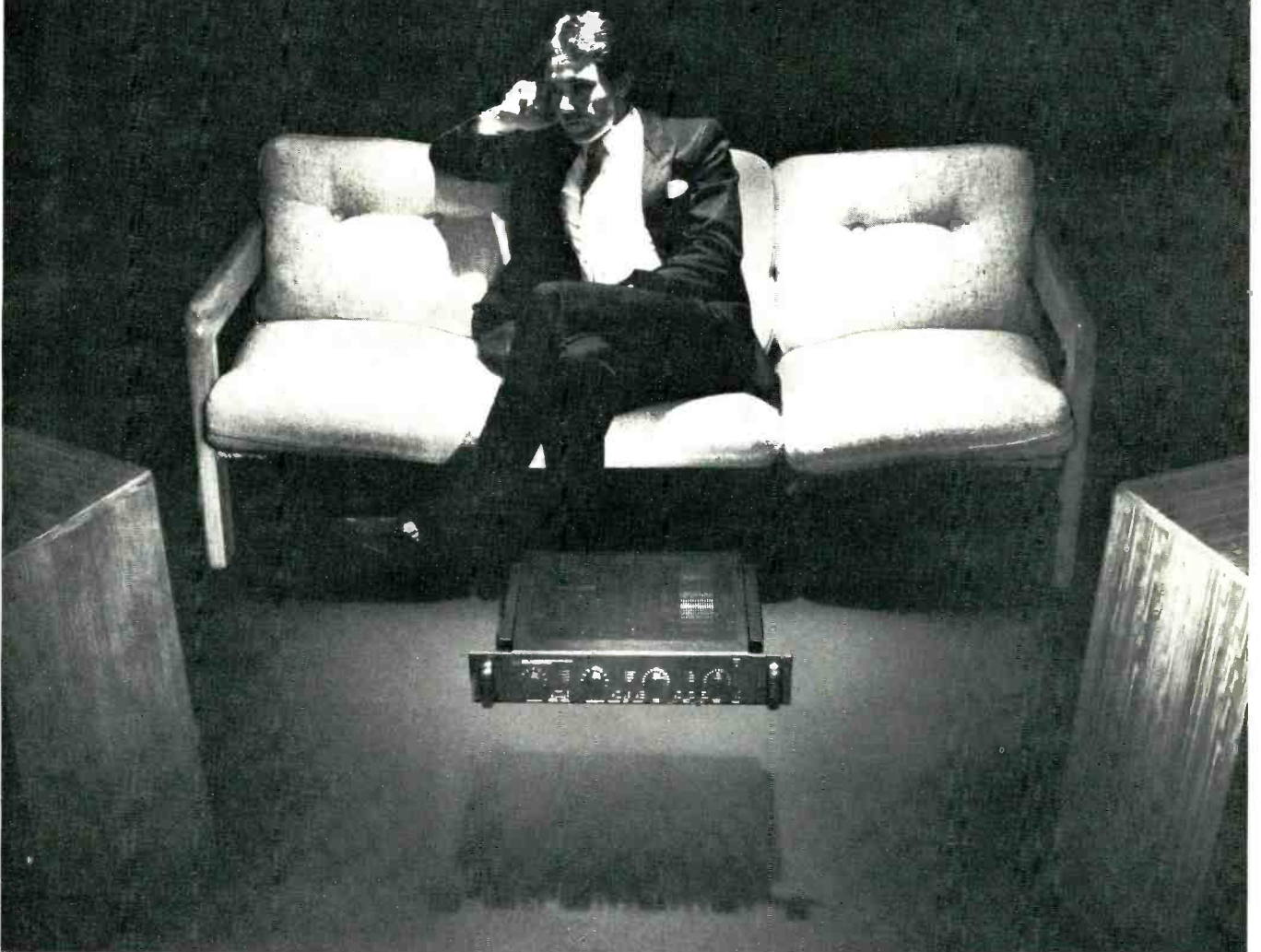
Why, then, will an AM broadcast received in a car be cut off or severely attenuated while travelling under concrete bridges, through tunnels, etc., while FM signals won't be?—Alex Schuman, Latexo, Tex.

A. "Line of sight" refers to any signal path which stretches directly between the transmitting antenna and the receiving antenna and which does not go over the horizon. This term does not take into account physical obstacles, such as a bridge or tunnel, limiting the radio's visibility of the broadcast antenna.

Higher frequency radio waves (such as broadcast FM) have a way of penetrating obstructed locations where longer wavelengths (such as broadcast AM) can't. This is why FM stations can be heard when driving in an underpass, and AM stations cannot be heard. On the other hand, AM stations can be heard over the horizon, or out of the line of sight, while FM stations cannot. **A**

If you have a problem or question about audio, write to Mr. Joseph Giovanelli at AUDIO Magazine, 1515 Broadway, New York, N.Y. 10036. All letters are answered. Please enclose a stamped, self-addressed envelope.

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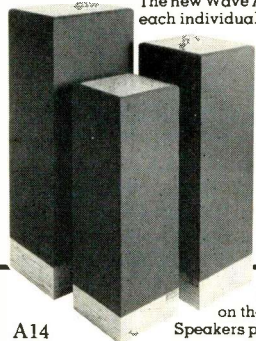
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TAPE GUIDE

HERMAN BURSTEIN

Make an Educated Degausser

Q. I plan to buy a degausser, one end of which is intended for demagnetizing tape heads, and the other end for use as a bulk eraser. I have read that a bulk eraser may possibly damage tape heads and VU meters. Is this a safe tool to use for demagnetization? — Maurice Zeff, Oakland, Cal.

A. The degausser will not harm your heads, assuming you use the end intended for demagnetizing them. And I trust you have no intention of putting the bulk erasing end smack against the meters. Do not attempt to bulk erase tape while it is still on the deck, because you will risk bringing the bulk eraser dangerously close to the heads and meters.

Preamp Power

Q. The line input of my tape deck is too low for recording from my phonograph. Therefore, I have taped through the mike input. The sound that comes out is clean, but I am getting no bass, only the highs. Can you tell me what to do? — Jerry Ubels, New Westminster, B.C.

A. The output of a magnetic phono cartridge requires considerable bass boost (in accordance with the RIAA standard), as well as overall amplification. Thus if you feed the cartridge output directly into the mike input of a tape machine, you are not going to get the required bass boost. Probably the easiest solution would be to buy one of the inexpensive small preamps, for about \$25.00 to \$50.00, that are sold in audio stores. The express purpose of these preamps is to supply the equalization needed for signals from magnetic cartridges and tape heads.

What Does This Loss Signal?

Q. My problem is a gradual loss of signal on my tapes. The signal seems to stabilize at a low level, but sometimes this signal level is farther down in some spots, giving an up and down effect. If I replay these tapes, the variation of the signal level may not recur or may not be as noticeable as before. Is the cause the tape or the recorder? — Terrell Cook, Spartanburg, S.C.

A. Your problem is not a common one. Some tape formulations are more susceptible to loss of recorded signal than others, but usually this phenomenon is confined to the treble range. How-

ever, you might try different brands of tape to see if you can eliminate the problem.

Magnetized heads and dirty heads, particularly the latter, can account for your problem. Dirt causes separation between the tape and the head, resulting in reduced response, although, again, especially at high frequencies. Magnetized heads or other magnetized objects making contact with the tape can cause loss of signal, so careful cleaning and demagnetization are recommended. Some tapes shed more oxide than do others, presenting more of a problem in maintaining good tape-to-head contact. Therefore, certain brands of tape may cause more signal loss. Finally, there may be something wrong with the tape guides or other elements in the tape path so that the tape is skewing and failing to make constant firm contact with the heads.

Erase Now, Pay Later

Q. After dismantling an old portable electric generator, I discovered that the magnet was powerful enough to fully erase my tape reels. Can I continue to use this method in place of a commercially advertised bulk eraser, and how will it affect my tape recorder? — Ray Gilbert, Baltimore, Md.

A. If yours is a permanent magnet, do not use it to erase tapes. Such a magnet will leave appreciable noise on the tapes. If it is an a.c. magnet, you can use it to erase tapes, but do not bring it in the vicinity of the tape deck, for it might do harm to the heads or meters.

The Agony of Delete

Q. I frequently make cassette copies of my phono discs, and I have noticed that when I attempt a simultaneous playback to make an A-B comparison, the tape gradually falls behind the disc. Is this an indication of defective equipment?—R.A. Stephan, Carmel, Cal.

A. In the present state of the art, moderate price cassette decks do not maintain as constant a speed as do record players. So I would say your experience is typical. **A**

If you have a problem or question on tape recording, write to Mr. Herman Burstein at AUDIO, 1515 Broadway, New York, N.Y. 10036. All letters are answered. Please enclose a stamped, self-addressed envelope.

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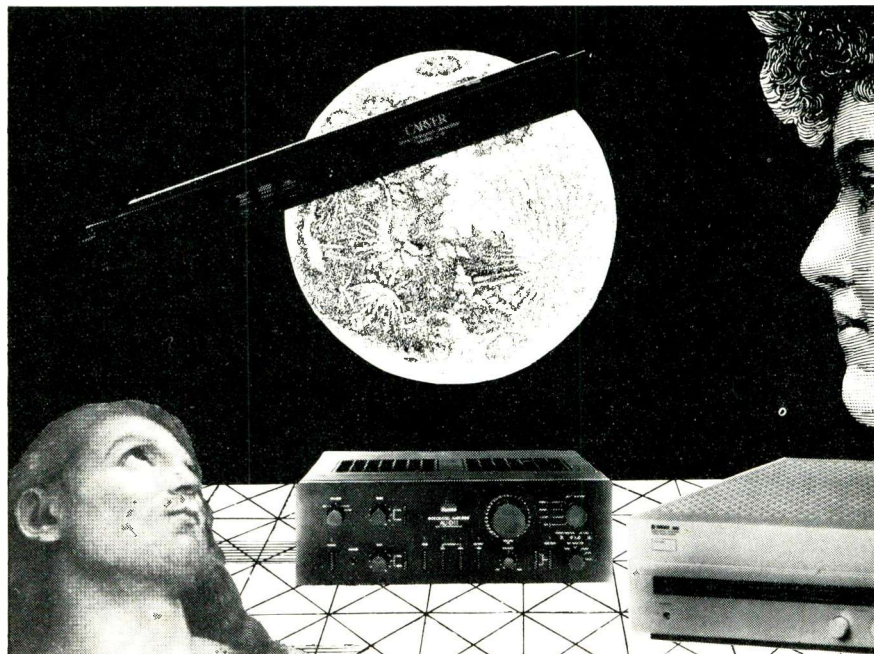
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BEHIND THE SCENES

BERT WHYTE



At the beginning of every new year, barely a few days after the tumult and the noise and throbbing headaches of some few persons' intemperate celebrations, we are faced with the prospect of attending the Winter Consumer Electronics Show in Las Vegas. Apparently there is a groundswell of opinion in which a growing number of companies find this winter trek to Las Vegas increasingly burdensome. Pioneer did not attend, neither did many lesser fry, and quite a few of the "biggies" were rather reluctant participants. There was open doubt expressed as to the wisdom of two annual Consumer Electronics Shows. Many supported the idea of an annual show in June, alternating between Chicago and Las Vegas. Whether this attitude would prevail in the best of times or is merely a reflection of the present bleak economic climate is a moot point.

In any case, the CES people claimed a new attendance record of better than 53,000 for the four-day run of the show. Although this interest is encouraging, it would appear that buying was of the careful, cautious type that has characterized the last few conventions. Once again, video was clearly a dominant factor at the CES — so much so, that some warnings were sounded about not forgetting our audio roots and not getting

burnt in the video boom. As always there were the querulous cries of "there's nothing new," and, as always, there were products which merited attention. In my assessment the key word is selectivity, since it is obviously impossible to cover everything.

Although digital developments are more usually in the province of Audio Engineering Society Conventions, the WCES had some action in this area and one new product will have far-reaching significance. In a very low-key introduction (more of a "test the water" sort of thing) Technics demonstrated their Model SV-P100 digital audio cassette recorder. This unit looks very much like a Panasonic videocassette recorder, but it is specially designed for digital audio. The system uses standard 1/2-inch VHS cassettes and conforms to the NTSC rotary head, slant helical recording format. Instead of a large cumbersome PCM outboard processor, the SV-P100 has one of the biggest LSI (large scale integrated) chips ever manufactured. This is on a module, incorporated in the chassis of the SV-P100, and affords complete PCM digital recording and playback facilities. The digital recording system is the new EIAJ standard of 14-bit linear encoding, with a sampling rate of 44.056 k per second.

The SV-P100 has a dynamic range of

better than 90 dB, a frequency response of from 2 Hz to 20 kHz at +0 and -2 dB. Distortion is quoted at 0.01 percent, and it is important to note that this figure is given for 0 dB, not at the -20 dB level as is usually the case. I have been told that an electronic editor will be available when the SV-P100 is marketed. Most remarkably, the Technics digital recorder is not a blue sky project; it will be available after the June CES in Chicago. The projected price is less than \$3,000, and I have it on good authority that the price could be "significantly less" than the figure quoted.

This SV-P100 digital recorder could have a profound effect on the audio market. If performance specs are indeed as good as stated, it would make the system superior to any professional analog recorder now on the market. While some high-end audiophiles would obviously be attracted to such a recorder, one must speculate about what they would record. The performance of the SV-P100 would be vastly superior to any conventional off-the-air FM source, and phonograph records would not provide a really high-quality program source. Of course, live recording is possible, as it is with present analog tape machines, but opportunities to make high-quality recordings of this type are extremely limited. It would be logical to assume that prerecorded digital cassettes would be offered for these machines, especially since the production of this type of cassette is not technically difficult, and these cassettes would quite literally be duplicate master recordings.

Yamaha got into things digital by introducing a prototype of an AHD (Audio High Density) digital audio disc playback system. The AHD disc developed by JVC is of the grooveless capacitance type and has previously been described in these pages. The Yamaha AHD consists of the disc playback unit in one case, with all operational controls on the front panel, and a companion PCM processor in another case. Yamaha officials feel that the AHD digital disc system offers superior sound qualities, with significant advantages in economical replication since PVC is used for the disc and present conventional record presses can be used. The Yamaha people also stressed that while their AHD player is a prototype, it is "production ready." If the EIAJ approves AHD as the digital disc

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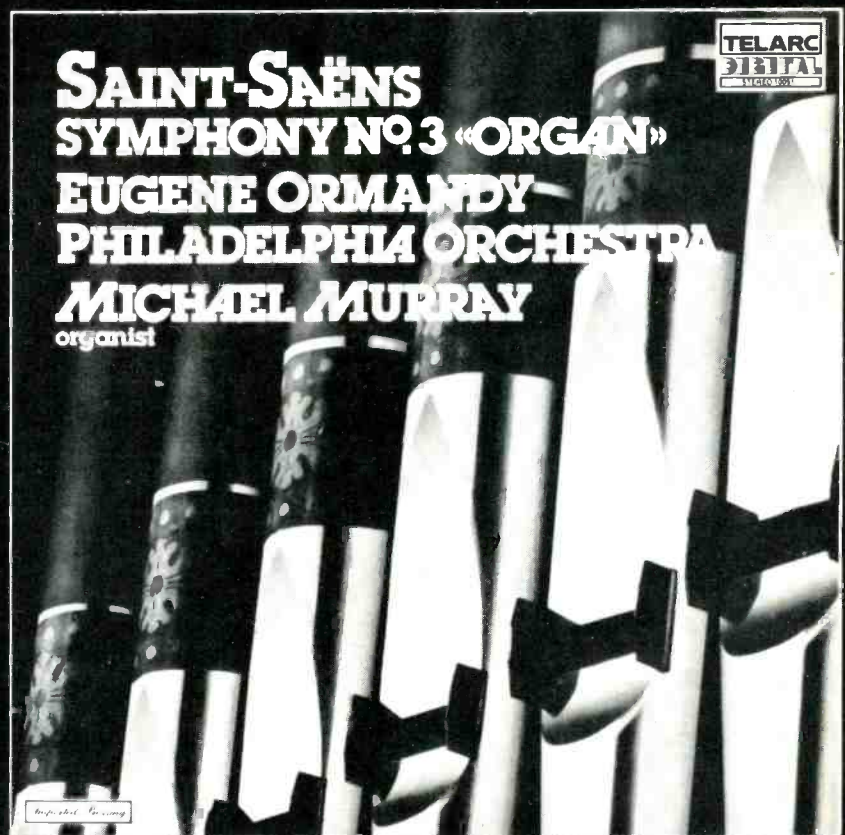
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Video was a dominant factor at CES — so much so that warnings were sounded about not forgetting our audio roots.

standard, Yamaha is all set to swing into action. Might as well mention that Yamaha was also showing their new B-6 magnetic field amplifier (made under license from Carver Corp.); its price is said to be about \$900. This small black truncated pyramid weighs but 19 pounds and puts out 200 watts/channel. There are no controls on the unit; a warning light comes on if the amplifier's protection circuits are activated.


Meanwhile, the Carver people were demonstrating their C-1.5 amplifier. This is a further development of the magnetic field circuit, this time contained in a slim-line design 19 inches wide by about 2 3/4 inches high. Power output is said to be a whopping 750 watts per channel into 8 ohms, hence the "C-1.5" designation of the unit! Bob Carver states that the amplifier has a number of new proprietary protection circuits that enable it to be used with any loudspeaker regardless of its power-handling capacity. Availability is expected late this year with a price less than \$800. Also available from Carver is a separate outboard hologram generator, a second generation of this device with improved performance in image stability, broader listening area, and the elimination of comb-filter effects. The C-9 sonic hologram generator is \$279. Carver stated that earlier embodiments of his sonic hologram circuit can be brought up to second-generation status for a nominal charge.

David Hafler continues to add to his line of amplifiers and preamps. At CES, he showed prototypes of his big new DH-500 amplifier — a 250 watt/channel into 8-ohm MOS-FET design, said to have less than 0.015 percent distortion. The massive heat sinks on the unit are cooled with a special low-noise fan, and the power supply has 40,000 µF of capacitance. The DH-500 can be bridged to give a mono power output of 800 watts. As with all Hafler amplifiers, it will be available either as a kit or assembled.

These days, there is a lot of controversy about Class-A operation of amplifiers. There are engineers who steadfastly maintain that any of the newfangled circuits that employ dynamic biasing (or variations thereof) to achieve what is described as Class-A operation are just not the real thing. Jim Bongiorno of Sumo Electric is especially adamant on this point. He claims his new Model 9 amplifier is "pure" Class-A and in fact re-

mains so at all load impedances. His amplifier is rated at 70 watts/channel into 8 ohms, 120 watts/channel into 4 ohms. Rise time is said to be 3 µS, and TIM is claimed to be nonexistent. Perhaps one of the most remarkable things about this amp is its price of \$550, which is a new low for units of this class and output.

Sansui has been trumpeting the advantages of its new Super Feedforward amplifier circuitry at several of the recent AES Conventions. At the WCES, they showed the first fruits of all this new design work. Their Model AU-D11 is a 120 watt/channel into 8 ohms integrated amplifier. Very simplified, the feedforward technique employs an error-correcting amplifier with a phasing network whose output is summed together with that of the regular amplifier stage. This permits nulling the residual distortion that remains (mostly TIM) after an optimal amount of negative feedback has been applied. The Sansui AU-D11 is said to have less than 0.004 percent THD, a slew rate of 400 V/µS, and a rise time of 1.5 µS. A fast amplifier like this must have appeal for audiophiles, but may I gently suggest that most do not prefer integrated amplifiers. They dislike the idea of tone controls, filters, etc. and a phono stage that, in a sense, is thrust upon them since they are denied the choice of their own preamplifier. At \$1,000, this amp is obviously high-end, and Sansui would probably find more acceptance with audiophiles with a straightforward (no pun intended) power amplifier.

There were other interesting items of audio hardware at the WCES which I will report on next month. Most notable in audio software is the improving quality of prerecorded music cassettes. Mobile Fidelity is now in production of their first cassettes. Duplication is on a one-to-one real-time basis, using banks of JVC cassette recorders. The cassette tape is BASF Professional Chrome II, which means playback at the 70-µS setting of your deck. I sampled Steely Dan's Aja and found the reproduction to be outstanding. Using a JVC KD-A7 deck for playback, high frequencies were well maintained, bass was clean and solid, overall distortion was very low, and, with Dolby B noise reduction, tape hiss was negligible. All in all, a first-class effort that puts cassettes up quite a few notches in fidelity. 

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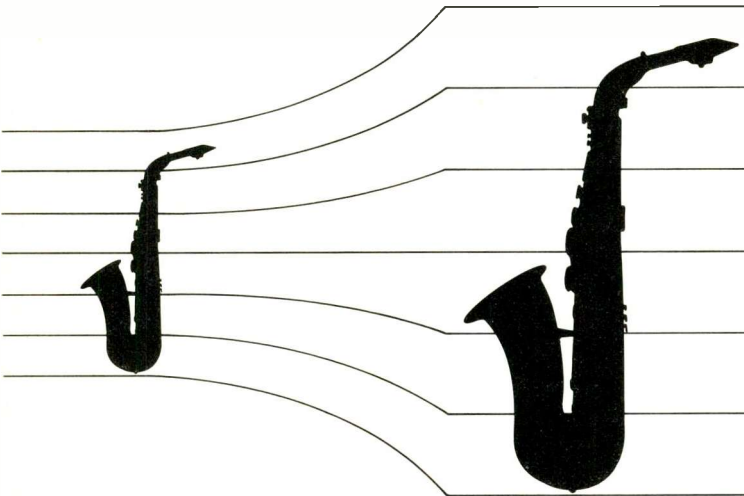
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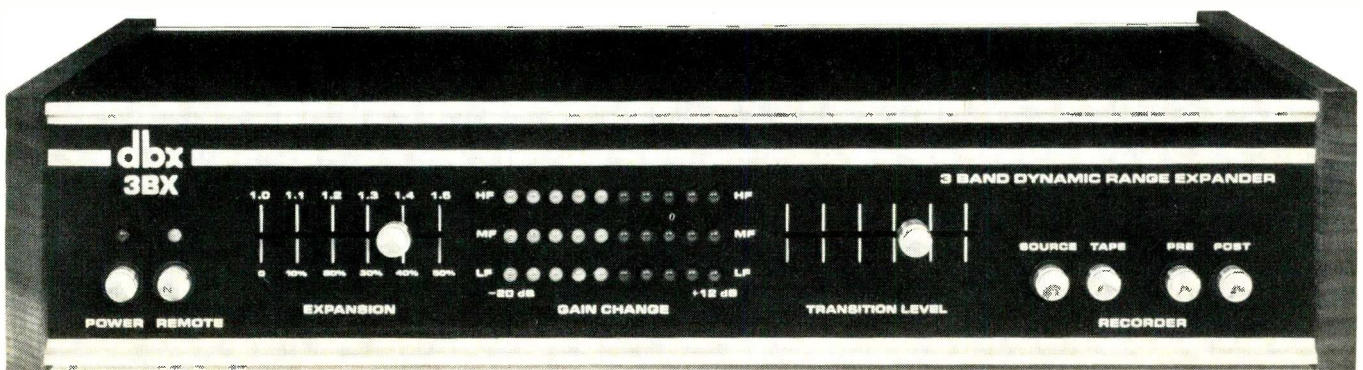
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THE MECHANISM OF MAGNETIC TAPE ERASURE

PETER VOGELGESANG*

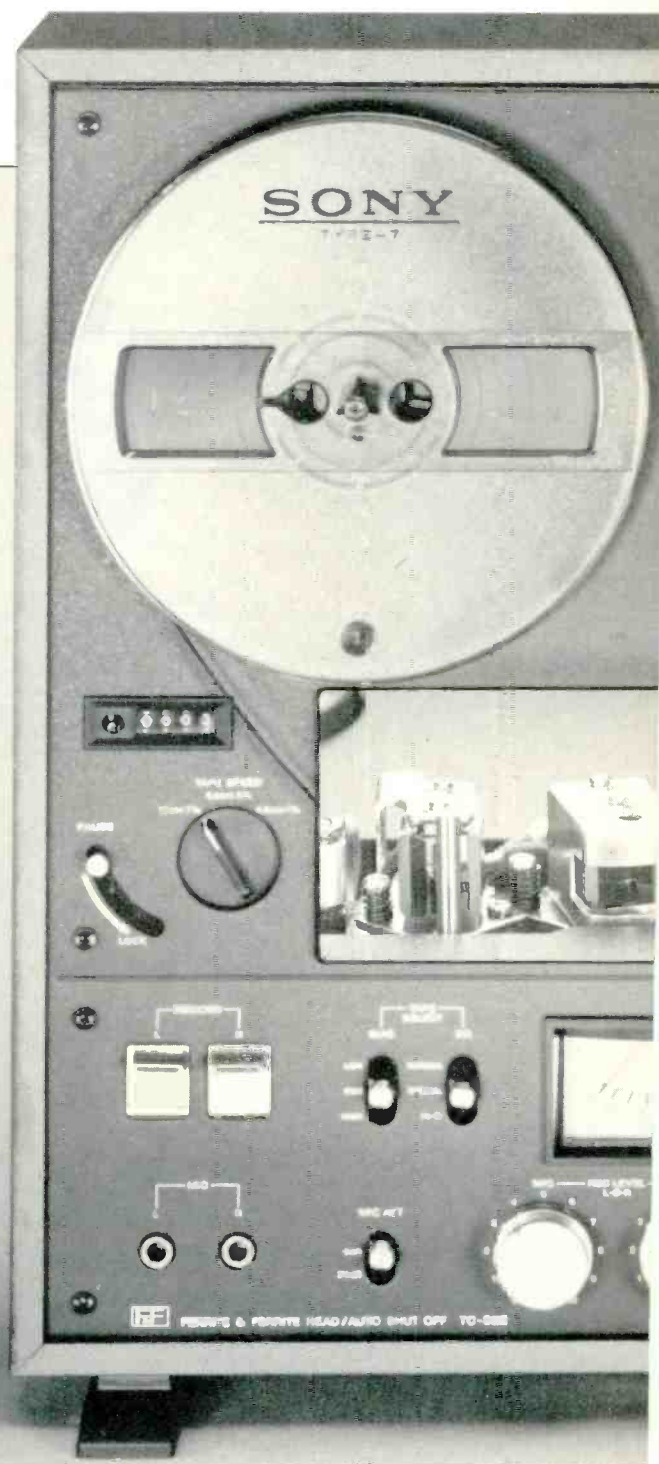
Certainly one of the greatest virtues of magnetic tape as a recording medium is the ease with which old information can be erased to make room for new information. Compared to other kinds of recordable media, such as photographic film which is chemically processed and permanently written, magnetic tape can be used thousands of times through the faculty of erasure. Although the process of erasing tape is performed automatically in recording systems and manually with the aid of bulk demagnetizers, the precise mechanism of erasure within a tape is not commonly understood. Perhaps this lack of understanding results from the apparent simplicity of the erasing process — a simplicity which does not challenge the interest of those who use the process. But tape erasure is not as simple as it appears, and perhaps the following description of the erasure mechanism will both interest and enlighten.

