ISSN0011-7145

THE SOUND ENGINEERING MAGAZINE

MAY 1978
$1.00

db

Digital Logic in Audio

fact:
you can choose your microphone to enhance your sound system.

Shure makes microphones for every imaginable use.
Like musical instruments, each different type of Shure microphone has a distinctive "sound," or physical characteristic that optimizes it for particular applications, voices, or effects.
Take, for example, the Shure SM58 and SM59 microphones:

SM59

Mellow, smooth, silent...

The SM59 is a relatively new, dynamic cardioid microphone. Yet it is already widely accepted as a standard for distinguished studio productions. In fact, you'll often see it on TV . . . especially on musical shows where perfection of sound quality is a major consideration. This revolutionary cardioid microphone has an exceptionally flat frequency response and neutral sound that reproduces exactly what it hears. It's designed to give good bass response when miking at a distance. Remarkably rugged — it's built to shrug off rough handling. And, it is superb in rejecting mechanical stand noise such as floor and desk vibrations because of a unique, patented built-in shock mount. It also features a special hum-bucking coil for superior noise reduction!

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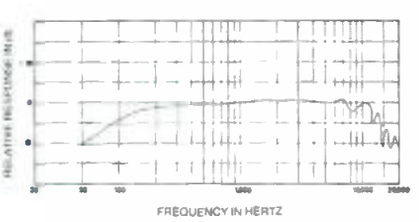

SM58

Crisp, bright "abuse proof"

Probably the most widely used on-stage, hand-held cardioid dynamic microphone. The SM58 dynamic microphone is preferred for its punch in live vocal applications . . . especially where close-up miking is important. It is THE world-standard professional stage microphone with the distinctive Shure upper mid-range presence peak for an intelligible, lively sound. World-renowned for its ability to withstand the kind of abuse that would destroy many other microphones. Designed to minimize the boominess you'd expect from close miking. Rugged, efficient spherical windscreen eliminates pops. Lightweight (15 ounces!) hand-sized. The first choice among rock, pop, R & B, country, gospel, and jazz vocalists.

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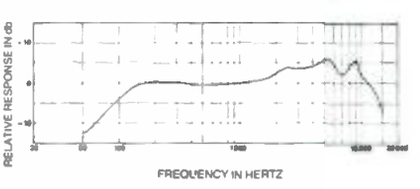

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Coming Next Month

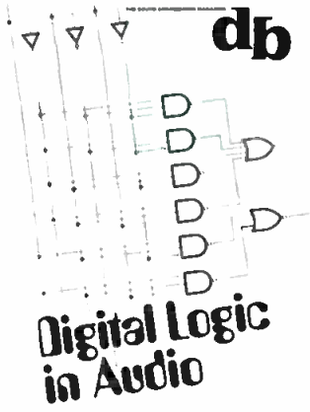
- Marshall King returns to our pages with the first installment of a two-parter that explores the relationship between the professional audio man and unions. Marshall King tells it like it is!

- Sidney Silver also returns to our pages with another article, this time getting down to the basics of the audio man and digital recording. This is an (almost) everything-you-wanted-to-know-but-didn't-know-how-to-ask article that will have you knowing when to byte and what to do with a bit.

- We'll also have a report on the recently concluded National Association of Broadcasters Convention that John Woram attended in Las Vegas.

- All this and more coming in **db, The Sound Engineering Magazine.**

About The Cover



- Ronald Ajemian not only is writing about digital logic in this issue, but he also found time to submit this block schematic of a logic circuit. Ron did it in blue, art director Bob Laurie added the other colors.

db
THE SOUND ENGINEERING MAGAZINE
MAY 1978 VOLUME 12, NUMBER 5

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

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db Letters

THE EDITOR:

In looking through your February issue at the various stories about audio education, nowhere do I see mention of the electroforming step in record production. Of all the technical areas that make up recording and reproduction of phonograph records, electroforming is perhaps the least understood and, in general, the most poorly realized of the processes.

True, the glamour of a live recording session is not to be found here, but this is an area in the recording industry that desperately needs new talent and people who care about quality. When one asks why the best European records are so superior to their American counterparts, the answer is largely to be found in the differences in the way this critical process is done.

It's time that record plating came out of the closet and received the same engineering attention and technological excellence that tape recording and disc mastering processes have received. All the vast resources used to increase signal-to-noise ratios in tape recording goes right down the tubes through poor plating. The same goes for the elaborate signal processing possible in mastering.

Instead of covering the same tired subjects over and over, why not try a little innovation? Publish some information about a part of audio recording about which the entire industry is so ignorant. Let's try to interest some of these bright young people in an area where they are really needed!

JAMES P. SHELTON
President, Europadisk Plating Co.
New York City

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db Calendar

MAY

20-22 **International Light & Sound Show.** Sheraton Atlanta Hotel, Atlanta, Ga. Entertainment equipment. Contact: Multimedia International Inc., 155 Michael Dr., Syosset, N.Y. 11791. (516) 364-1912.

29-6/2 **Fundamentals of Recording.** Seminar at Banff Center for Continuing Education. Contact: Banff Centre, Box 1020, Banff, Alberta TOL OCO, Canada or Stephen F. Temmer, Gotham Audio Corp., 741 Washington St., New York City 10014. (212) 741-7411.

JUNE

9 **NRBA Sales Management Seminar.** Welsh Company, Tulsa, Okla. Contact: NRBA, Suite 500, 1705 De Sales St., N.W., Washington, D.C. 20036. (202) 466-2030.

9, 10 **Industrial Sales Workshop,** for manufacturers, distributors, representatives. Hartford Graduate Center, Hartford, Conn. Contact: Hank Lavin, Box 159, Cheshire, Conn. 06410. (203) 272-9121.

11-14 **Consumer Electronics Show.** Chicago. Conrad Hilton Hotel, McCormick Place, McCormick Inn. Contact: CES, 2001 Eye St. N.W., Washington, D.C. 20006. (202) 457-4919.

