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db

THE SOUND ENGINEERING MAGAZINE

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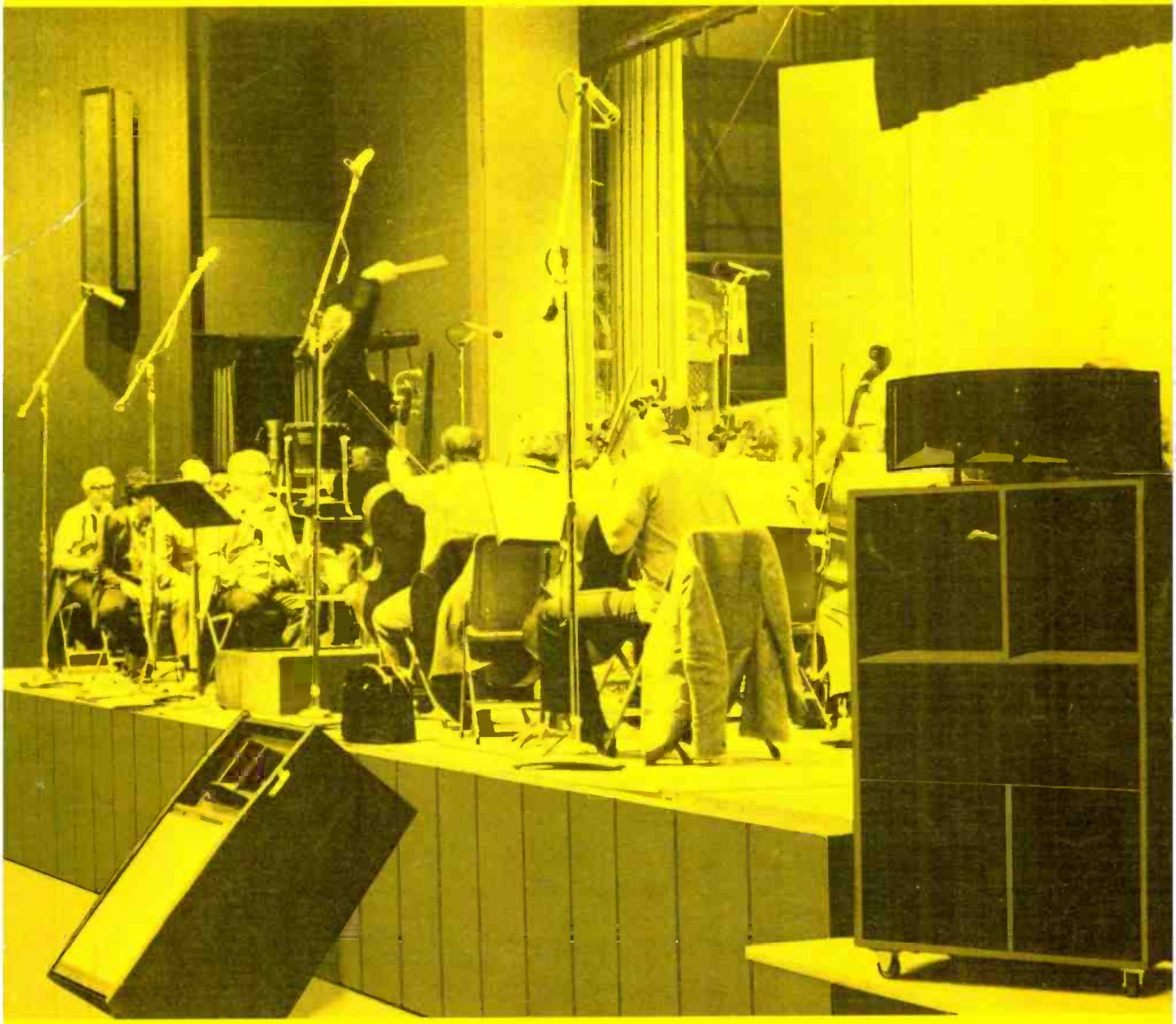

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● Michael Rettinger presents part 2 of his series RECORDING STUDIO ACOUSTICS. In this chapter he deals with the monitoring room. His analysis can provide solutions to problems you have assumed unsolvable.

In NOISE CONSIDERATIONS in AUDIO AMPLIFIERS, R. S. Mintz will discuss some of the ramifications of input noise in audio amplifiers and offer methods of elimination. The article will also offer a state-of-the-art microphone preamp.

Stephen H. Lampen returns to our pages with an article called BUILD A SUPER WINDOW FOR YOUR STUDIO. Pictures and diagrams will show you how to get a panoramic view from merely a large hole in the wall.

And there will be our regular columnists: Norman H. Crowhurst, Martin Dickstein, and John Woram. Coming in **db, The Sound Engineering Magazine.**

ABOUT THE COVER

● This is the mic setup described in Stephen Lampen's article. Begin his story on page 32.

db
THE SOUND ENGINEERING MAGAZINE
SEPTEMBER 1974, VOLUME 5, NUMBER 9

db is listed in **Current Contents: Engineering and Technology,**

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letters

THE EDITOR:

I read with interest John Pritchett's comment on Norman Crowhurst's column in your November issue of **db**. As a faculty member of a state supported university who is vitally concerned with what can be loosely termed "audio engineering education," I would like to make a couple of points that both of these gentlemen missed.

One reason for going to a college or university instead of studying at home is to gain access to laboratory facilities. The state of Colorado has already invested over $150,000 for equipment to establish the laboratory portion of the electrical engineering program here in Colorado Springs. Included in this is an elegant analog computer facility which has enabled my students to make very important contributions to loudspeaker crossover network theory. Working with this computer on a "hands on" basis led one student* to a discovery about Butterworth crossover networks that I highly doubt any of us would have discovered at home generating wastebaskets full of paper theory. Working with calibrated, high-quality test equipment instills an attitude in the student that theory *can* be verified in the laboratory and related to the real world of equipment, production lines, and profits which turn negative if a design is bad.

Another facet of modern university level education is the availability of digital computer facilities. My students can submit a deck of cards to the operator of a batch terminal located right in this building and the answer (or diagnosis of his errors) from a multi megabuck CDC 6400 computer is handed back in, typically, a minute. As an example of how this aids audio education, I gave a final exam problem which required a group of seniors

and first year graduate students to reduce Dr. Small's elegant theory for closed box loudspeaker systems to a digital computer program. Once they got this working, they could duplicate the development of the AR-1 for about ten cents' worth of computer time. Even more important than the low cost is the amount of loudspeaker theory they learned in developing the program and getting confidence that the answers were right.

I heartily agree with Mr. Pritchett that hard work is the key to success in engineering. Good laboratory and computing facilities and competition from other students motivate a person in a formal educational program and take away at least some of the pain of this hard work.

J. Robert Ashley
Professor of Electrical Engineering
University of Colorado at Colorado Springs

*J. R. Ashley & L. M. Henne, "Operational Amplifier Implementation of Ideal Electronic Crossover Networks," *J. Audio Eng. Soc.* 19, 7 (1971).

THE EDITOR:

I have just read Jack Gilfoy's letter to the editor in your April edition. You and your readers may be interested to know that the incident described is apparently not an unusual service provided by Willi Studer of America. We use one A-80 and two B-62 Studer tape recorders. Shortly after being put into service, one of the B-62s developed tape tension problems. The unit is crucial to our operation. We contacted Willi Studer of America by phone and, sure enough, the same two gentlemen, Bill Woods, the president, and Bruno Hochstraser, arrived that evening by Studer private aircraft. They worked until close to midnight, not only rectifying our problem, but also changing the head stacks on all three machines as they did for Jack Gilfoy.

The Studer machines are well built and need very little of this type of service. However, it is commendable that the Studer organization is set up with a pressurized twin engine aircraft and the staff able and willing to provide on-the-spot service when required.

John A. Radford
President. CFJR Radio,
Brockville. Ontario

THE EDITOR:

Jim Pinkham's letter in this column (**db**, June, 1974) brings out a problem which besets most broadcasters—common technical language between the telephone company and the broadcaster-user. In the years I've dealt with the telephone company. I've always found them to be responsive and honest and willing to work to improve circuits which are not up to standards. And I've discovered that it helps a great deal to be able to speak at least some of their language and to try to understand some of their problems. Most local Program Service Supervisors who deal with your order for equalized circuits are eager to help broadcasters and to understand *our* language problems as well.

As I understand it, the *dBRN* referred to by Mr. Pinkham is telco language for a noise level referred to, −90 dBm. Thus a telephone channel with a noise level of "25 dBRN" is equivalent to a measurement of −65 dB—not at all uncommon for 15 kHz

Shown above during a daytime session at WCWP are: William J. Mozer . . . Nancy Toran . . . William Epperhart . . . Joel A. Feltman . . . Alan Boritz . . . Phil Lebowitz . . . Michael A. Phillips.

A Prime Training Ground For Broadcast Engineers of the Future Finds a Stanton Cartridge in Every Head

Not many college radio stations are as fortunate as WCWP, C. W. Post College, Brookville, L.I., in possessing such a magnificent building and studios. But, college radio stations all over the nation, in common with WCWP, prefer Stanton cartridges for all their turntables.

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William J. Mozer, Director of WCWP, and an engineer at WABC (shown directly above standing in the studio) says:

"We have never used anything but Stanton Cartridges on all of our turntables. Currently, we are outfitted with the 681 EE which meets our needs both in terms of reliability and excellent sound quality in on-the-air playback as well as in our production of transfers. We are looking forward to a future step-up to the new Stanton 681 Triple-E".

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(Class AAA) circuits of typical length. It's important, too, to realize that noise measurements made on such circuits are *weighted*, i.e., noise on an 8 kHz equalized circuit will be measured by the installers only within that bandwidth. A station engineer using a *wideband* instrument is apt to measure higher noise levels.

Another thing to note is that most noise measurements are referred to as *0 dBm*, whereas for years the standard transmission level has been a +8 dBm. Users who measure against 0 dBm will improve the noise level on the circuit by 8 dB, using the higher transmission level.

In dealing with installers, I've noticed what appears to be a greater proficiency and understanding of broadcasters' problems in recent years, gained perhaps through experience with stereo circuits for f.m. and for remote use. This awareness seems to penetrate to even the higher levels of engineering at the phone company. For example, in our area when you order a pair of lines for stereo use, you can now specify "matched pairs" and be assured of two circuits with identical amplifiers, cable length, equalizers, etc. . . . a great help when it comes to the Proof. I really think the telephone company is in the broadcasters' corner!

Mark Durenberger
Chief Engineer, WCCO FM,
Minneapolis, Minn.

THE EDITOR:

As one of those people who has a great number of occasions to work and/or play with the almighty microphone, I couldn't help but notice and enjoy John Woram's comments in the June *Sync Track*.

I should like to add a corollary to what will henceforth be identified as Woram's Law, which states that "... there is rarely, if ever, a uniquely 'correct' way to place a microphone" . . . Woram's words, and I agree. What I would like to add is that any properly designed microphone of decent quality can be made to do a presentable job if the engineer knows what he is doing, or, as stated many years ago, experience is the best teacher.

Let me clarify a bit. A properly designed microphone, by my standards, is one with a good frequency response and the general pattern characteristics that I want for the job. In other words, you don't use garbage; you use equipment intended for professional use.

My problem has never been which microphone to use; I have been limited by the old "no money" syndrome to old but reliable mics. Remember the RCA 44-BX? Try using a couple of those to record a high school band concert in a gymnasium. I've got the tapes to prove that it can be done—well. I have found it very true that polar patterns don't mean all that much by themselves. Sure the old 44-BX is bi-directional, it's delicate (that poor naked ribbon), it's heavy, it's clumsy— in fact, it probably has every flaw to be found in the modern sound engineer's book of gripes. But the only thing that is of interest to me is that it also has a good even frequency response (even if I can't hear it, I know it's there working for me), and it also is of low impedance so I can run a mile of cable if I have to. In short, with maximum sound pressure, the only limiting factor (I wouldn't even attempt rock with the 44; rebuilds are too expensive), and given sufficient time and ability to control recording conditions (which every engineer should have anyway) I'll match my limited stable of mics with any engineer who dreams of the ideal polar pattern any day.