To understand tape erasure one must first understand the composition and behavior of the magnetic material used in tape. The most commonly used material is the gamma form of iron oxide, or gamma Fe_2O_3 . This material exists as tiny, needle-shaped particles having an average length of 0.4 micron, and is shown magnified 42,000 times in the photomicrograph of Fig. 1. Although other magnetic materials such as chromium dioxide (CrO_2), cobalt modified iron oxide, and metallic materials may have different chemical compositions and physical structures, they respond magnetically in a manner similar to gamma iron oxide.

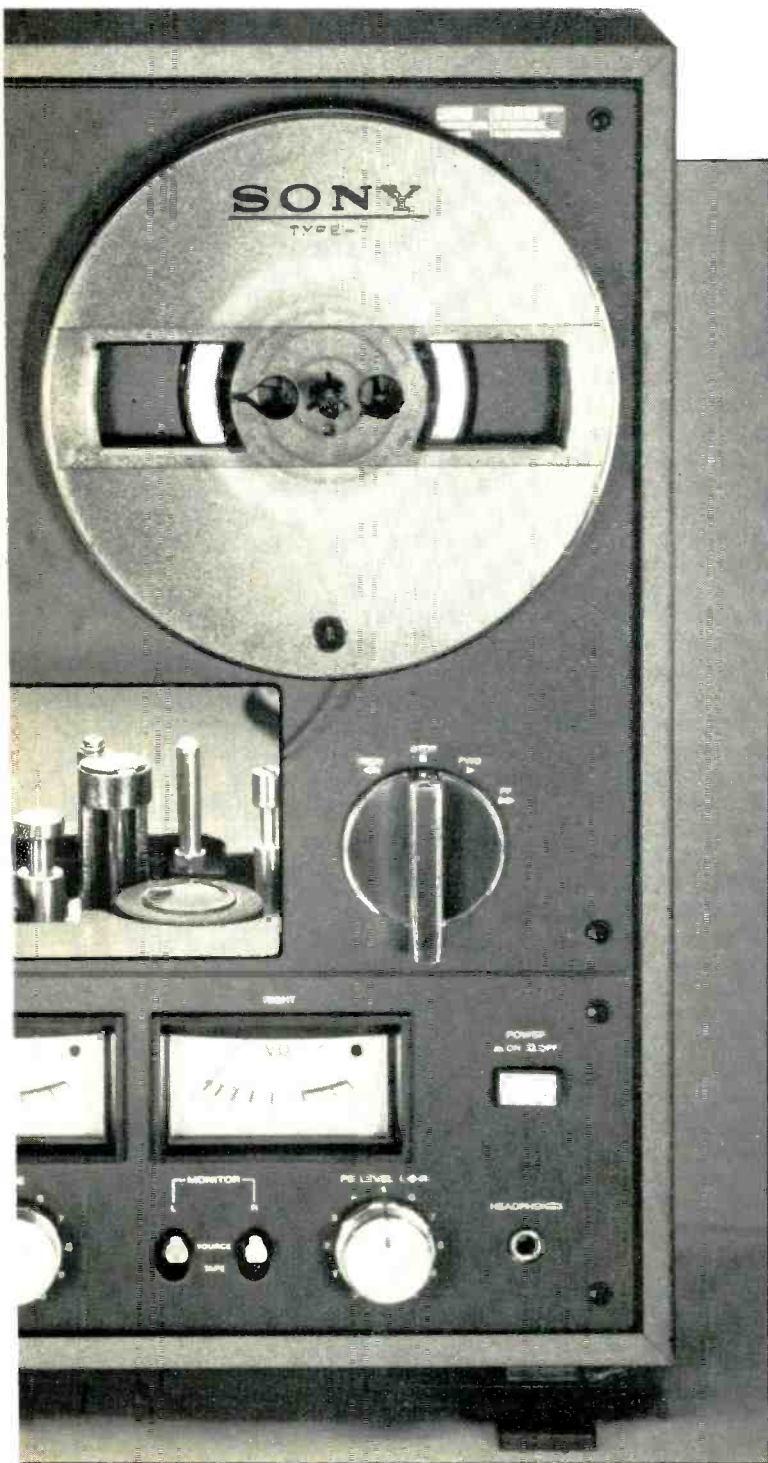
Each iron oxide particle is a permanent magnet containing only a single magnetic domain. The single-domain structure of the particles dictates that each particle is forever a permanent magnet which cannot be demagnetized. If subjected to an external magnetic field of sufficient intensity, a particle will reverse the polarity of the field it generates, but the reversed field will not be

Continued on page 26

*Manager, Advanced Recording Technology, Magnetic A/V Products, 3M Company, St. Paul, Minn.



RECORDERS



FOCUS ON HEAD DEMAGNETIZATION

HERMAN BURSTEIN

Until recently I accepted without question the widely propagated dictum that tape heads must be periodically demagnetized — roughly after about 8 to 16 hours of use. My acceptance became embedded in concrete several years ago, but cracks have developed in this concrete as a result of several letters from "Tape Guide" readers and some inquiries I have made.

At this point perhaps a brief review would be appropriate of the commonly given reasons for demagnetizing tape heads; in other words, The Gospel: The waveforms of most source material are asymmetrical, thus in effect contain a d.c. component, which tends to magnetize the heads. Distortion in the bias waveform has a similar effect. Magnetized heads act as erasing devices, particularly as recorded wavelengths on the tape grow shorter, i.e. as frequency rises at a given tape speed. Furthermore, magnetized heads translate physical and magnetic irregularities in the tape into noise. Altogether, it is claimed, magnetized heads produce treble loss and noise.

Several months ago I received a challenge to this conventional wisdom from Ramon Valdes in Miami Lakes, Florida. He wrote: "Two years ago I did a test to see how important tape recorder head magnetization is. I took a TEAC 7010 GSL tape deck with automatic reverse and optimized it for 3M 206 tape; a test tape was then made with tones from 20 Hz to 15 kHz. I then took a 10½-inch reel of 206 tape and proceeded to record at 7½ ips three hours at 20 Hz, three hours at 1 kHz, and 3 hours at 15 kHz in that sequence for 100 hours. I cleaned the heads every three hours but did not demagnetize them. After 100 hours, I played back the original test tape and also rerecorded the test tones. All parameters (distortion, signal strength) were the same as before the 100 hours of recording. I went another 100 hours before my patience ran out — the results were the same."

My reply to Mr. Valdes was essentially as follows: "If I understand correctly, at 7½ ips you recorded and played tones of 20

Continued on page 30

greater or smaller in magnitude than the original field. Thus, each particle can be thought of as the magnetic equivalent of an electronic flip-flop which has two stable states. Just as a flip-flop can be switched into one of two saturated states, energy applied to a single-domain magnetic particle can cause it to reverse polarization virtually instantaneously but cannot cause it to generate a magnetic field of variable intensity within the particle.

The switching characteristic of a particle is illustrated graphically in Fig. 2. A magnetic field which varies sinusoidally in amplitude is applied to the particle so that the direction of the field is parallel to the long axis of the particle. (A different result is obtained if the applied field is at right angles to the axis.) Particles in most magnetic tapes are aligned along the length of the tape by immersing the tape in a longitudinal field while the magnetic coating is still fluid. Once dried, particles in the coating remain physically aligned in that direction.

As the applied field in Fig. 2 increases from zero, a level is reached (point a) where the coercivity of the particle is equalled, and at this point the field within the particle instantaneously reverses. The particle will not again switch until the applied field has reversed and reached the equal but opposite magnitude. The hysteresis waveform of a single particle will be recognized by electronic engineers as similar to the graphs used to depict the behavior of electronic flip-flops and Schmitt triggers.

Each area of a magnetic tape which is uniquely magnetized during recording contains thousands of magnetic particles throughout the width and depth of the recorded track. The magnetic field emanating from a recorded area is the sum of the fields produced by these individual particles. A magnetic tape is said to be saturated when all the particles are switched with the same magnetic polarity. A discrete area of tape thus saturated will produce the maximum external magnetic field of which the tape is capable. In the erased condition, one-half of the magnetic particles are switched with one polarity while the remaining half retains the opposite polarity, and since the particles composing these halves are closely intermixed, their external fields cancel, producing zero external field from the tape.

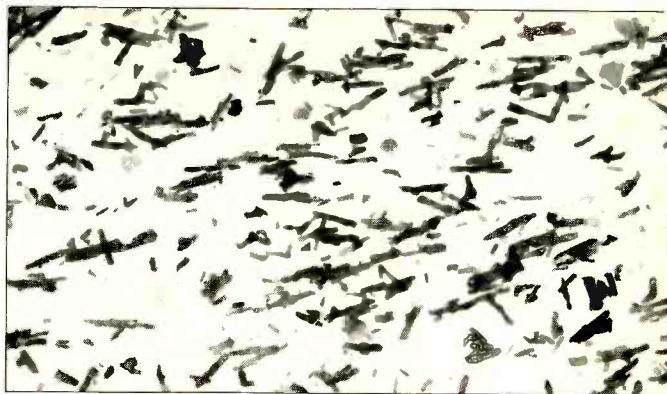


Fig. 1 — Photomicrograph of iron oxide particles used in magnetic tape, 42,000 X magnification. The particles' magnetic properties are controlled largely by their shape, and their magnetic characteristics from stimulation fields which are parallel to the particles are different from ones which are perpendicular. The long dimension of the particles is aligned parallel to the recording direction in most tapes.

Varying levels of tape magnetization are produced during the recording process by causing the particles to be switched to the opposite polarity in proportions varying between the saturated (100% switched in one direction) and erased (50%-50%) states. It is seen, then, that the analog recording process in the strictest sense is really not analog at all but is a binary process in which the magnetic outputs of thousands of flip-flop elements are summed in the pole pieces of the reproducing transducer.

It is also apparent from the foregoing that the magnetic transfer characteristic of a tape would not permit the recording of an analog signal if the coercivities of all particles in the tape were identical. A tape made with such magnetic material could exist only in alternately saturated states of two polarities, and would have a hysteresis curve identical to that shown in Fig. 2. (Note: In reality an analog signal could be recorded on a tape having a rectangular hysteresis curve because of the three-dimensional geometry of the magnetic field produced by a recording transducer [1]. In this instance, varying magnetization of a tape would be achieved by modulating the depth of magnetization within the thickness of the magnetic coating. The recording character-

istics of such a tape, of course, would be quite different from conventional tapes.) Fortunately, the millions of particles that exist in even a small section of tape have coercivities which cover a broad range. The population of coercivities is similar to the distribution of a normal curve, as shown in Fig. 3. A value of coercivity assigned to a specific tape refers to the average coercivity of the oxide particles, and in most instances, this value will be the peak of the distribution curve.

The task of erasing a magnetic tape can be defined as the necessity of establishing a condition whereby all external fields are zero as a result of a one-to-one ratio of oppositely polarized, closely intermixed magnetic particles [2]. Most explanations of a.c. erasure utilize the expedient of a family of hysteresis curves to show how the mechanism of

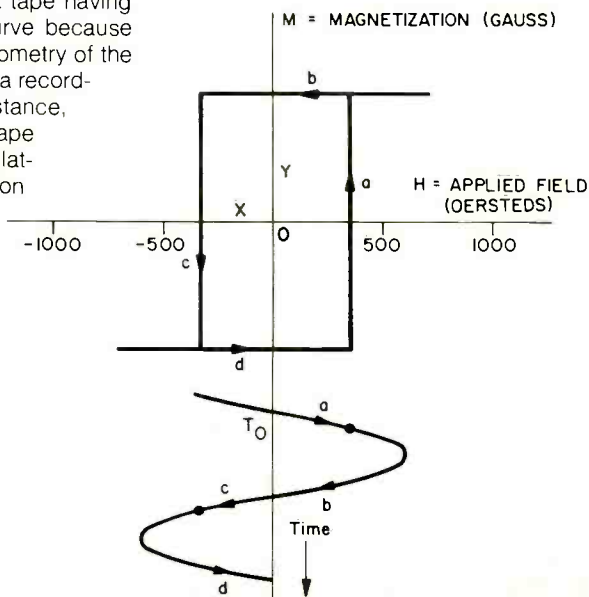


Fig. 2 — Magnetization characteristics of a single-domain particle.

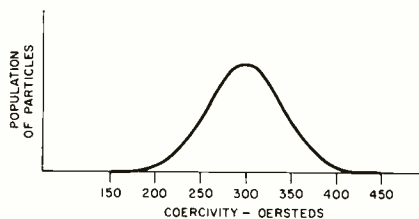


Fig. 3 — Distribution of coercivities in a large group of particles.

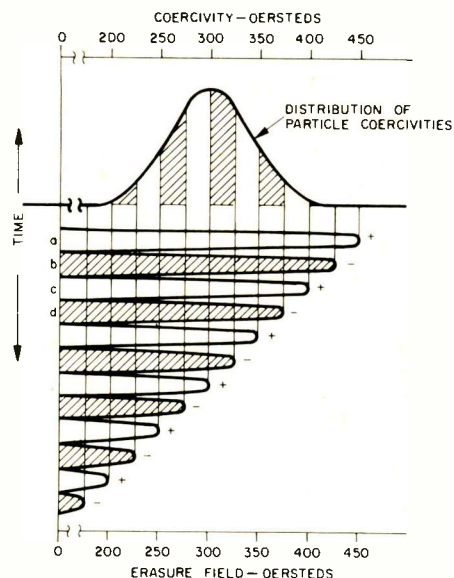


Fig. 4 — Relationship of a magnetic material distribution curve to an erasure field.

erasure works [3]. An alternative explanation which may be more conducive to an understanding of the physical events which occur in the erasure process is presented with the help of Fig. 4. The uppermost curve represents the distribution of coercivities of magnetic particles used in a tape, where the greatest population occurs at 300 oersteds (the specified coercivity of the tape). The waveform below the distribution curve represents an applied a.c. field which varies sinusoidally and which diminishes gradually from a high magnitude to zero. This diminishing field is the kind of field that a tape will experience as a bulk degausser is slowly withdrawn from its vicinity or as a particular area of the tape moves away from the erase head of a recorder. The shaded half-cycles represent a field of negative polarity and for the purpose of illustration are folded over from the negative side of the zero line. The unshaded half-cycle portions represent the positive polarity.

Starting with half-cycle a, the peak applied field is of sufficient magnitude that all particles are switched in the positive direction, and at that point the total magnetic material is saturated positively. Half-cycle b also saturates the tape, but with a negative polarity. Half-cycle c again reverses most of the magnetic particles, but leaves a small percentage in the negative polarity because the decreased magnitude of the field is too low to reach the highest coercivity particles. The largest part of the particles are yet again reversed by half-cycle d, but this time a greater percentage are left in the positive polarity because of the diminishing erasure field. This process continues until the erasure field reaches zero. At this point note that approximately half of the particles remain switched positive and the other half are switched negative;

in other words, the sum of the fields produced by all the particles is zero. Note also that the probability of arriving at a one-to-one ratio of polarities is greater as the number of half-cycles is increased (longer diminish time). This analysis shows why a tape must be withdrawn slowly from an erasure field to insure full erasure. It also shows why the field of a bulk degausser cannot be interrupted until the tape being erased is outside the influence of the field. To obtain complete erasure, the applied field must be greater in magnitude than the coercivity of the highest coercivity particles in the tape. An erasure field which is merely equal to the specified coercivity of a tape will not totally erase it; the field will switch only those particles with coercivities in the lower half of the distribution curve, while those particles in the upper half will be unaffected.

Of increasing concern today is the erasure requirement of the so-called "high-energy" tapes which have coercivities considerably higher than gamma iron oxide. As a general rule, the width of the distribution curve of these high-coer-

civity materials increases in proportion to the increase in specified coercivity. Consequently, a tape which has a specified coercivity twice as great as another will require an erasure field of double the magnitude.

The measured distribution of a 625-oersted magnetic tape is shown in Fig. 5, and it can be seen from this curve that a significant portion of the particles have a coercivity above 1,000 oersteds. The signal which remains after a tape has been erased to a level 60 dB below the maximum output level of a tape may be stored by only one-tenth of one percent of the magnetic material in the tape, and, of course, that small portion of the material will be at the uppermost end of the distribution curve. The tape represented by the curve of Fig. 5 requires an erasure field intensity of 2,000 oersteds to achieve this level of erasure.

The peak field requirement for a bulk degausser is even greater than that of an erase head, because in most bulk degausser configurations the direction of the erasing field is at right angles to the direction of tape orientation. (The excep-

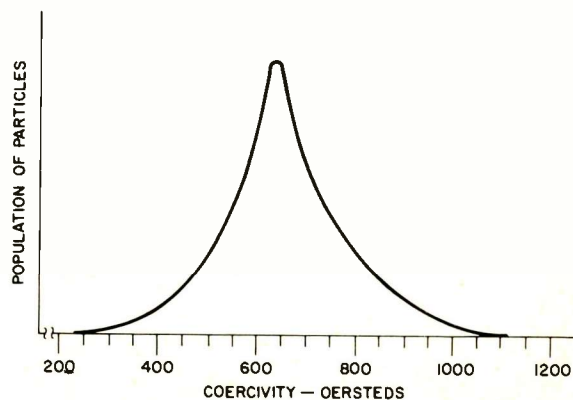


Fig. 5 — Measured distribution of a high-energy tape having a coercivity of 650 oersteds.

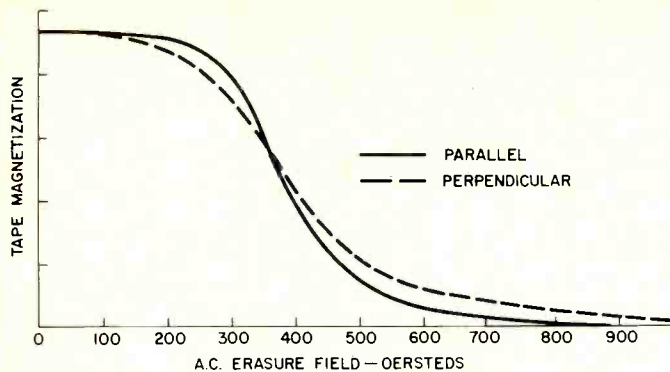


Fig. 6 — Erasure curves for a gamma iron oxide tape using parallel and perpendicular erasing fields. The effective distribution of coercivities is broadened when the applied field is perpendicular to the direction of orientation, substantially increasing the field strength needed for erasure.

tion, of course, is quadruplex videotape, where orientation is across the width of the tape rather than along its length.)

Erasing with a perpendicular field effectively broadens the distribution of the magnetic particles. Figure 6 shows demagnetization curves for a gamma iron oxide tape in which the erasure field is first parallel with the direction of orientation and then perpendicular to it. Note that erasure starts taking place at a lower magnitude of erasure field for the perpendicular case, but that more than 200-oersted greater magnitude is needed to achieve maximum erasure equivalent to the parallel case.

Since bulk degaussers almost invariably use a magnetic field which penetrates the flanges of a reel or the wall of a cassette, the most intense component of the field is perpendicular to the tape. Erase heads, on the other hand, have magnetic gaps which generate intense parallel as well as perpendicular erasure fields and consequently are somewhat more efficient than bulk degaussers. Also, the erase head is in contact with the tape, whereas the bulk degausser must penetrate the thickness of the tape container. While a magnetic field experiences no difficulty in penetrating plastic or cardboard material, the physical separation caused by the container can greatly reduce field intensity. In selecting a degausser to erase a particular tape product, or in the design of degaussers and erase heads, the principal parameters which must be considered are:

1. The specified coercivity and distribution of the magnetic material involved.
2. The direction of the erasure field relative to the orientation of the tape.
3. Separation of the tape from the erase field (in the case of bulk degaussers the field must penetrate the full thickness of the tape pack).
4. The level of erasure which is required.

These parameters will be translated into an erase field intensity.

Most purchasers of bulk degaussers do not have the instruments needed to

measure tape distribution or degausser field intensity and so must rely on the claims of manufacturers relative to the suitability of a specific product. Perhaps the best means of determining suitability is to erase a saturated recording with the degausser under consideration and then measure the magnitude of any remaining signal.

The discussion of tape erasure to this point has dealt only with a.c. erasing fields, which are commonly generated by erase heads used in recorders and by bulk degaussers. In terms of ridding a tape of a recorded signal, drawing the tape over the end of a permanent magnet will erase a signal as effectively as any other means. Permanent magnet erasure was used in early recording systems for the sake of simplicity, but it has been abandoned for years in favor of a.c. erasure. Only in a very few applications of magnetic recording is permanent magnet erasure still used.

D.c. erasure was abandoned to minimize the noise which is generated by tape erased in this manner. D.c. magnetization of a tape will cause any irregularities in tape surface and thickness to generate fields which appear in the reproducing transducer as noise. Since the field generated by a given area of tape is

the sum of the fields of all the particles within that area, it can be seen that localized concentrations or rarefactions of oxide will produce different sums when all particles are polarized in the same direction. The differences in these sums constitute a varying external magnetic field and a noise signal.

Great care is taken in the tape manufacturing process to produce uniformly dispersed oxide in the magnetic coating, but slight density irregularities are unavoidable. These irregularities, combined with slight thickness variations of the coating and slight surface irregularities, produce unacceptable noise when a tape is magnetically saturated in order to erase a signal. (See Fig. 7.)

Strong evidence that d.c. erasure noise is caused by physical irregularities in tape is provided by the simple test of comparing the output noise waveforms from the same area of a tape on two successive passes where polarization of the d.c. erasure field has been reversed. One would expect the noise waveforms to be identical but inverted, as indeed they are in Fig. 8.

A correlation coefficient between two noise waveforms was determined by measuring the waveform amplitudes at 50 different sample points spaced at

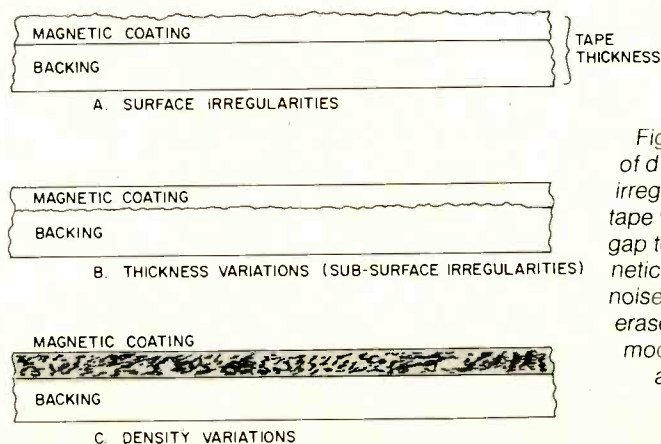


Fig. 7 — Three sources of d.c. erasure noise. Any irregularities in a magnetic tape which cause the head gap to "see" varying magnetic material will generate noise when the tape is d.c. erased and will also cause modulation noise from an a.c. erased tape when it is recorded with an analog signal.

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Crown now announces the second microphone – the PZM™.

During the last century, microphones have been much improved, but they still employ Bell's basic concept: a movable diaphragm connected to a transducer, the whole assembly intended to be stuck out in the air somewhere near the sound source.

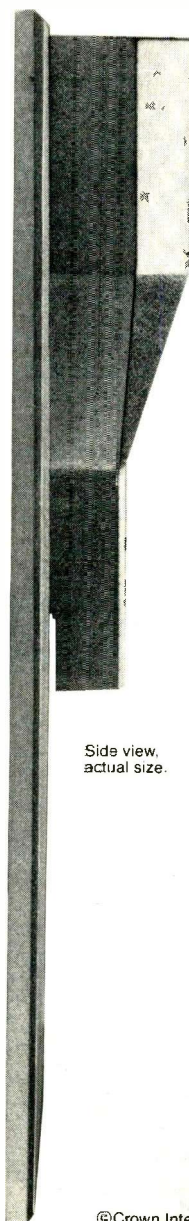
Comb filtering is a side effect of that design that cannot be eliminated.

Every Bell-design microphone demonstrates frequency response anomalies because of an inability to satisfactorily combine direct and reflected signals. Phase-induced amplitude cancellation and reinforcement are the inevitable result.

Crown PZM microphones eliminate comb filtering from the primary boundary because they detect sound according to a new principle, the Pressure Recording Process™. As a sound wave approaches a boundary (wall, table, floor) a pressure field four or five millimeters deep forms at the boundary, within which the direct signal and its reflection from the boundary add coherently and remain in phase.

The Crown PZM™ places a small pressure transducer into the primary boundary pressure zone, eliminating the possibility of phase-induced interference. The PZM concept thus provides a significant improvement in signal quality. Its small profile also improves microphone aesthetics.

The PZM pickup pattern is hemispherical, with no "off-axis" position.



Side view, actual size.

Singers and speakers can move more freely around the PZM. Gain related to distance will change, but not tonal quality.

The PZM responds accurately to SPL up to 150dB. You can put it right inside a drum, a bass fiddle, or a piano. The PZM hears whispered conversations in an ordinary room at thirty feet. In certain situations where undesired ambient noise can't be eliminated, or in halls with poor acoustics, the PZM probably should not be used – it will pick up everything.

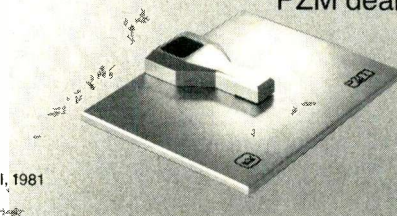
Singers, orchestra conductors, pianists, percussionists, broadcasters have all tried – and praised – the PZM.