New York Management Seminars. Contact: Heidi E. Kaplan, 14NR, N.Y. Management Center, 360 Lexington Ave., New York, N.Y. 10017. (212) 953-7262.

1, 2 **Unlocking Creativity.** NYU. Chicago.

5, 7 **Project Management for Engineers.** NYU. Houston, Texas.

8, 9 **The Federal Procurement Process.** U. of Chicago. Los Angeles.

12-14 **Management of New Technology Projects.** NYU. Chicago.

21-23 **Effective Communications for Engineers.** NYU. New York.

22-23 **Industrial Noise Control.** NYU. New York.

22-24 **Understanding Finance for Mfg. & Production Mgmt.** NYU. Chicago.

(continued)

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calendar (cont.)

26-27 **Project Management.** U. of Pennsylvania. London, England.

21-23 **International Exhibition of Professional Recording Equipment.** Connaught Rooms, London, England. Contact: Assoc. of Professional Recording Studios, Att. Mr. E. L. Masek, 23 Chestnut Ave., Chorleywood, Hertfordshire WD3 4HA, England. (Rickmansworth 72907).

26-8/4 **Summer School, New England Conservatory of Music,** including an Electronic Music Workshop, with a portion for the secondary school music educator. Contact: Robert L. Annis, New England Conservatory of Music, 290 Huntington Ave., Boston, Mass. 02115. (617) 262-1120.

JULY

10, 11, 12 **J.B.L. Seminar,** design and installation of sound reinforcement systems. Contact: Ms. Nina Stern, James B. Lansing Sound, Inc., 8500 Balboa Blvd. Northridge, Ca. 91329. (213) 893-8411.

12, 13 **NYU Seminar,** New Products: A Systematic Approach. New York. Contact: Heidi E. Kaplan, Dept. 14 NR, N.Y. Management Center, 360 Lexington Ave., NYC. 10017. (212) 953-7262.

17, 18 **NYU Seminar,** New Products. Toronto, Ontario. Contact: See above..

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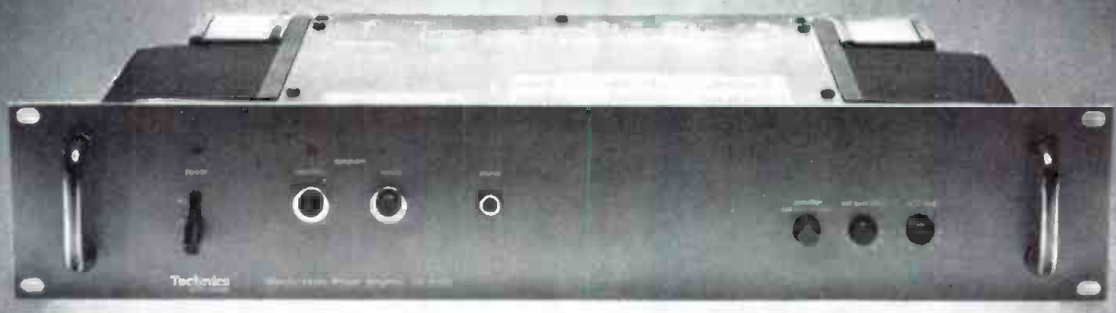
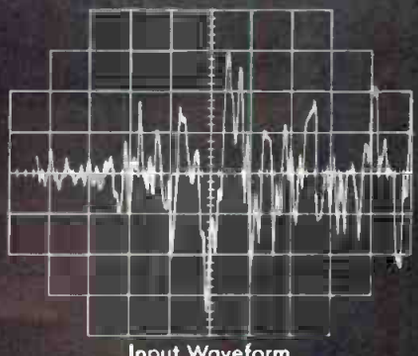


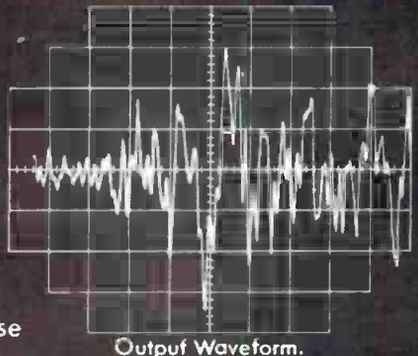
THD as low as 0.02% says a lot about any amplifier. But oscilloscope readings show it all. Look at the waveforms. The output waveform of the SE-9060 is virtually a mirror image of the input.

One way Technics achieved this goal was with dual FETs in the differential amplifier. They give the SE-9060 the DC stability necessary for the highest gain in the crucial first stage. While the constant current load and current feedback used in the voltage amplifier keep distortion to a minimum.

And since the SE-9060 is a DC amplifier, each amplifier section and the NFB loop are directly coupled without the use of any capacitors. So the SE-9060 not only has virtually nonexistent phase shift, it also boasts flat frequency response from DC to 100 kHz. And with completely independent power supplies for each channel, Technics eliminated all signs of transient crosstalk distortion.



Input Waveform.



Output Waveform.

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Technics SE-9060. A rare combination of audio technology. A new standard of audio excellence.

Technics *Professional Series*
by Panasonic

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PATRICK S. FINNEGAN

db Broadcast Sound

Over Equalization

• The average broadcasting station contains numerous equalizers within its audio system. All of these serve useful purposes. But any good thing can be overdone. When equalization is overdone, a number of side effects and problems can result. So, let's take a look at some of these.

PURPOSE

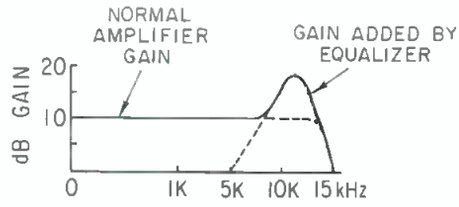
The interconnecting wiring, telephone lines, and interfacing impedance irregularities all tend to produce a poor audio response curve in the system. In the most basic sense, the equalizer is intended to compensate for these response deficiencies in the bandpass of the audio system. Besides the system itself, certain types of equipment, such as the tape recorder and transcription turntable, have response problems because of their special components. These two kinds of equipment require equalizers, which are designed into the units. In other cases, audio equalizers are used to compensate for system noise, such as in the wideband f.m. rf transmission system.