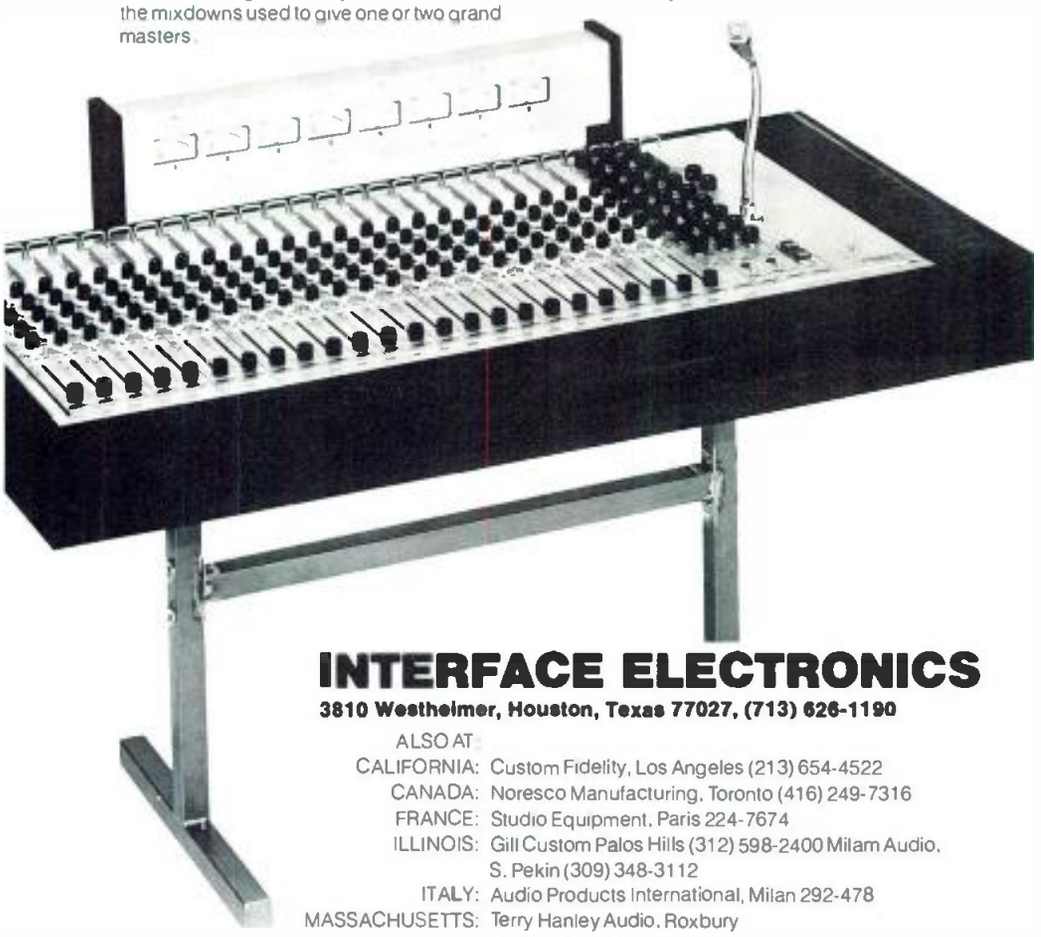
Most engineers today are so insecure, it seems, that they run around looking for the perfect sound system without any idea of what perfect is. With so many manufacturers making so many claims, I can see why a lot of good men panic at the thought they might not be getting the best sound. But I think they would be a lot better off if they would forget about patterns and curves and work toward overall performance. Just because a mic is super-directional or has three-and a-half major lobes in its pattern doesn't make it a good mic. Don't get me wrong; I look at patterns and curves too. But let's not forget that curves and patterns are determined, for the most part, under ideal laboratory conditions and usually represent an average for several models of the particular mic. Every mic, like every engineer, is an individual and will perform as such. An engineer with a stable of perfectly matched microphones, recording in an anechoic chamber will perhaps have a perfect sound but I doubt if anyone except the ultimate purist would buy it. The mics I use are very individualistic, and you know, I like them that way. They're all very good friends of mine.

Ronald J. Potaczala
Chief Engineer,
WUSJ, Lockport, N.Y.

PROFESSIONAL MIXERS FROM INTERFACE ELECTRONICS

Model 8X4-100 Series 100 portable eight-input four track mixer shown at left includes trackswitching, echo send, equalizing, panpot, conductive plastic sliders, VU meters, and options including interchangeable modules (see right), internal reverb. Used for remote or small-studio recording on up to four tracks, mixdown of up to eight tracks, small sound systems (with up to four submasters), stage monitoring, production work. The Series 100 also comes in 16 and 24 input mainframes.

Shown below, the **Model 24X8 Series 300 mixer in 24C8 console,** a 24 input eight track mixer with pushbutton trackswitching, multifrequency equalizing, echo send, panpot, cue/solo, 6" conductive plastic sliders, monitor mixdowns, masters, VU's, talk/slate, module outputs, fully wired and ready to operate. Also available in 16 and 30 input mainframes. Used for studio recording up to eight tracks (more using module outputs,) mixdown of up to 24 tracks; also suitable for large sound systems, wherein the track masters may be used for submasters and the mixdowns used to give one or two grand masters.



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SERIES 100 four track mainframes are fully wired with input and output connectors, power supply, VU meters, and masters, for Series 100 plugin modules listed below, in the Model 8X4 shown at left, also in the 16X4 and 24X4, which are folded aluminum pans for console or trunk mounting. Modules include:

Model 100D—Basic module with track-switching, panpot, echo send, high and low equalizers, high and low rolloffs, solo switch, slider attenuator, gain set switch with input pad, line/mike switch.

Module 100B—Similar to the model 100D but with three equalizers with a choice of three frequencies on each.

Model 100C—Input module with 40 db compressor with high compression ratio to ride gain on varying signal to hold constant record level, includes equalizers, track-switching, gain set pot, slider, echo send

Models 100AQ and 100CQ—Single input modules with four-way pan between the four tracks; CQ also has compressor as above.

Model 100R—Combination sound-system and stage monitor module feeds stereo sound system through panpots plus independent monitor feed to four monitor busses plus echo send, equalizer.

Model 100J—Stage monitor module provides eight monitor sends from each input plus three equalizers with a choice of frequency on each, rolloffs, gain set switch with input pad position, line/mike switch, mute.

Model 100Q—high-level four-input module with level, cue switch, four-way pan, for feeding the four track output.

SERIES 200 two track stereo mixers come in standard 8 × 2 portable two track panpot mixer with Bauxendall equalizers, echo send, conductive plastic sliders, setup oscillator, master and VU meters; can be slaved to give 16 or more inputs, also nicad battery option, 16 or 24 input versions on special order.

SERIES 300 offers eight track 16 and 24 input fully wired mainframes with power and XLR type input and output connectors, plug-in input modules with nonexclusive pushbutton track selection, panpot, echo send, cue (which doubles as monitor-only solo), three octave-wide peaking boost or cut equalizers with a choice of three frequencies on each, adjustable input gain and input pad, line/mike switch, and a six inch conductive plastic slider. Each module is provided with balanced 200 ohm mike input and bridging single ended line input, as well as module output. Using module outputs, more than eight tracks can be fed. The fully modular system also includes masters and setup oscillator on the output module, and up to three mixdown-monitor modules with automatic transfer of cue to monitor if desired, and mixer-playback switch; the talk-slate module includes slate track select and talkback/slate microphone.

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DISTORTION:
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NOISE:
less than 0.6 microvolts equiv input
INPUTS:
MIKE: 200 ohms balanced, XLR type connector max. level 0.5 volts RMS max. level 5 volts with int. pad
LINE: 10K unbalanced phone plug
OUTPUTS:
TRACK: approx. 1 volt RMS at zero VU unbalanced, to not less than 600 ohms, XLR connector
ECHO: same as track, but phone plug
ECHO RETURNS:
1 volt RMS into 5K required, phone plug

Circle 37 on Reader Service Card

John M. Woram

THE SYNC TRACK

● Sometimes I wonder just what I'm going to stuff into this column next. *The Sync Track* has been rambling on for several years now, and how much can one person have to say about recording anyway?

But, just as I get around to realizing that I'm all talked out, something happens. Like the June column.

For readers fortunate enough to have missed it, I got carried away with answering an angry letter from a disenchanted reader. He felt he had been cheated by buying a microphone book that didn't tell him which mic to use and how to use it.

My God, what a response! Earlier, I had come to the conclusion that **db** readers just didn't write letters. From time to time I'd write a "masterpiece" and then sit back and wait for the rush of congratulatory letters.

Nothing. Or occasionally a letter asking about how to get a job. After a while, I realized that as long as I stayed away from religion and politics, I could say just about anything I pleased without having to worry about reader response.

Wrong again! Apparently the June column struck a nerve, for the letters are still coming in. To all those who have taken the time to write, thank you! The response has been mostly favorable, with one or two spectacular exceptions. For instance;

Dear Mr. Woram:

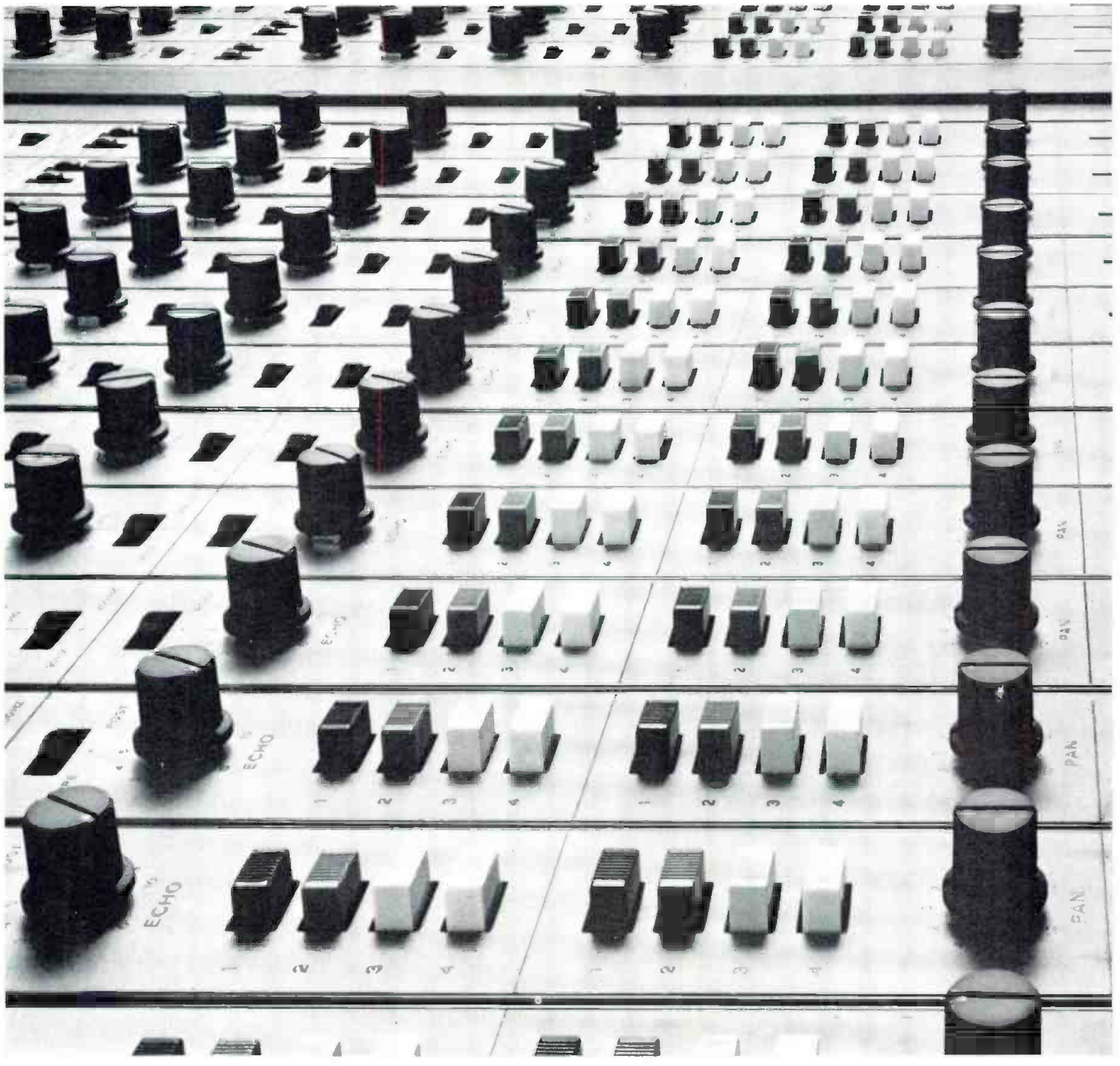
I feel that I must take exception to your column. First, you humiliate and belittle a person who writes to you with what he considers a legitimate complaint. I believe I understand his complaint, as I sometimes have the same questions myself.

If I were CBS or RCA or Vanguard I could afford to buy 30 or 40 microphones, B&K test equipment and have three or four engineers run tests to determine which mics are best for specific instruments or jobs, but, I do not have the money or time and neither do most of your individual subscribers. I assume that a man with 23 patents on electro-acoustic "prodects" (your spelling, rear cover) should be able to recommend one mic over another if he has tested both of them. Perhaps both manufacturers are advertisers which would complicate things.

As to your comparison with Da Vinci, I have heard many painters discuss how to mix a certain color, which medium is best for a particular effect, etc. I have also heard photographers discuss lenses, films, printing papers, by the hour because if one likes an effect he tries to duplicate it, or avoid pitfalls.

A person might buy a mic (turntable, cartridge, tape recorder, etc.) if he were reasonably sure it would be the best value for a particular job, assuming he could trust manufacturer specs, but if he had a reliable source of information about specifics he would not need the services of an audio consultant such as Woram Associates.

There are two ways to learn; one is by the book, the other is through trial and error. Is it so wrong to ask for a little specific help in a reference book? Tell me, do you not read manufacturers' application notes because they are specific? I also note you are an associate editor of **db**. *You use the English language constantly as a tool and as such never make errors of grammar, spelling or punctuation, but someone who does not write often sometimes loses these skills. You did not seem to get his message: he wants to learn (he spent $20 for information)*



The Model 10 Mixing Console
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and he feels cheated! You could have helped him without writing like a pompous ass about a man's ability to dress himself.

I neither know the letter writer, nor care to, but I certainly do not want to hire a consulant who belittles a man coming to him for help.

Like I said, you can't please everyone. Since reader reaction is running about 10 to 1 favorable, I suppose I shouldn't get upset about this letter. However, the favorable letters are from chief engineers, educators, and others well established in the audio industry; people who have been around for awhile.

The unfavorable letters seem to be from people just starting out, who feel that the old timers are withholding information from them. I suspect this letter represents the sentiments of a number of people who want to learn more, so, for their benefit, or annoyance, here we go again.

First, don't ascribe to CBS, RCA or Vanguard such a ridiculous notion as you mention. Any recording studio chief engineer who would have three or four engineers run B&K tests on 30 or 40 microphones to find out which were best for specific jobs would probably be unemployed long before the tests were done.

If you wish to think that's the way things are done by CBS and the others, that's too bad. Actually, a microphone gets bought because the manufacturer's representative brought one or two around and asked some of the studio engineers to try them out on their sessions. Frequently, an engineer is told nothing about the microphone in advance, so he will form no preconceived notions. Invariably, one engineer will like the microphone on guitar, another will prefer it on piano, and a third may not like it at all. If enough engineers, and artists, like the mic, the studio may buy a few. Some of the mic mavens may then look at the spec sheets, but they will certainly find nothing there to tell them how the mic will sound on the next session.