Recording engineers find that the PZM suggests new miking techniques. For small groups it now seems that the best place for a PZM is on the floor! Recording and reinforcement may well require fewer PZM mikes.

Several PZM models are now available at the manufacturer's suggested list price of \$349.00 each.

The PZM is changing ideas about how a microphone ought to sound, look and be used. Find out for yourself how it might improve your own recording or reinforcement systems.

Send the coupon to Crown for information and a special list of PZM dealers.



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Innovation. High Technology. American. That's Crown.

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CROWN INTERNATIONAL

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(Mail this coupon to Crown.) Send PZM info. Hurry!

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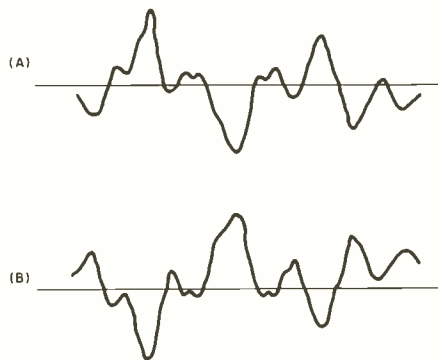


Fig. 8 — Noise waveforms generated as the result of reverse magnetization.

equal time intervals and then mathematically computing their similarity. When the tape was magnetized by passing it over a recording head excited with direct current, correlation of the two waveforms was -0.89, where ideal correlation would be -0.9 (rather than -1.0) because of amplifier and system noise. This high degree of correlation is convincing evidence that noise output of a d.c. saturated tape results from permanent physical features of the tape.

The same density variations that cause d.c. noise also give rise to modulation noise, that is, noise which occurs in the presence of a recorded signal. Imagine, for example, that a tape has been a.c. erased and then recorded with a long-wavelength, high-level audio signal.

Insofar as the segment of tape which contains a half-wave of the signal is concerned, magnetization within this segment is no different than magnetization which might have occurred from d.c. erasure. Once again density variations produce external fields, but in this case the noise which is generated has a frequency relationship to the recorded signal and is termed modulation noise. D.c. erasure noise and modulation noise thus have substantially the same origin but are manifested in different ways. While d.c. erasure noise can be virtually eliminated by using a.c. erasure fields, modulation noise is minimized only by judicious design and manufacturing of magnetic tape.

In conclusion, the magnetic recording

process is almost always preceded by an erasing process, either by bulk degaussing or by magnetic-head erasure. Erasure is a fundamental step in achieving high-quality recordings. The simplicity with which erasure is performed belies the complexity of the process. It is hoped that the foregoing has created a little higher regard for this seemingly mundane procedure. ▲

Acknowledgment

The author wishes to acknowledge the work of E.F. Wollack of the Data Recording Products Division of 3M Company, whose research of the recording process contributed significantly to the information presented.

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DEMAGNETIZATION

Continued from page 25

1,000 and 15,000 Hz, each 3 hours at a time, for a total of 200 hours and after such use found no deterioration in the ability of the heads to record and reproduce a 15,000-Hz tone relative to 1,000 Hz.

"However, I have several problems with your findings. The first is that you used a speed of 7 1/2 ips. A number of adverse magnetic tape phenomena, including erasure due to magnetized heads, are wavelength effects. That is, they become more severe as tape speed decreases. I wonder what you would have found if the same test were conducted at a lower speed, say the cassette speed of 1 7/8 ips.

"Second, gradual magnetization of heads is attributed to the asymmetric nature of the typical audio signal. For your test, you probably used very pure sine waves devoid of significant asymmetry.

"Further, your letter says nothing about noise. In looking for head magnetization effects, one should look not only

for deterioration of high-frequency response but also for increase in noise."

Mr. Valdes shortly replied: "Your first paragraph is correct; that is the way I ran the test.

"Concerning your second paragraph, I only ran a 7 1/2-ips test since that is the (minimum) speed I consider useful for serious recording.

"Concerning the third paragraph, I did use very pure sine waves because that was then the only way I had to measure distortion and frequency response. However, now I have a method of recording precise square waves with different rise and fall times, resulting in asymmetrical waveforms. I can view them with a spectrum analyzer and photograph the screen. Let me know if you think making before and after comparisons, following 200 hours of deck operation, would be a valid test. Using a musical waveform would show whether the heads become magnetized, but only gross distortion would be noticed.

"Concerning your fourth paragraph, the noise increased after 45 hours, but it was due solely to tape erasure by the

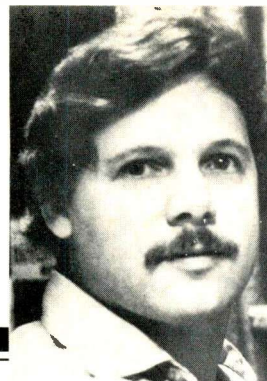
erase head. When the tape was bulk-erased, the noise disappeared."

In turn I wrote: "It would be interesting to see if asymmetrical waveforms recorded over a long period do raise the level of magnetization of a tape head, and to compare the reproduced waveforms at the end and beginning of the test."

As of the present writing, it is several months since my last letter to Mr. Valdes. This may well be too short a period to permit him to give an account of the results of running his tests with asymmetrical square waves. However, in view of continuing reader interest in the subject of head demagnetization over the years, I thought it best not to delay the present article by waiting further for this account.

About the same time that I received Mr. Valdes' first letter, another challenging letter came from Henry B. Ruh of Owen Valley Broadcasters, Inc., Ellettsville, Indiana: "... From my 15 years of broadcast and audio experience, let me state that if your deck needs to be demagnetized, you probably need a new deck! Back in the days when a perma-

Bob Carver tells you (briefly) how Sonic Holography works. (Others tell you how it sounds.)



Q. Exactly what is Sonic Holography?

A. It's a term I use to point up the similarity of the sonic illusion that enables one to hear a stereo recording in three dimensions, and the optical holographic illusion that allows one to see a flat photograph in three dimensions.

Q. What does Sonic Holography sound like?

A. I'll let others answer that for me. Hal Rodgers, Senior Editor of Popular Electronics: "When the lights were turned out we could almost have sworn that we were in the presence of a real live orchestra."

Julian Hirsch of Hirsch-Houck Labs: "The effect strains credibility—had I not experienced it, I probably would not believe it...the 'miracle' is that it uses only the two normal front speakers."

Larry Klein, Technical Director of Stereo Review: "...it brings the listener substantially closer to that elusive sonic illusion of being in the presence of a live performance."

And High Fidelity put it this way: "...seems to open a curtain and reveal a deployment of musical forces extending behind, between and beyond the speakers...terrific."

Q. How many speakers are needed for Sonic Holography?

A. Just your usual two. But for optimum Sonic Holography, the speakers *must* be equidistant from the listening position, and somewhat closer together than is usually required for stereo.

Q. What do I hear when I'm not in the middle?

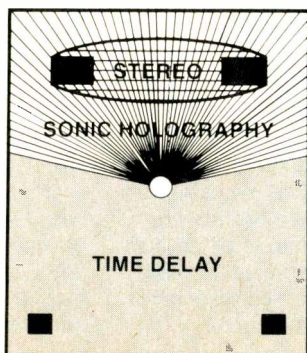
A. We'll let Julian Hirsch describe what he heard: "still noticeably better than normal stereo, particularly in respect to a greater sense of 'warmth' such as is experienced in a concert hall."

Q. How is Sonic Holography achieved?

A. The technology is fairly complex, involving acoustic psychoacoustic and electronic factors. Using standard stereo program sources—discs, tapes, FM broadcasts—the Sonic Hologram Generator recreates the spatial information of the original recording that is all but lost during normal stereo presentation.

Carefully calculated and controlled psychoacoustic crosstalk cancellation techniques expand the sonic image beyond its normally confined area between the two speakers and deploy instruments and voices naturally in front of the listener over a broad deep arc.

Sonic Holography does not create this illusion artificially, but rather lets the listener hear fully for the first time the phase and timing information on the original recording that up till now could not be heard.



That's why Larry Klein described Sonic Holography in Stereo Review as producing "a far more plausible sonic illusion of space and localization than is produced by normal stereo."

Q. Isn't Sonic Holography something like time delay?

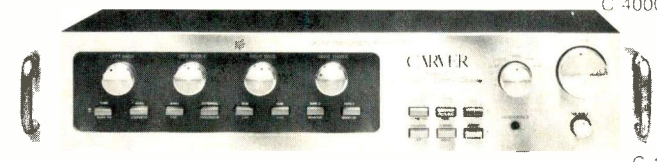
A. No. Sonic Holography takes the normal stereo signal and feeds it through the normal two speakers in a

way that recreates the actual locations of instruments and voices throughout the front hemisphere where they were originally "heard" by the microphones.

Time delay, on the other hand, feeds the stereo signal through additional amplifiers and rear speakers in a way that recreates only the spatial ambience of the original recording environment.



C 4000



C 1



C 9

Q. How can I add Sonic Holography to my system?

A. Three different ways

1. The C-4000 Control Console includes the Sonic Hologram Generator plus: a full-function stereo preamplifier, a time-delay system with built-in 40 watt (total) power amplifier for time delay speakers, the Autocorrelator system that reduces noise up to 8 dB with any source material and a peak unlimited downward expander that nearly doubles dynamic range.

2. The C-1 combines the Sonic Hologram Generator with a full-function preamplifier.

3. The C-9 Sonic Hologram Generator allows you to add Sonic Holography to any system, including one with a receiver.

Q. How can I get more information?

A. Easily. Just write to us

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ment magnet was used for erasure . . . the continuous stream of one-way magnetized tape particles would over a period of time tend to magnetize items downstream from the erase magnet. Thus, you had to demagnetize the heads, guides, capstans But when the cost of a high-power a.c. erase system was reduced to a reasonable level and permanent magnet erase heads were eliminated, so was the problem of magnetized heads.

"Although I have checked hundreds of times on many different makes and models of tape machines, I have never found on a modern machine any residual magnetism which could in any way erase any portion of the signal on the tape

"In conclusion, you can throw your head demagnetizers away and forget the problem. While in the service field, I encountered more magnetized tape heads caused by improper use of demagnetizers than I found blown fuses."

Comments By Several Authorities

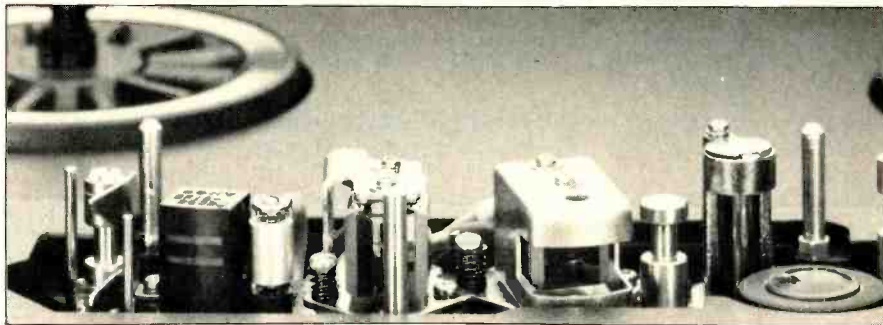
After hearing from Messrs. Valdes and Ruh, I solicited views on the matter from several knowledgeable persons in the field of tape recording. While they do not necessarily constitute a representative sample, their positions lend authority and interest to their comments.

Delos A. Eilers, Technical Service Supervisor at 3M Co., St. Paul, Minnesota, wrote: "Head demagnetizing at regular intervals is a good preventive maintenance practice. What that interval should be is difficult to define.

"It is true that improper head erasure can cause more problems than if one didn't demagnetize the heads. If the demagnetizer isn't gradually pulled away from the heads, you won't be showing the head a gradually decaying magnetic field. You will leave the head magnetized. A slowly decaying field is essential for good demagnetization.

"The magnetization that a head can build up over a period of time is not from the earth's field but more from accidental exposure to magnetized particles or build-up of residual magnetization from nonsymmetrical bias or program signals. Thus, we recommend that heads be demagnetized after every 10 to 15 hours of recording."

The chief engineer of a well-known



manufacturer of tape decks (who prefers not to be identified) indicated that the need for head demagnetization appears to vary from one deck to another. To illustrate, he cited his ownership of two fine decks, one requiring frequent demagnetization in order to prevent obvious treble loss, and the other apparently never requiring it. To play it safe, he periodically demagnetizes both.

Don Eger, an engineer with Crown International, Inc., gave the following remarks: "Our experience with tape recording heads during the past two decades does not support occasional claims that tape head demagnetization is unnecessary or harmful.

"The effect of using a head that has become magnetized is loss of short wavelength material from the tape, as such material is erased by the magnetism of the head. If the tape is continually exposed to a magnetized head, the recording will lose most of its high-frequency content.

"Occasional dissatisfaction with the demagnetizing process experienced by some recording enthusiasts may be a result of degaussing the head too quickly and/or improperly. If the degaussing coil is removed slowly from the head, it will demagnetize the head properly."

Finally, we quote Henry C. Pollak, an electronics engineer who has spent much of his career designing professional tape equipment and servicing consumer audio equipment, including tape decks. At one time he owned Western Radio Lab of Sunnyvale, California, an audio service shop. (It may be added that he is co-author, with me, of the book *Elements of Tape Recorder Circuits*, which was published in 1957.) He stated:

"My experience with demagnetizing play heads has been that I have never found any benefit. It's like washing before eating. My mother said to do it, so I wouldn't think of not doing it, although now I'm certain that nothing adverse would happen if I neglected my upbringing. At Western Radio Lab, as a matter of course, we demagnetized all decks that we serviced. The amount of magnetization the play head receives from the tape oxide is extremely small. The

narrowness of the hysteresis loop of the play head material is so small that the remanence of the head would be trivial. And, anyway, the next playing of a loud passage would restore the head to its previous condition.

"I would worry more about the harm a head demagnetizer can do (if carelessly used): Bending flimsy tape guides, cracking plastic covers, or scratching head surfaces. Most demagnetizers are too bulky to do a proper job on the cassette heads. At Western Radio Lab, we covered the tips of the demagnetizer with mylar tape to prevent scratching the heads.

"There is an argument for preventing d.c. from flowing through any head — erase, record, or play. And, to minimize noise, it is important to have minimum distortion in the bias and erase waveform."

Summary

From the foregoing, it doesn't appear that a definitive case can be made for or against head demagnetization. However, some conclusions can be drawn:

1. Demagnetization of the heads is advisable as a *precautionary* tactic, for some decks might need it.

2. If used, a demagnetizer should be operated with proper care so as not to leave the heads in a more magnetized condition than previously. The device should be turned on while several feet from the heads, brought slowly to the heads, moved in slow circular fashion while near the heads, removed gradually, and turned off at a distance of several feet. The tape deck should have its power off during this process.

3. If the demagnetizer is used, care should be taken to avoid physical harm, such as scratching the tape heads with the tips of the demagnetizer, bending any of the tape guides, or damaging a sensitive record-level meter by subjecting it to an excessively strong magnetic field.

The "Tape Guide" will be pleased to hear further from readers who can supply authoritative information on the pros and cons and cautions of tape head demagnetization. Assuming receipt of such items, the subject will be continued.

WHY ONLY SONY WINDS UP WITH FULL COLOR SOUND.

Strangely enough, some of the things that make Sony Full Color Sound sound so terrific are things you can't hear.

Such as Sony's unique experience and technical achievement. Sony makes both tape *and* the equipment that plays it. So Sony's experience with tape recording is unique among major tape manufacturers. After all, you'd better know all there is to know about tape decks before you make a tape. Sony does.

Then there's unique Sony *balance*. The fine-tuning of all the elements that go into making a tape, so that each synergistically complements the other and delivers the finest recording humanly and technically possible to achieve.

You also can't hear Sony's unique SP mechanism, one of the carefully balanced elements in every Sony tape. It's a perfect example of Sony technical achievement. The SP mechanism is what makes the tape run so smoothly inside the cassette. And smoothly running tape is critical for total, perfect tape performance.

Smooth running means less friction. So some of the most popular tape makers give the tape as much clearance inside the cassette as possible. (We used to do the same thing.) But this method results in uneven or too tight winding and actually increases friction as you wind and rewind the tape. Jamming and even a stopping of the tape in its tracks can result.

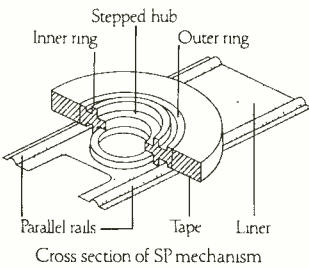
It was clear to Sony that even, uniform winding was the key. So Sony reversed the basic thinking about friction completely and invented the SP mechanism, the first positive guidance system on the market. Instead of giving the tape lots of room, it gently guides the tape smoothly and precisely through the cassette, and onto the reels, with a maximum of positive precision support, yet with an absolute minimum of friction. This is a perfect example of Sony

pioneering and how the Sony balance system works.

Some of the unique patented Sony innovations are the stepped hub wheel, which suppresses wobble; parallel "rails" of the liner which guide the tape and hub and keep the tape winding flat and even. Even the surface which touches the tape is special graphite-coated polyester, for the least possible friction.

Our Sony SP mechanism is actually 10 times more trouble-free in lab tests than our old conventional mechanism. And the increase of friction after 200 "torture-test" windings and rewindings has been reduced by nearly 2/3!

The fact is, the more sophisticated your equipment, the more you'll appreciate Full Color Sound. Listen to Sony SHF (our best normal bias tape), EHF (high bias), FeCr or Metallic tape. Listen to the perfect balance of its perfect components. It's the secret of Full Color Sound. **SONY.**



Precision guide roller Tape Pressure pad Shielding plate

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WILLI STUDER

GARY STOCK

Rags-to-riches tales of hardworking entrepreneurs are fairly commonplace in the United States but not so in Europe, where class distinctions and remnants of the guild system have made upward mobility a relatively uncommon achievement. Willi Studer, founder of the Swiss-based Studer Revox group, surmounted all of these factors and built a company whose name is known worldwide for performance based on extremely high standards of precision and careful design. At the age of 68, Studer stills runs the activities of the company in both its professional and consumer veins, and he is active in design.

Dr. Studer has been in the electronics manufacturing business for many years. He left an apprenticeship program after his graduation from high school in order to market his own radio receiver at the age of 19. Two years later, he and a partner formed Sondyna — a firm still in existence — to manufacture his receivers in large quantity. From there, he pressed on into test equipment, founding two firms — one which produced measurement instruments and his first audio products, and another which built electrochemical test equipment, including a then-exotic oscilloscope.

Studer's first involvement with tape recorders — the product which has come to be most closely associated with the Revox and Studer names — came in 1949, when the European importer of the U.S.-built Brush tape recorder asked Studer to modify a group of these recorders for European voltages and line frequencies. After engineering all of the complex elements required for the conversion, Studer bought 500 of the ma-

chines to sell himself and simultaneously commenced development of a recorder of his own design. Marketed in 1950 under the Dynavox name, the first Studer-developed recorders were rapidly accepted among broadcasting and professional users, and the company's long tradition of simultaneous involvement in professional and amateur recording applications began.

Throughout the '50s, Studer Revox built the compact, extremely rugged open-reel machines that were de rigueur among the location recordists of the day, including early examples of three-motor-transport-equipped and direct-driven machines (both introduced in 1954).

Studer Revox products from the '60s and '70s are readily familiar to American audiophiles. The A77 portable open-reel recorder was among the most successful reel-to-reel designs ever marketed in terms of sales volume and was remarkably long-lived for a consumer electronic product as well (12 years without major changes; now succeeded with the B77). A series of amplifiers, preamplifiers, and tuners based on the visual styling of the A77 have met with only moderate success in the U.S., perhaps due to their cosmetics or their comparatively modest power output ratings, but they remain very well respected throughout Europe and Asia. The company is now a major manufacturer of loudspeakers, tangential-tracking turntables, a full spectrum of professional recorders and ancillary equipment.

Dr. Studer himself possesses enormous personal reserve; his voice rarely rises above a murmur. In contrast to an extraordinary personal containment, however, are Studer's candidly expressed judgments of the future of high fidelity, his competitors, and the road to The Digital Revolution. Here, he goes far beyond the degree of openness revealed by most corporate executives, as

can be seen in his conversation with Features Editor Gary Stock.

Audio: Studer Revox has made its position of welcoming the Digital Revolution while continuing to work with analog technology admirably clear in recent months, but the specific formats and technological approaches that your company will support haven't yet been discussed publicly. Where will Revox go, for instance, with respect to a digital audio disc format, and will you become involved in the manufacture of a digital audio-disc player?

Studer: We will support the Philips Optical Compact Disc format which as you know uses a small, 4½-inch disc read by a laser element. The reasons for our choice are straightforward. The Philips system offers ample playing time, adequate dynamic range and low distortion, all in a compact form. It does not make the error of being too complex in its digital encoding or in its physical mechanism, just for the sake of specifications. We intend to manufacture a disc player as soon as it is appropriate to do so, and we will, in fact, shortly be acquiring a Compact Disc license.

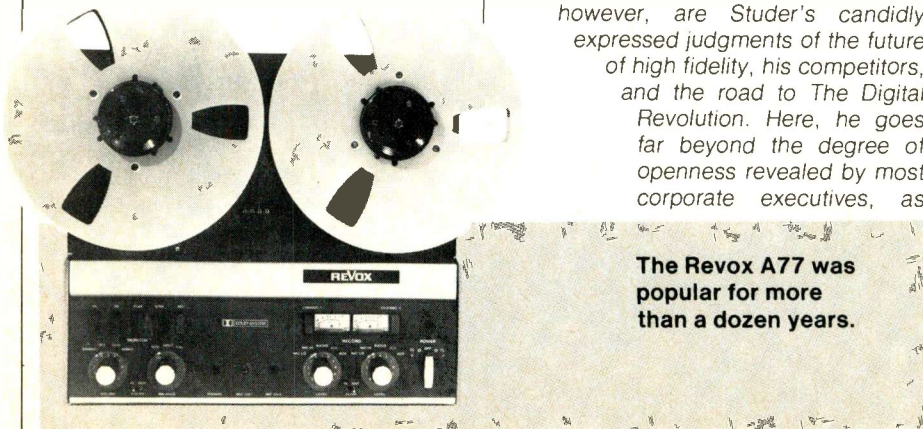
Audio: What about efforts in related fields? Will Studer Revox also become involved with the videodisc, or perhaps videocassette?

Studer: Our intention is to remain in the audio field. But there is no question that the digital disc will be in our development program.

Audio: What about the idea of a consumer digital tape recorder?

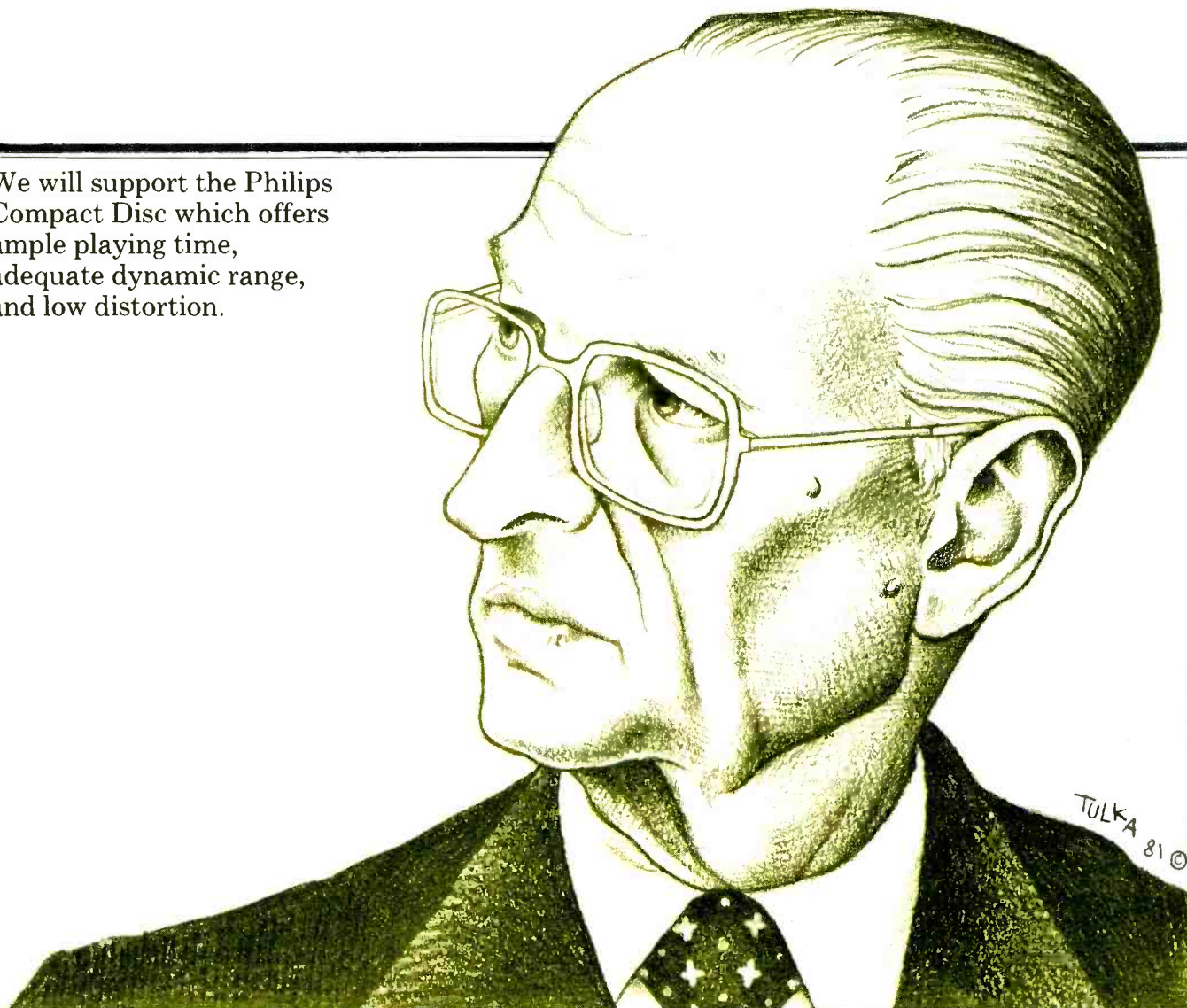
Studer: We have done considerable thinking on that question. One approach that could be realized using current-day technology would be a digital cassette recorder using either the Elcaset or the Uniset. [These are both large two-reel-cassettes developed as high-quality alternatives to the traditional Philips cassette. — Ed.] Such a device, with a sampling rate somewhere between 34 and 44 kHz, would have the capability of 45 minutes of stereo playback. With the proper analog-to-digital and digital-to-analog (A-D and D-A) converters, there need be no audible phase shift to 18 kHz, and beyond that, a man of my age cannot hear [laughter].