Compensating for system or equipment bandpass deficiencies is not the only use made of equalizers. In production work, for example, the equalizer is used to deliberately distort or reshape the bandpass or segments of the bandpass to produce special effects, or to make the finished work sound the way the producer desires it to sound.

In all these applications, the equalizer or equalizers may be inserted at various places in the audio path. When inserted ahead of the deficient circuit, this is pre-equalization. And when inserted after the deficient circuit, this is post-equalization. Both types of equalization are used, and in many instances, both at the same time, as well as at intermediate points along the path.

OVERLOAD

Perhaps the first most serious problem which can develop when overcompensation is done by the equalizers is amplifier or system overload. This type of problem is more generally associated with cases of pre-equalization, or when special effects are used in the production booth. In the more general case where equalization is needed, the system bandpass is poor. The response curve shows a rolling off at the ends, especially the high end. At this point in the path, the equalizer is inserted, and then adjusted so that it presents a complementary curve to that of the system. Besides this simple equalizer, other more sophisticated units may be used which allow adjustment of various bands of frequencies in the audio spectrum



The gain of the equalizer in the boost area of the bandpass is added to the gain of the amplifier.

The net result of adding the equalizer to the circuit is an increase in gain in the boost area of the bandpass. The amount of boost adjusted into the equalizer is added to the normal system gain at that point. There is little danger from overload if the bandpass of the circuit is very deficient at this point; there will be very little signal energy in the deficient area anyway. But when pre-equalization is done, the system to this point is not deficient, and there can be a considerable amount of signal energy in the boost region. The normal amplitude signal will be increased by the amount of boost. Unless the deficient circuit immediately follows this boosted signal, any amplifiers that follow can be seriously overloaded..

The amplifiers which immediately follow a pre-equalized signal circuit must be operated carefully. Much depends upon the normal operation of these amplifiers and the amount of headroom available. If the headroom is not adequate, the high level signals in the boost area of the bandpass will drive the amplifier stages into nonlinear operation or saturation on signal peaks. Saturation will clip signal peaks, and if the boost is high enough, the stage may also be driven into cutoff on the negative peaks. All these generate various forms of distortion. and so should be avoided.

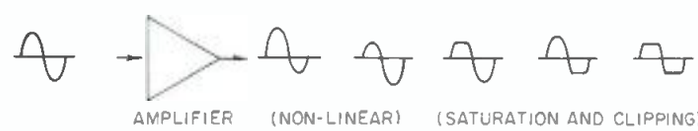
TAPE SATURATION

The audio tape recorder must use equalizers in both the record and the playback units to overcome deficiencies of the head, tape, and to overcome system noise. Pre-equalization will be used in the record unit, while post-equalization is used in the playback unit. The pre-equalization of the record unit is intended to overcome the poor high frequency response of the record head and the tape, and to help boost the upper end of the curve above system noise.

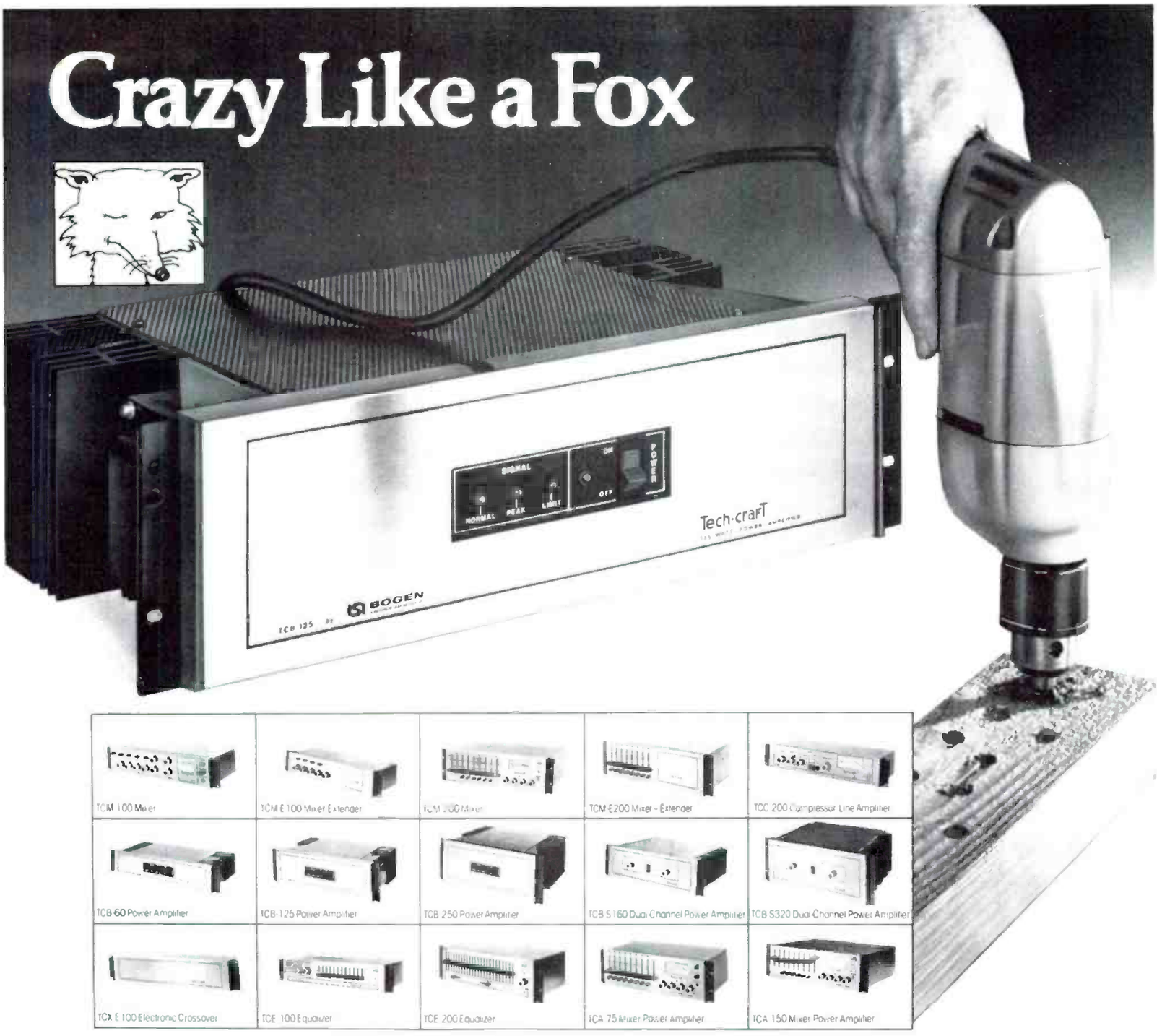
The curve presented by the record unit equalizer is essentially a pre-emphasis curve, that is, one which shows a rapidly rising gain with increase in frequency. The boost at 15 kHz is considerable. In normal program audio, although there may be a high frequency component present, the energy is not too great. A normally adjusted equalizer and sensible input signal levels can handle this without difficulty. But if the signal has high energy content, such as a sine wave tone, or if the equalizer is misadjusted, the signal in the boost area can drive the head and the tape into saturation. This is very similar to an audio stage being driven into saturation, and it will produce similar results in signal quality and distortion. There is still another side-effect; highly saturated tape is difficult to erase.