Apparently, you don't want to believe that, and neither do a lot of others. Of course, both you and the first writer think you have a legitimate complaint, and I think you're looking for the wrong kind of information, so, we obviously have a difference of opinion.

But first, are you the instructor, or the instructee? If you know something about how any of us can select the right mic for the job by running B&K tests on it, for God's sake step forward and allow the recording industry to salute you. B&K themselves should be good for a few thousand, to say nothing of all the microphone manufacturers.

But, won't you assume that a man with 23 patents on electroacoustic "prodects" (our spelling) may—just perhaps—know a trifle more about the subject than the three of us put together? Yet he says ". . . there is rarely, if ever, a uniquely correct way to place a microphone."

And, there is *never* a uniquely correct microphone for the guitar. Or for the piano. Or whatever.

If you don't care to accept that, so be it. Prove to the world that there is a way to select and use microphones by evaluating their spec sheets. But in the meantime, don't be so harsh on those of us who honestly don't know how. There are a lot of us you know. Like AKG, Beyer, Shure, Electro-Voice, etc. Isn't it strange that not one of these manufacturers has ever so much as suggested that a particular microphone is the definitive mic for a particular application?

Some time ago, **db** magazine did a forum on microphones, in which a group of studio engineers and a design engineer from one of the major mic manufacturers got together to rap

What do you call a great new synchronizer that does everything you need and costs under $2000?

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MINIMAG synchronizes any two mag tapes. Connects two 16-track machines to function as a single 30-track machine. Provides variable or fixed delay effects. Keeps an audio recorder in perfect sync with a VTR for audio "sweetening", including offsets . . . synchronizes TV and stereo FM simulcasts . . . permits remote overdub recording without releasing the master tape.

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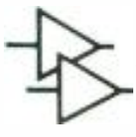
MINIMAG measures only 1¾" high x 19" wide x 12" deep for convenient rack mounting. Plugs into any 115/230 volt, 50/60 Hz power source. Power consumption is only 2 Watts, (100 Watts with the optional motor drive amplifier required for machines with synchronous capstan motors).

MINIMAG was developed by Automated Processes, creators of the MagLink® Synchronizer, and one of the most respected names in recording and broadcasting equipment. Our consoles and audio components have long been recognized for their quality and performance. This tradition of serving the professional has been continued in this new synchronizer.



AUTOMATED PROCESSES, INC.
80 MARCUS DRIVE, MELVILLE, NEW YORK 11746 · 516-694-9212

Circle 22 on Reader Service Card

about their favorite subject: microphones. At no time was there a unanimous preference for any one microphone. Most felt that the microphones included in the discussion were very nice, but there was almost total disagreement on the subject of which mic was best for drums, guitar, piano, etc. Each engineer had his opinion, based on personal taste, but none would say that his favorites were the only correct mics for the job.

Some other magazines do stories about specific recording sessions. An engineer will talk about how he recorded a certain session. It's very interesting, particularly if you are familiar with the microphones mentioned, and the work of the engineer being interviewed.

A writer might be just as interested in reading about how and under what conditions, a distinguished colleague wrote his last novel. But this tells you more about the writer than about the book. When he represents his style as *the* correct way to write, he's either on an ego trip or out of his mind.

Anyway, this sort of information should never be thought of as directions to a beginner. In fact, if you read several of these engineer interviews, you'll be forced into the same conclusion: there is no uniquely correct way to select or use a microphone.

Taste is the answer, or, part of the answer. The other part is, learning what you can from those who have something to teach. But, both of you who wrote these letters are being cheated out of learning. Unfortunately, you're being cheated by yourselves. You have decided that the world is withholding something from you, and if it won't give you the information you demand, on your terms, you'll accept no other. That's pretty close to pomposity too, isn't it?

As for my ad, consulting services are not storehouses of privileged information that is unavailable elsewhere. If that were the case, I'd be out on my yacht somewhere off the coast of Mallorca. Consultants (and writers) rarely have something new to say. Usually they interpret, or clarify, the facts as they understand them, and do what they can to help clients (and readers) avoid all the mistakes that they themselves made years ago.

Neither you nor the June writer hired me (was it something I said?) and if you did, I certainly wouldn't belittle you. As a matter of fact, all the little nasties that creep into this column are really not directed at the poor guy who has taken the time and trouble to sit down and write a letter. I know it doesn't seem so, but I really feel sorry for the guy who thinks he is being let down by this column or the recording establishment in general. It's probably unfair to snap at people who are looking for information. But from my vantage point, I see a lot of information being dispensed. (by Lou Burroughs and all the others who have something to say). And I see a lot of that same information being ignored by people who have decided that they alone shall judge what information is needed. So, I get a little testy at times. I guess it's old age or something.

Anyway, here's some more free information. Do with it what you will.

We are all in the communications business. Success is based on the ability to communicate. You must be able to receive, and transmit, information. Believe me, I'm not making this up. Clarity of transmission is perhaps not the life-or-death matter it may be in aero-space or medicine, but it is important. You don't have to have an

HOW TO MOVE YOUR TAPE RECORDING TECHNOLOGY AHEAD OF THE BROADCASTERS

A quartz crystal controlled three speed drive capstan, relay-less, large scale integrated circuit (L.S.I.) controlled triple motor tape transport, plus photo-electric and motion-sensing tape protection arrangements – put the Revox A700 into a class by itself.

A host of further technological features combine to make the Revox A700, in our opinion, the most desirable tape recorder ever built.

See it at your Revox Professional Equipment Dealer. Try the faultless tape handling. Explore the comprehensive mixing and audio control facilities. On top of all this examine minutely the precision of the detailed construction – something Willi Studer is already world famous for – but now executed so well it's breathtaking.

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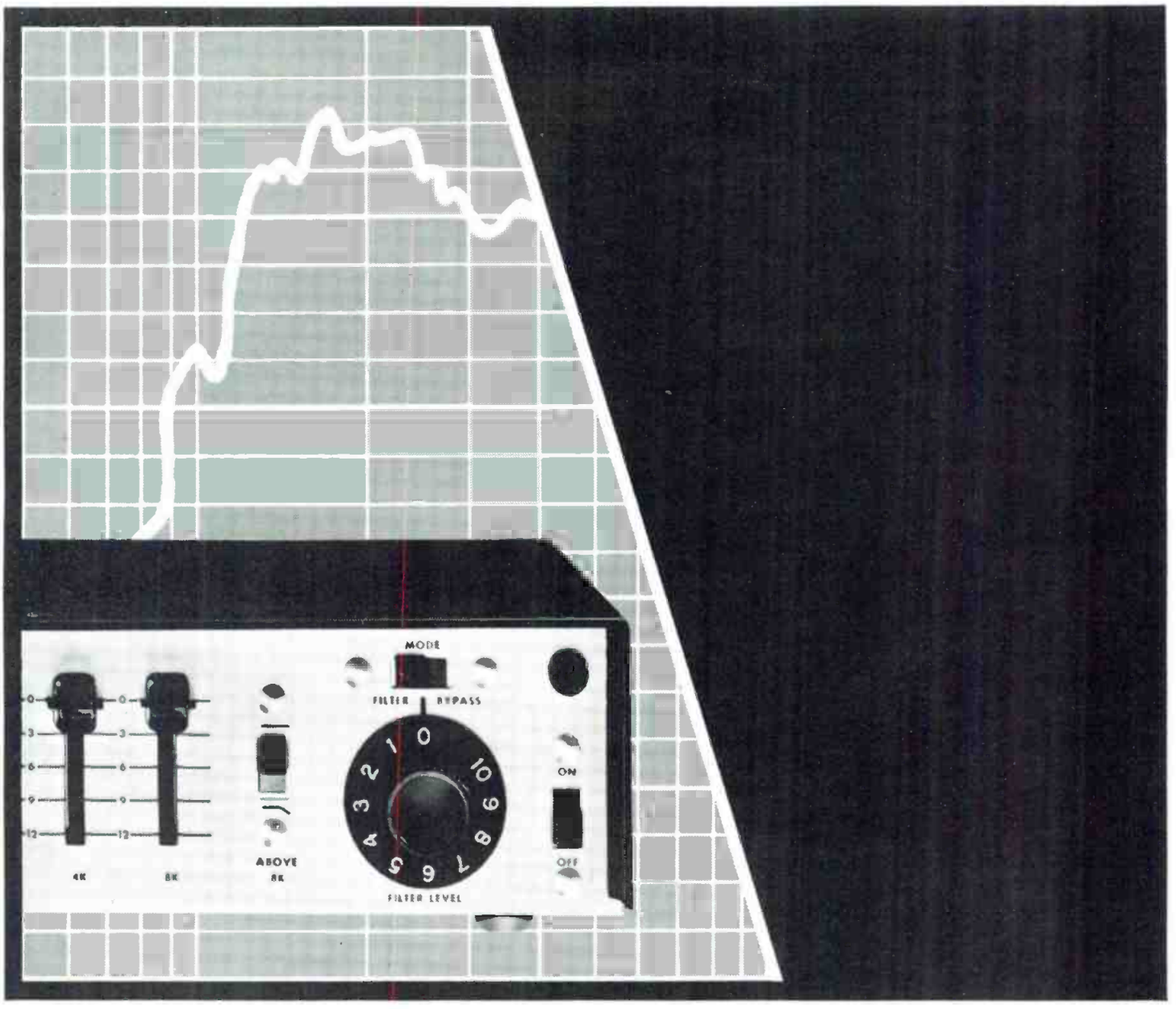
honors degree in English literature, but you do have to be able to express yourself clearly. If, after you have spoken, people wonder what it is you have just said, you should go into politics and leave tape recorders alone.

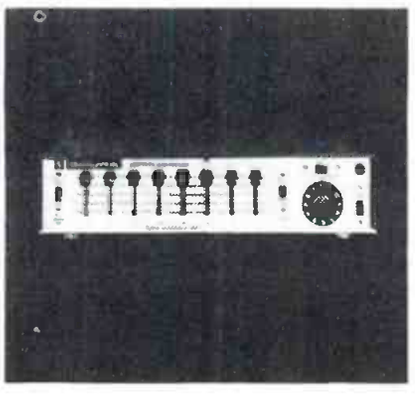
When I get a letter, I really don't give a damn about the writer's grammar. I have enough trouble with my own, which the editor straightens out as best as can be. But sometimes, a letter is just about incomprehensible. That worries me. Sure, it's none of my business whether or not the writer can communicate, but when the letter is a gripe about a book that doesn't reduce the art of the recording industry to cook book format. I go off the deep end.

To the writer, I'm truly sorry for being so obnoxious. To the others, Am I getting through?

I guess this will have to be continued next month since there's still more to say. Also, several other letter writers brought up interesting points which should be covered. Tune in next month. ■



The feedback buck stops here.



They said it couldn't be done, but our engineers developed a simple, low-cost component to give sound reinforcement systems *increased gain with reduced feedback danger!* The Shure M610 Feedback Controller utilizes eight resonant dip filters and high- and low-end roll-off switches which enable the user to "tune" system response to room acoustics, maximizing output and minimizing feedback. Convenient filter level control allows increase of system gain as filters are adjusted. Use the M610 to control feedback in any acoustic environment; use it to filter problem frequencies that cause ringing, boominess or other troublesome resonances.

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Circle 36 on Reader Service Card

Norman H. Crowhurst

THEORY AND PRACTICE

● This is being written just after my return from the workshop at Brigham Young University in Audio Recording Technology, where I was invited as a guest lecturer. It proved an enlightening experience, with many facets that are appropriate to this column. In fact one of the participants suggested that I had probably gotten enough material from the discussions at this workshop to keep my column going till the next one!

Whether that is so remains to be seen. Although it seems that way, and right now I hardly know what, of the many topics that came up, to start with, the main lesson persistently comes back to what I have been trying to hammer at all along in this column.

Those enrolled came from a wide variety of backgrounds, with almost as wide a variety of expectations from the workshop. Some of them came with considerable experience and a realization that they could be more successful if they had a little more theory to go with their practice so they would know why things happen the way they do and could meet unusual requirements more readily than by trial and error.

But many came with an attitude that said, consciously or subconsciously. "Don't bother us with the whys and wherefores, and all that math stuff, but just tell us, or better yet, show us, how to do it." BYU is abundantly equipped to do that last bit, and those attending the workshop had "hands on" opportunity that they found valuable. And by the end of the time there, they all realized that theory and practice must go hand in hand: there are really no short cuts.

One thing that impressed me, as well as all the participants, was the agreement among all those responsible for the presentation side: Dean Austin and myself, who worked together through most of the workshop, sharing the "nuts and bolts" aspects, as well as the several specialists who came in at various points to handle their own specialties.

With all the contradictions that prevail from time to time about the best way to do this or that, one might have expected that we would somewhere have encountered opposing views about one of these things at the workshop. The fact that we did not seems to reflect that all those who contributed their expertise shared this same concern for combining theory and practice, and thus are not the kind that get on a bandwagon!

One of the smaller questions that came up concerned the picking up of a program for which amplification or reinforcement is already provided, in one way or another. Quite recently, at the high school my children attend, because the band class in which my son Nigel plays has become very good (musically), they decided to make a record that parents could buy.

When I heard about this, I volunteered to give any assistance I could: equipment, help in setting it up, whatever. The response I got was "Thanks very much, we have all we need." I

you write it

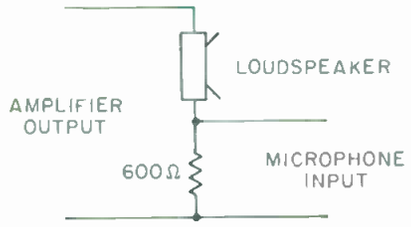
Many readers do not realize that they can also be writers for **db.** We are always seeking good, meaningful articles of any length. The subject matter can cover almost anything of interest and value to audio professionals.