Audio: But would this approach be the ideal one, or is a clean sheet of paper the best starting point for a consumer digital tape machine?



The Revox A77 was popular for more than a dozen years.

We will support the Philips Compact Disc which offers ample playing time, adequate dynamic range, and low distortion.



Studer: Neither the Unisetete nor the Elcaset is an ideal device. We would like to propose a new type of cassette package, specifically designed for the purpose.

Audio: *What would a cassette designed for digital look like?*

Studer: Somewhat different from either Elcaset or Unisetete. For one thing, the spools on the Elcaset are held in place by the player when it is loaded to prevent friction that could cause wow and flutter and to provide a carefully controlled movement of tape. Such a technique is not really so important when the tape is digitally encoded because one can do a lot of electronic correction, making a PCM recording much less affected by mechanical wow and flutter. With a new cassette format, one could simplify the mechanical elements and reduce the cost considerably. However, in any new cassette designed for PCM, one would have to pull the tape out of the cassette

in order to play it and guide it accurately across the heads. This is because a very low tape speed would be required on this type of cassette, due to the need for distributing the musical information on several tracks to facilitate the correction of errors.

Audio: *Then a great deal of redundancy would be built into the format. [Redundancy is the deliberate repetition of information done in order to prevent a momentary signal loss from eliminating parts of the final signal. — Ed.]*

Studer: Yes, in order to distribute the information. The density of information on such a digital cassette would be so high that one is dependent on a very good out-of-shell tape guidance system where the tape does not skew.

Audio: *How large would such a cassette be, and what tape width would it use?*

Studer: It would probably use ¼-inch tape, and be about the size of a Unisetete or Elcaset [which are in turn approxi-

mately the size of a Beta-format videocassette — Ed.].

Audio: *How much would one of these digital recorders cost, and how soon could it be available, either from Studer Revox or another source?*

Studer: Machines of this type could be built within four to six years, and the price would probably be approximately \$3,500 U.S. (1980). Technology is changing very rapidly, though, and in four to six years we will have very highly integrated circuits, and these chips will bring the price down considerably in the first couple of years after the product is introduced.

Audio: *What might the price be after a full reduction of all electronic elements to integrated-circuit form?*

Studer: A good digital tape recorder won't ever be as cheap as a good current-day cassette recorder because the heads in a digital unit will require multiple, extremely narrow gaps. These

Copies made over four generations on a digital machine sound far worse than first-generation tapes or tapes made on a good analog machine.

heads will always be considerably more expensive than a normal analog tape head. A digital tape machine could eventually cost as little as \$1,500 U.S. once the chips become available, however.

Audio: *Do you feel that present-day digital studio recorders have substantive sonic deficiencies? Is there a characteristic "digital coloration" that they impart to music?*

Studer: There is some coloration. Despite what is said to the contrary, copies made over four generations on a digital machine sound far worse than first-generation tapes or tapes made on a good analog machine. It all comes back to the fact that present-day A-D and D-A converters are the source of the problem. There are extremely good converters available, but they are also extremely expensive. With the right converters and the right anti-aliasing filters, there need not be any distinctive "digital coloration." Remember that new technology is never perfect at the time of its first commercial introduction. The automobile is over a century old, yet still very imperfect.

Audio: *A question about the business side of the audio industry, Doctor. Given the present rates of currency exchange, virtually all Western European goods — be they German automobiles, Swiss watches, or French suits — are rather expensive by American standards. Japanese-made products, including their audio products, are by contrast moderately priced. How do you see this disparity affecting the future of Studer Revox? Do you think that European products of high quality can remain competitive with Far Eastern goods?*

Studer: There is no way that we in Western Europe can compete directly with Japanese mass-produced merchandise. In 1979, our basic labor wage in Germany was 23 Deutschmarks per hour, while in Japan, the basic wage was equivalent to 16 Deutschmarks. The Japanese work a week that is 15 hours longer, on the average, and also work more intensely than Europeans or North Americans. The only salvation for a European company is to offer superior technology, greater innovation, and a better-quality product. That is the only way for us to survive and prosper.

Audio: *If large Japanese firms continue their large-scale research and develop-*

STUDER'S LATEST

After years of speculation about the intentions of Studer Revox in the cassette field, the company will introduce its first cassette machine sometime this spring. The B710, as it is designated, is pure Revox: Unorthodox in approach, visually distinctive, built like a battle cruiser, and concomitantly pricey. Some recording-studio engineers and serious audiophiles are already calling it the "reference standard cassette deck," based on the Revox reputation and a brief U.S. showing last autumn.

The B710's transport consists of a total of four motors mounted on massive multiple castings; two direct-drive spooling motors and a Hall-effect capstan motor for each of the two capstans. As is common in European cassette machines, the cassette snaps into place on the front panel, rather than being held in an enclosed well. The head block assembly is hinged and swings up like a trap door to engage the tape. The entire transport is controlled by a microprocessor that also runs the digital display and clock functions, the deck's various memory functions, and a timer circuit capable of turning on both the deck and an ancillary component at a predetermined time.

Interestingly, despite the presence of a microprocessor, Revox has chosen not to incorporate an automatic bias/equalization optimization circuit of the type now popular on top-line Far Eastern cassette decks, and has

also located the B710's bias fine-adjustment potentiometer internally, rather than on the front panel. Dr. Studer comments that such adjustments can only be made with precision by technicians using the appropriate test gear. The machine does incorporate automatic switching of EQ based on the coding slots found in many cassette shells, as well as manual tape selector switches. Another interesting point concerns the Dolby HX switch in the lower left portion of the prototype's faceplate. Revox engineers decided in the latter stages of development to remove the feature (production versions will obviously not have the switch). Dr. Studer noted that "the disadvantages of Dolby HX, especially with respect to modulation noise, proved in the end to outweigh the advantages."

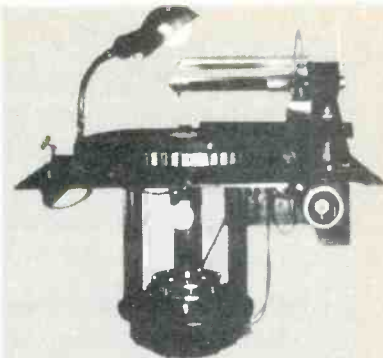
Metering on the B710 is done by two LED bar displays, calibrated in 1-dB increments from -10 to +6 dB and in 2-dB increments over most of the remainder of their range. The heads are Revox-built Sendust/ferrite units. As is characteristic of Studer Revox equipment for both home and professional use, the electrical elements of the B710 are individual printed circuit modules that lock into a master board.

Oh yes, the price. If you have to ask, you may not be able to afford it. Revox estimates the ticket at about \$1,800. After all, Swiss precision never comes cheap. —G.S.

The Revox B710 will be the firm's first cassette deck.



**• 1939...FIRST DIRECT-DRIVE TURNTABLE SYSTEM.
1951...FIRST MOVING-COIL CARTRIDGE.
1972...FIRST DIGITAL (PCM) RECORDING.**



In 1939, while many turntable manufacturers were trying to make the transition from horn phonographs to electrical record players, Denon developed its first direct-drive turntable. (shown above). Denon engineers discovered that only a direct connection between motor and platter – free of the pulleys or belts found in more primitive drive mechanisms – could completely eliminate speed fluctuations that obscure musical detail.

Today, many turntable makers have discovered the virtues of direct-drive. It is now the accepted means of approaching state-of-the-art performance. But only one company has had 40 years to refine the direct-drive principle. It is the same company that 29 years ago developed another technology now in widespread use: the Moving-Coil Cartridge. It is the same company that changed the entire process of recording music by inventing digital (PCM) recording.

The company is Denon.

• 1981...DENON'S DP-60L DIRECT-DRIVE TURNTABLE.

The latest stage in Denon's refinement of direct-drive is the DP-60L Semi-Automatic Turntable. It uses a unique AC Servomotor with a quartz "clock" speed-reference to achieve exceptional torque and speed accuracy, while eliminating the corrective speed surges that degrade the performance of other direct-drive turntables. The DP-60L is supplied with two plug-in tonearm wands – one straight and one S-shaped – to assure a precise match-up with the characteristics of any phono cartridge.

The result? Musically cleaner sound, free of sonic smearing.

The Denon turntables for 1981: Six musical instruments from the company where innovation is a tradition.

DENON
*Imagine
what we'll
do next.*

Enter No. 7 on Reader Service Card

Denon America, Inc.
27 Law Drive, Fairfield, N.J. 07006

The only salvation for a European company is to offer superior technology, greater innovation, and a better-quality product.

ment efforts, however, can European companies continue to hold an edge in innovation? Or is it likely that Japanese products will become as technically advanced while the production costs of the Far East remain moderate?

Studer: I can only speak for my company, but I believe we will retain our edge over Far Eastern competition. Our company is not a typical commercial firm in that there is a lot of idealism both on my part and on the part of the employees. That should make all the difference. We do not intend ever to lag behind in technology. A very substantial part of our profit is invested in new technology, new machinery, and so on. We believe strongly in a commitment to remaining

first in our field.

Audio: As you are a major innovator in the field of high fidelity, I'm interested in your perspective on upcoming changes in home high-fidelity systems. Do you believe that we will see a return to multi-channel sound in the home — that is, more than two channels — as a means of reproducing concert-hall ambience or other special sonic effects?


Studer: No. I don't believe that the quality of reproduction we have today will be greatly improved by the addition of more channels of information.

Audio: What do you feel will be the next big step forward in home high fidelity?

Studer: There is no question in my mind that the introduction of the PCM disc will

mark the next milestone in audio development. Two of the most serious problems we have in home music reproduction — dynamic range and distortion — will both be greatly reduced in magnitude by the digital disc.

Audio: Beyond the digital disc, what might be the step that follows?

Studer: I see certain possibilities. One is to substantially increase the storage density of the medium, which will in turn improve its resolution and playing time. Whether this will have any direct sonic benefit is another question. All things considered, though, I think I am content for the moment to work on achieving the full benefits of digital technology and to wait a bit for the step that follows. 

A DIGITAL MANIFESTO

The worldwide transition from analog to digital that we'll witness over the next decade will be an expensive, involved, and risky stage for manufacturers. Those firms which develop or back the right formats and technical approaches will reap huge rewards, while the losing firms will in some cases lose big. Many companies in the audio industry, therefore, are jockeying for position, remaining uncommitted on the issues of standards and formats, and sizing up the competition.

All of which makes the Studer Revox position on the digital transitional phase a refreshingly candid one. In addition to taking clear, early stands on its choices for both professional and consumer digital formats, Studer Revox has also promulgated a sort of Digital Manifesto that discusses the technical and political sides of the digital transition in very candid terms. Released to both the press and the professional recording community late last year, the 26-page brief discusses Studer Revox objectives and thoughts on achieving a smooth transition with a precision of thinking that matches what goes into its motors, circuit boards, and tape heads. The document speaks for itself best:

"Audio PCM is on its way. As we all know, the first prototypes are oper-

ating, and the first multichannel recorders will soon be available on the market Will Studer go PCM? Yes, Studer will

"At the same time, we think that analog equipment still has a long way to go. Too much has been invested in analog products to discard them hastily. New, improved, easier-to-use analog products will appear along with matching PCM components. If they are correctly designed, they can coexist peacefully for a while. . . .

"Introducing PCM the *right* way, at the *right* time, is a vitally important task for both users and manufacturers. To help you decide how, and when, and how fast audio PCM should be introduced, we would like to give you a few facts about the emerging technology

"There is little doubt that audio PCM studios will have to accommodate at least two sampling rates, one for studio recordings and the other for consumer recordings. Translating a digital signal from one sampling rate to another is basically possible, although it may involve a great amount of circuitry Sampling rate conversion is made very much easier if the two sampling rates are in simple ratio, like 8 to 7. The cost of conversion increases very rapidly if unfavourable sampling rate ratios are cho-

sen or if they become necessary because of conflicting standards

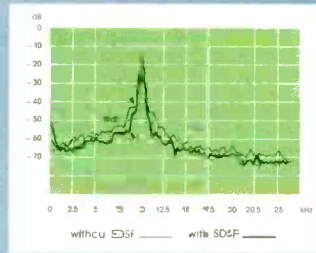
"There should be standards for audio PCM discs, pseudo-video PCM on VTRs (both consumer and professional), and for stationary head studio machines. The different standards should be harmonized, and make signal conversion and transfer from one product to the other relatively easy. In the long run, bad standards cost a lot of money and effort We need an interface definition for digital audio, with an audio PCM signal format, and control bits for simple interconnection and remote control. This means connectors, plugs, signal levels, timing, and lots of details.

"How should standards emerge? Perhaps by consensus, though we doubt it. If the process of standardization by conferences is too slow, the proposals of a major manufacturer of audio PCM should be adopted."



MORE MUSIC. LESS NOISE. MORE MACHINE. SANSUI.

Noise is a thief. It robs you of the quality of music you are entitled to hear from a fine cassette deck. On the right is a picture of a type of dynamic distortion known as modulation noise. It makes music sound gritty, whether the sound is loud or soft. What these spectrum analyzer traces show, and your own ears will confirm, is that Sansui's new D-550M cassette deck with



D-550M

its exclusive (pat. pending) Dyna-Scrape Filter, reduces modulation noise by as much as 10dB! That represents a startling audible difference and a profound reduction in this most pervasive of tape noises. Until now, scrape filters were found only in professional reel to reel tape decks. Now Sansui has ingeniously engineered this valuable technology into a truly affordable cassette deck.

The D-550M is a 3-head machine with full IC logic control. It has a frequency response from 25-21,000Hz (± 3 dB, metal tape); user adjustable bias control; 2-motor drive that reduces wow and flutter to a miniscule 0.035% (WRMS); plus state-of-the-art heads and electronics that improves signal to noise ratio to 70dB (with Dolby-B™).

And if it is logical for our top-of-the-line D-550M to have full IC logic, then it is logical for our more modestly priced D-300M to have it as well. In fact, much of Sansui's advanced technology that's in our most costly models is also found across the entire Sansui line. Indeed, our lowest priced cassette deck, the D-95M, like the D-550M, D-350M and D-300M, has metal tape capability.

More music, less noise. More machine. Better value. That's what Sansui cassette decks are all about.

Come see the full line now at your local Sansui dealer.

D-95M



D-300M



SANSUI CASSETTE DECKS

- D-550M**
Metal-Tape Compatible
- D-350M**
Metal-Tape Compatible
- D-300M**
Metal-Tape Compatible
- D-95M***
Metal-Tape Compatible

*D-95M available in silver only. All other models in silver or black.

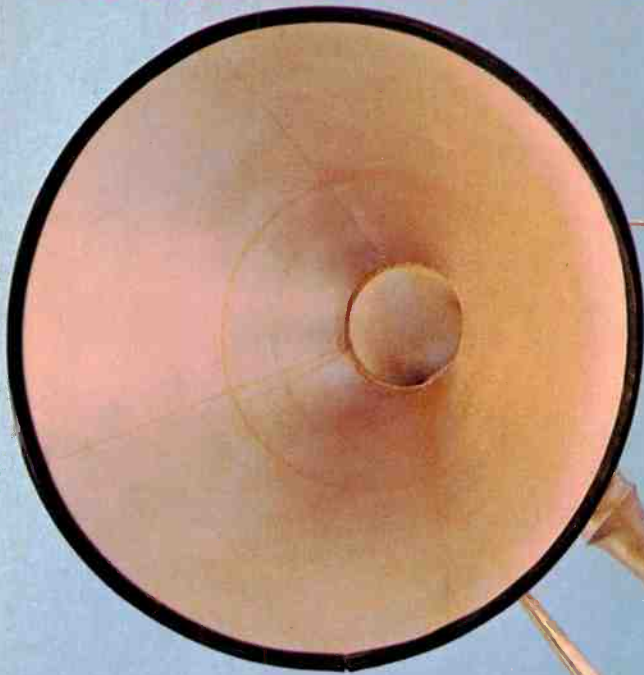


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LIRPA

STEREO MUSIKON DIS



March 17, 1893
Eugene Pitts, Editor
Music-Box & Player-Piano Fancier Magazine
New York, N.Y., U.S.A.

Dear Friend Eugene,

I am greatly pleased to learn that, notwithstanding the general dullness of business, you have succeeded in obtaining an editorship. I doubt not your publishers will regard themselves fortunate in securing your services. In the meantime, accept my congratulations upon your success. *M-B&P-P F* has long been one of my favorite publications. I am sure that, under your tenure, it will go on to even greater popularity.

Also, accept my congratulations upon the birth of your son, Eugene Pitts II. May his years be long, may he honor his parents and be the blessing and support of their declining years. I anticipate holding the young gentleman on my knee, and will be over to see you in a few weeks.

Young Eldridge Johnson was in our offices recently, demonstrating the Gramophone, which he has been improving for the Edison Company. He was attempting to raise funds to organize a company to manufacture the device in Camden, N.J.

At first, we marvelled at the machine, but once the surprise of hearing the sound of a full orchestra issuing from a trumpet was abated, I halted the accolades with a statement that, while it was an interesting toy, it was never going to replace the player-piano. I pointed out that while a player-piano sounds exactly like a piano, his Gramophone did not sound exactly like an orchestra, unless the listener imagined himself with one ear to the keyhole of a music hall. I asked, "Do you seriously believe that gentlemen will purchase for their parlors an instrument which implies voyeurism in its owner?" I admitted that some elements of the lower classes indulge in



could have only gotten *those* words eavesdropping at a bordello — one patronized by Navvies, at that.

You will probably be approached by the charlatan, in the interests of publicising his "Canine-O-Phone." Consider yourself warned.

That incident, unpleasant though it was, did start me to thinking about how a realistic-sounding device might be made, utilizing the principle of the Gramophone. I believe that it is possible to develop this "StereoMusikon" so that it approximates the experience of listening to an orchestra *within* a music hall, preferably from an expensive seat.

You may rest assured that I will keep you informed as to the progress of the invention. It is possible that you may even desire to publish an article about the device, although it may never hope to displace the player-piano from its place in the parlors of America.

My kindest regards to Mrs. Pitts; I remain,

Faithfully your friend,
Prof. I. Lirpa
Bucharest, Romania

Accompanying the StereoMusikon was an operating manual intended to explain the machine to its new owner. Considering the exotic nature of its mechanism, the device's manual seems a bit skimpy, especially when compared to its modern-day equivalent. We have reproduced the contents of "Working Your StereoMusikon" herewith, and as you will see, "working" is no exaggeration.

CREDITS: Created and produced by Jim Wilson ©1981; photography by Carl Waltzer; disque graphics by Rick Stark; metalsmithing by Stanley Smokler; woodcraft by Willy Dotson; needlework by Kas Schlots-Wilson, and demonstration by Tom Saunders.

MUSICAL HYGIENE



Cleanliness is of the utmost importance in the successful operation of your StereoMusikon. For this purpose, we have included two towels of Egyptian cotton for cleaning of the hands and the disques played by the machine. It must be remembered that the right towel is for the hands and the left is for the disques. Failure to remember this will result in harm to one of the above; we forget which.

2

INTRODUCTION

Welcome to the world of musical verity. Your new StereoMusikon is the supreme achievement of our age. With its aid, you may close your eyes and be instantly transported to an expensive seat in a music hall, a box at the opera, or the reviewing stand at a parade. Like other of life's pleasures, StereoMusikon ownership entails hard work and education to achieve. But, with practice, anyone capable of mastering Greek and Latin and repacking the bearings of a steam carriage may readily avail himself of the joys of StereoMusikon stewardship. This booklet contains everything one need know to operate the machine, except some of those fine points which come only through years of practice.

1

STYLI PRESSURE



Insufficient pressure on the styli will result in music which sounds as though one were in a cheap seat at the music hall, while too much results in the styli slicing the disque into what resembles a spiral of licorice. We have devised a simple test for correct pressure. Place a fingertip between the styli and strike the trigger. If the skin is punctured, adjust for less pressure. If it does not hurt, adjust them for more.

3

DISQUE CHANGING I



There are two ways of changing disques on your StereoMusikon. In the automatic mode, one presses the foot pedal and an almost miraculous process occurs. The tone arms snap apart, the plenum assembly rotates counterclockwise, and the drive arm rises to release the disque. Then one replaces the disque and presses the pedal again. Music plays.

4

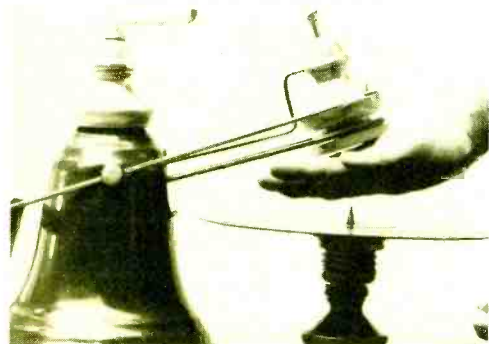
DISQUE CHANGING II



Serious *StereoMusikonnerati* will most likely prefer the manual mode of changing, in which one gives a sharp blow to the styli trigger, forces the tonearms to the right, applies fifty pounds of force to the drive arm release, hopefully locking it into the raised position, replaces the disque, and repeats the process in reverse. Music plays.

5

ABOUT SAFETY



There is risk in all pleasure. As the StereoMusikon is extremely pleasurable, you may rest assured that the risks are commensurate. The most important warning is depicted in the photograph above. That warning is **NEVER STICK YOUR HAND IN THERE!** Other things to remember: Do not press the drive arm release whilst the motor is still spinning, and always sterilize the styli before pressure tests.

6

MAINTENANCE



Although the StereoMusikon is as perfect a machine as one could imagine, it still requires certain up-keep. We include a tool kit for this purpose. It contains an oil can for treating all sliding metal surfaces and the oil is also good for polishing the cabinetry. The Stylus Wrench facilitates removal of styli for sharpening and sterilization. The tube of grease is for packing the baseplate bearings.

7

1

SONY ST-J75 FM TUNER

Manufacturer's Specifications

Mono Usable Sensitivity: 10.8 dBf (1.9 μ V).

50-dB Quieting Sensitivity: Mono, 16.8 dBf (3.8 μ V); stereo, 37.3 dBf (40 μ V).

Signal-to-Noise Ratio: Mono, 92 dB; stereo, 87 dB.

THD: Mono, 0.05 percent at 100 Hz, 1 kHz and 10 kHz; stereo, 0.07 percent at 1 kHz, 0.08 percent at 100 Hz, and 0.20 percent at 10 kHz.

IM Distortion: Mono, 0.05 percent; stereo, 0.07 percent.

Selectivity: 90 dB.

Capture Ratio: 1.5 dB.

Frequency Response: 30 Hz to 15 kHz, +0.2, -0.5 dB.

AM Suppression: 65 dB.

Image Rejection: 95 dB.

I.f. Rejection: 100 dB.

Spurious Rejection: 100 dB.

Sub-Carrier Rejection: 75 dB.

Muting and Tuning Threshold: Low, 25 dBf; high, 45 dBf.

Output Level: 750 mV.

Power Requirements: 120 V, 60 Hz, 20 W max.

Dimensions: 17 in. (43.18 cm) W x 3 1/4 in. (8.25 cm) H x 12 1/2 in. (31.75 cm) D.

Net Weight: 10 lbs., 10 oz. (4.78 kg).

Price: \$450.00.



Until now, it has been commonly accepted that frequency synthesizing tuners offer more precise tuning than is possible with conventional mechanically tuned systems, but that they are inferior to the best of the variable-capacitor-tuned units insofar as signal-to-noise ratios and distortion figures are concerned. All of that will change now that Sony has introduced their new digital synthesized tuner, Model ST-J75. Its signal-to-noise ratio exceeds that of any tuner we have ever measured and is, in fact, unmeasurable on our presently available test equipment. Just how Sony managed to accomplish this feat will be explained presently, but for the moment let's examine the layout of this new product.

Near the center of the slim front panel is an alpha-numeric display area which shows tuned-to frequency, programmed station numbers (up to eight separate frequencies can be memorized and recalled at will), and the words "memory" and "set" which indicate readiness to program the tuner and to have it memorize station frequencies, when appropriate. Frequency display utilizes up to five digits so that incremental tuning may be accomplished in 50-kHz steps (e.g. 104.35).

To the left of the display area is a signal-strength indicating system consisting of five LEDs and several status words which become illuminated to indicate such things as method of tuning in use (manual or auto), status of muting (off, low level or high

level), and mode (auto FM/FM stereo or stereo-only). The words "cal tone" below the signal-strength LEDs light up when the built-in 400-Hz calibration tone is activated.

A power switch is located at the extreme left of the panel. Below the display area and word indicator areas are a program on-off switch (used in conjunction with a separate, optional PT-77 timer for unattended recording), a button labelled "next call" used to set next programmed station, a memory-set/program-set button, a memory scan button, the aforementioned 400-Hz calibration tone button, a mono/stereo mode switch, and a muting switch. The first touch of the muting switch turns off the muting and activates manual tuning. Successive touches of this switch introduce low-level or high-level muting in the auto-tuning mode. Just below the frequency display are a pair of tuning buttons which cause tuned-to frequencies to change in an upward or downward direction, automatically or manually, depending upon the setting of the muting switch. The right section of the panel has eight push buttons, each of which can be set to recall a favorite station frequency. Tiny windows above each button can be "loaded" by the user with frequency numerals corresponding to the memorized station frequencies of each of the eight buttons. Sony calls them "multi-process" memories since they can go from any station to any station, randomly, in either mono or stereo mode, and will call up each station at the muting level required for each station. These station memories are nonvolatile and are retained for as long as 10 years even with the power cord disconnected!

When the "scan" button is pressed, the tuner tunes to each of the eight memorized frequencies in sequence, remaining at each frequency for about 3.5 seconds. If the listener likes what he or she hears at any of the settings, the "set" button is pressed to lock the program in. If the tuner is used with an external timer, such as Sony's seven-day programmable timer, the PT-77, it is possible to program for unattended recording and playing of up to eight preset stations in any sequence desired.