A tape recorder has its own idiosyncrasies. This is especially true when we use sine wave tone to dynamically align the heads and adjust the equalizers. The method most generally used is to feed sine wave tone into the record unit and then observe the output of the recorder after it has been recovered from the tape, adjusting the head or heads and equalizers to obtain the best results. As anyone knows, poorly aligned heads will produce a very poor response curve. Problems can arise if the heads are out of adjustment, and the engineer overcompensates with the record equalizer to

Some different types of distortion are due to amplifier stage overload.



Crazy Like a Fox



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They are designed with unsurpassed features and specifications for today's sophisticated requirements, highest reliability and total system compatibility. We believe they offer the finest values in professional sound equipment.

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make up for the deficiency. Although the output of the system may be poor because the record and playback heads are not in exact alignment, so long as the record head and tape are in good contact, the full signal will go onto the tape. That highly boosted signal from the overadjustment will cause the head and tape to saturate, with its various forms of distortion.

Sine wave tone contains a much higher frequency energy content than does program audio, so input levels must be considerably lower in tone. If the input level is too high with tone, the tape and head may be deeply into saturation, and the beautifully flat response curve obtained at the output is not a true curve of the tape system and it can be very misleading. This is why the signal level into the recorder should always be *at least 10 dB* below normal program levels for checking the response curve, and 15 dB lower is better yet if the noise problem is not too great.

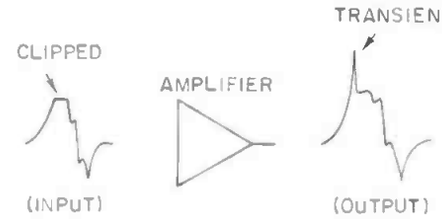
DISTORTION

One of the more common effects which over-equalization can produce is distortion in various forms. When adequate signal is present in the circuit and then given the additional boost by the equalizer, the following stages can be driven into non-linear operation on their input/output curves, positive and negative peaks may be clipped, or tape heads and tape may saturate.

When a stage is driven into its non-linear region, the signal becomes distorted. The peaks might be compressed in relation to the rest of the signal. The compression may take place on one side of the signal only, resulting in unequal peaks. The output signal is not a true replica of that which went into the amplifier and is thus distorted, besides having harmonic distortion added.

Saturation of a stage or tape clips the signal peaks. This is a more serious form of distortion since the peaks are not merely compressed—they are lopped off! Besides seriously distorting the waveform, a very rich supply of harmonics are generated. The flat top

Clipped signal peaks can create transients, and these transients can create more overloading down the chain.



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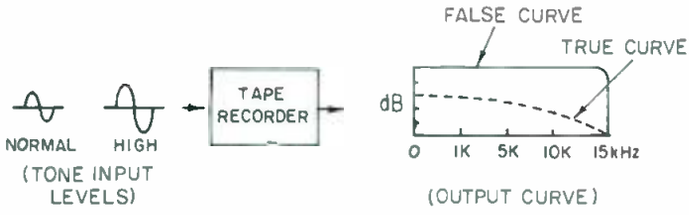


When tone levels into the tape recorder are too high, saturation will produce a flat (but false) output response curve.

peaks can cause further trouble down the line in the form of transients and ringing. When transients do occur, these can cause additional overloading in themselves.

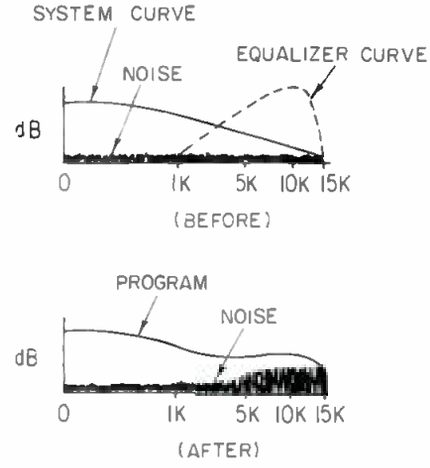
There is yet another by-product of all this. Whether it is non-linear operation or outright clipping, conditions are now present which will allow intermodulation distortion to occur with program signals, further deteriorating the audio quality.