Are you doing something original or unusual in your work? Your fellow audio pros might want to know about it. (It's easy to tell your story in **db.**)

You don't have to be an experienced writer to be published. But you do need the ability to express your idea fully, with adequate detail and information. Our editors will polish the story for you. We suggest you first submit an outline so that we can work with you in the development of the article.

You also don't have to be an artist, we'll re-do all drawings. This means we do need sufficient detail in your rough drawing or schematic so that our artists will understand what you want.

It can be prestigious to be published and it can be profitable too. All articles accepted for publication are purchased. You won't retire on our scale, but it can make a nice extra sum for that special occasion.



1. The first idea put forward, for connecting a loudspeaker output to a low level input.

persisted, wondering what they really had, because they had never made any recordings before, except a stereo tape for which they put two mics at considerable distance from the band. As a sort of routine, self-criticism measure, the band master concluded by suggesting that if I cared to come along about an hour before the performance, I could.

When I got there, I found that they had a locally made sound reinforcement system that uses phone jacks to connect the 130 watts per channel (which incidentally proved to be 2-channel monophonic, not stereo) to the column speakers that go with it. They were also using a Sony tape recorder that has phone jacks for microphone input, but phone inputs for various auxiliary functions, requiring line level input, instead of mic level.

Before I arrived, an hour before the program, they had already plugged the speaker output cords into the microphone input sockets because that was the only place they would fit, to enable them to use multiple microphone inputs. By the time I got there, the left channel of the recorder had inexplicably gone out! What puzzled me, of course, was why such folly had not taken the right one as well.

Then their miking technique was crazy. At one stage they had two mics picking up both ends of a solo flute player and wondered why the flute didn't sound so good on the tape. I think I have said enough to show that they really needed expert help, which they had so graciously declined to accept!

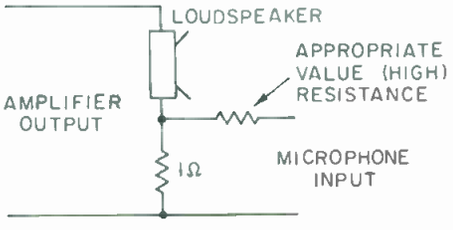
At least their *idea* may have been a little better than what I have seen many amateurs do: just hang a microphone in front of a p.a. speaker to pick it up acoustically. As the question came up at the workshop, I briefly related this recent experience of my own. Naturally, none of the participants would have done either of those things!

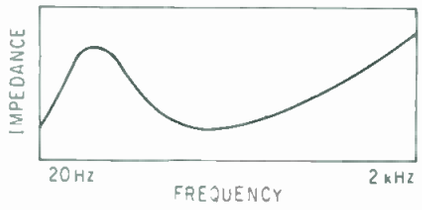
Of course, the question of mic quality for various purposes, and miking for various purposes was discussed fully in other sessions of the workshop, but as a matter of interest I threw the question back to them as to what they would have done to solve this problem, in an on the spot manner.

One suggestion was to put a high resistance in series with the speaker (FIGURE 1), from which to take off a mic input. This appeared to be based on some notion of impedance matching, without giving any attention to the levels involved. The suggester seemed to think that the loudspeaker would work normally that way, and a good microphone input would be obtained. I am glad he had not tried it!

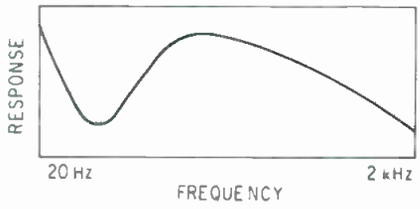
The next suggestion was to put a low resistance in series with the loudspeaker, and then attenuate the output obtained from it (FIGURE 2). That

2. The second idea.

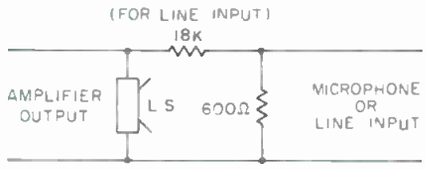




3. A typical loudspeaker impedance characteristic.



4. The response picked off across the 1 ohm resistor of Figure 2.



5. The kind of circuit that can be used, subject to limitations given in text.

looked better, as far as the impedance and level questions were concerned. Nobody at the workshop had ever tried that—incidentally, neither have I—yet my background of theory and practice told me what to expect.

So again I threw a question back at them: why would I not do that? The twinkle in Dean Austin's eye told me he knew, but none of the participants seemed ready to volunteer a reason. Many of them could operate a system when they had patchcords or other interconnection devices ready made, but had no inkling of what to do when no such ready provision was at hand.

So it occurs to me that many readers may not know the answer to that either. The idea is based on the concept of a loudspeaker as an impedance that is linear, or constant as frequency changes, so the voltage across that 1 ohm resistance is just a small replica of that across the speaker itself.

In the workshop, we had already discussed the impedance characteristic of various types of loudspeakers, and the influence that enclosures have on the reflected electrical impedance. Yet this did not connect in their minds, apparently, with the immediate question.

Taking an average speaker impedance curve (FIGURE 3), it is apparent that the current through a relatively low series resistance would be an inversion of this, because the loudspeaker gets a constant voltage drive; the voltage at various frequencies is proportional to the level required at those frequencies.

This means that the frequency response picked off the low value resistor in series with the speaker will look like FIGURE 4. One should not need to *try* it, to find that out! "So how would you do it?" the group wanted to know.

The linear output is speaker voltage, not current. Assuming the speaker circuit has one side grounded, and that the line, or even microphone input circuit is also unbalanced, all you need to do is to use a resistor appropriate to the input impedance, say that is 600 ohms, and then figure out the attenuation you need. in voltage, to find the series resistor you need (FIGURE 5).

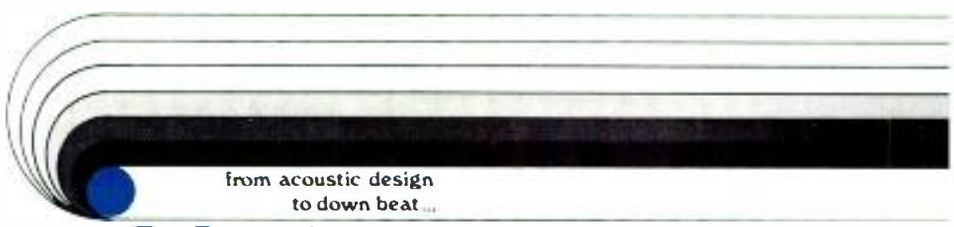
Suppose the peak output voltage is 32 volts rms and your input level requires about 1 volt peak, rms value. Then you need about 30 dB attenuation, or a little over 30:1. An 18k resistor should about do it. At least it would he a good starting point. ■

Guaranteed Acoustical Performance Specifications ...from Westlake Audio "The Gold Record People."

Westlake Audio is the only studio designer-builder offering detailed, written guarantees of acoustical performance to clients who entrust Westlake with full responsibility for their projects — from acoustic design to downbeat. This guaranteed performance is one major reason why so many hundreds of Gold Records have been recorded in Westlake installations.

Westlake provides a complete "package" including unequalled skills and experience for turn-key "gold record" installations: pre-planning, site evaluation, acoustic design, construction, equipment selection and supply, financing, technical electronic interface, training of personnel and studio management consultation. From 2 to 24 track, for live recording, mix down, remote or mastering.

On the next two pages you will find the performance specifications which are guaranteed when Westlake assumes complete responsibility.



Westlake Audio

Guarantee of Acoustical
by West

I. Control Room

Acoustical and Geometric Design by Westlake Audio

A. Frequency Response

± 3 dB upon installation, 31Hz-16KHz measured with B & K ⅓ octave, pink noise source.

B. High Frequency Dispersion

± 2 dB maximum @ 10KHz across a minimum 10 foot horizontal plane at the console (from left of the mixer to the right of the producer or vice versa) **from any one of the four monitors,** measured with pink noise source.

± 2 dB maximum @ 10KHz across a minmum 5 foot horizontal plane front to back of the mixer or producer **from any one of the four monitors,** measured with pink noise source.

C. Power

116 dB SPL minimum, linear scale, with broadband pink noise source from one monitor measured at the mixer's ear. The control room potential with four monitors is a minimum of 128 dB SPL.

What the above really means is that as the mix is being created, the mixer and producer will accurately hear the same music timbre balance.

II. Studio

Acoustical and Geometric Design by Westlake Audio

A. Room Character

The characteristic "room sound" which results from record ing in a three dimensional area is eliminated by the utilizati of an active ceiling providing a minimum of 50 dB attenuati @ 40Hz. This, in effect, produces an infinite third dimensio such as would be present in an amphitheater.

B. Decay Time

Multiple decay times of various frequencies may be incorporated into the studio design. Thus a tight rhythm sound may be achieved in one area while a bright string sound is obtained in another.

erformance Specifications
ke Audio*

C. Multi-track Separation	Active traps are built into the studio walls which allow "in-studio" vocals, eliminating the usual need for vocal booths. 40 dB of isolation can be provided between the band and a vocalist only 10 feet away resulting in 40 dB of isolation @ 40Hz or tuned to selected frequencies.
D. Drum Isolation	A drum cage is provided, either built into the structure or on a movable platform. Again an infinite third dimension is achieved through an active ceiling design. The highest sound pressure level (SPL) are generated by the bass drum at 90Hz and the stick on the cymbal at 8KHz. These are attenuated a minimum of 24 dB measured one foot outside the drum cage. If desired, the cage may be built to project mid frequencies into the studio to give the musicians a better "feel." The "character" of the drum cage may also be designed for bright, dim or variable results.
E. Bass Traps	Bass guitar traps are incorporated into the design to provide 24 dB of attenuation at 40Hz with an SPL of 116 dB exciting the trap.
F. Piano Trap	A piano trap is also included for the purpose of rejecting unwanted sound from the studio to the piano microphones. The broadband rejection to the piano trap will be in excess of 20 dB.

III. Live Quad Echo Chamber	**Acoustical and Geometric Design and Active Components by Westlake Audio**
A. Timbre	Variable control of low frequencies from section to section of the chamber.
B. Decay	Individual variable control of decays from all four chamber areas.
C. Echo Mix	Variable mix of echo content, parent to decay.
D. Depth	A three dimensional effect in echo content thru the use of two MS stereo return (4 channel).
E. Stereo	If stated prior to construction, the quad chamber may be used as two independent stereo echo chambers.

Which other professional studio design company will guarantee in writing these features and specifications, prior to construction?

*On all jobs commencing March 1974 or later.

Kent R. Duncan, President, Kendun Recorders, Burbank, California: "The new room has been in operation for six months now and our success is as much a tribute to Westlake Audio and Tom Hidley as it is to our long hours and attention to detail (and possibly some good engineering). Our Westlake room made us a 2 studio operation but instead of just doubling our gross, we went from $12,000 a month to $60,000 a month. The incredibly accurate planning of our Westlake turnkey installation resulted in completion exactly on time, response precisely as promised, all equipment functioning within one day of installation, and all within budget! In the past six months we have mastered such acts as Stevie Wonder, Bob Dylan, America, Buddy Miles, Fleetwood Mac, Rick Nelson, Tower of Power, Livingston Taylor, Isley Bros., Rod McKuen, Nitty Grity Dirt Band, Emitt Rhodes, Richard Greene, El Chicano, Nana Mouskouri, Cleo Laine, Bola Sete, San Sebastian Strings, Jo Stafford, Maxayn, Pharoah Sanders, Archie Shepp, Ballin' Jack, Vickie Lawrence, Maureen McCormick & Chris Knight, Don McLean, Vikki Carr, Bill Medley and even Rodney Allen Rippy. Over half these acts were recorded on Westlake monitors in various studios around the country, attesting to the fact that truly, you are *the* professional."

Christopher Stone, President, Record Plant Recording Studios, Los Angeles: "As you know, we have used Westlake Audio and yourself since the inception of the company for all of our studio design, construction, electrical interface and implementation. During the past four years you have designed and implemented eight studios for us in New York City, Los Angeles and Sausalito. Obviously we are known as a Westlake-designed operation. We have built our total reputation around your studio design and have always been happy with our decision to utilize you on an exclusive basis for all our acoustical requirements and equipment consultation. The success of your design speaks for itself in the form of our success as an independent studio operation."

John Sandlin, Vice President A & R, Capricorn Records, Macon, Georgia: "All of the work done was of a quality that is almost non-existent today. The people from Westlake *cared*, and saw to it that their work was of the highest standards. The carpentry work is incredible. The complete construction and equipment interfacing went more smoothly than can be expected in such a major undertaking. Westlake's delivery dates were either on time or before the time they were promised. The real test, however, is in the performance of the control room. Our room sounds great and objectively measures great. Also, the room is comfortable and easy to work in. It is really a pleasure to work with people of the integrity and abilities of Tom Hidley and Paul Ford and the rest of the Westlake personnel."

Complete, unedited photocopies of these and many other testimonial letters are available on request from Westlake Audio.
Phone or write direct to Tom Hidley, President.

Michael Nemo, Independent Recording Engineer: "My clients and I have found that the closest approach yet to a true standard is the integrated concept of speaker and room acoustic control found in studios built by Westlake Audio. What a pleasure to go from one Westlake installation to another and not have to be concerned about compensating for too much or too little bass, or high frequency response.

John Boylan, John Boylan, Inc., Hollywood, California: "First of all, this is my third project in a row to be mixed on your monitors and once again it looks like we have a winner — a record that sounds as good at home as it did in the control room. From a producer's nontechnical viewpoint, this ability to trust a studio monitor and come out with even results is extremely satisfying. Secondly, the Westlake Monitor never seems to vary in any substantial way from studio to studio, in the control rooms that you've designed. So I have no worries about consistency in today's widely dispersed recording scene."