The rear panel of the ST-J75 is equipped with the usual 300-ohm and 75-ohm antenna terminals as well as with the expected output jacks of the phono-tip type. The 75-ohm antenna connection is a coaxial type.

Technical Highlights

Among the outstanding performance characteristics of the ST-J75 tuner are its extraordinary freedom from noise. A contributing factor to this low-noise performance is Sony's newly developed "direct comparator," a multi-functioned IC.

In all frequency synthesized tuner designs, the tuner's local oscillator frequency is constantly compared with a quartz-generated reference frequency. This comparison is made by a phase comparator IC. Previously, conventional phase comparators have operated at a frequency of 10 or perhaps 12.5 kHz — well within the audible range. Some of the signal from the comparator "leaks" into the high-gain stages of the tuner's front end, causing audible background noise and affecting the performance of such tuners. Sony engineers concluded that if the comparator frequency could be raised above the audible range, background noise in synthesized tuners could be drastically reduced. This led to the development of a new phase comparator IC, Sony's CX-778.

Unlike conventional comparators which require an external

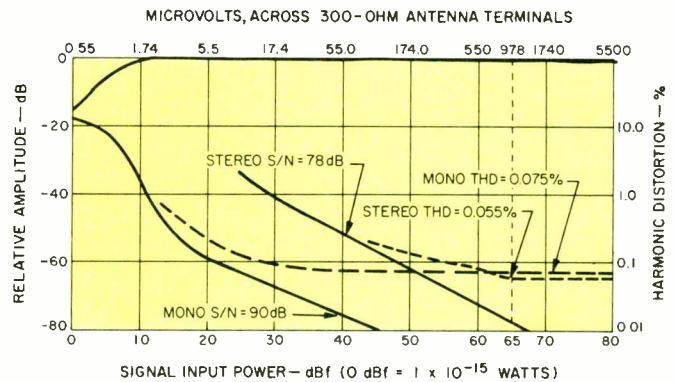


Fig. 1 — Mono and stereo quieting and distortion characteristics.

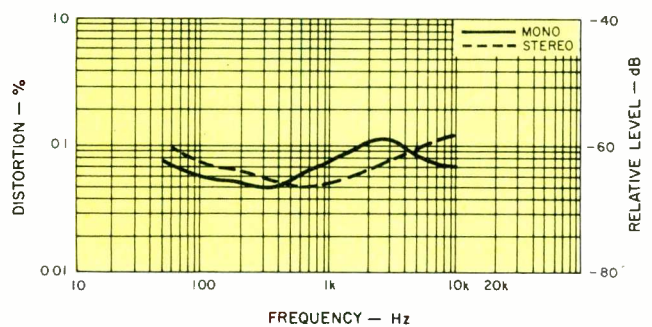


Fig. 2 — Distortion vs. frequency.

prescaler to divide the local oscillator frequency down to a usable value, this IC operates at high enough frequencies to accept the local oscillator frequency directly. The comparator frequency, in fact, can be raised to 50 kHz, well above the audible range. The result is a great reduction in noise.

Laboratory Measurements

Mono and stereo quieting and distortion characteristics of the ST-J75 stereo FM tuner are plotted in Fig. 1. Usable sensitivity in mono measured exactly 1.9 μ V (10.8 dBf), as claimed, while the 50-dB quieting level was reached with signal inputs of only 2.7 μ V (13.8 dBf). In the stereo mode, usable sensitivity measured 6.5 μ V (21.5 dBf) and 50-dB quieting was achieved with a signal input level of 39.2 dBf, somewhat higher than claimed. We were unable to confirm Sony's claimed 92 dB signal-to-noise figure in mono or 87 dB in stereo simply because our signal generator has more residual noise in both the mono and stereo modes. Still, we were able to read an incredibly high 90 dB in mono (the highest we have ever read for any tuner, whether frequency synthesized in design or not) and 78 dB in stereo. Harmonic distortion in mono, for a 1-kHz signal at 100 percent modulation, measured a very low 0.075 percent, while in stereo the measured THD was even lower, at 0.055 percent.

Distortion versus audio modulating frequencies is plotted in Fig. 2 for both mono and stereo FM reception. At 6 kHz, the highest required test frequency, harmonic distortion in mono

This tuner will become a new standard against which all other tuners will be judged.

was still only 0.08 percent, while in stereo it measured only 0.1 percent.

Frequency response was virtually flat from 30 Hz to 15 kHz, within 0.1 dB. Response of a modulated channel's output as well as that of the opposite or unmodulated channel is plotted in the spectrum analyzer 'scope photo of Fig. 3. In this display, frequency sweep is from 20 Hz to 20 kHz while vertical sensitivity is 10 dB per division. Separation at 1 kHz measured 50.5 dB, while at 100 Hz and 10 kHz, stereo FM separation measured 50 dB and 42 dB respectively.

Switching to a linear sweep covering frequencies from 0 Hz to 50 kHz (at 5 kHz per linear division), we plotted the crosstalk components that appear in the unmodulated channel's output when the other channel is 100 percent modulated with a 5-kHz signal. In Fig. 4, the tail spike at the left of the display represents the desired 5-kHz output from the modulated channel. The lower spike contained within that reference spike is the 5-kHz output from the unmodulated channel. The minute components to the right represent harmonics of 5 kHz appearing in the unmodulated channel's output, while the somewhat taller spike to the

Fig. 3 — Frequency response and separation.

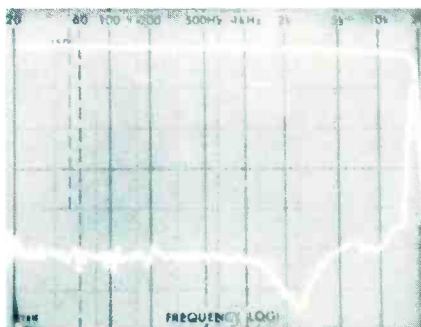
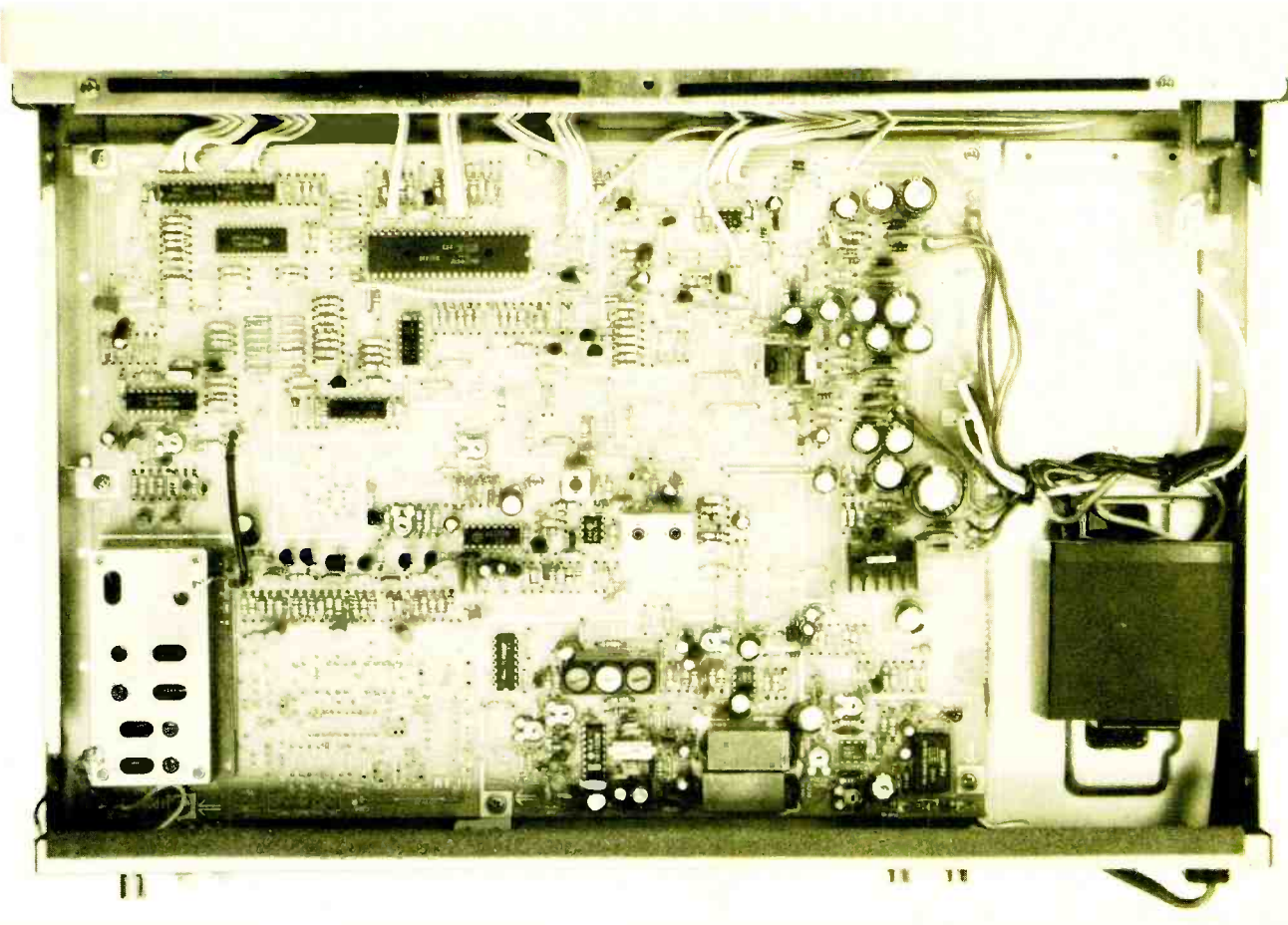
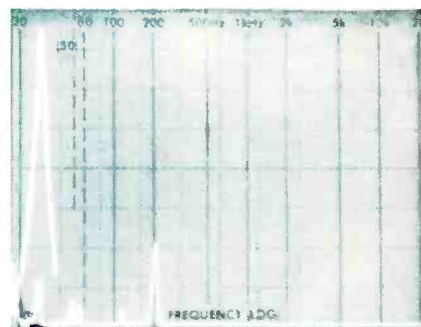
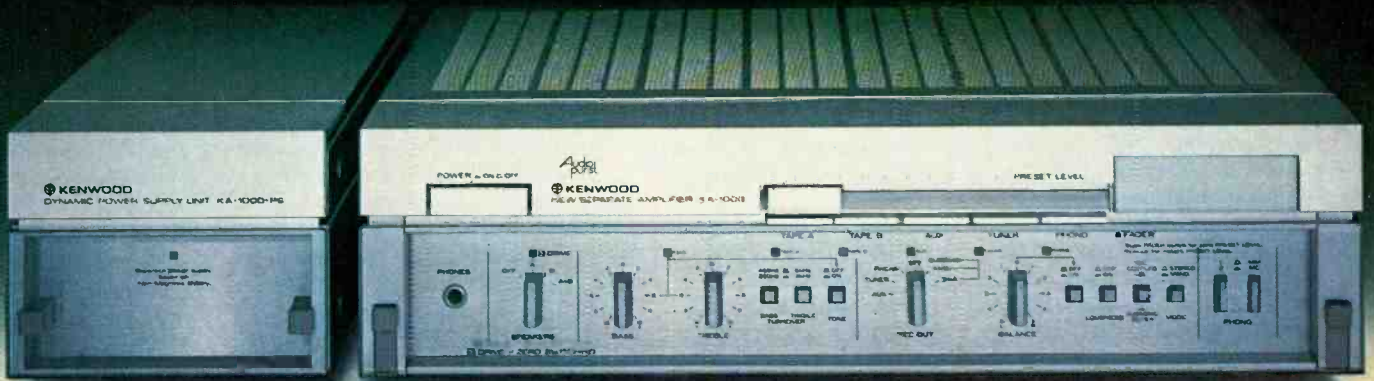


Fig. 4 — Crosstalk components for a 5-kHz signal.



SIGMA DRIVE



Without it, an amplifier simply isn't good enough for the Purist.

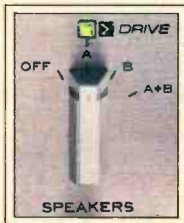
While everyone else was bogged down in the same old concept, Kenwood's engineers were busy developing a totally new way to look at amplifier performance.



Traditionally, audio engineers have tended to approach amplifier design from the same misconception: that an amplifier and speaker should function as separate entities; when in reality they function together.

After years of extensive research, our engineers have solved the problem with a radical departure in amplifier design. It's incorporated for the first time in our new KA-1000 Purist Amplifier.

Kenwood's exclusive patented SIGMA DRIVE ignores traditional amplifier-speaker relationships by extending the KA-1000's negative feedback loop past the output terminals, all the way to the speaker terminals.



SIGMA DRIVE ties a speaker's behavior directly to the amplifier's performance, which produces an unprecedented damping factor in excess of 600 at the speaker terminals and literally forces a speaker to behave in perfect sync with the amplifier.

Just as impressive are the other Kenwood advanced audio technologies which helped pave the way for SIGMA DRIVE.

For instance, an exclusive non-magnetic chassis. Dual power supplies, totally separate from the main chassis to further minimize magnetic interference.

And DC amplification for crystal clear tonal response down to 0Hz. Plus a built-in preamp for moving coil cartridges.

We've also included our famous HI-

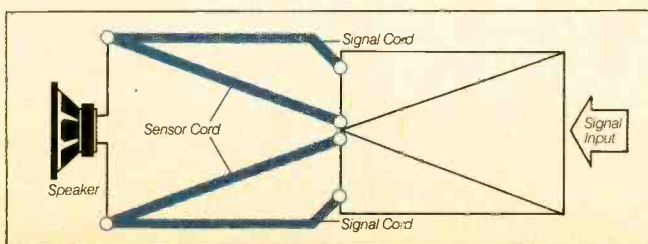
SPEED™ circuitry, which allows the KA-1000 to react much faster to dynamic music changes. And an ingenious touch-sensor



volume control that increases to any preset volume level or fades to silence.

Of course, there's even more to the KA-1000 than we can possibly mention in this limited space. For the complete story, visit your nearest Kenwood Audio Purist Dealer. And find out for yourself why anything less simply isn't for the Purist.

Significant specifications measured at speaker terminals: 100 watts per channel, minimum RMS into 8 ohms from 20Hz to 20kHz with less than 0.005% total harmonic distortion. Transient Response: Rise Time 0.9 microsecond; Slew Rate ±120 volts per microsecond. Phono S/N: MM 93dB; MC 67dB. Special 10 meter speaker cables included.



Not all Kenwood dealers carry these products. For the Audio Purist dealer nearest you, write Kenwood, P.O. Box 6213, Carson, CA 90749.

Enter No. 13 on Reader Service Card

Every single measurable parameter of this tuner was beyond any criticism.

right is the 19-kHz sub-carrier residual component which is down some 55 dB compared to the reference (100 percent modulation) level. (Frequency notations at the top of the display should be ignored when viewing this linear-sweep spectrum analysis photo.)

Low-level muting threshold was 10 μV (25.2 dBf), while the high-level mute setting threshold was 90 μV (44.3 dBf).

Alternate channel selectivity measured a shade better than the 90 dB claimed by Sony. Capture ratio measured 1.5 dB, exactly as claimed, while image rejection, i.f. rejection, and spurious rejection were all in excess of 100 dB. AM suppression was remarkably high, especially for a frequency synthesized tuner, measuring exactly 65 dB as claimed. Stereo switchover (threshold) occurred at 6.5 μV (21.5 dBf).

We measured the signal strengths required to illuminate the five signal-strength LEDs and found that they lit sequentially with input signal levels of 8.7 dBf, 29.8 dBf, 37.2 dBf, 45.2 dBf, and 54.7 dBf. These signal-strength points are far more useful than those usually established for conventional mechanical signal-strength meters. In fact, the graphic arrangement of the LEDs is worth mentioning, since the first two LEDs are arranged at a lower level on the panel than are the remaining three. The visual implication is that only when the third (or fourth or fifth) LED illuminates is the signal strong enough for acceptable stereo reception, and that turns out to be exactly true.

Listening and Use Tests

The Sony ST-J75 stereo FM tuner is, without a doubt, one of the finest, if not the finest tuner I have ever heard. One need not make any excuses for this tuner because of its precision tuning; it's simply no longer true that this form of tuning makes necessary a trade-off or acceptance of a poorer signal-to-noise ratio or higher levels of distortion. Every single measurable parameter of the tuner was beyond any criticism, and I firmly believe that this tuner will become a new standard against which all other tuners, frequency synthesized or conventionally tuned, will be judged in the future.

To be sure, there are very few broadcast stations in my listening area that transmit signals worthy of a tuner such as this, but with the one or two that do, the audible difference is truly amazing. To satisfy our own curiosity, we "transmitted" several of our favorite recordings via a laboratory closed-circuit hookup directly to the antenna terminals of the tuner. A comparison of the sound of the ST-J75 against what we had previously regarded as our reference tuner quickly convinced us that we were in the presence of a new and definitive stereo FM tuner. Finally, the clear advantages of frequency synthesis have been matched to superlative basic tuner performance. If FM is an important program source to you, you can't afford *not* to audition this engineering masterpiece from Sony. It is, as that company often says, the *one and only*.
Leonard Feldman

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The Dynavector DV/Karat series is the culmination of these efforts.

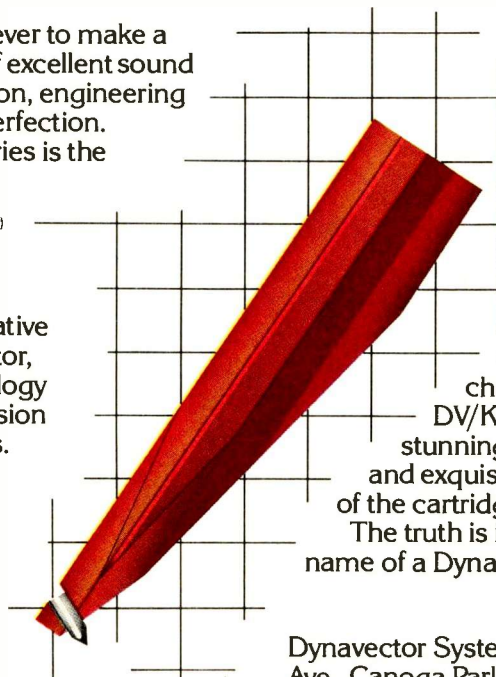
$$C_{11} = \alpha \sqrt{2\pi f} \left[1 - \frac{1}{4}\beta \frac{2\pi f}{\alpha^2} + \frac{1}{4}\delta (2\pi f)^2 + \dots \right] \dots \dots (2)$$

$$\alpha^4 = \frac{EI}{m}, \quad \beta = \rho \alpha^4 \left(\frac{1}{E} + \frac{\gamma}{G} \right), \quad \delta = \frac{\rho^2 \gamma \alpha^4}{EG}$$

Dr. Noboru Tominari, the creative genius and founder of Dynavector, developed a radical new technology taking into account wave dispersion and cantilever vibration theories.

Dr. Tominari reasons that the "soft" sound of most cartridges was due to the various delays of frequencies along the length of the cantilever.

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Without the "creeping time effects of rubber" (temperature changes and age deterioration), the DV/Karat's ability to produce sound with stunning realism, brilliant tonal balance and exquisite detail is maintained over the life of the cartridge.

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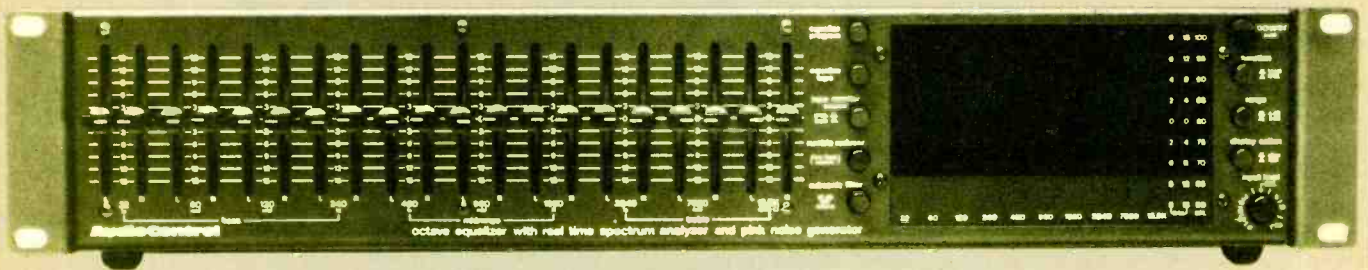
a try. You'll see why we're introducing a totally new look in hearing aids.

TEAC®



V-9 3-Motor Cassette Deck

2

AUDIO
CONTROL
C-101 RTA/
EQUALIZER**Manufacturer's Specifications
Equalizer Section****Frequency Response:** 3 Hz to 100 kHz.**Distortion:** 0.025 percent.**S/N:** 96 dB re: 1 V.**Maximum Input & Output:** 7 V.**Center Frequencies:** 32, 60, 120, 240, 480, 960, 1920, 3840, 7680, and 15,500 Hz.**Control Range:** ± 15 dB.**Subsonic Filter:** -3 dB at 20 Hz, -21 dB at 10 Hz.**RTA Section****Display:** 9 x 10 LED matrix.**Range:** 16 dB with 2-dB steps, 32 dB with 4-dB steps.**SPL Reference:** 76 dB.**Adjustment Range:** $-\infty$ to +35 dB.**General Specifications****Dimensions:** 18 1/4 in. (465 mm) W x 3 7/8 in. (100 mm) H x 7 in. (705 mm) D.**Weight:** 7 lbs. (3.2 kg).**Price:** \$549.00.

The Audio Control C-101 equalizer and RTA combines a number of interesting features, and the joining of the two functions is quite advantageous for many equalization tasks. The inclusion of a test microphone greatly facilitates making system/room response tests. The majority of the front panel is occupied with the equalizer boost and cut controls which have a more-than-adequate ± 15 -dB range. There are handy, and important, center detents for the sliders. The left and right controls for each octave are side by side, which is a timesaver if adjustments are made in kind for both channels. The advantage is lessened when the channels must be set differently, which would also confuse the graphic display.

To the right of the controls are five push-button switches. The *Equalize Program* and *Equalize Tape* switches are interlocked, for the equalizer can be in only one signal path at a time. *Tape*

Monitor (Source) selects the line, or program, input or tape recorder playback to feed through the equalizer section. The designation might be a little confusing to some, but it makes more sense if the user sees it as a replacement for his preamplifier/receiver tape-monitor switch. The *Rumble Reducer* introduces a crossfeed summing between the two channels so that out-of-phase signals at the lowest frequencies are nulled out. Audio Control feels that the benefits extend beyond the reduction of rumble, actually improving the clarity of many records. Test data and results from the listening tests of this unusual feature appear later. Finally, a subsonic filter can be inserted into the signal path to eliminate possible problems from record warps or other below-band signals.

The RTA display is of good size with bright LEDs which are easily seen in bright room lighting, even at some distance. In

RTA mode, the distribution of energy is shown with a red LED in each channel, and there is a horizontal row of green LEDs at the zero reference. In *Level* mode, the green LEDs are extinguished, and a horizontal row of red LEDs appears at a level corresponding to the total energy in all 10 channels. The center frequencies are listed along the bottom, and on the right there are scales for RTA from -8 to +8 dB (2 dB/step) and from -16 to +16 dB (4 dB/step) and for SPL from 64 to 92 dB (4 dB/step), with the input level cal. pot at zero detent. The pot adjustment range is from $-\infty$ to +35 dB, relative to the zero detent position. Push-button switches, also at the right of the display, select slow or fast display action, 2 or 4 dB/step scaling, *Level* or *RTA* mode and power on/off. The front panel is attractive, but the tan-on-brown designations are hard to read unless the room lighting is on the bright side.

There are twin phono jacks on the back panel for connection to the built-in pink-noise generator, which is just about essential for doing some of the tasks made possible with the EQ/RTA combination. There are also phono-jack pairs for tying the unit into a tape monitor loop, as well as a set for connecting a tape recorder back into the loop when desired. There is also a phone jack for plugging in the supplied test microphone to feed the RTA, which automatically disconnects the internal connection from the EQ section.

A partial disassembly was made to permit examining the interior construction. There were six p.c. boards which had good soldering, in general, but there were a number of spots with flux residue. There was direct multi-pin plugging of one card into the other. There was some springiness in the cards, but the layout used made a fairly rigid assembly. The manufacturer provides a most appropriate caution that the unit should not be used for "pro audio applications."

Performance

Equalizer Section: With all of the controls at zero detent, the frequency response was very flat with the -3 dB points at about 2 Hz and 200 kHz. The filter center frequencies were more accurate than most such devices, with most discrepancies from nominal less than 2 percent. Maximum boost and cut values were close to 12 dB (Fig. 1), and filter shapes were fairly consistent. With all sections at a maximum, the average change in gain was about 16 dB with a 3-dB ripple, a bit on the high side. For a limit of $Q = 1$, the maximum boost with the 960-Hz filter was 7.9 dB, a typical figure for octave-spaced filters.

The input impedance was 88 kilohms at 1 kHz, and fell slowly at the highest frequencies to about 20 kilohms at 20 kHz, which is high enough for any normal situation. The output impedance appeared to be close to 150 ohms across the band, which is even better than the specified 680 ohms. With all of the sliders in detent, punching in EQ caused a gain change of -0.15 dB. This difference is quite insignificant, but there was no way to match gains with combinations of boosts and cuts. The maximum input/output voltages were within 0.1 V of the specified 7-V limit, except for a drop to 6.6 V at 20 kHz. The polarity of the output was in phase with the input with or without EQ in.