OTHER PROBLEMS

The system gain is changed at the point the equalizer is inserted, regardless of whether it is pre- or post-equalization. The gain at the amplifier which follows the equalizer is the normal gain of the amplifier plus the boost provided by the equalizer. This combined gain varies with the adjustment of the equalizer and the area of the bandpass the equalizer is set to correct. When the equalizer is set very high, as in an overcompensation situation, the gain of the combination in that frequency area is very high and the circuit is very sensitive. Conditions are set for problems to develop. Very strong signals, for example, can shock that sensitive circuit into oscillation. This may not be a sustained oscillation, but may occur only on peaks. This is a form of distortion, although we may consider it as spurious interference. The oscillation and frequency depend upon the components and setting of the equalizer and may not be at the frequency we would expect. Besides that, the oscillations can create beats with the program signals and further clutter up the quality.

NOISE

Noise problems can also be created or emphasized by over-equalization. This is more generally associated with post-equalization, but not always. If the equalizer/amplifier/gain combination is very high because of maladjustment and the program signal in the equalized area is very weak or non-existent, circuit noise will be amplified. This can seriously erode the system signal-to-noise ratio. Some circuits have a normally high noise factor anyway, for example, tape, telephone lines, and so forth. But other circuit problems may be creating noise levels that are higher than normal, such as a noisy resistor, capacitor, transistor, or strong rf fields around a transmitter. Without a reasonably good signal in that area of the bandpass, the noise will be amplified considerably. Lack of signal response, however, is often the very reason we attempt to overcompensate with the equalizers and create more problems than we cure!



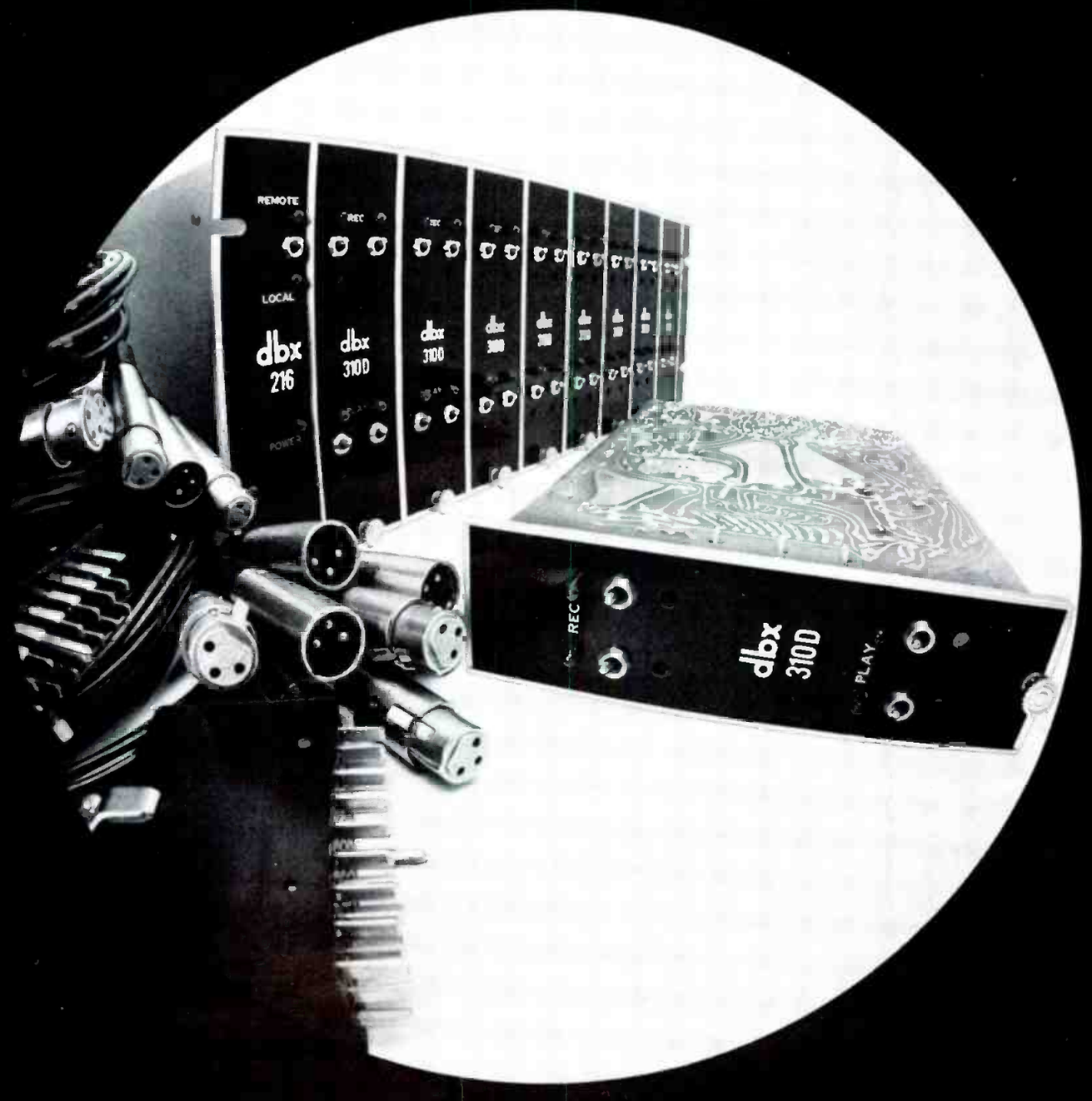
The boost area of the equalizer will also boost the noise in that area of the bandpass.

Pre-equalization can also create noise problems. To prevent the various forms of distortion we discussed earlier, the operator may *reduce* the gain of the system that follows the equalizer. This action will keep the signal peaks in the boost area from overloading amplifiers, but the non-equalized portion of the signal is now at a much lower level. So consequently, the signal-to-noise ratio in *that* part of the bandpass will now suffer.