Edward J. Green, Director of Engineering/General Manager, MGM Recording Studios, Los Angeles, California: "The studios and the control rooms have been completely successful for MGM Records from the time they were finished. Our mixers have, for the first time, the kinds of 'acoustical tools' that are needed for contemporary recording. That is, multitrack recording with all but complete isolation of elements whose parts can be later mixed or deleted and replaced. In the control room, the mixer and producer must be able to accurately monitor the recording so as to make technical and artistic judgements. Your booth design and particularly the Westlake monitors have proven themselves thoroughly workable and accurate. It is to your credit that these recording systems have withstood this test of time, particularly during the last three years, and that we wish to make no changes in studio or control room design in the immediate future."

Robert M. MacLeod, Jr., Artisan Sound Recorders, Hollywood, California: "Now that we have been in our new building for a couple of months, I thought you might like to know how it is working out. About all I can say is fantastic! We have had nothing but good reactions to the monitoring systems, and the acoustics of the mastering rooms are superb. Almost everyone who comes in comments on the quality of the workmanship. We have encountered no problems at all, and we find it a joy to cut records without the constant noise of the vacuum system in our ears. Producers seem to agree, and I am sure these beautiful new facilities will put us in a far stronger competitive position in the industry. In today's world of shoddy workmanship, it is really a delight to see the results of such painstaking care."

Westlake Audio

6311 Wilshire Boulevard
Los Angeles, California 90048
(213) 655-0303

Martin Dickstein

SOUND WITH IMAGES

• Between September 16 and September 21, much of the world of video communications attended or kept its eye on VIDCOM '74 which took place in Cannes, France. This *International Market for Video Communications* included under its overall heading the fourth VIDCA (International Market for Videocassettes and VideoDiscs) which in its 1973 meeting gathered more than 1,500 participants from 650 firms in 33 countries; the second MICAB (International Cable Television Market), which was last held in 1972 and brought together more than 600 people from over 300 firms in 19 countries; and first MIPFORM, International Market for Training Programs. In addition, there was a large display of hardware related to video cassettes, discs, and cable; a presentation of software with specific programs for training, education, information, promotion, and leisure and culture; a display of equipment used in program production; and ten sessions of study, discussion, questions and answers on the subjects covered by the software programs.

The meaning and importance of such a gathering, at which well over 300 companies participated, can be readily visualized when it is seen that in the United States alone the total dollar volume for hardware, software, and services related to non-broadcast television now exceeds $200 million, and in 1976 is expected to reach $850 million. This figure will go up to $1 billion by 1980. Last year total programming time produced by private industry and public organizations amounted to 3,500 hours. The rapid growth of the industry can be seen in the fact that the video cassette was introduced at the 1st Vidca, back in April of 1971. Now there are cartridges, discs and cable.

At this year's Vidcom, Thomson-CSF of France introduced for the first time their videodisc system, which operates on an optical principal, designed entirely in France. This company also showed its line of video distribution equipment, including receivers for central stations, PAL-SECAM transcoders, wireless beams capable of carrying up to twenty television channels, transmission line amplification equipment that ensures two-way communication over a distance of about 20 miles, and VHF/UHF distribution amplifiers. Thomson-CSF also makes subscriber selectors for cable t.v. and equipment for installation of t.v. systems in buildings. Incidentally, the Thomson-CSF disc was used by L'Ofrateme of France (which produces video programming) to present one of their productions.

At this exhibit, both Sony and Sanyo presented their new portable video cassette systems. Sony also showed their new miniaturized Trinicon color camera, and their newest electronic editing device.

It was expected that 1974 would be the year of the video disc. Telefunken and Bogen both presented their latest developments in this field. The former showed its TED system, while the latter presented its MDR system. At this writing, little information was available on the TED, but it was made available to us that the MDR system is quite different from the others, operating on magnetic principles. MDR (Magnetic Disc Recording) will provide up to about twelve minutes on each face of the disc.

Philips displayed their PAL and SECAM player/recorders, their PAL editing system, a vcr duplicating system, and their hand-held monochrome camera.

Schlumberger (France) showed its video tape recorders and color monitors, the latest studio color cameras, a new color switcher, color movie scanners, and encoders.

The total display of equipment for program production other than broadcast, such as in industry, education, training, etc., occupied a full floor of the Palais des Festivals. Much of the software presented elsewhere was produced on this equipment, and in some instances, the production company markets the equipment also.

In the field of cable television, many of the corporations presently involved in video distribution introduced their line of equipment at this convention. Jerrold Electronics, for example, showed its latest equipment through its European subsidiary. EMI of Great Britain showed its new series of distribution amplifiers and associated equipment with six channel capability, VHF and UHF converters and a line of CATV equipment with two-way operation.

The subject of cable television carried over and was covered in the convention conference study sessions as well. In the discussion on *Cable Television: Political and Economical Conditions,* nine countries participated and took up the problems of financing, taxes, subscription costs, the role of government, marketing and network policies, the impact of television as a group media, advertising, and many other pressing conditions with which program production and distribution are involved. Specific cases under discussion were presented from Great Britain, USA (by Teleprompter Corp. of N.Y.), Netherlands, and Canada.

During the various discussion sessions, there were over a hundred participants in the panels and question-and-answer groups. The size of the hall and the number of people in the audience provided a good reason for the unique attempt to make the people on the panel visible to all in the auditorium by use of the Eidophor. This applictaion of the large screen video system made interesting use of a video technique and equipment to enlarge the size of the panelists for all to see. The panel was actually hidden behind a curtain on stage and were seen on the large screen during their presentations. Following the talks, the question and answer period provided a look at the real people when the curtain was drawn aside.

In the two-day sessions on Education, ten countries participated; the first session alone covered such subjects as the position of the teacher in an educational video system, whether the actual systems were adapted technologically to the needs of education, psychological changes in the teacher-student relationship, justification of the choice of videocommunication tools and methods in an educational process, collaboration between various levels of educational institutions, and the renting, leasing, purchasing and financing of equipment and program production.

The second day's subjects covered the advantages of cable or cassette, internal cable installation, cable and the use of networks in the process of education, specific programming and the production thereof, and of course,

financing. Production houses, institutions of learning, and organizations involved with both video and education presented specific cases for discussion. In addition to European and American participation, a presentation was also made by a representative of the Ivory Coast.

The subject of vocational training was also covered for two days. Among the participants were IBM of Great Britain, Xerox and Chase Manhatan Bank of the USA, and the American Academy of Family Physicians of the United States. About ten countries were on the panels—some of the subjects covered were the position of the moderator in a training video program, copyright problems, aid to continuing education, definition of systems and software applicable to distribution, the importance of the medical market, protection of confidential information, and the distribution of medical programs to doctors and hospitals.

The subject of leisure and culture took the longest time, three days. Sessions included cases presented by companies involved with pay television, software development and production, and cable networks. Some of the subjects discussed included development in hotels, relationship of movie representatives and t.v. channels, tax problems, copyright laws, invoicing of customers, public video libraries, financing and production centers, two-way cable problems and the consumer's responsibility, program selection systems, and the involvement of community leaders in cable operation.

The concluding session covered the future trends of video-communication and group talks and debates covered such subjects as product marketing policies, the role of videocommunication in social applications, and group communication.

Further information on this convention can be received from Mr. John Nathan at 250 West 57th St., New York, N.Y. 10019, Suite 1103.

We should also like to tell you, just in case you may not be aware of it, that Video Expo V is coming up on October 1, 2, 3 at Madison Square Garden in N.Y. Information on this convention can be obtained from Knowledge Industry Publications, Tiffany Towers, Box 429C, White Plains, N.Y. 10602.

Another reminder of an upcoming convention is the 116th SMPTE Conference at the Four Seasons Sheraton Hotel, Toronto, Canada, November 10-15. Contact SMPTE at 862 Scarsdale Ave., Scarsdale, N.Y. 10583.

When inquiring about any of the above, tell them we sent you. We will cover the New York conference for you in a subsequent issue. ■

NEW PRODUCTS AND SERVICES

CASSETTE DUPLICATOR

● Self-contained model DP-4050CC cassette to-cassette duplicator can make five copies from one master start control. Both master and slave decks simultaneously stop automatically by use of sensing foil. The duplicator speed is eight to one. The manufacturer claims a signal-to noise ratio of better than 50 dB for the duplicated tape and crosstalk at better than 45 dB. A similar model, DP-4050-OC, has a reel-to-reel master with six cassette slaves.

Mfr: Otari Corp.
Price: From $5,530.
Circle 51 on Reader Service Card

PUSHBUTTON RECORD PLAYBACK SYSTEM

● An electronically controlled tangential arm controlled by a servo motor, with a maximum tracking error of 0.04 degrees, permits the sensing of the presence or absence of a record on the turntable of Beogram 4002. A separate detector arm, housing a small lamp and photocell, detects the presence of the record. If there is no record, the machine will not go into play mode. Once the detector arm and circuitry determines that a record is present, it will lower the pickup into the first groove, selecting the correct operating speed. Eleven integrated circuits in the unit's "mini-computer" will not permit it to obey meaningless manual orders. Cueing can be directed from the front panel without touching the arm. A patented leaf suspension system reduces the vibrations of low frequency disturbances from the environment. An electro-pneumatically operated system for arm lowering is combined with an electro-magnetic override for rapid arm raising. The unit uses model MMC-6000 cartridge, rated Class A in the RCA/JVC discrete four channel category. Utilizing a Pramanik multi-radial stylus, tip resonance is claimed over 45,000 Hz and compliance higher than 30 x 10^{-6}.

Mfr: Bang & Olufsen
Price: $650.00
Circle 52 on Reader Service Card

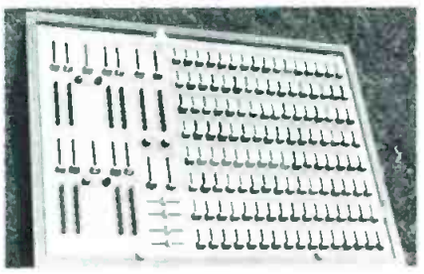
Circle 40 on Reader Service Card

THREE MOTOR OPEN REEL TAPE DECK

● A servo-control capstan motor, 10½ inch reel capacity and tape speeds of 15 and 7½ ips are incorporated into model TC-756 three-motor open reel tape deck. The motor adjusts immediately to any line voltage changes to assure constant tape speed; closed loop dual capstan tape drive isolates the section of tape passing before the heads. The unit contains ferrite and ferrite heads, which the manufacturer claims to maintain high performance characteristics up to 200 times longer than standard permalloy heads. Total mechanism shut-off disengages the tape drive mechanism at end-of-tape in any mode. The deck also features a mechanical memory capability that works with an optional timer to engage the tape drive mechanism at pre-set time. Other facilities include a record equalization, bias selector, variable playback volume control with center detent position to pre-set the playback level for monitoring and external Dolby calibration, two pro-type vu meters, mic/line mixing, adjustable tape height guides, feather-touch logic control transport functions, and a two-position mic attenuator switch. The unit also contains a four-digit tape counter, locking pause control, built-in reel locks, fet amplifier, stereo headphone jack, and two front panel microphone jacks. A two-track stereo version, TC-756-2, is available for the same price.

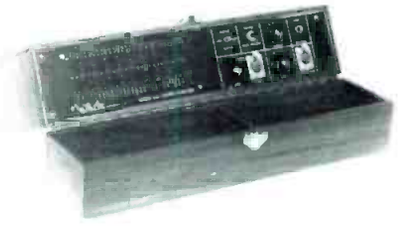
Mfr: Superscope
Price: $799.95
Circle 56 on Reader Service Card

THEATRICAL SOUND CONSOLE



• Convenient to use, model 816 console is designed for use in small to medium-sized theaters. It offers a total of eight inputs and sixteen outputs, switch/control operation of volume and speaker changes, applicable to over a hundred controls, and full portability. All connections are made through standard professional audio connectors. The unit is set in a solid panel of eighth-inch aluminum in a shielded cabinet.
Mfr: Richmond Sound Design
Circle 54 on Reader Service Card

SOUND ANALYZER

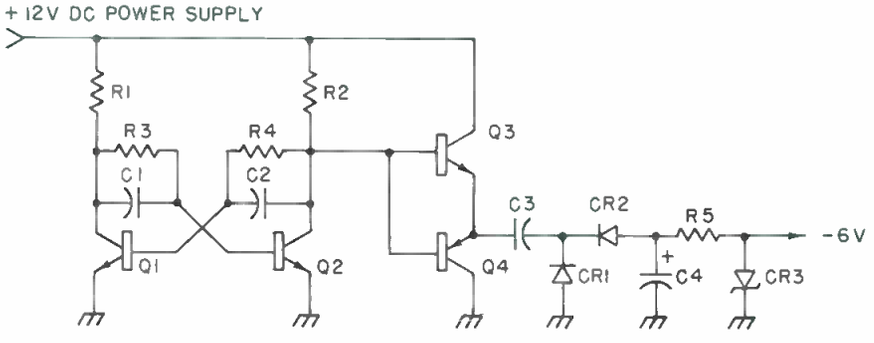


• A bank of red leds, 11 high by 28 wide, provides a graphic display on model 140 sound analyzer. 27 one-third octave channels on standard ISO centers are covered from 40 Hz to 16 kHz. Each of the channels consists of a double-tuned filter for maximum rejection of out-of-band noise, followed by a converter and an appropriately weighted smoothing network. A high gain front end, which can be calibrated for display of true dB-SPL using a standard dynamic microphone, provides a dynamic range from 40 dB-SPL to 110 dB-SPL in six 10 dB steps. In addition, a line input is provided so that line level signals can be analyzed. The unit contains a built-in pink noise generator of the digital type, which provides flat output from 40Hz to 16 kHz at either high level or microphone level. The unit is a real time analyzer, built on a standard 19 inch rack panel. A self-contained three microphone multiplexer is available for the remote averaging of sound pressure levels.
Mfr: White Instruments
Price: Under $2,500
Circle 55 on Reader Service Card

JAMES W. BURLINGAME

An (almost) Something For Nothing Power Supply

If you ever need a negative voltage in the field when all that exists is a positive 12V car battery, you will be glad to save this simple circuit.