In midband, the distortion was primarily second order, a superbly low 0.0008 percent with EQ and 0.0007 percent without. There was an increase at the frequency extremes, to 0.007 percent at 20 Hz and to 0.012 percent at 20 kHz. All figures are for 1 V in/out, and they did not increase until the point of clip-

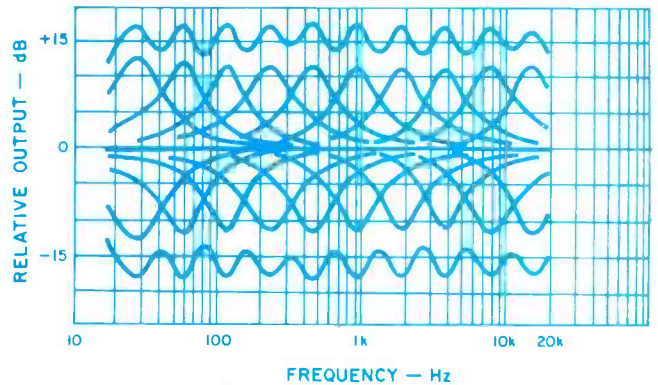


Fig. 1—Frequency responses of individual filter sections at maximum boost and maximum cut, of unit with no boost or cut, and with all sections at maximum boost and at maximum cut.

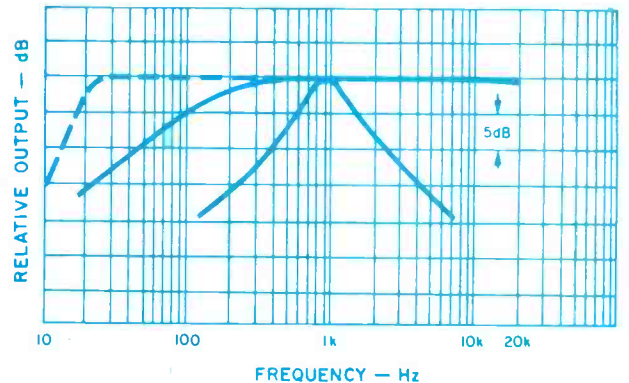


Fig. 2—Frequency responses of the following: 960-Hz filter of RTA, equalizer channel A output with rumble reducer in and out-of-phase signals to A and B inputs, and (dashed line) subsonic filter.

ping was reached. The slew rate was about $8 \text{ V}/\mu\text{S}$ with EQ, one of the best figures measured on such a unit. Even with 6.0 V in/out, the distortion at 20 kHz was only 0.072 percent — excellent performance. IM distortion was only 0.003 percent with 2 V in/out, not rising with higher levels except near clipping. The signal-to-noise ratio was 99.0 dBA re: 1 V, so good it was hard to measure and 3 dB better than the spec.

Frequency response plots were generated (Fig. 2) of the subsonic filter and the rumble reducer, which circuitwise are after the equalizer filter sections. The plot of the rumble reducer was made by feeding an out-of-phase swept-signal pair to the A and

The filter center frequencies were more accurate than most similar devices.

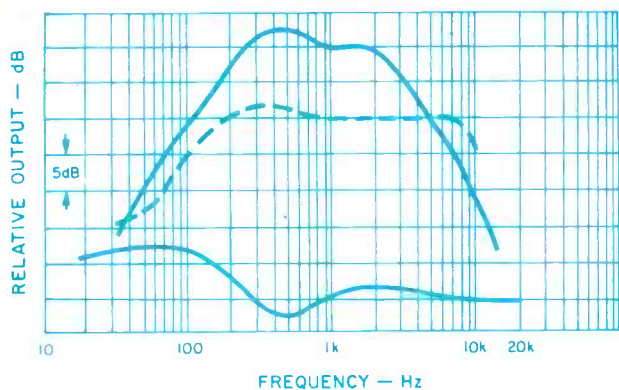


Fig. 3—Top: Response first measured of stage-monitor speaker; middle: Response after increasing tweeter level and adjusting EQ, and bottom: Swept response of equalizer with adjustments used.

B inputs. The curve shows that at 20 Hz there was 16 dB cancellation of in-phase voltages, 5 dB at 100 Hz and less than a dB by 300 Hz. There are comments later in the in-use section on reactions from listening with this function switched in and out.

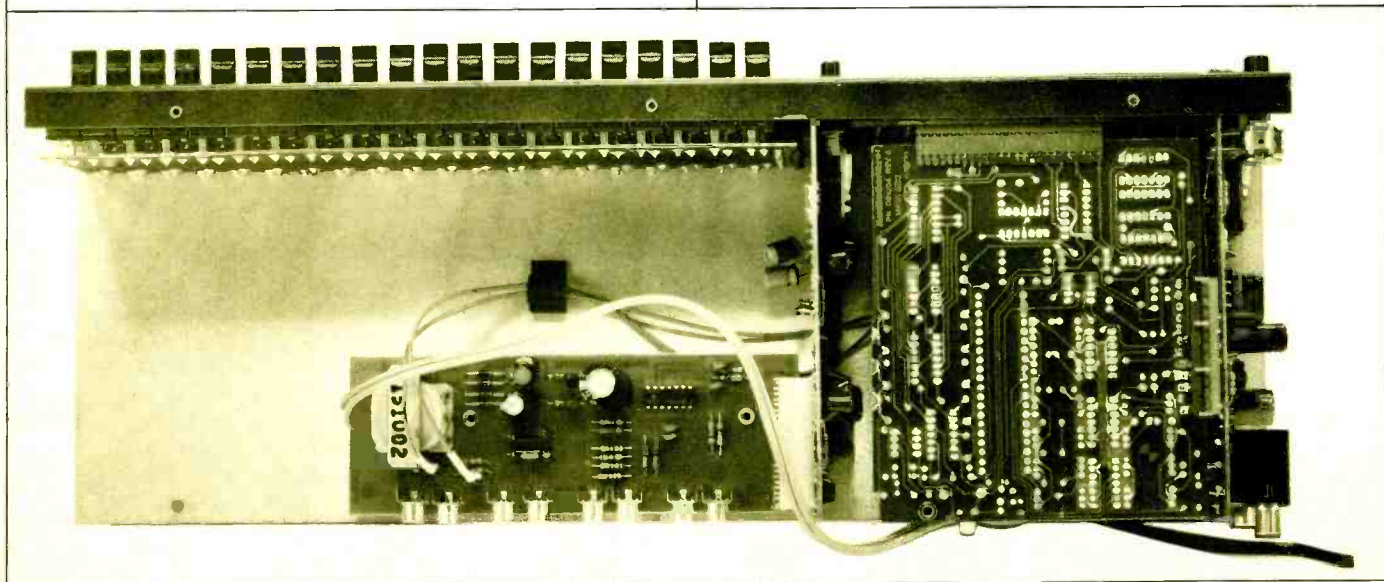
RTA Section: Also shown in Fig. 2 is the response curve of the 960-Hz filter in the RTA, typical of its filters and those in other inexpensive RTAs, with the skirts down about 8 dB at the centers of the adjacent channels. The peak responses of each filter with a CW test tone were within ± 0.2 dB, with the exception that the highest one was 0.8 dB less sensitive — still very good accuracy. Most of the filter centers were within 4 percent,

quite acceptable for the purpose. The response of the RTA to pink noise was flat for all channels, with just a few lower-level firings at 15.5 kHz.

The 2-dB steps were all quite close, but the "4-dB" steps were actually about 3.3 dB each. The inaccuracy would probably not be noticed by most users, but it would be better to have the full 4-dB steps. There was a shift in displayed level between *Slow* and *Fast* of about 2 dB. As the display is driven by both channels of the EQ section, unless the mike is used, the measured sensitivity depends upon whether one or both channels are driven. Sensitivity at *Gain Cal* was 84 mV for RTA and 226 mV for *Level*, both channels driven, double the figures for one channel driven. The mike sensitivity was at considerable variance with the indicated 76 dB SPL for a zero indication on the display. The display showed about 80 dB SPL with the actual level at 68 dB, as shown by both an Ivie IE-30A and a GenRad 1933. There was a slight falling in the response of the supplied microphone at 4 kHz and above and a roll-off at the low end, starting at 125 Hz. For most purposes, the mike will probably be satisfactory, but careful listening is suggested to forestall putting in a low-end boost not really warranted. A supplied data sheet indicated excellent response by a 1/4-inch diameter microphone, but the one supplied was actually 0.322-inch diameter, which also prevented its being checked with an acoustical calibrator.

A 500-Hz tone burst was used to measure the time constants of the display circuits. In *Slow*, the attack time was about 120 mS, and the decay time was about 10 S. In *Fast*, the attack time was about 50 mS, and the decay time was around 1 S. The results appeared to be about the same whether in *RTA* or *Level* mode. A single discrete tone was displayed 10 dB lower in *Level* than in *RTA*. This is not the contradiction it may appear, for equal energy in all 10 bands would result in the same display for both modes. (Level in all bands with equal energy in each band = level in one band + $[10 \log N = 10 \log 10 = 10 \text{ dB}]$.)

The pink-noise generator output was within ± 1 dB from 25 Hz to 20 kHz, just fine for any tests the unit might be put to. The level was a good 0.22 V rms, but there is no output control. There was no recycle clunk observed during any of the testing.



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An entirely new design... but one true to the Nakamichi 700 tradition. A unique blend of beauty and technology as ravishing to the eye as to the ear. And now... a choice of 700ZX cassette recorders. The 700ZXE with 50-dB peak-responding electronic metering, 9-program interstice-searching RAMM, and automatic calibration of azimuth, bias, and level attains a response from 18 to 23,000 Hz \pm 3 dB...




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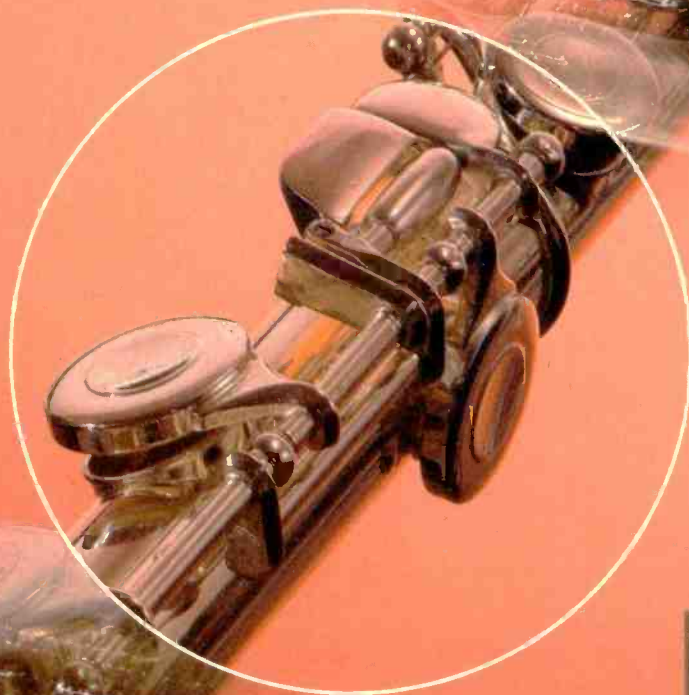
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Audio Control's C-101
is a well-performing,
feature-laden combination
at a good price.

but the sound had a slightly odd burbling characteristic — this was not a problem, just a curiosity.

In-Use Tests

The C-101 was used for monitoring music over a long period of time, off and on, and RTA and Fast with 4 dB/step made the best combination. The input-level control was used to center the display vertically. The bright LEDs were easily seen under many conditions, with a slight problem one time because of reflections with bright room lighting. The Audio Control EQ/RTA in Slow was used to check out a stage-monitor speaker, which was sounding more than a little dull, in contradiction to statements made when the speaker was delivered. Figure 3 shows a number of responses measured during the checking of the speaker. The top trace is the response first measured (with 4 dB/step), and there is no doubt that there is almost no tweeter output. With the RTA display being fed from the test microphone and a pink-noise source, it was a matter of a minute or so to find the best setting for the tweeter control. Then, the EQ of the sound system was adjusted (with 2 dB/step) for further improvements. The final result is shown in the dashed line, shifted for illustrative purposes. The bottom trace is the swept response of the EQ section with the adjustments made.

There wasn't any question about the fact that the subsonic filter would reduce unwanted signals below 20 Hz. There was particular interest, however, in trying out the rumble reducer. As

the reader may recall, it was mentioned earlier that this circuit functions by combining and cancelling out-of-phase signals below 200 Hz (see Fig. 2). (Vertical groove modulation generates out-of-phase outputs from the cartridge.) With both manual and automatic tonearm drops onto a disc, the reducer did lower the level of the set-down clunk, although not as much as I had hoped. A more obvious change was noted when a switch was made during very low-level or unrecorded grooves; then, it was immediately clear that there was a worthwhile reduction in rumble. During music passages, there was greater clarity with many records, but there was also an apparent reduction in the level of bass. The conclusion was that this is a nice feature to include, but personal taste will determine the extent of its daily use.

The instructions supplied consisted of a manual for the C-22/C-25 EQ and a supplement for the RTA portion. The text was generally quite good, in a humorous vein, with a number of serious points well made. The illustrations were adequate, and the schematic included would be greatly improved with notations on switch and circuit functions. There's some sloppiness in equating SPL (a pressure function) and sound intensity (a power per unit area function) and in referring to microphone measurements in dBA when, in fact, there is no weighting applied. The objections are minor, however, and the overall conclusion is that the Audio Control C-101 is a well-performing, feature-laden combination at a good price.

Howard A. Roberson

Enter No. 91 on Reader Service Card

The MC201 Cartridge—“Closer to the Reality”

Fidelity Research's moving coil cartridges are still turning a lot of heads and ears. Read this latest rave review from David Lintz, marketing director of Direct-Disk Labs, Nashville, Tennessee.

“Three years ago, we tried the FR-1Mk2, our first Fidelity Research cartridge. We noticed the beautiful clarity, depth and sweetness it imparted to our reference system.

“Six months later, we purchased the new FR-1Mk3F and found it to be an improvement over the previous FR-1Mk2. It remained as our reference for a year and never missed a beat.

“Recently, we ordered the new MC201 and we were knocked out by the dramatic improvement it made in listening to our direct-to-disc, digital and half-speed mastered

discs. The improvement was amazing. Tracking was much better; clarity, stereo placement and upper treble smoother still.

“Each new Fidelity Research product takes us closer to the reality of what our studio sessions are all about. Dynamic range, imaging and natural bass exceed anything else we've heard.”

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3

JVC HR-6700U COLOR VIDEO- CASSETTE RECORDER

Manufacturer's Specifications

Format: VHS.

Maximum Recording Time: 2 hours or 6 hours with T-120 cassette.

Antenna Impedance: Unbalanced, VHF 75 ohms; balanced, UHF 200 ohms.

Channel Coverage: VHF, 2 to 13, UHF, 14 to 83.

VHF Output Signal: Channel 3 or 4, switchable, 75 ohms unbalanced.

Power Requirements: 120 V, 60 Hz, 55 W.

Video Input Level: 0.5 to 2.0 V p-p, 75 ohms unbalanced.

Video Output: 1.0 V p-p, 75 ohms unbalanced.

Video S/N: Better than 45 dB.

Horizontal Resolution: More than 240 lines.

Audio Input: Mike, -67 dB, 10 kilohms

unbalanced, line, -20 dB, 50 kilohms unbalanced.

Audio Output Level: -6 dB, high-impedance load.

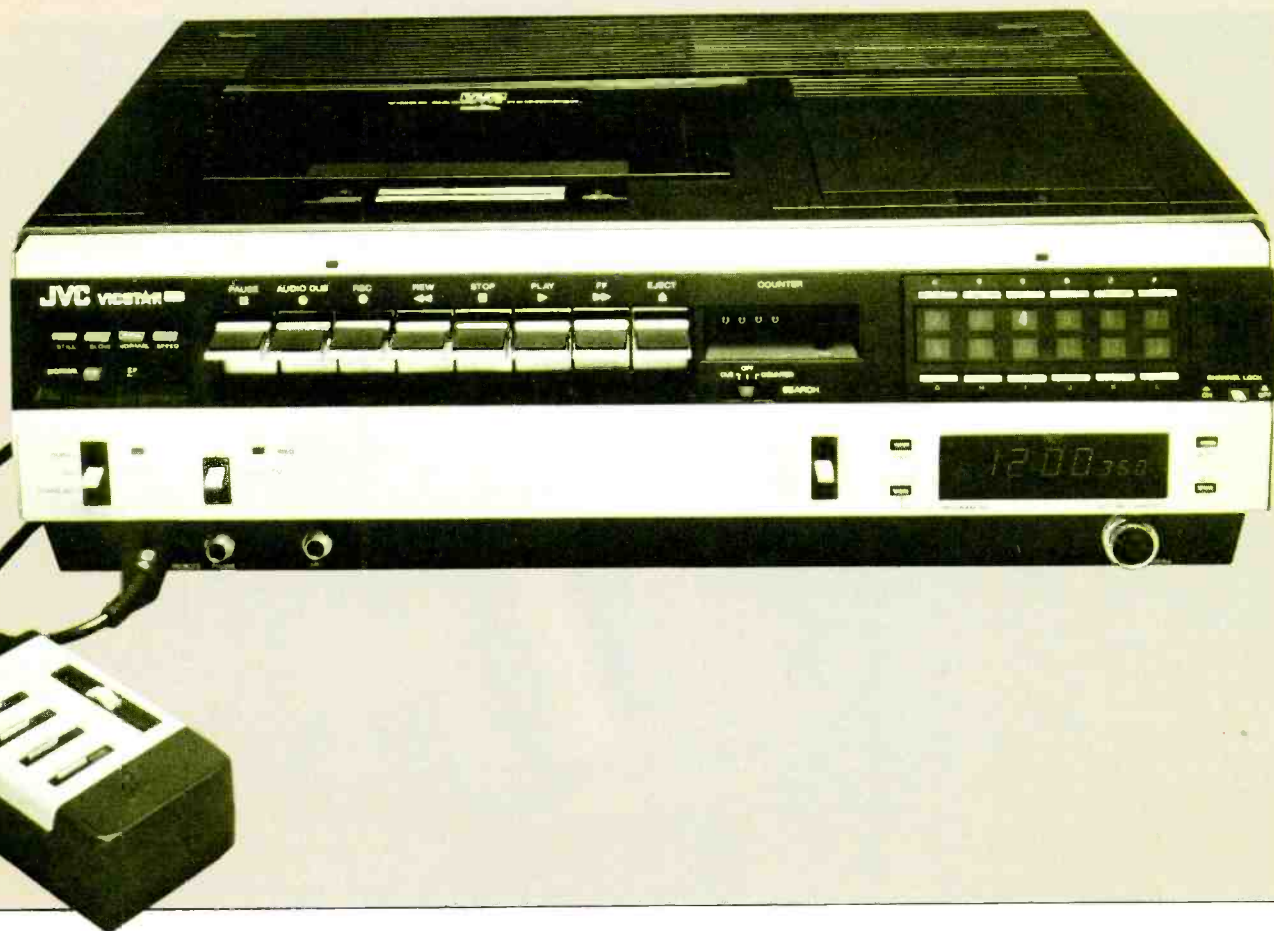
Audio S/N: Better than 40 dB.

Audio Frequency Response: 50 Hz to 10 kHz.

Dimensions: 18½ in. (46.99 cm) W x 5-13/16 in. (14.76 cm) H x 13¾ in. (34.92 cm) D.

Weight: 31 lbs. (13.95 kg).

Price: \$1,350.00.



JVC, the people who developed the VHS (Video Home System) format of video recording, have given in to public demand and have now come up with a VCR that can record or play back for a total of six hours, using what had been nominally called a two-hour tape cassette (T-120). Surprisingly, JVC was not the first company to increase record/play time. Sister company Panasonic (actually, Matsushita Electric Company) and other VHS-format licensees had been slowing down tape speed for a few years to provide both four-hour and six-hour record/play times. JVC held out until just short of a year ago, maintaining that their first and most important consideration was high-quality video reproduction with good color purity and superb resolution or picture detail and, that unless and until they could provide similar quality in a longer play format, they were going to stay with their original two-hour format.

Well, instead of increasing record/play time to four hours, JVC has skipped right over to a six-hour capability in the HR-6700U, which offers either two-hour (SP) or six-hour (EP) recording and playback modes. And as for holding up picture quality at the slower tape speed, JVC has accomplished that feat with a four-headed system of videotape heads on the fast-rotating head drum instead of the usual two. The two original heads are optimized (as to gap and other parameters) for two-hour tape speed, while the added pair of heads are designed to extract the best possible picture when the tape is operating at its slower speed for six-hour maximum time.

JVC has added a multi-function programmable timer to this model, and, having checked out several other programmable VCR units, I found that this timer-programmer is one of the simplest to use correctly that I have encountered thus far. At first glance, the digital display and programming button area of the front panel seems unusually bare. Further investigation (including a reading of the owner's manual or the abbreviated user's guide) reveals that the combination channel display and digital numerical display perform a variety of functions. To set up one of the six possible advance programming instructions, you simply push a button called *Program Set*. Program numbers from 1 through 6 may then be called up. Next, a *Select* button is depressed and this calls up, one at a time, all of the elements which need to be preprogrammed, in sequence (desired channel, day of the week, hours, minutes and, finally, duration of desired unattended recording). Each item is entered into the program memory by depressing the *Set* button until the correct information is displayed in the digital readout area. A great deal of programming display information has been logically compressed into a minimum of front-panel space and with a minimum of switches and buttons. Three of the six programs which can be entered into memory will be erased as they are executed, while the remaining three remain in the memory until manually cancelled (useful for recording the same program each day or at the same time each week, for example). A welcome convenience feature is the ability of the clock/memory system to retain its programs (and correct time) for short periods (about 10 minutes) during brief interruptions of power such as occur in many communities during summer storms, etc.

The start of each recording includes a built-in signal which enables a search-cue control to "instruct" the tape transport to proceed to the start of the next program when in the fast wind (rewind or fast forward) modes. Alternatively, the counter may be used for conventional "memory rewind," in which the fast mode

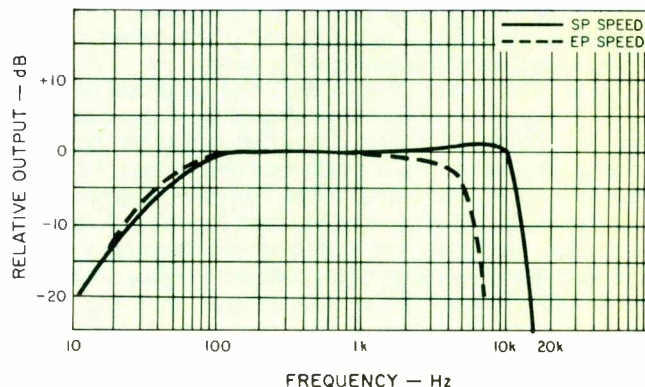


Fig. 1 — Record/play audio response, JVC HR-6700U videocassette recorder.

will bring the tape to a point corresponding to "0000" on the conventional digital tape counter supplied with the machine.

Special-Effects Capabilities

The Model HR-6700U has been endowed with an assortment of video special-effects features. These include still or freeze-frame viewing, slow-motion viewing, and fast-speed viewing (two times normal speed in the two-hour SP mode; three times normal viewing speed in the six-hour EP mode). During fast viewing in the two-hour mode, the audio track remains completely intelligible, thanks to a clever circuit which has been incorporated by JVC to "halve" the audio frequencies picked up from the tape. In the six-hour mode, audio is silenced when the fast-view mode is employed. A hand-held remote-control unit duplicates all of the special-effects features just mentioned, including the variable slow-motion feature. When using either the still/pause or slow-motion modes, these effects will be automatically defeated (and normal viewing will resume) after about seven minutes if you should forget to restore normal viewing manually. This safeguard is incorporated since extended viewing of still pictures may damage the tape, or even the tape heads of the machine. In the still mode of any VCR, the tape actually does not move; the playback heads simply trace the same frame or diagonal track across the stationary tape over and over again.

A phone jack, microphone jack, and camera cable connector are all located along the lower edge of the front panel of the recorder. A door hinged along this section of the panel swings away to disclose an AUX/TV switch (you use the AUX setting when working with a video camera connected to the VCR), a slow-motion speed control (which performs the same function as the slider on the remote-control unit, varying the speed of slow-motion viewing), and a pair of "tracking" controls which are used to eliminate any noise bars which may be visible during slow-motion or fast-speed viewing.

EP or SP tape speeds are selected by means of a small switch located near the left edge of the front panel, but such selection need be made only when recording. During playback,

This is JVC's finest VCR to date, in terms of its picture reproduction capabilities and its special-effects and programming facilities.

the unit senses the speed at which a given tape has been recorded and will switch automatically to the correct playback speed regardless of the setting of this switch.

Up to 12 channels (VHF or UHF) may be preset on the TV tuner section of the VCR, and numbered labels are supplied so that you may tune channels in any preferred order, depending upon which channels are active in your viewing area. A door-flap atop the unit provides access to the TV channel adjustment and selection panel. Piano key-type transport controls include pause, audio dub, record, rewind, stop, play, fast forward, and eject. The eject action has been highly damped compared with earlier model VCRs so that there is no longer that frightening "clunk" of the cassette compartment springing up when this button is depressed.

Tests and Evaluations

Most of the tests and evaluations which we performed using the JVC Model HR-6700U were largely subjective. Such parameters as resolution (picture detail), color purity, and gray-scale linearity (ability to reproduce shades of gray ranging from black to white in linear fashion), while measurable in quantitative terms, would require an enormous amount of test equipment to do accurately and meaningfully. An alternative approach is to compare these qualities, as observed on the VCR under test, with the same qualities observed on a growing assortment of competing VCRs and to assign purely subjective ratings to them. We have chosen the latter course for the time being.

It should be noted that all of our evaluations were made using two modes of connection. All VCRs are supplied with a built-in r.f. modulator. It is this device which causes the recovered video and audio signals to modulate an r.f. carrier (tuned to either VHF channel 3 or 4) so that connection from the VCR may be made to your TV set via its regular antenna terminals. In addition, all VCRs are equipped with video output jacks which bypass the r.f. modulator module completely. At these jacks, a composite video signal is available which may be applied directly to a TV monitor screen, bypassing the r.f. section of one's TV set. The last-described method of connection is to be preferred in evaluating a video recorder's picture quality, since such a connection bypasses both the r.f. modulator section of the VCR and the front-end or tuning section of the TV set used to view pictures reproduced from the VCR in question.

On the other hand, if results obtained directly from the video output jack are comparable to those obtained using the demodulated TV signal as fed to the TV set via its antenna (r.f.) input, this is an indication that the r.f. modulator supplied with the VCR is in no way responsible for deterioration of picture quality. In fact, that is just what occurred in the case of the HR-6700U. Pictures observed using the antenna connection to the viewing TV set were just about as good as those viewed via the direct video output connection jack.