RECAP

Equalization of audio systems is both necessary and desirable. But we must be careful not to overdo it. Over-equalization can create many side effects that can outweigh the desired results we had hoped to obtain with equalization. ■

this dbx 216 comes with pre-assembled cables and connectors and a free spare plug-in module



something to think about if you've ever wired in a Dolby M16

dbx noise elimination

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NORMAN S. CROWHURST

db Theory & Practice

Putting It All Together

● Some people would like to think that they know it all, and can trot out answers as required. A related attitude is the expectation that every question must have just a simple, direct answer. In last September's issue, the letter from Harrison J. Klein, Chief Engineer of a radio station in Seattle, and my reply, drew responses from all over the world. As I write this, I have just received a comment from Australia.

In the last column, I discussed what quadriphonic sound can add to the two-channel variety of stereo, merely as a matter of principle or basic theory. What most people want to know is how to install properly quadriphonic equipment in their rooms at home, where they plan to do their listening. The point is not to follow set rules blindly, but to understand the basic principles that make the rules work.

From what I have already said, in the well-damped, or "dead" room, there is little problem. Just find places for the four loudspeakers, using a type that radiates in as diffuse a manner as possible so all the loudspeakers can be heard from any part of the room.

But plushly furnished rooms are not the predominant type. Audiophiles also want to have good reproductions in a room which is full of reflections. Perhaps quadriphonic is of doubtful advantage to them. But how is someone with such a room to play recordings or programs that are issued only in quadriphonic sound?

That is a good question and perhaps worthy of some further thought. What are the extra two channels supposed to do? Primarily they were seen necessary to provide ambience, that sense of being surrounded by the program. This was mainly needed in the "dead" room environment. The live room has its own ambience.

But those extra channels can do more than that. Even as a means of conveying ambience, they can supply the impression of quite a variety of different rooms. And they can also provide new effects, such as sounds originating from the back of the room, or auditorium as well as at the front where the stage usually is situated.

REFLECTION

When I discussed two-channel stereo, I looked at ways to use the reflective properties of the room, rather than have them fight you. Can we do the same with 4-channel? Why not? Let us think about what reflection does.

You must have been in a room

where one whole wall, or most of it, was covered with mirror, or perhaps more than one wall. What is its visual effect? It makes the room look twice as big, doesn't it? A glass mirror also makes a very good sound reflector at all frequencies, so the aural effect matches the visual effect.

If the rest of the room is furnished absorptively, the effect is consistent with what you see. But how about reproduction? You have no way of making sound seem to come from the looking-glass room" do you. Or do you? Maybe that is worth thinking about.

You cannot get loudspeakers over into the looking glass room, it is true. But maybe you could direct loudspeakers in such a way that you hear them predominantly after the sound has been reflected by the mirror. How you would use that effect may take some thinking about, but it is an idea.

However that is a rather special case. There must be a great many more rooms where all the walls, floors and ceilings are more reflective than they are absorbent, for which I described some ways of treating for 2-channel stereo. Can we just double up on that, to get 4-channel stereo?

WHERE TO PUT IMAGE SOURCE

If you are going to rely on reflections, as in the case where we used units in the end of a console to direct sound at the walls, to produce an image source for each loudspeaker, then you need to think about where each such image source needs to be, to make the composite system.

What if you point a loudspeaker unit — and in any of this "pointing" we must be thinking about units with an appreciable degree of directionality — into a corner? You are pointing it into a right angle convergence between two walls. It will not produce an image along the diagonal formed at the corner, because that is not how reflection occurs.

What it will produce, academically at any rate, is two images, one from each wall. Thus if your unit is two feet from each wall, pointed into the corner, there will be an image two feet behind each wall, produced by the same loudspeaker unit. This means that, provided the distance is not too great, the apparent source will be midway between these two images. Where is that?

If you join the two image sources, you will draw a line right through the corner where the two walls join. Thus, by this means you cannot really push the sound back much, as you did when you directed the sound mainly at one wall.

The other useful trick, with 2-channel sound, was to use open-backed loudspeaker units, instead of closed-back pressure radiators. Forgetting about reflections for the moment, if you place yourself equidistant between two closed-back units fed with single-channel sound, the apparent source will be mid-way between them.

Now, you move yourself away from that equidistant position, and you begin to receive more sound energy from the nearer unit, with the result that the apparent sound source moves from midway, toward the nearer unit. That effect is present even in a well-damped room with few reflections. Reflections complicate it, confuse the sound.

Now consider using two open-backed units, angled in so that your first listening position is equidistant from both of them and they both face you directly. From that one position the effect will be not unlike that with the closed back units, because the sound you hear will come directly from the front of each. With equal

intensity, single-channel sound, the apparent source will again be midway between the units.

Now think of what happens when you move aside. First of all, consider the sound from one unit; then we will think about two, and later we can get to four. When you are directly in front of an open-backed unit or directly behind it, the sound-wave particle movement is longitudinal, directly back and forth along a line from yourself to the loudspeaker.

When you put yourself edge-on to such a unit, the particle movement is also edge-on to a line from you to the unit. While you moved 90 degrees of a circular trip around the unit, the particle movement has turned 180 degrees. Now consider what this means. for moving just a little way off axis. It means that if you move to the right. the apparent source of sound will move to the left.

So moving away from the middle position, the apparent source of the right loudspeaker, as you move to the right, will move to the left and the apparent source of the left loudspeaker will also move to the left. Thus the apparent position of the right unit will move in, toward the center, and the apparent source of the left unit will move out, further left.

APPARENT SOURCE

The combination will determine the apparent source. You are still moving closer to the right unit, so its apparent position will influence the combination's apparent position more than the unit from which you have moved away. But the two effects offset one another so that the sound still appears to come from midway between the two units, which is the center of that side of the room, or thereabouts.

If you now think of four units facing inward toward a central listening position, or approximately so, then you have a means of moving the apparent source anywhere around the walls by changing combinations of relative intensity from the different units. The effect we have just described will mean that those same positions will hold when your listening position leaves its central location.