R1, R2	2.2K	1/8 W	Q1, Q2	2N3904
R3, R4	1MEG.	1/8 W	Q3	2N3053
R5	220Ω	1/4 W	Q4	2N3495
C1, C2	.005μf	50V	CR1, CR2	1N4152
C3	10μf	50V	CR3	1N753A
C4	100μf	50V		

Figure 1. The -6V supply described in the article.

FACED WITH A REQUIREMENT for a negative voltage supply in a mobile application where only the positive 12 volt battery was available, I came up with the following solution: Since the requirement was only minus 6 volts at 4mA, I decided the chopper-transformer rectifier supply would be too heavy and expensive. The solution turned out to be a simple free-running multivibrator as a chopper, and a rectifier. The circuit provided 8.8 volts at over 8 mA with reasonable ripple. When this was zener regulated to 6.2 volts, the ripple was negligible and regulation was more than adequate.

Referring to FIGURE 1, Q1 and Q2 operate as a free running multivibrator, in this case at about 7kHz. Q3 and Q4 are a complementary emitter follower to buffer the multivibrator. In operation, when the collector of Q2 is at its most positive level, C3 charges through CR1 and Q3, which is turned full on. This drags the positive end of C3 to almost supply voltage. When the collector of Q2 falls to its most negative level, Q4 conducts and pulls the positive end of C3 to almost ground. This in turn forces the negative end of C3 to some negative voltage, (supply voltage less the drops of Q3 and CR1) which charges C4 through CR2. (The charge on C4 will be that of C3 less the drop of CR2 and Q4.) Since the drops of Q3, Q4, CR1 and CR2 are all accumulative in reducing the output voltage from the supply voltage, I decided to forego voltage dropping diodes between the bases of Q3 and Q4 and current limiting resistors in the emitter, collector circuit of these transistors.

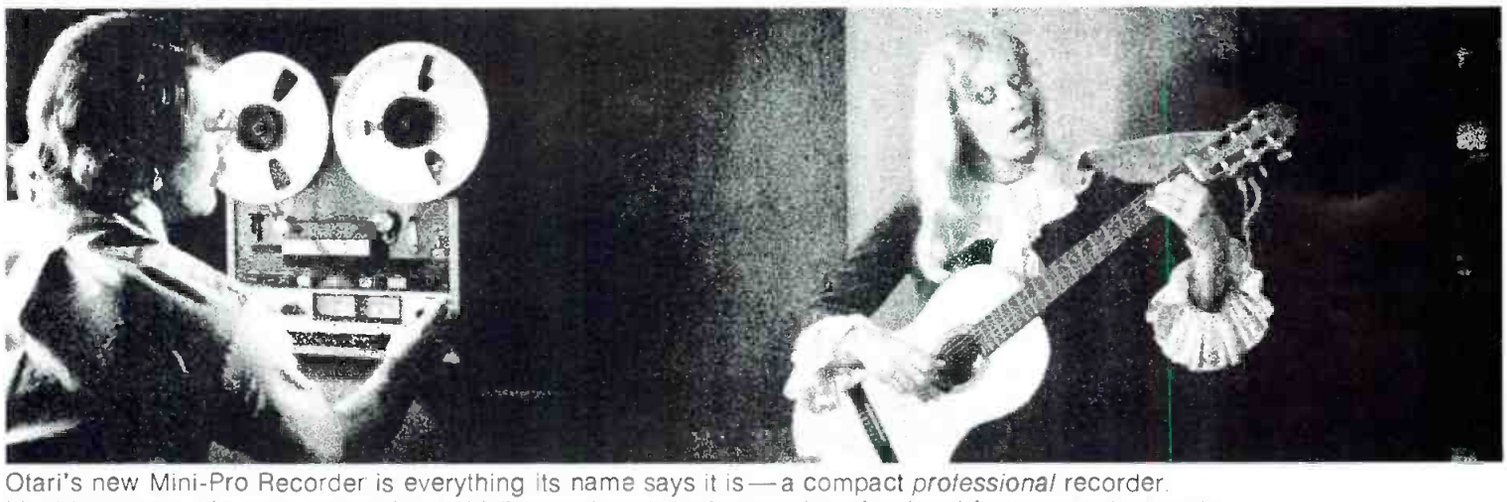
The values given were settled upon considering availability and functional adequacy for my particular application. The circuit functions well with an input voltage of 5 volts, which gives an output of 2.4 volts to 24 volts with an output of 21.5 volts and with proportional current availabilities. The multivibrator could be easily synchronized with an existing clock signal to limit any ripple or switching transient effects, or an existing clock signal could be amplified and buffered and used as the chopper, where an engineer is adding to existing circuitry.

Although this "Almost something-for-nothing circuit" is rather limited in current availability, it may get other design engineers out of sticky situations in the future. ■

The author describes himself as a trouble shooter at Tektronix in Beaverton, Oregon and a free-lance broadcast engineer (his first love).

MINI-PRO!

Little brother to the MX-7000--the MX-5050.



Otari's new Mini-Pro Recorder is everything its name says it is—a compact *professional* recorder. Most important, it's not a warmed over hi-fi recorder with a few semi-professional features tacked on to wow the audiophile. Instead, it's a true professional recorder scaled down in size but not in performance or features.

Who did we design the Mini-Pro for? A whole host of professional users, like the small recording studio, the A/V facility, or the broadcast station that's really beginning to get into production. Or the large studio that needs a compact recorder for its own small studios or its many outside assignments where no-compromise quality is still a requirement. Or for broadcast automation systems where the calculated MTBF of 2000 hours continuous operation can make the difference between success or failure?

How professional is the MX-5050? Check these features: Synchronous reproduce, front panel edit control and mode, two or four channel versions, IC digital control system with motion sensing, optional DC capstan servo system, 15 and 7½ or 7½ and 3¾ ips tape speeds, front adjustable bias, record lockout, built-in test and cue oscillator, head lifters with adjustable-tension cueing feature, plug-in balanced line transformers, built-in mic preamps, Cannon connectors for line input and 600-ohm (+4 dB) output, optional swing-out rack mounting panel, standard reference level calibrate position, and four heads.

Want to know more about this mini with the maxi performance? Or about its MX-7000 big brother, the three-speed machine with built-in test oscillator and some of the best flutter and frequency response specs in the industry? Contact Otari or your nearest Otari Professional Dealer.

OTARI

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(415) 593-1648 TWX: 910-376-4890

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Circle 15 on Reader Service Card

STEPHEN H. LAMPEN

Amplifying an Orchestra

Classical symphony orchestras sometimes require electronic assistance for musical as well as sound reinforcement reasons. The author describes a musical need for audio assistance.

Figure 1. The general miking arrangement.

On Friday, August 10, 1973, the San Francisco Symphony presented the World Premiere of Loren Rush's musical composition, *I'll See You In My Dreams*. This presentation was the climax of the 1973 Summer Music Workshop where students, instructors, and symphony members had joined for one month to give music students greater learning opportunities and discoveries in classical music.

I'll See You in My Dreams was based on the *Wedding March* from Mozart's opera, *The Marriage of Figaro*. The adaptation called for full orchestra, magnetic tape, and other effects, in the words of the program. It was the last two where we came into play.

3P Recording is an independent studio in San Francisco specializing in on-location recording. Hansonic, also San Francisco-based, specializes in public address systems, especially theater systems. "Dreams" demanded that both talents be used because the "other effects" mentioned included amplifying the entire orchestra.

The approach was simple: obtain a balance of the orchestra in the hall and amplify it to the point where the orchestra, playing at low levels, could overcome the tape effects of splashing waves and jet take-offs! Quite an order! Amplified orchestras have existed before. They usually consisted of either transducers attached directly to the instruments and mixed or a normal recording mic set-up with the speakers at some remote location. In both instances, feedback would be a low-priority item. Yet here the composition called for a normal recording mic arrangement with speakers situated directly in front of the stage. It had to sound, Mr. Rush told us, as if the orchestra were simply getting louder and louder, but we would be in control. Thus, speakers could not be placed at remote locations: they had to be right in front of the orchestra. Naurally, feedback problems became priority number one.

There are a few generally accepted methods of reducing feedback which were discussed. First, the use of directional microphones was an absolute must. Close, tight group-

Stephen H. Lampen is president of 3P Recording, San Francisco, Ca.

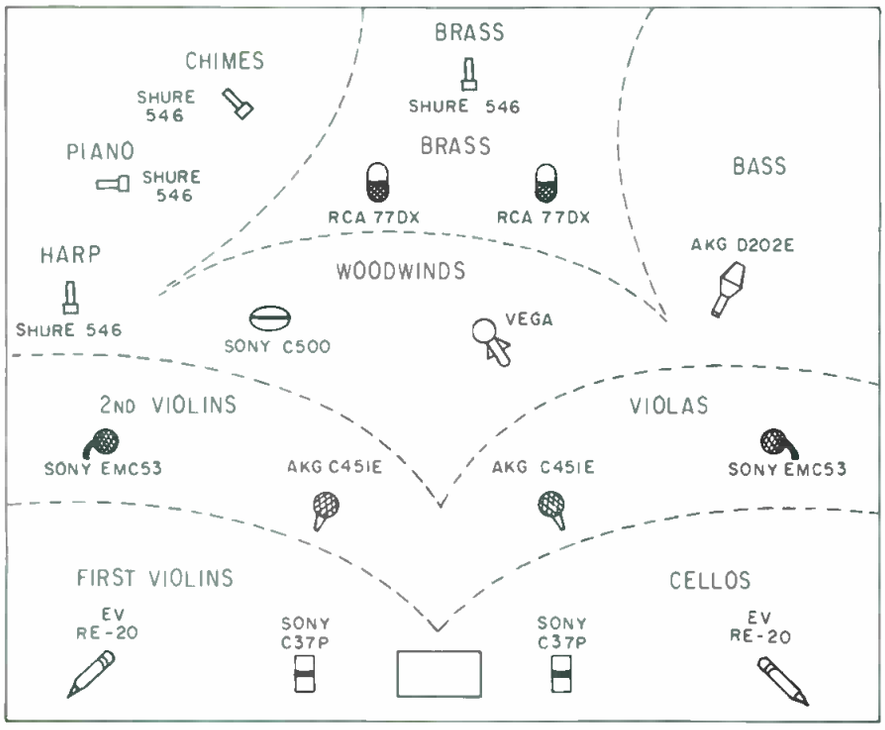


Figure 2. The mic setup that was used.

miking was in order. Highly directional speaker systems were discarded as they were either too limited in quality or in smooth coverage. We ended up with the set-up shown in FIGURE 1 and diagrammed in FIGURE 2. The microphones were split into sections and fed to five Shure M-67 mixers. The output from the mixers was fed to a Sony MX-16 mixer and the output from it, through an SAE graphic equalizer, fed four Bogen power amplifiers. The speakers used were two Electro-Voice Sentry IV and two Altec 1202s.

Tuning the auditorium was necessary and a novel method was evolved to accomplish it. With the 12-position SAE equalizer in place and the microphones set up, the system was turned on and the microphones balanced (during a rehearsal). Afterwards, the power amplifiers were turned on with the mics still live, and the volume brought

Figure 3. The equipment cabinet. From the top: two AKG C451 battery power supplies; a Sony MX-16 mixer; four Shure M67's; two Shure SE-30 mixers for standby; one more M67; an SAE equalizer; and two of four Bogen power amplifiers.

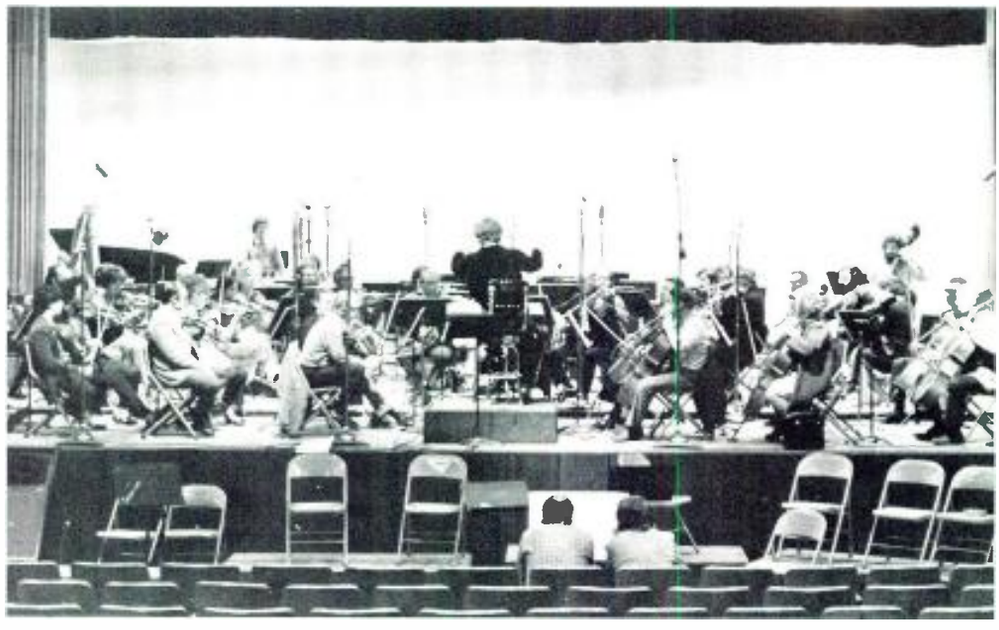


Figure 4. The speaker and front row mic placement.