Video frequency response, or picture definition and resolution, was extremely good at the high-speed SP tape speed, and it was difficult to distinguish between pictures received over the air using a properly oriented outdoor antenna and those reproduced from tape at the faster tape speed. At the slower six-hour EP tape speed, some degradation of picture definition was noted, but it was minimal. Color purity remained excellent at both speeds as did gray-scale linearity. As nearly as we could judge by eye, video signal-to-noise ratio was about 2 dB poorer

in the longer play mode than it was at the higher two-hour speed.

Audio Section Measurements

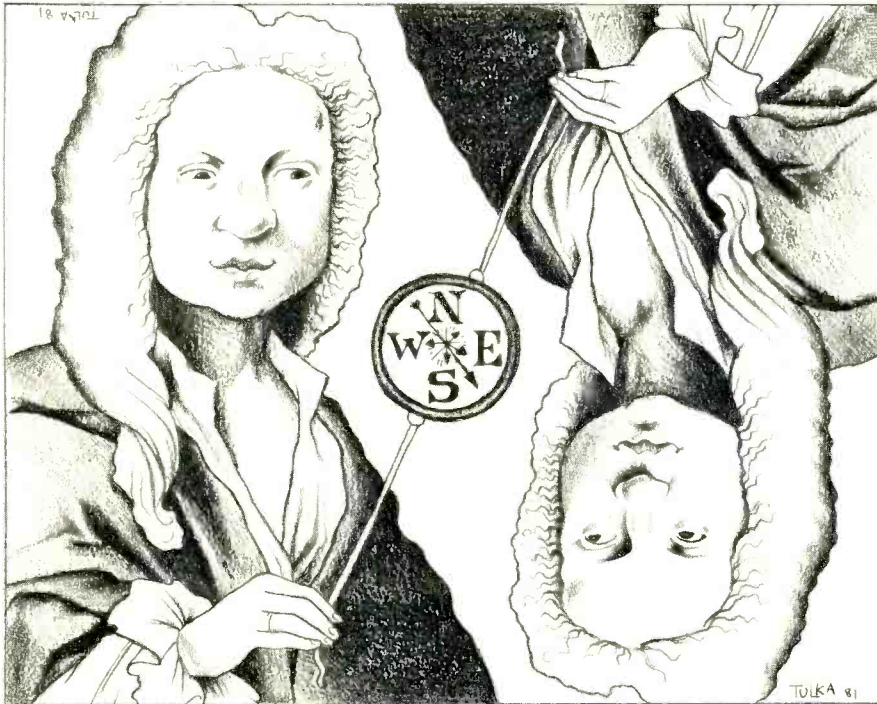
As for audio performance of a videotape recorder, our laboratory is equipped to make quantitative measurements, of course. It is important to bear in mind that the linear tape speed of a VHS-type VCR is only 1.31 ips in the standard-play (two-hour) mode and an even slower 0.43 ips in the six-hour mode. At such slow speeds it is not surprising that record/play frequency response of the audio portion of this VCR is not much better than one would expect from a low-cost portable audio-cassette recorder. Record/play responses in the SP and EP modes are both shown in the curves of Fig. 1. The -3 dB roll-off points at the faster tape speed occurred at an acceptable 11.0 kHz and 70 Hz, but at the slower tape speed high-end cut-off (-3 dB) occurred at only 4.5 kHz. Harmonic distortion, measured at a record level of -10 dB referred to maximum level, was 0.8 percent at 1 kHz and at 100 Hz when the tape traveled at its faster speed, and it increased to 1.0 percent at the slower tape speed for the same record/play levels. Signal-to-noise ratio, referred to maximum record level, measured an acceptable 46 dB in the two-hour tape speed mode and a bit better, 47.5 dB, at the slower speed. In case that seems to be the reverse of what you would expect, remember that the bandwidth is much narrower in the slower-speed mode, and therefore high-frequency tape hiss components contribute less to the overall S/N reading.

In-Use Tests and Summary

Having had an opportunity to experiment with earlier VCR models from JVC, I can say with some certainty that this is JVC's finest videocassette recorder to date, both in terms of its video picture reproduction capabilities and in terms of its special-effects and programming facilities. Six programs over a period of one week seems to be about all anyone would be likely to really need in a home VCR. After all, the number of "events" that the VCR can record in an unattended manner is still limited by the time available on the tape in most instances, and not by the number of programs that can be "memorized" by the VCR's microprocessor circuitry. And just in case you want to record the same soap opera every day for more than a week (assuming the show runs for only a half hour per episode) that possibility is not precluded, since a program can be set up to record the same thing every day on the same channel. That would constitute only a single instruction out of the six which can be stored.

The supplied remote control-unit worked perfectly, duplicating all of the special effects which might have been selected at the front panel itself. As we said at the outset, not too long ago one had to pay about as much for a VCR that provided only two hours of recording, single-event programming, and few special effects facilities as is now being charged for units such as the JVC HR-6700U. Increased production runs, advances in IC technology, and general advances in video recorder engineering, in this case, have actually more than countered the effects of world inflation. To get the same quality in a major appliance today as we did a year or two ago without having to spend more would be an achievement in itself; getting *more* value and better performance for no increased cost, as is the case with this VCR from JVC, is nothing short of miraculous. *Leonard Feldman*

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Music of the Collegium Mysticum Esperanto (Works by Emmons non Vivaldi). Hypercollegiate Players, dir. Eugen Lirpa-Sleeper.

LirpaDisc LPD 100½, non-stereo, \$17.99+.

Sound: Anon Recording: Non + Surfaces (North): Sur +

Like the famed Renaissance composer Clemens non Papa, this artist is quite obviously *not* Vivaldi, but somebody else. Who? And yet, to my real astonishment as I listened to the Northern half of this new LirpaDisc, he *sounds* like Vivaldi. Strange! Now *that*, as any *afficionado* (or *-a*) of the Lirpa musical Establishment knows, is really something.

In Lirpa land, Vivaldi is Classical King, if not Queen — and for my ear this music was no less than Himself, as the Irish say. I wouldn't have believed it. Please, let us have more non Vivaldi.

For the sake of audio appropriateness, I had, of course, to place this excellent disc directly beneath that paragon of turntablability, the Lirpa Whatyoumaycallit (you'll remember — the self-powered phono pickup on wheels that runs circles around all others on any old disc) — this in order to bring out the Vivaldi-esque qualities of the music in no

uncertain terms. I will say no more (well, not much more, anyhow).

Those portions of the LirpaDisc which actually tracked under the rapidly circling Whatyoumaycallit were excellent, even though no more than the North half of the disc was audible, the Southern section being momentarily out of contact with the LirpaStylus as the W. became airborne for the South lap of the track. My fault — I set the point pressure at a modest 5.76 grams which, nevertheless, was too much to keep the wheels down without the special sticky neoprene tires with studs optionally available. Yet even so, I really did enjoy the North segment of the disc, which could not have been more convincing in the, er, fi.

(North? Well, doesn't the earth go 'round and 'round and yet, after all, North is always North? So it is with the highly innovative LirpaDisc, the first ever to have a North and a South.)

I suggest that in playing future LirpaDiscs you might consider a more pliable partridge, I mean a more ciable cartridge, with an adequate point pressure for playing both North and South segments of each record face. That should do wonders. Meanwhile, musical praise to the excellent Hypercollegiate Players

and their somewhat nepotic director, Eugen Lirpa-Sleeper. What more can I say? (Nothing.) E.T.C.

Beethoven: Symphony No. 3, Op. 55 ("Eroica"). New York Philharmonic, Zubin Mehta, conductor.

CBS Mastersound IM 35883, digital, stereo, \$14.95.

Lalo: Concerto in D minor (1876); Saint-Saens: Concerto No. 1 in A minor, Op. 33. Orchestre National de France, Lorin Maazel, conductor; Yo-Yo Ma, cellist.

CBS Mastersound IM 35848, digital, stereo, \$14.95.

CBS' new audiophile classical label, Mastersound, debuts with a diverse mainstream repertoire and a fair sampling of top artists. Simultaneous release of Mastersound CrO₂ cassettes and 12-inch LPs (under its recently abandoned name of Columbia, the company introduced the letters LP almost a third of a century back) joined this last of the domestic major labels with the ranks of those marketing digital and other special-handling recordings in this country. The new CBS discs are noticeably thicker than most of those turned out in the 1970s, and nearly every other detail speaks of the care expended on Mastersound. Perhaps the first outward sign of this care is the simplicity and restraint of the covers of these two releases. The cover format is very similar to many London albums — excellent photographs of the star artist are featured on each album. Certainly, there is little resemblance to most of the earlier Masterworks discs, which were often a bit over-designed and perhaps a little artsy in their most blatant examples.

As often happens with audiophile recordings, the repertoire takes a second place to the prominently touted artists and digital production. CBS, being one of the few big American classical labels, maintains an impressive array of musicians in their continuing list of releases. Zubin Mehta leapt from being a California to a New York cult figure when he signed a contract to head the New York Philharmonic not so long ago. Of course, he soon became a national personality. Highlighted by magazine cover photos and public radio/TV broadcasts, the intense face of the Vienna-educated Parsee became an American symbol. CBS

has used this masculine idol's photograph liberally in recent albums, and this "Eroica" is no exception. In fact, this album contains a two-by-two foot poster of the maestro.

The largest letters on the cover go to the conductor, the orchestra and "Eroica." Beethoven and "Symphony No. 3" get less conspicuous billing. In a way, this parallels the listener's impression of the performance, not too surprisingly. The highlighted orchestral sound, with occasional spotlight solo instruments, is superb, if not the same as in a concert. It is one of the best examples — and most

successful ones too — of the traditional Columbia stereo sound, not a recreation of the live music experience, but a recording treated as an art work of the mixing console. Since I wasn't there, I cannot vouch for the number of microphones used in the sessions, but the balance engineer — Bud Graham — obviously had sufficient channels at his beck and call to pinpoint woodwind and percussion passages when they appeared, exposed, in the score. It is actually one of the most seamless and enjoyable multi-miked recordings I've heard, with superlative clarity and imaging. It's not like

the real thing, but then it wasn't aimed at sonically photographing a New York Philharmonic subscription concert.

Everyone grows up with certain performances. And since any listener naturally uses his past "greats" as a musical, er, meterstick, I should mention mine. The balance between the Beethoven "Third's" tension and its serene sweep is best caught, to my mind, by Furtwangler and the Vienna Philharmonic. This recording is sheer chamber music in spirit, both grand and intimate. Personality it has, but personalities never intrude in the sheer sweep and poise of the music-making. This Mehta "Eroica" is mostly very successful, but substitutes the heroic for the poetic in most of the massive sections of the first movement. The tension springs forth nicely, at the slight expense of unity, and makes for a pretty exciting opening. The *marcia funebre*, though, is more taut than it need be. The movement has more potential for resignation and pathos than this performance brings out. As expected, the *scherzo* is full of life and verve. Its straightforward nature may leave some emotional possibilities unexplored, but it works effectively within the whole. My sole disappointment is the slow pacing of the concluding *allegro molto*. The end of the "Eroica" has a magnificent inevitableness to it that doesn't quite come out here, especially since the strings don't have the bite and sizzle to command total attention for each phrase.

The sound quality? Simply superb. Coupled with a very quiet pressing on the review copy, the superior dynamic range of the record was a treat. The care with which the performance was mastered makes this album a musical joy. It is no mean feat to contain the complexity and impact of orchestral sound within tiny plastic rills, and CBS has done an eminently tasteful job of it. I especially enjoy the restraint — that word again — with which balances have been maintained. No sonic meddling has brought overemphasized bass or sparkle into the recording, rather, there is an unstressed naturalness that is welcome (and relaxing). In this album, PCM recording takes its rightful place as a new technological tool for faithful reproduction, and unwanted bombast and hyping are just not there.

Much the same things are true of Yo-Yo Ma's two romantic cello concerti. I get the impression of two somewhat different orchestral layouts and recording sessions; there is a different sense of image and space in each work. The Lalo benefits from better balance and conveys greater warmth. It is a more homogeneously orchestrated score, which

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doubtless helps, but the sense of ensemble and sonority of this side of the record is greater than that on the St. Saens side. As in the Mehta recording, there is no fussing with dynamics. Once the engineers had established mixing levels and punched "go," the digital recorder — a Sony PCM system for both albums — simply whirred away, did its job with competence, and delivered a clear, unrestrained sound record of what the microphones heard. As with the Beethoven, I felt that a certain amount of highlighting was accomplished at the mix-down onto a two-channel master, but find little to carp about.

Ma is a deservedly beloved young cellist. He was born in Paris of Chinese parents, and will be a venerable 26 years old this fall. Both in concert (he has a frantic schedule) and on recordings, he is an amiable, convincing artist. This record stars him as the solo protagonist, without hokey over-miking, and rightfully so. The two French romantic concerti are well known, the Lalo a little less so, and accordingly have gotten a certain amount of attention from the likes of Starker, Fournier, Cassado, Rostropovich, and Du Pre. Neither is among the composer's best work, especially since the St. Saens spends a lot of time tossing dithering passages back and forth between the cello and the sections of the orchestra, but both scores have plenty of beautiful writing. Ma shows technical ease of an unusually relaxing kind; one simply sits back and listens to his stunning tone and phrasing without the old listener's fear of missed notes and fingers gone awry. There may be one or two other good, young cellists around, but none, to my ear, shows the poise and security of Ma. With age, he will acquire a greater sense of relaxation and lyric simplicity, but both performances are top rated. I must commend Lorin Maazel, who turns in a quintessentially polished performance with the Orchestre National de France, neither subjugating the orchestra to the dominance of the big solo part nor tossing in irrelevancies.

Mastersound can count itself wise to have pushed such carefully produced evidences of musicality and engineering good taste out with its other debut releases into the maelstrom of the current classical record marketplace. Neither of these is a sonic blockbuster, but both, in their clarity and impact (in the right spots), are true audiophile records. If the cassettes live up to this standard, CBS may be among the first to have left the short-term pay-off of sonic marvels (a la 1812) for a more permanent plus, the enormous service to music that digital recording will make.

Christopher Greenleaf

Massenet: Ballet Music from Le Cid; Scenes Pittoresques; The Last Sleep of the Virgin. City of Birmingham Orch., Fremaux.

dbx-Klavier Patrician KS 522, stereo (encoded), \$8.50.

This dbx-encoded reissue comes from a notable series originally recorded by EMI in England and imported by Klavier. The City of Birmingham Orchestra is a lively one, and Fremaux is an enthusiastic conductor; the sound is big and the music is played in a very reverberant hall.

There is one notable minor fault in the production, probably unnoticed. Background ambient sound is considerable in this hall, but even so, the die-away reverberation at the end of the LP bands is regularly and very noticeably cut off before it ends. Is this in the original EMI tape? In the Klavier editing, if any? (On standard LPs these snipped-off endings would be less noticeable due to normal LP surface sound.) Or is it a dbx fault? No way of telling as one listens — in any case, it is a minor but unpleasant weakness in an otherwise excellent dbx disc.

E.T.C.

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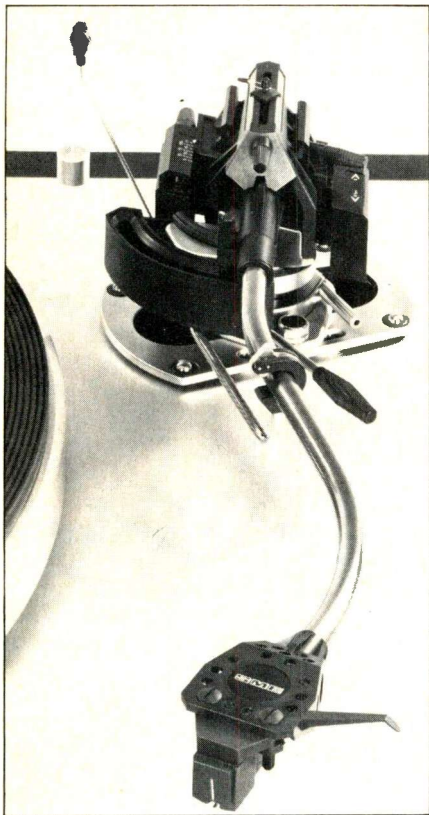
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Hotter Than July: Stevie Wonder Tamla T8-373ML, stereo, \$8.98.

Sound: A- Surfaces: D+ Performance: A

What a joy it is to hear a new collection of songs by Stevie Wonder, and the kind of things he does best, too. I like *Hotter Than July* more than anything Stevie has done since *Fulfillingness First Finale*. The textures are rich and full and beautifully enhanced by Stevie's use of state-of-the-art digital recording techniques which let every nuance leap out of the speakers.

In fact, the superb sound inadvertently exposes the album's weak link: The pressing. Motown discs are notorious for poor pressings but the whoosh of surface noise before and after and during the music is inexcusable. But even this insult is worth putting up with for as fine a performance as this one from Stevie.

Side one has love songs for dancers (please do not read disco into that). "Did I Hear You Say You Loved Me" segued

directly into "All I Do" is swirling, hypnotic music that ranks with anything the man has done, an absolutely thrilling album opening. And "All I Do" isn't even a new song, as it was written in 1966. "I Ain't Gonna Stand for It" is one of those "I know you been foolin' round, babe" songs with a wink that Stevie inserts into it, making it work... it's a hard song not to grin through. Closing the side, "As If You Read My Mind" raises the thermostat higher still.

Side two is more concerned with the issues on the street, particularly the smash hit "Master Blaster (Jammin')" which contains the album's title in the words. That sinewy, insistent reggae beat just can't be denied. "Do Like You" is the story of Keita and how he worked to be "The baddest dancer in the neighborhood." "Cash in Your Face" is the album's "Living for the City," portraying housing discrimination, vintage 1980. "Lately" is the album's torch song, one that other singers are

going to make into a standard over the years. Last is "Happy Birthdays," saluting Dr. Martin Luther King.

Throughout the LP, Stevie plays most instruments, and everywhere, the performance level of the players and backup singers is excellent. The sound, fabulous! *Hotter Than July* is the Stevie Wonder record many of us hoped for.

But the pressing! Mobile Fidelity, where are you when we really need you?
M. T.

Doin' It My Way: Tracy Nelson
Adelphi AD 4119, stereo, \$7.98.

Sound: A Performance: A

This is absolutely the best album Tracy Nelson has cut within memory — maybe ever. It reprises many of her signature songs, including: "Lies," "Temptation Took Control of Me and I Fell," "I'll Be Long Gone," "Goin' Back to Tennessee," and the classic "Down So Low." The lady takes a great turn with The Rolling Stones' "Time Is On My Side." For a change, on this record, Tracy sings with conviction when she has all too often sleepwalked through entire albums.

Probably the chief reason *Doin' It My Way* works so well is that it was cut live-in-the-studio and first released as a direct-to-disc album. Happily, the Adelphi pressing has excellent sound with lots of ambience.

A side result in Tracy's case is that the live performance situation has freed her from her own self-consciousness as a singer. That's really why *Doin' It My Way* is the best available Tracy Nelson record by several lengths.
M. T.

Face to Face: Rick Derringer
Blue Sky JZ 36551, stereo, \$7.98.

Sound: A Performance: A-

Derringer's guitar has been indisputable since the debut of the McCoys 15 years ago, and he usually manages to come up with effective hard rock (or more recently, even light pop) tunes, but his ability to put those two elements in a production which also suits his unique vocal stylings has been a somewhat erratic affair. Despite using every top producer from Mike Chapman (Blondie, Pat Benatar) to Todd Rundgren (Meatloaf,



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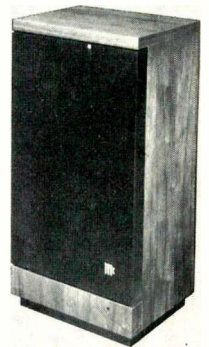
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Grand Funk), this enormously talented fellow hadn't been able to concoct a hit single regardless of how many surefire elements he'd throw into the package. Taking note of his career's commercial standstill, Rick decided to take the production reins into his own hands and geared his latest album, *Face to Face*, around his voice rather than his songs or guitar riffs. Fortunately Rick's got the pipes to stand up on their own without heavy camouflage, and for once his

singing stands out as being honest and unmannered, drastically distinguishing *Face to Face* from its predecessors.

In the past, Ricky D. has also relied on outside writers such as Cheap Trick's Rick Nielsen, Warren Zevon, and former Edgar Winter compatriot Dan Hartman to provide the hits, but this time around most of the material is written by the artist, with some aid from his band members. When he does do a cover, it's slung off with a sense of humor — Neil

Young's "My My, Hey Hey (Out of the Blue)," of which there are already three live versions available by the author. Derringer uses it as an excuse to barrage the listener with his B.C. Rich licks, rather than emulate the rather lazy feel of the original. Again, the song seems to have been picked due to the way it shows off Rick Derringer, Lead Vocalist, rather than for the tune itself.

Face to Face is the first album Rick's made since the Derringer group (with Kenny Aaronson, Vinnie Appice, and Danny Johnson) disbanded that can stand as a solid and creative achievement and not a collection of exciting but disparate tracks. He hasn't lost his edge, and he's still hot as a pistol guitar-wise. It appears that when he's able to fully control his sound, Derringer stands up as a mature artist of the '80s — more than a heavy metal maniac, and a survivor of several periods of musical transition. Obviously a musical talent who is still growing both horizontally and vertically.

Jon & Sally Tiven

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Jeff Beck is still reaching further than anybody else even if he's just fooling around.

There and Back: Jeff Beck
Epic FE 35684, stereo, \$8.98.

Sound: B Performance: A-

Jeff Beck's recording career has been so completely erratic that most of his albums are total non sequiturs, each having little to do with its ancestors. From the original great Blues-Rock-with-Flash-Guitar-and-Blonde-Venus-Vocalist, which about 25 percent of today's groups are patterned after (and from the remains of which emerged Rod Stewart, Led Zeppelin, a Rolling Stone, and who knows what else), Beck next created a visionary Heavy Soul Group that unfortunately flopped. His next project — Beck, Bogart & Appice — promised to be the noisiest band ever manufactured, but Jeffrey finally became fed up with its lack of musicality. From this point onward the career of Jeff Beck, Serious Musician began. *Blow By Blow* allowed him to play to his legions of fans crazed by Mr. Nimble's fingers, but brought in a

new audience composed of Mahavishnu-Stanley Clarke aficionados astounded by Beck's chops. Thus was born a fusion of Fusion (electric jazz) and Heavy Metal, which produced a followup album in the tradition of most: *Wired* seemed slightly inferior to *BBB*, and the following live album (with Jan Hammer) seemed a further deterioration into lack of distinction.

Which brings us to Beck's current *There and Back*, which is not exactly "What I've been doing for the last five years" but is a considerable improvement over his last two discs. We know what he has been doing for the past few years — fixing his sports cars, touring Japan with Stanley Clarke, and picking up girls. The finest moments on *There and Back* are those in which Jan Hammer doesn't contribute, as the two of them duel proficiently but end up sounding like they're aping one another — Beck puts so many effects on his guitar that it sounds like a synth, and Hammer's work always sounds like he

wishes he picked up the six-string instead. Not that the three tracks they do together aren't interesting, but the remaining five show Beck off in his most flattering light. His melodies sparkle the brightest when the crisp tone of his guitar is untouched by treatments, and the explosive way he attacks the axe is altogether more impressive when there's no one sharing the bill with him. It is most interesting that Beck only takes songwriting credit for one-half of one tune on the entire record, when it's obvious that his creative juices are what make this disc.

All you can really say is that this is yet another Jeff Beck album in a series of vaguely related works by the same artist who gave us "Rock My Plimsoul" and "Love Is Blue" in practically the same breath. He's yet to make a record that makes you say "That's the Jeff Beck album" — but if you want to hear the true parameters of electric guitar, Beck is still reaching further than anybody else even if he's just fooling around.

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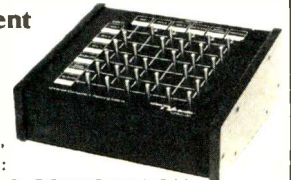
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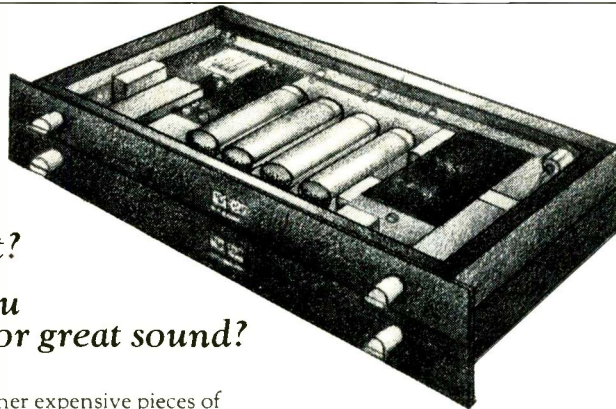
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CORRECTION

IN THE MARCH ISSUE, THE ADVERTISEMENT FOR AUDIO HORIZONS SHOULD HAVE READ AS FOLLOWS:

AUDIO HORIZONS

Issue #4 is now available. It contains reviews of CRAMOLIN contact cleaner, the DYNAVECTOR DV-100R and DV-100D moving-coil cartridges, the LINN Ittok LVII pickup arm, the MARCOF "Glass Mat" platter plate, the HAFLEH DH-200, MICHAELSON & AUSTIN TVA-1, SUMO "Power", and SUMO "Gold" power amplifiers, the MICRO SEIKI BL-91 and ORACLE turntables, the MUSICAL FIDELITY bb-1 and POWERLIGHT MC-4 pre-amplifiers, the SAEC SS-300 platter plate, and the SPECTRA Disc Cushion. Issue #4 also features a survey of interconnecting cables with reviews of cables from AGI, AUDIOCRAFT, AUDIONICS, AUDIO NOTE, AUDIO-TECHNICA, BELDEN, DISC-WASHER, FULTON, MELCO, MITCH COTTER, NEUMANN, PETERSON, SAEC, SOUND CONNECTIONS, SOLAR TRADING, SUPEX, and ZEPHYR.