But what about reflections, which are the real bane of highly reflective rooms? This is where the open-backed loudspeaker really gains the advantage. As previous studies have shown, the apparent position of sound depends on the first, direct sound, and on its being reasonably stronger in intensity than reflected sounds. The problem with closed-back units is that sound intensity diminishes with distance on the inverse square law.

This means that reflective surfaces may deliver reflected sounds not too much lower in intensity, on a dB scale, than original sounds. The confusion factor is high. But the open-backed unit has a reduction in particle movement that starts out on a cube-law reduction, or higher, until the radiation becomes longitudinal, which is the same as that of the closed back type.

OPEN BACK DIAPHRAGM

The open-back diaphragm moves more easily, moving more air, than the closed-back type, because the closed back unit first spends more of its energy inside the box, compressing and rarefying air that goes nowhere, than it does radiating sound outside. The open-back unit moves much more air out in the room, most of which is of this rapidly reducing amplitude-with-distance, at angles other than longitudinal.

Thus the listener is within this special intensity air movement, that gives the illusion of the direct sound source, while movements that get reflected by the walls diminish to a level comparable with vibrations produced by the closed back type. True. these reflected waves still produce additional reverberation. But it is such as to be characteristic of the room, and of lower intensity than the synthesized "direct" sound that gives the desired effect directly to the listener. wherever he may be located.

The foregoing discussion has been somewhat idealized. It assumes you can place any kind of loudspeaker just where it will do the best job, which probably is seldom true. After all. rooms are primarily to be occupied for various purposes other than listening to reproduced sound, so placement of the loudspeaker must suit the room, where doors and windows are located, and other little things like that.

When you have four loudspeakers to place, finding a position, or four positions, that will result in proper symmetry may be difficult. So you may need to experiment, whichever type of loudspeaker you find best suited. But knowing what you are trying to do is always a big help. Which comes back to our first point. Understanding principles is always better than trying to follow rules or simple "pat" answers intended to "make things easy." ■

MARTIN DICKSTEIN

db Sound With Images

How To Produce An Audio-Visual Show

● Speaking of a/v programmers, as we have been doing for the past two or three months in this corner, here's just one more. Only this one is slightly different.

Back a couple of months ago, a combined show/seminar was put on by AVL, manufacturers of programming equipment ranging from the "real-time" type which puts a tone on a second track of audio tape while the show is going on, to the very complex multi-cue memory/20 cues-per-second/digital readout type which has to be programmed "off-the-line" for full effectiveness. For three days, the equipment was demonstrated with a special show called *Visual Experience*, which kept the images hopping and dancing (literally, with a couple doing the tango across three screens) for some eye- and mind-boggling effects. This was followed by a two-day seminar under the auspices of the Institute for Multi-Image Education. The whole week's affair was primarily sponsored to provide those attending with a visual experience of the capabilities of AVL's equipment, but the seminar was unique in that it offered a chance to find how to put together an audio-visual presentation and how to best make use of the potential that programming, at any complexity level, offers.

The students included heads of the audio-visual groups of various industrial organizations, an advertising agency, production houses, etc. To assist them with their education, they were given copies of a hard cover loose leaf book entitled *The Experience*, written by Robert E. Ertel, who also taught the material. The book (subtitled "A Path To Multi-Image And Audio Visual Production") has a rather extensive table of contents with section headings such as, "Why Should You Produce A Show?," "Preplanning," "The Script," "The Storyboard," "Photography," "Graphics," "Audio," and of course, "Programming," among others. The last two sections give screen formats and and a list of definitions

and terms. In addition, to enhance the interest of the material further, each section is abundantly illustrated with both drawings and photographs at the left of each page of the book wherever it was thought necessary.

PREPLANNING

In the section on *Pre-planning*, the subtopics discussed are: the audience, the facilities, and the medium. In the audience section, the material focusses on the vitally important questions of the age of the audience, who they are, their experience and knowledge of the subject matter to be presented, the question as to whether they were compelled to attend or came of their own free will, and the size of the group.

The *Facilities* section discusses some of the subjects with which every audio visual person must be very familiar: the size, obstructions, screen size, projection distance, power requirements and outlets, height of the ceiling, sound equipment, seating, etc. This leads into the next topic of what medium would be best to use—perhaps something as simple as a blackboard, a flip chart, or an overhead projector or the more involved film strip and film projector, slides, video, and screen format and multi-image presentation.

PRODUCTION

The *Script* section deals fully with the way to build a complete script from the beginning. Examples of how to organize the material to be included are given along with a discussion on bridging of topics, evaluating the outcome of the script presentation, and so on. Similarly, the *Storyboard* section gives a fully illustrated study on how to add visuals to the script.

After this, the subject material gets really involved. First, under *Photography*, there is a discussion on slide formats—their shapes, how they go together on side-by-side presentation, how to shoot indoors, outside, on table tops, for multi-images or for panoramas, even a study on camera lenses, including an explanation of fragmentation, which consists of the very intricate process of shooting images in different segments of the slide area, the variety of parts in precise locations on the slide forming a desired pattern such as animation when projected in a proper sequence by high-speed programming. Then, there's registration of slides, how to set up for multi-imaging, and more.

Graphics goes through a thorough discourse on making bar charts, graphs, lettering, proper size of image material, use of symbols, etc.

The material on *Audio* goes into head and track configuration for multi-track work in either mono or stereo, recording procedures, mixing of music and sound effects (sfx) and gives specific examples on how certain mixes can be made from different sources, editing and splicing of tape with examples, and even provides some sources for material.

The student is then taken to a "getting it together" session in which an explanation is given on how to set up trays, inserting slides to assure proper order in multi-projector showings, and finally into programming the show. Using AVL equipment for explanatory purposes, examples are given of how to produce the desired action of images on the multi-screens. Upon completion of the course, the attendees are then equipped to present to their superiors the philosophy of multi-imaging using a multi-projector and multi-screen presentation, according to Mr. Ertel's methods. The decision, of course, still to be made is when to use this sometimes overwhelming visual experience, and when to remain at the one-image, one-projector, manually-controlled show stage.