Figure 5. The general speaker placement can be seen along with the balloon climax.

up. At a certain setting, feedback would start to be heard. As it is usually at specific frequencies, a little jiggling with the equalizer determined just what frequency was being accentuated by the hall or the speaker placement and compensation was made. When the volume was turned up a little more, other frequencies would appear in feedback and were adjusted. Thus, when it was necessary to move *all* controls on the equalizer, that is, when the feedback covered the entire audible range at a certain (very high) volume setting, it was obvious that no frequency was being accentuated more than any other in the hall and the hall could be considered tuned. And all this without white

Figure 6. In this view from further back the equipment location becomes visible.

noise, spectrum analyzers or complex in-audience mic setups. Most of the equipment was enclosed in a roll-around cabinet shown in FIGURE 3.

There were other possible feedback helpers. Frequency shifters, which change the apparent pitch by a few cycles to avoid feedback, were discarded as they do not work well at all with musical material. Short delays, digital or tape, would only worsen the problem of a too-reverberant hall, as this auditorium was. There is one other possibility which was attempted. The orchestra was miked in stereo to preserve realism. If the stereo channels were reversed, the mics on one side would be more than twice as far away from the speakers which would be reproducing their input material. This would allow levels to increase 3-4 dB all around. However, it was found that a stereo set-up, especially at high volumes, simply reproduced part of the orchestra in one part of the hall and part in the other, so a monaural mix was used.

To make matters worse, Mr. Rush decided that, to have the amplified sound "floating" around the hall, some of the speakers should be tilted facing up. As can be seen in FIGURE 4, the Altec 1202s were tilted as requested. This lost about 2 dB in feedback levels. This picture gives a good idea of how the miking was arranged for the front strings. Two Electro-Voice RE-20s and two Sony C-37Ps were used close over the front instruments. In fact, in order to increase levels, these mics were brought down slightly. I shall not forget the look on the face of the first violinist, Stuart Canin, as I slowly let down the microphone directly above him. He clutched his Stradivarius and shot an apprehensive glance my way, sure that his instrument was in danger of being smashed to smithereens.

A test during rehearsal was then made. The tape portion, played on a Sony 854-4S through our system, was mixed with the orchestra by the composer who was running the main mixer. (As feedback levels had been set, the main output was run up just below feedback, so he had all the leeway possible without feedback.) During this test, a sound level reading was taken at the last seat in the hall. It measured peaks of over 115 dB during loud passages. However, the reproduction of the orchestra sounded so natural that everyone was asking, "Where's the sound?" "Are the amplifiers on?" and one had to walk right in front of each speaker before he was assured they were indeed running—and at high levels too.

Not only were the sound effects written in the score, but the climax was also: dropping hundreds of balloons held in a large net onto the audience. These can be seen in FIGURE 5, as can the relative position of the speakers on each side of the orchestra. The horn speakers on stage were part of another system and not used with ours. Niklaus Wyss, the brilliant young assistant conductor of the Symphony, who was maestro for the Workshop, was the most tolerant musician I have ever seen. Feedback, loudspeaker levels and tape mis-cues did not seem to bother him. He was a considerable help, in fact, in suggesting solutions to some of our problems.

All that was taking place in the auditorium was visible from our equipment box, located behind the main seats (as shown in FIGURE 6) but in front of a bleacher seating section.

Finally, the day of judgment arrived: the actual performance. The system worked flawlessly, the tape was right on cue, the balloons fell (on a section of kids, of course—even the popping of the balloons was contemplated by Mr. Rush) and the piece *I'll See You in My Dreams* was a great success. Even the critics for various papers liked it. How strange it is that we human creatures put so much work into a few seconds of creativity. Yet all the planning, testing, discussing (FIGURE 7) setting up and pulling down, all seems to be worth it. ■

M. BOYANOVA

Equalization in Magnetic Recording

The method described is used to evaluate recording channel non-linearity by means of modulation characteristic and data concerning amplitude distribution over the entire audio spectrum.

DISTRIBUTION of equalization in magnetic recording is closely related to two most important factors—nonlinear distortion and noise level. Selection of the appropriate corrective pre- and post-emphasis depends on a multitude of disputable factors. Therefore, compromise is essential.

FIGURE 1 shows a typical distribution of equalization at the speed of 38.1 cm/sec (15 inches/sec.). Assuming that the differentiating characteristic of the reproduce head is corrected by the playback amplifier, then curve (A) represents the residual flux of the tape with constant current recording, and curve (B) the standard frequency response of the residual magnetic flux (it corresponds to the impedance of the parallel connection of the r-c section with the time constant—t = r − c = 35 usec.). The distance between the curve (B) and the zero reference line gives us the amount of correction at all frequencies in a standard playback channel, and the distance between curves (A) and (B) indicates the necessary correction in a recording channel or otherwise so-called pre-emphasis correction.

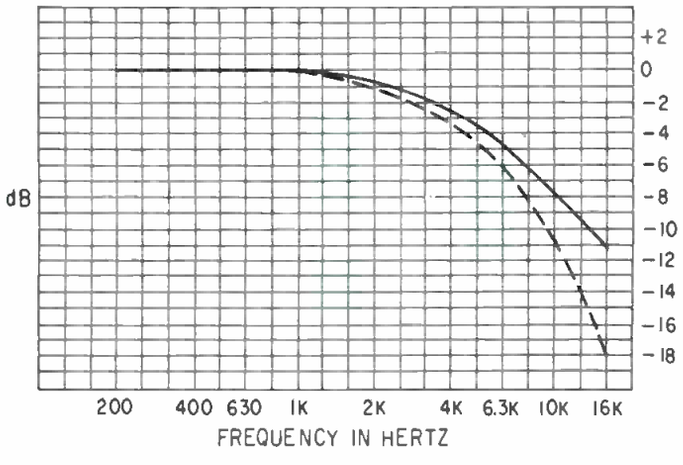
Standard correction of the flux is valid only at the low levels of the recording; therefore, all measurements of the frequency response are made at the level of −20 dB, even as low as −30 dB with respect to the maximum level. With the increase of the input signal, nonlinear distortions appear and the relationship between input and output signals changes. At even higher levels, tape saturation occurs.

At high frequencies, tape saturation starts sooner and at much lower levels than at mid-frequencies. Yet this is exactly where most of the frequency correction or pre-emphasis is being used! What is the reason for this? An increase in the recording level at high frequencies is possible because natural sources of sound (speech, music) have lower average amplitudes in a region of high frequencies in relation to their amplitudes at mid-frequencies. Pre-emphasis of a signal is used not only in sound recording on tape, but in other types of recording and communication circuits, such as UHF transmitters (f.m.). Optimum benefit from using pre-emphasis can be realized only if the spectral analysis of the program material to be recorded is known. Here we are going to analyze the reasons for selecting the appropriate equalization for a particular magnetic recording system.

RELATIONSHIP BETWEEN THE MODULATION ABILITY, SPECTRAL DISTRIBUTION, AND PRE-EMPHASIS

The problem of the frequency spectrum of maximum amplitudes derived from sound sources has been analyzed in Figures 1-6. Curves of the spectral distribution have been derived on the basis of the statistical analysis of a large number of musical compositions; therefore, they are known as *statistical curves*. Nevertheless, all data pub-

Figure 1. Relationship between a residual flux of the tape and frequency with a constant current recording (curve A). Standard characteristic of residual flux, as measured (curve B).



This article originally appeared in the Russian publication Film and Television Technique. It is translated and published by us with permission. Translation from the Russian was by George Alexandrovich.

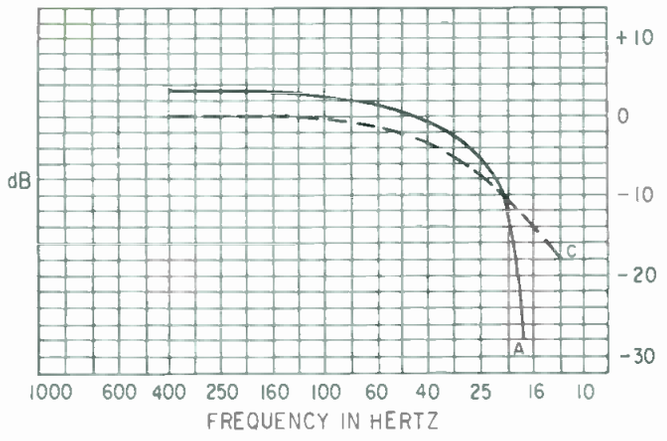


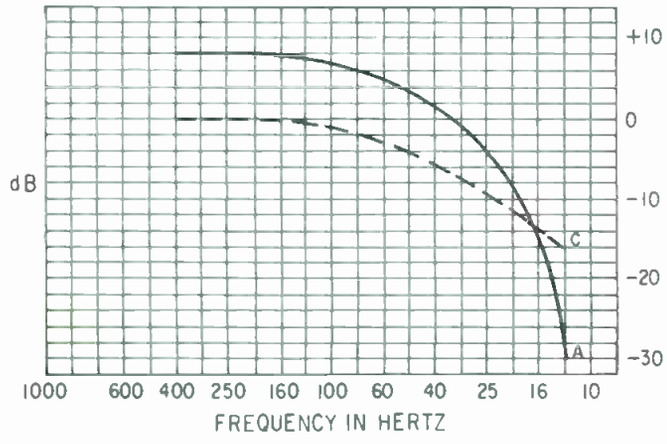
Figure 2. Dependency of modulation capability on wavelength (curve A). Necessary pre-emphasis (curve C).

lished differs considerably because tests have been made under various conditions and with an assortment of program material. Many authors of such statistical analyses work with pre-recorded material which includes electronic doctoring of the signal, including the equalization and level control.

In his work, J. McKnight[3] shows the area between two curves where spectral characteristics of various programs fall in. The upper, or maximum, curve shows that on occasion, amplitudes of the mid-range and the upper range frequencies are identical. In recent publications it is revealed that the duration of an existing condition when maximum amplitudes coincide may be as long as .1 percent of the time, even as long as 1 percent.[4,5,6] All of this information can be used only as a reference because it has not been determined yet precisely how much of a distortion can be tolerated by subjective listening at different parts of the audio spectrum.

Belger[7] concludes that a more realistic picture of the average statistical curve can be achieved by an inverse method—judging by the recording technique. It is accepted that at 38.1 cm/sec (15 ips) and with modern oxides, a compromise has been found between an acceptable nonlinear distortion and noise level. This means that the selected amount of pre-emphasis is close to the optimal. Then the spectral characteristic, which corresponds to the pre-emphasis at 15 ips can be considered as the average and can be used as a basis for our further analysis. This characteristic, accepted as the average, indirectly

Figure 3. Dependency of modulation capability on wavelength (curve A). Necessary pre-emphasis (curve C).



contains a subjective evaluation of acceptable distortion levels.

In evaluating nonlinear distortion over the entire audio spectrum, we use the ability of the magnetic tape to accept modulation (the relationship between the frequency and the constant nonlinear distortion). In scientific literature, the question of the relationship between the ability of the tape to accept modulation and the statistical average curve has not been determined as yet. In Belger's article,[7] he discusses analyzed processes taking place at the *input* of the tape recorder, i.e. the recording current producing the constant nonlinear distortions as compared to pre-emphasis. However, it is more convenient to evaluate nonlinear distortion at the constant output than to compare it to the recording current.

Other authors have also researched the relationship between nonlinear distortion and pre-emphasis[8,9,10] using a pre-emphasis boost of 15 dB at 10 kHz for a tape speed of 9.53 cm/sec (3¾ ips). It is considered that the distortion will remain within acceptable limits when the rise in amplitude with the increase of frequency corresponds to the level drop of the statistical curve or is the same as the recording current amplitude. In reality, the relationship is much more complicated.

The modulation ability of the recording medium has to be compared directly to the statistical curve. Since within the limits of non-distorted reproduction of a signal there is a definite proportion between the input and output signals, in order to prevent excessive output levels restricted by the modulation curve, recording signals at the input have to have the same frequential relationship. In cases where the modulation curve and the statistical curve coincide, conditions for non-distorted reproduction will be met in the entire audio spectrum and the capability of the recording tape fully utilized. If a recorded program contains high frequency, large amplitude information, then saturation (overmodulation) takes place. On the contrary, if the tape remains under-modulated, it will perform its functions with a certain amount of reserve (or headroom).

Sample measurements shown in this paper indicate that tapes with smaller losses have a smaller drop in the modulation curve, but these variations in characteristics don't match and are not even proportional.

EXPERIMENTAL DATA

Nonlinear distortion characteristics of a large number of recording tapes has been analyzed at speeds of 38.1, 19.05, and 9.53 cm/sec. The method for measuring the nonlinear distortion used was based on a beat frequency technique (intermodulation)[11] which enables us to make measurements up to the upper limits of the audio spectrum. FIGURES 2-5 show curves of modulation capability (A). These curves represent the output level with a constant coefficient of the differential tone d = 3 percent, at speeds of 38.1 and 19.05 cm/sec. Modulation capability can be determined not only by the beat frequency method, but also by using another, more easily conducted test. At the mid frequencies, the output level is determined by the allowable distortion of 3 percent, while at the high frequencies the maximum output level is reduced by 4-6 dB. Experience tells us that curves showing modulation levels, using these two test methods, match rather closely. An output level of 0 dB corresponds to a maximum residual flux of 320 nWb/m (nanowebers/meter) and the frequential correction (post-emphasis slope) is t = 35 usec. and t = 70 usec., respectively. Bias in each case was done according to respective standards.