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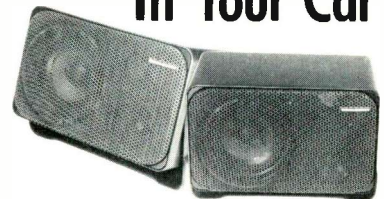
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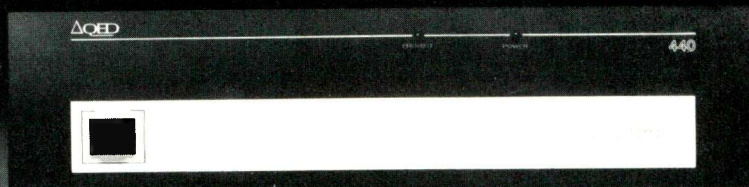
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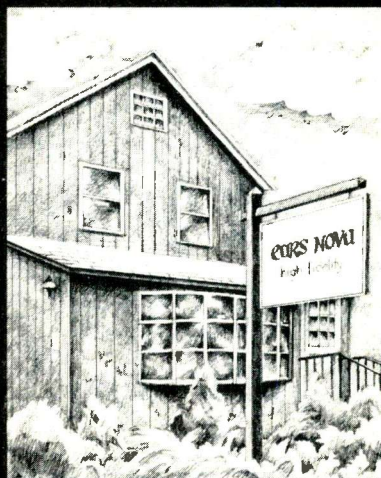
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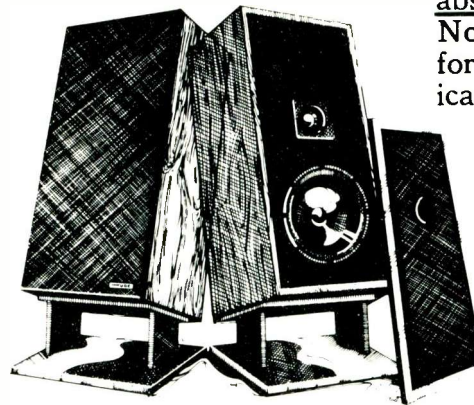
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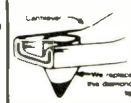
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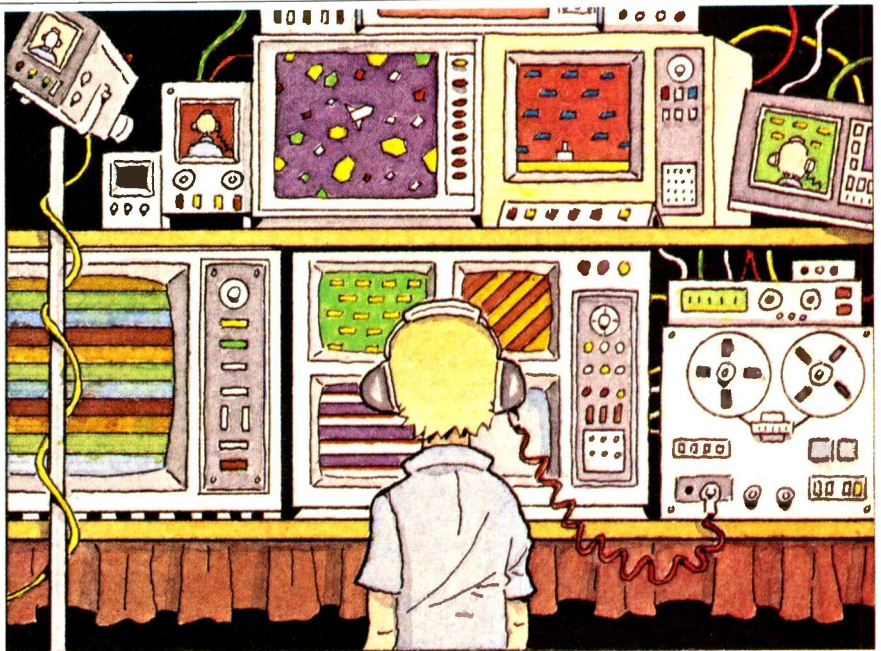
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At the WCES in Las Vegas, it was apparent that we are in a video boom with a vengeance. On the floor of Convention Hall, you could wear a blindfold, throw a stone and be sure of hitting something connected with video. Some in the business were frankly upset by all the uproar over video. They seem to be reluctant to accept the fact that to ignore video is to ignore the future. This is not to say that audio specialty stores will not survive, but with so many opportunities where audio and video can profitably interface, why fight it?

As you might expect, the videodisc was quite literally center stage. Interest was intense, and considering the great amount of money already expended by the proponents of the competing systems, it is no surprise that a videodisc standard has not been chosen. This is certainly the most vexatious problem facing the video industry. The basic incompatibility of the Philips laser/optical, RCA SelectaVision, and JVC VHD videodisc formats hangs like an albatross around the industry's neck. No company will concede anything; the engineers in the competing companies smugly assert that their system will win in the marketplace. It is ironic but entirely possible that the system which eventually wins out may not be chosen on the strength of its technical superiority, but because of its dominant position in respect to software. You may well ask: What about making all software available in all three formats? After all, prerecorded videocassettes are sold in both Beta and VHS versions. In fact, some video manufacturers have already indicated that, although they may be on record as favoring a particular system, their intent is to sell software in all the formats.

In the meantime the videodisc battle rages on. At the WCES, RCA, already snugly in the catbird seat with a substantial lead in videodisc software, had a really spectacular display designed to overshadow their competition. Imagine a four-sided, roughly pyramidal tower 14-feet high. The base of the tower contains a total of 84 RCA CED SelectaVision videodisc players connected to 84 color TV sets further up on the sides of the tower. Now envision this panoply of 84 TV sets, each playing a *different* SelectaVision videodisc program. Did this impress people? You bet! RCA had all guns blazing as attractive models ex-



plained the virtues of the SelectaVision system at eight strategically located positions within the RCA display area. Visitors were told that the CED SelectaVision videodisc is to go on the market for consumers on March 22, 1981. Initially, 150 different videodisc titles are to be immediately available, with more than 300 titles on the market by the end of this year. Comments from viewers of the multiple videodisc programs were generally favorable. However, with a signal-to-noise ratio of only 36 dB, quite a few people, including myself, noted some hash and glitches from chroma noise. On the plus side, no serious drop-out problems were noted. The pictures were of good brightness and contrast, with clean black and white. With SelectaVision systems being shown by Zenith, Toshiba, Hitachi, and Sanyo in addition to RCA, there was no shortage of interested dealers. Add the formidable merchandising clout of Sears, J.C. Penney, and Radio Shack, which have opted to handle the CED SelectaVision system, and it is no wonder the competition was a mite apprehensive.

It was left to Magnavox to fly the flag for their Philips laser/optical Magnavision videodisc on the convention floor, since Pioneer was not officially at the WCES. The Pioneer LaserDisc could be seen at the Riviera Hotel, but this was no substitute for the main arena. Magnavi-

sion had a good display, and there is no doubt that when the laser/optical system is operating properly, it produces an excellent picture. Magnavision has been plagued with replication problems on their videodiscs, with a high consumer rejection rate, and they must remedy this situation with the imminent introduction of SelectaVision.

JVC, the inventor of the VHD videodisc system, had an impressive display using multiple players and dozens of color TV sets. Picture quality was of exceptional quality, being especially stable. However, a few minor malfunctions of their videodisc players occurred at inopportune moments, and needless to say their competitors didn't miss the opportunity to discomfit them! Sansui was showing their new prototype VHD videodisc player, with a fine sharp picture. However, there seemed to be some confusion as to whether Sansui was officially adopting the VHD system. At the Panasonic and Quasar displays, you expected to see a good picture from their respective VHD videodisc players, and this was indeed the case. Here again, in addition to a picture with good resolution, the picture stability was impressive. General Electric, the American "big gun" in the VHD camp, was demonstrating their VHD player at the Riviera Hotel, but I think they are wisely concentrating on software acquisition.



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As noted, the videodisc was unquestionably the star of the WCES. But until the SelectaVision and then the VHD systems reach the marketplace, the battle for supremacy will not be truly joined.

Glamorous though the videodisc may be, it is the videocassette recorder which is making the greatest impact on American TV viewing habits and is making cash registers ring a merry tune. At the WCES, new models of VHS and Beta VCRs were available from the majority of Japanese companies, with far too many to fully document here, but it was evident that a very high level of quality has been reached by most VCRs in respect to good picture quality and reliable mechanical operation. Most VHS models now offer two-, four-, and six-hour recording capabilities, and a fair number of Beta units now provide the three special Beta speeds. The difference between most VCRs today is mainly in the number and type of convenience features, and price. In a situation that once prevailed with automobiles, it would seem the higher-priced VCRs loaded with features sell better than the cheaper so-called stripped models.

More than ever, there are special-model VCRs, particularly in the portable types. Akai's VP-7350 portable Activision VCR is an especially versatile unit that even provides stereo sound recording, and it can record video up to six hours. New also is the JVC HR-2200 portable videocassette recorder. This unit has most of the convenience features of its big brother, the HR-6700U, plus solenoid controls, a quartz-locked direct-drive drum motor, servo capstan motor, reel motor, and loading motor. It can operate off a.c. or car batteries or rechargeable Nicad batteries. The HR-2200 also has provision for direct camera input, and JVC has two excellent new lightweight color cameras for it, Models GX 88U and GX 68U, with such features as 6:1 power zoom lens with macro focusing ability to 1¼ inches from the object, automatic iris diaphragm exposure control, and an optional electronic viewfinder.

One of the most significant developments at this WCES was the introduction of automatic focus color video cameras from Akai and Toshiba. The Toshiba IK 1850-AF and the Akai VC-X1 accomplish their auto-focusing with a basically similar process. On top of the camera lens housing are two "windows" which admit light to fixed mirrors and image-forming lenses. The light beam then is directed to opposite sides of a mirror prism. The prism reflects two images to a 240-segment CCD (charge-coupled device) which converts the light to electrical signals. The output of the CCD is

monitored by a microprocessor computer which compares the difference between the signals, notes the position of the lens at the moment of signal address, and then activates the zoom lens motor to move the lens backward or forward to achieve an accurate constant focus.

These auto-focus color cameras feature 6:1 zoom F-1.4 lenses, automatic irises, videon tubes for 270 lines of resolution, and electronic viewfinders. The VC-X1 features a reverse polarity control which can convert film negatives into videotape positives. In other words, with auto-focus and automatic iris, the camera operator is free to just literally aim and shoot. Foolproof indeed! I have stated in the past that when home video movies could be made with the equivalent simplicity of the Brownie Cine Kodak movie camera, a great boom would occur in this area. Not only is it now possible, but thanks to the auto-focusing feature, the cameras are even easier to use than the Brownie. Although the cost of a standard or portable VCR and these auto-focus color cameras are substantially more than the cine equivalents (the Akai and Toshiba each cost about \$1,200), they are far cheaper to run. Both the Akai and Toshiba cameras will be available by May of this year. The palm-sized all-in-one combination mini VCR and camera, shown by Sony and Hitachi and said to be several years in the future, will have to incorporate auto-focusing if they are to be competitive with these present portable automated VCR camera systems.

Toshiba had another innovative product at the WCES which is a portent for the future. They showed three hand-held TV sets measuring 6.8 inches long, 0.7 inches thick, and 3.2 inches wide. Weighing in at a flyweight 10.5 ounces, the sets have TV screens approximately 2 inches diagonally. Instead of the usual CRT screen, the screens are a variant of liquid crystal display technology. One set is a TV only, another combines with a digital clock, and the third features an AM radio. All have zoom devices which can double the size of the image in the center of the screen. Although these units may be nothing more than "look Ma, ho hands" products, the use of liquid crystal display has been considered for that ongoing fantasy, the flat wall TV screen. At present the cost would be horrendous, although strong rumor has it that JVC has decided not to get into the large-screen projection TV market and will concentrate instead on the development of the flat wall TV screen. **A**

(Editor's Note: Watch for a technical article on flat-screen TV technology in future issues.—E.P.)

THE LOWER YOUR RECORDING SPEED, THE MORE YOU NEED MAXELL HIGH GRADE.

Whenever you use your video cassette recorder for slow motion, freeze frame or in the six-hour mode, it must operate at a lower speed. Even though most recorders are designed to handle this, most video-cassettes aren't.

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PAUL MILLER

Words are pouring from the print medium concerning the struggle of videocassette recorders versus videodiscs, and it seems as though the hardware giants are about to place themselves on a battleground where a war of dollars will be waged to lure consumer spending towards a particular system. The words extol the "new" systems and the "future" trends as though the past were completely passe. The disc systems represent an extremely viable entertainment source for the consumer. And, most certainly, the manufacturers wish this source to represent an accepted and growing market where they can reap consumers' leisure dollars. Calling the market a battleground, however, overstates the case because most disc hardware manufacturers are also deeply involved in VCR. They will win if the consumer accepts either or both formats.

Since all the written attention seems to emphasize hardware and technical specification differences, I suggest we look at another and often overlooked factor — how you and I, as consumers, would use the different formats. First, a bit of history.

Industry forecasters annually make their predictions of the future: Hardware sales, consumer trends, purchasing demographics, and usage of the purchased product. Home video has been particularly blessed by astute hindsight and stumbling foresight.

In 1978 VCR sales forecasts proved so optimistic that many companies were

ready to treat some of their executive staff to long, unpaid vacations. The next year, 1979, brought an extremely cautious, conservative look to the market and seemed close to target. Then, 1980 turned out to be a realization of 1978's optimism . . . and the exploding consumer acceptance of the VCR format is even stretching the manufacturing capacity of some plants.

But 1980 also brought forth a solid, though somewhat specialized, market for projection television in the home. The early sales to lounges and clubs exposed the television theater concept to the affluent consumer. We now have improved hardware and a greater selection of models which are moving into more and more homes . . . with a decreasing market share to educational and institutional markets.

Enter the videodisc wars, but not really. Videodisc has been with us almost as long as home VCR except that it was available in limited distribution only. We saw in 1980, however, the debut of extended geographic availability and the entry of more than one new brand name.

We now see that 1981 will bring increased videodisc hardware to the market, with the probable addition of at least two new and competitive formats from many companies. Excitement about the potential of the disc medium is rampant in newspapers and magazines. It makes good copy, but I question whether the copy is presented as information truly useful to the consumer or as just a hot headline to sell that issue.

Many videodisc proponents relate the potential of their new market to the broader usage of the audio disc as opposed to audio tape. The forgotten historical fact is that the audio disc was an established format for decades prior to audio tape usage. In video, the tape format has the pioneering position.

While consumer audio tape formats were receiving limited recognition in the mid-'50s, truly significant usage has only occurred in the last decade, particularly since 1976. During the '70s, audio tape recorder and player hardware showed the largest growth of any single segment of the entire home electronics industry. Since 1976, the U.S. consumer has each year purchased more tape units than television sets by 75 percent. And even stronger is the comparison to record players — average unit sales are



Videodisc growth would need to exceed 75 percent per year to displace VCR.



The existing population of VCR equipment is over 1 3/4 million units.

6.5 times higher for tape than disc, per year, since 1976.

The consumer is getting used to tape, used to tape handling, thanks to the convenience of cassette loading — in both audio and video formats. And also used to tape as a recording medium — not just as a playback process.

Today, the videodisc hardware comes to market with an existing population of VCR equipment exceeding 1 3/4 million units. Of these, 85 percent are believed to be in consumer use. This is not a market so vast that competitive penetration cannot be achieved, but one so in demand that videodisc hardware growth would need to exceed 75 percent per year, compounded for five years, to radically displace VCR.

The disc is a programmer/manufacturer-oriented product. It is the presentation of created programs that individually must meet the consumer's interest to be successful. It will depend on broad con-

Paul Miller is currently involved in the startup of a new magnetic tape company. Until recently he was Product Manager of Maxell.



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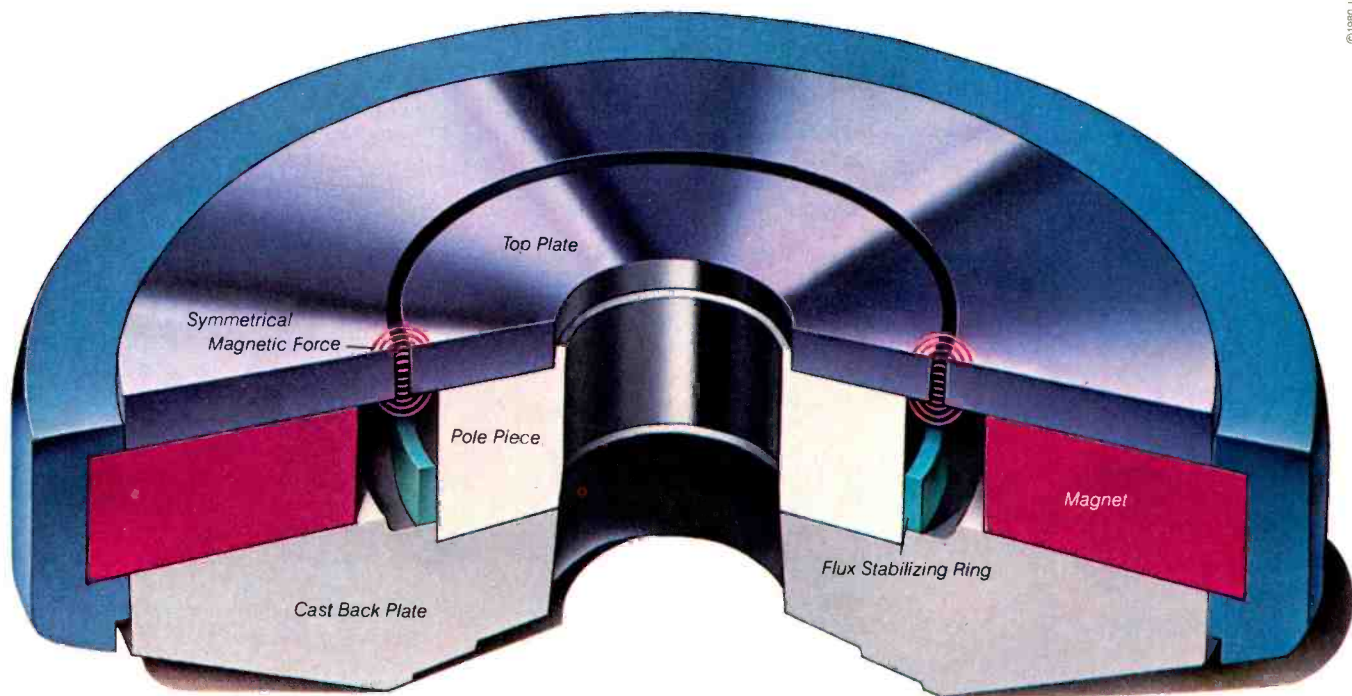
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maintains a constant level of magnetic energy in the voice coil gap, reducing second and third harmonic distortion to less than 0.1%.

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sumer acceptance, for each of the disc formats, in order to economically produce divergent programming.

As in today's audio market, major record companies find financial support of classical libraries difficult, if not impossible. Special interests in all forms of entertainment require a large enough base to provide the programmer with a return on the investment. Recent IRS rulings, adversely affecting aged inventories and their tax write-downs, have yet to be felt in the recorded music area but have already begun to pinch in the book publishing field. (Editor's Note: This IRS rul-

ing is being fought by book publishers in court and has not yet been settled.)

A further point in regard to the videodisc: Can sufficient programs be made available to the diverse interests to allow continued growth of hardware sales? The success of the videodisc will depend on available programs, and available programs will depend on the number of machines sold — a chicken/egg question which will only be answered in time.

The VCR is an active user-oriented product. While created programs are available, the user can select from sever-

al additional sources, network TV, cable TV, home television productions, and even videotapes of slides or home movies. Further, the tape medium allows the user choice of temporary or library storage.

Analysis by type of the growing VCR sales shows the influence of television programming on consumer usage. Expected is the recording of major movies, championship sports and blockbuster specials — such as NBC's "Shogun" which had an unprecedented effect on dealers' hardware and blank tape inventories. Not so expected was the discovery, when consumers were questioned about their VCR usage, that a heavy majority regularly practiced "time-shift" viewing with programmable VCRs. This particular usage indicates using the tape on a repeated basis, because the program is not necessarily intended for long-term storage.

This feature of the VCR format represents one of the most important to the tape user. Major networks, independent stations, and cable operators carefully plan schedules to bring popular programs to the greatest number of viewers possible. This generally relegates the special-interest program to inconvenient time slots. Time-shift recording also solves the problem of viewing two desired programs that are scheduled against one another.

The concept of building a permanent library is common to both the VCR and disc formats. There's no question that programs with high consumer appeal — movies with box office draw, specials with high Niensens, and championship sports — can reach a multitude of viewers. It is the capability of changing programs on a given piece of hardware, plus greater selection for library storage of special-interest or limited-appeal programs, that makes VCR the stronger format for the video consumer.

Disc systems will be sold, and many arguments and value judgments will be expressed about each of the different disc systems. As in audio, both disc and tape formats will coexist. In fact, many disc hardware units will be purchased simply to provide additional source material to the tape user.

Video is growing beyond the limits seen in the '70s; the consumer is making that happen. Our life-style is changing through picture expansion from large screen and projection TV, time expansion through time-shift recording, and entertainment expansion through major movies, uncut and uninterrupted, from quality programmers on both disc and tape. The disc will be a strong part of this video boom, but, in my estimation, the VCR could well be the strongest influence on our video lives. *A*

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WALTER I. SEIGAL



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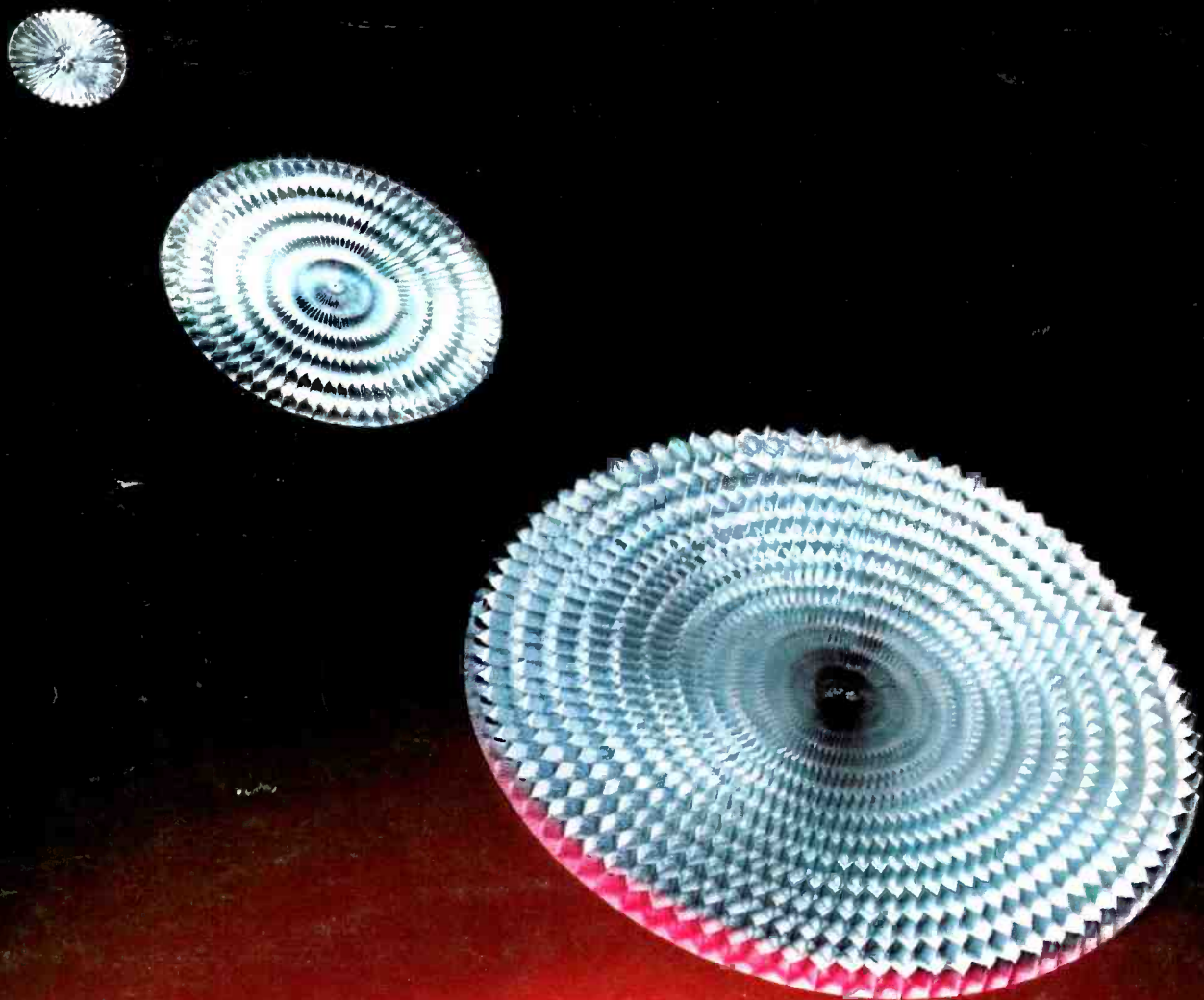
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The anatomy of a breakthrough in sound reproduction. Technics Honeycomb Disc speaker system.

You're looking at the heart of a revolutionary new speaker system—the flat honeycomb drivers of Technics new Honeycomb Disc speakers. A new shape that takes sound beyond the range of traditional cone-shaped speakers to capture the full energy and dynamic range of today's new recording technologies. It's the essence of a true sonic breakthrough.

All conventional cone-shaped drivers have inherent distortion problems due to uneven sound dispersion in the cone cavity. But Technics new axially symmetric Honeycomb Disc drivers are flat. So "cavity effect" is automatically eliminated. And just as important, phase linearity occurs naturally in Honeycomb Disc speakers because the acoustic centers are

now perfectly aligned across the flat driver surfaces.

Technics also added a unique nodal drive system designed to vibrate the speakers in more accurate piston-like motion to reduce distortion even further. The result is an incredibly wide, flat frequency response, broad dynamic range, and amazingly low distortion.

To complete the system, Technics Honeycomb Disc tweeter with special front-mounted acoustic equalizer extends frequency response to a remarkable 35 kHz.

Technics offers a complete new line of Honeycomb Disc speakers, all enclosed in a rich rosewood-grain cabinet.

Now that you've seen what a sonic breakthrough looks like, listen to Technics—and hear what one sounds like.

Technics
The science of sound

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