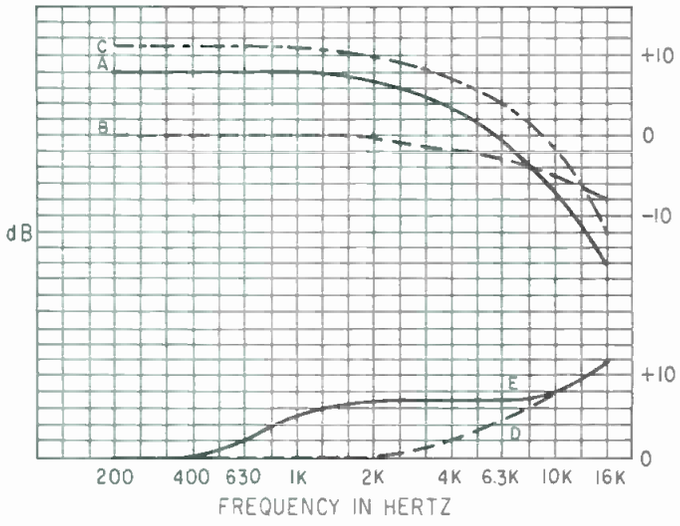


Figure 4. Dependency of modulation capability on frequency (curve A). Average spectral distribution of amplitudes (curve B). Maximum level at the saturation point of the tape (curve C). Equalization of the recording amplifier with T = 70 usec (curve D). Allowable correction of the recording amplifier (curve E).

Tape Speed cm/sec	38.1	19.05	9.53
Modulation Capability in dB	−3 to 1	−7 to −10	−8 to −14
Preemphasis in dB	4 to 6	6.5 to 11	4.5 to 9.5

In this table, data at the speed of 9.53 cm/sec refers to a distortion level of 5 percent with a magnetic residual flux of 256 nWb/m and a time constant of 90 usec. Let us compare the decrease of modulation capability with the needed pre-emphasis at one frequency only, for instance, at 10 kHz. Various types of tapes are selected for each speed, different from the ones usually used for the indicated speeds. The range over which the modulation qualities of the tape change and the range of pre-emphasis are shown.

At the speed of 38.1 cm/s, the magnitude of the pre-emphasis is larger than the fall of the modulation curve, while at the slowest speed of 9.53 cm/s the opposite is true. If we accept the fact that the spectral distribution of the incoming amplitudes is a mirror image of the pre-emphasis which results in a constant current recording, then at the speed of 9.53 cm/s overmodulation of the tape will take place, while at a speed of 38.1 cm/s, the capabilities of the medium are not being fully utilized. It can be seen from this that the pre-emphasis cannot be used as a criterion for distortion on tape and it cannot be compared to a statistical curve.

The same type of comparison has been conducted with two other types of tapes: CPR-ORVO (FIGURE 2) and PER-555 Agfa Gevaert (see FIGURE 3). The modulation capability (curve A) and the pre-emphasis curve (curve C, which is shown for convenience with a negative sign) are plotted against the wavelength. From the graph, it can be seen that the modulation capability falls faster than the pre-emphasis. Both curves, as well as the point of intersection, are unique for a particular type of tape and cannot be generalized. If the tape is modulated, using constant current and compensated, using a statistical curve

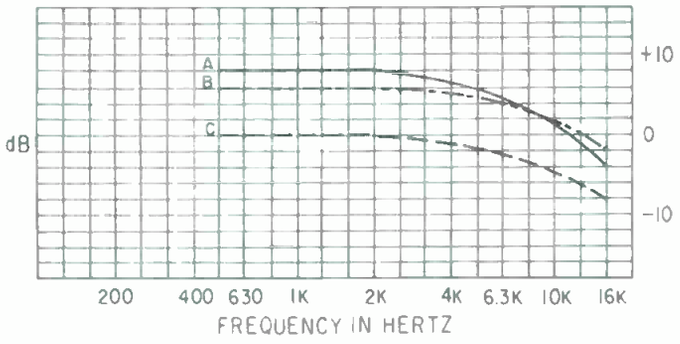


Figure 5. Relationship of the modulation capability and frequency (curve A). Average spectral distribution of amplitudes with a standard magnetizing force of 320 nWb/m (curve B) and with double current (curve B')
Table 1. Tape speeds versus modulation capability and preemphasis.

and pre-emphasis, then for frequencies before the intersection of the curves there is an insufficient modulation, and after the intersection there is an overload, or saturation, of the tape.

EVALUATION OF THE CORRECTIVE EQUALIZATION UNDER CONCRETE CONDITIONS

Let us review conditions when nonlinear distortion is generated at high frequencies in professional recording. For this, it is necessary to consider the statistical curve, which would very closely resemble the spectral distribution of the input amplitudes. Using Belger's suppositions, let us refer to the practical aspects of the recording, assuming that at a speed of 38.1 cm/s the optimum conditions for recording are obtained. The condition for distortion-free recording seems to be fulfilled when the statistical curve is equal to the curve of the modulation capability. If we take the average modulation curves of the several different types of tapes and consider the published statistical curves at a level of 1 percent, then curve (B) can be considered an average statistical curve, as shown on plots 4 and 5. Based on this statistical curve, it is possible to determine pre-emphasis under different recording conditions.

Parameters for the AGFA Gevaert tape, PER-525S, at a speed of 19.05 cm/s are shown in FIGURE 4. Curve (A) shows the modulation capability of the tape, curve (B) the accepted mean statistical characteristic, and curve (C) the maximum level, corresponding to the saturation of the tape. Under these conditions, distortion-free recording is assured up to 8 kHz. At higher frequencies, distortion rises rapidly and at 12.5 kHz reaches a saturation of the oxide; at frequencies above this point, maximum amplitudes will be clipped. Distortion appearing at frequencies above 8 kHz can remain within acceptable limits if we reduce the pre-emphasis, which adversely affects noise level. At a speed of 19.05 cm/s, due to a sharp rolloff characteristic of the modulation capability of the tape, indicators of the quality of the signal are not as easily found as at a speed of 38.1 cm/s. Here we have to compromise between overmodulation at high frequencies and noise level.

A condition of overmodulation creates less distortion in

recording short wavelengths than during saturation (level lower than the indicated maximum level). Besides, it is possible to affect the low frequency component signals of the program material.[12] Therefore, it is important to perform all design calculations for high frequencies and to take all precautionary steps against overmodulation. The use of a volume indicator with a tailored frequency response may be very helpful. It is possible that in the future, it may become necessary to split a musical picture into several channels and to control each channel separately.[13]

A superimposition of curves (A) and (B) (see FIGURE 4) indicates that there exists an unused reserve below 8 kHz. In this region, magnetization of the oxide can be increased without exceeding the acceptable distortion level. In this case, equalization of the recording amplifier will no longer be curve (D), but curve (E)—using a standard pre-emphasis with t = 70 usec. In the reproducer amplifier, a corresponding change made in the post- equalization curve will create a very welcome effect because most troublesome components of noise are being reduced. The magnetizing current at the reference frequency of 315 Hz remains unchanged. Use of this correction decreases the level of noise and the possibility of generating distortion at the high and mid frequencies is the same. This kind of corrective measure was used by the American firm, Ampex, for recording masters.[12]

In our demonstration, tape type PER-555 is used at a speed of 38.1 cm/s. This tape has a high coercive force and a large reserve (headroom) at mid frequencies. It accepts twice as large a magnetizing field, −640 nWb/m, at the midrange. Let us examine the relationships at all frequencies and determine the necessary equalization in this case. Curve (A, in FIGURE 5 represents the modulation capability of this tape at 38.1 cm/s and a time constant, t = 35 usec, and curve (B) the average statistical curve. When recording is done using a standard magnetization of 320 nWb/m, there exists a sizable reserve in the entire audio spectrum (8 dB in the midrange and 4 dB at high frequencies.[9] This reserve can be used in the same fashion as before, using additional corrective measures. With a double magnetizing field (640 nWb/m), the modulation curve coincides with curve (B^1). Nonlinear distortions below the 8 kHz mark are within acceptable limits and above this frequency they are approximately equal to 5 percent, which is acceptable.

Comparison shows us that with tapes having high coercive force both conditions are acceptable because a full

utilization of the tape capacity coincides with a reduction in noise. However, taking into account complications arising from modifying equalization circuits, it is more appropriate to use a stronger (double) magnetizing force.

CONCLUSIONS

Equalization in magnetic recording is related to the indicators of quality in the recording process. In order to get non-distorted recording in the entire audio range, a tape should not be overmodulated. It is shown that when the spectral distribution curve of maximum amplitudes for program material (statistical curve) is identical to the modulation capability curve, the condition is met.

Conducted tests indicate that pre-emphasis has no direct relationship to nonlinear distortion. These conclusions are confirmed by experimental data. By comparing a modulation capability over the entire range with a statistical curve, we are enabled to predict the appearance of nonlinear distortions. ■

REFERENCES

1. Belger, E. Techn. *Mitteilungen NWDR*, 1955 7, pp. 151-155.
2. Overley, J. *IRE Trans. on Audio*. 1956, 4, No. 5, pp. 120-123.
3. McKnight, J. *Journal of the Audio Engineering Society*. 1959, 7, No. 2, pp. 65-71.
4. Bauer, B. *Journal of the Audio Engineering Society*, 1970. 18, No. 2, pp. 165-173.
5. Steffen, E. *Techn. Mitteilungen RFZ*, 1965, 9, No. 2, pp. 66-71.
6. Jakubowski, H. *Rundfunktechn. Mitteil.*, 1971, 15, No. 6, pp. 275-284.
7. Belger, E. *Rundfunktechn. Mitteil.*, 1961, 5, No. 3, pp. 193-200.
8. Chistian, E. *Magnettontechnik*, Munich, Fransis-Verlag, 1969, p. 206.
9. Pieplow, H. *IRE Trans on Audio*. 1962, 10, No. 2, pp. 34-37.
10. Samoskij, V. A. "Influence of Rerecording on Quality of Magnetic Recording." *Work VNAIZ*. 1960, No. 7, pp. 35-41.
11. "Sound System Amplifiers," *IEC Publication 268-3*, 1969, pp. 57-59.
12. McKnight, J. *Journal of the Audio Engineering Society*, 1959. 7, No. 1, pp. 5-12.
13. Schultz, W. *Funkschau*, 1964, 36, No. 14, pp. 379-382.
14. Vasilevskij, D. P. *Technique of Motion Picture and Television*. 1968, No. 1.

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● **Altel Sound Systems of Connecticut,** a new company in Bridgeport, Connecticut, will serve the area as an Altec Lansing Acoustavoice sound contractor. The firm will specialize in the installation of sound, paging, and music systems as well as the sale and rental of professional, music, and p.a. audio equipment. Officers of the company are **Dante Cantalini, Richard Braca, Henry Cattaneo,** and **Larry Musci.**

● Several staff changes have been announced by the **Altec Corporation,** Sound Products Division, Anaheim, California. **Roger F. Cox,** formerly manager of administrative engineering, has been named director of marketing communications, responsible for advertising, sales promotion, and public relations. **Deryl Finny,** supervisor of marketing services, moves to the position of marketing services manager. **Irwin Zucker,** a former sales representative. has become product manager of high fidelity products. **Ray Arbuckle** has joined Altec as national sales manager of high fidelity products. Before joining Altec, Mr. Cox was associated with D.H.C. Inc. and Ampeg. Mr. Finny has been with Altec for nine years. Mr. Zucker has a retail background, as manager of an audio store. Mr. Arbuckle was with **Audio Magnetics, RCA Magnetic Products, Certon Corporation,** and **Empire Scientific.**

● **Martin Audio/Video Corporation,** well known New York City distributor of professional audio products, announces the appointment of **Dave Jett** to the post of Professional Sales Specialist. Mr. Jett, who was formerly associated with **Lang Electronics,** has had twenty years' experience in serving the professional needs of those engaged in the audio field.

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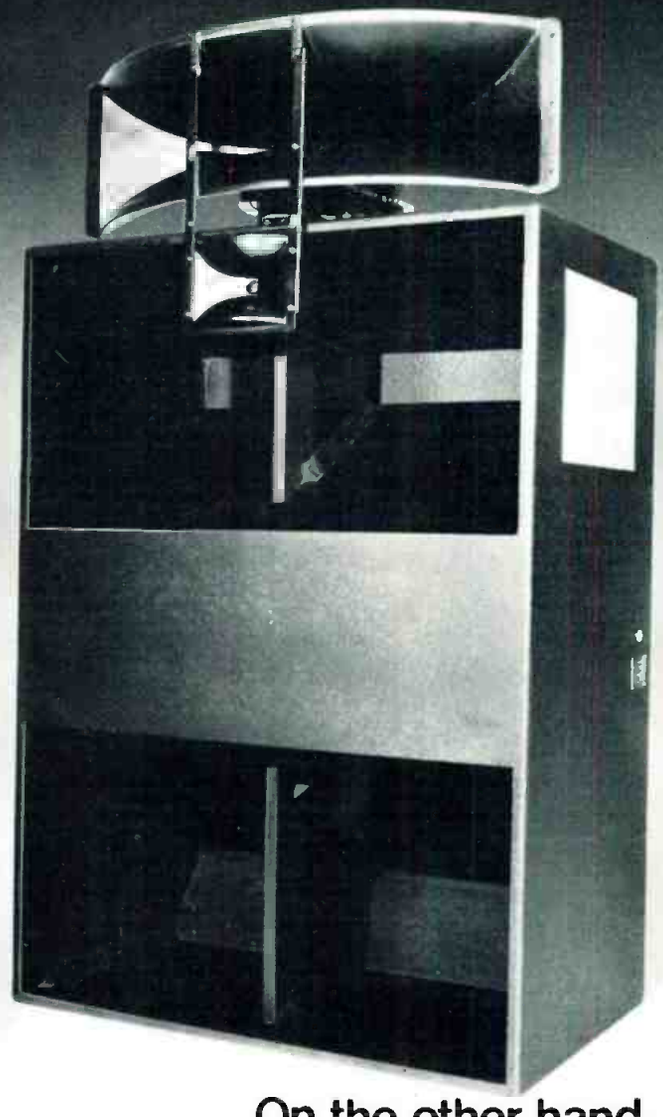

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