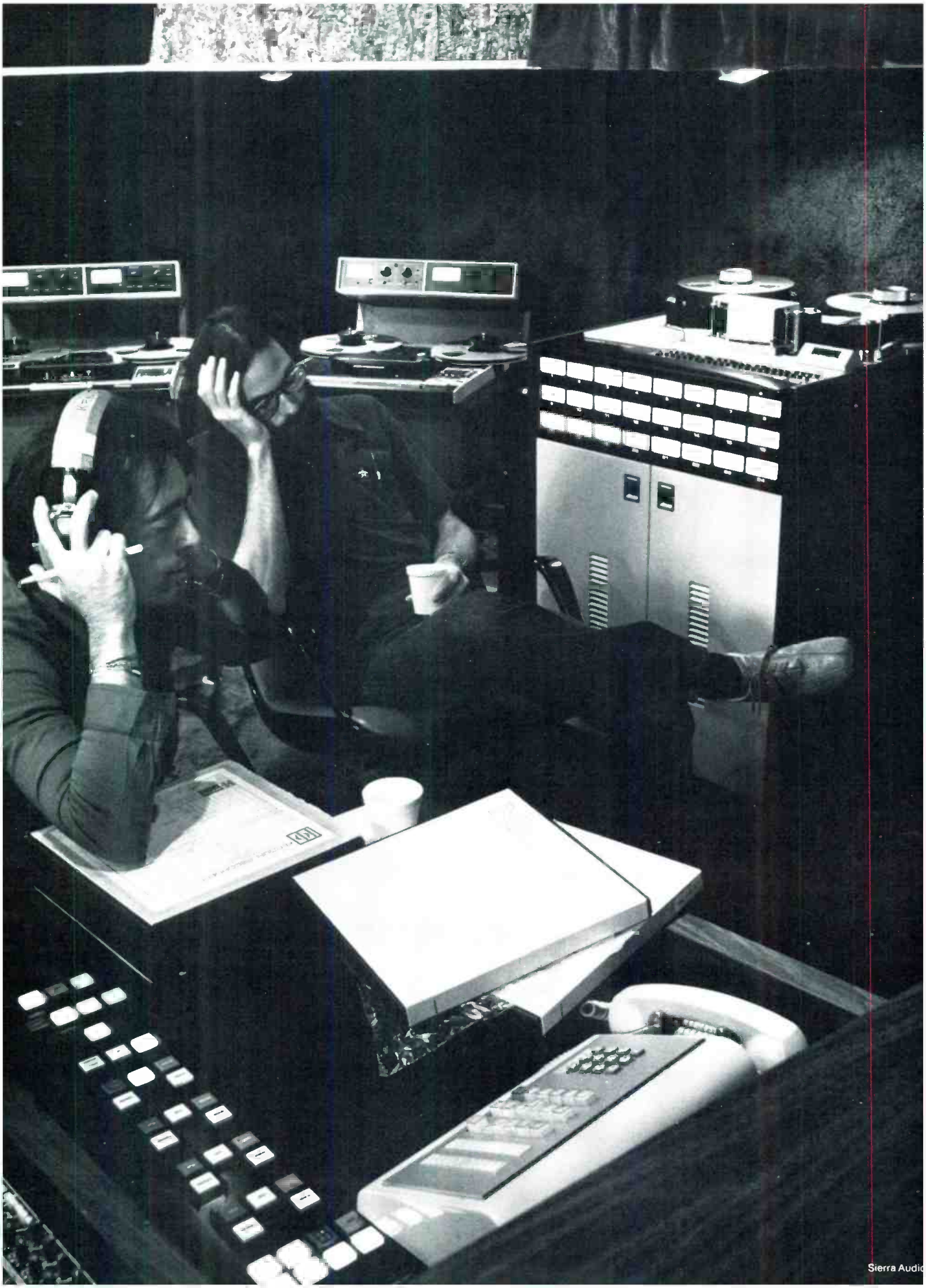
This last question was a problem some of the attendees expressed over lunch one day at the session. A few of the people wondered if there were some guideline which they could use to judge when to go up or down in number and speed. Another person wondered about compatability between the units used in the course and those of other manufacturers. Still another asked about using the drums with 140 slots and how this would work in multi-imaging. Each question and solutions were discussed among the attendees and the representatives of AVL, hopefully to everyone's satisfaction. All in all, it was an interesting session.

FIFTEEN PROJECTORS

AVL then set up a similar show using 15 slide projectors (six on the left screen, six on the right, and three in the middle), at a brand new company in New York which will handle the AVL line of equipment. When Audio Visual Workshop had its housewarming party, the guests packing the large facility saw the equipment do its stuff. Charles Spataro, who hosted the party and runs the show at the new company, invited everyone to see the show, the equipment, his stock of rentable devices, and his facility for program-

ming shows in his demonstration room. He sells equipment, has a fully staffed audio visual repair department, and can do just about everything in the a/v business. This service of programming multi-image shows is rather unique, and can be rented when necessary. The purchase of a proper playback module will then permit the show to go on the road. Charlie can be reached at 333 W. 52 St., N.Y. 10019 and 212-245-5020.

Incidentally, as long as I was discussing slides and multi-images, I thought I might mention that Berkey K+L Custom Services in New York City, has produced a process whereby they can get 16 slides shot on a super 2¼ x 2¼ in. slide, called *super-fiche*, to show not only what's on the slide itself, but also what is on the mount. This is an easy way to keep track of slides in a multi-slide storage system. Projecting the full slide on a square screen will show in some detail which slide shows what and makes it easier to pick slides for presentations. Maybe even the whole slide can be shown with its 16 separate images. Think of how this would work in a fast programming sequence. ■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db New Products & Services

DISTORTION ANALYZER

• True rms distortion analyzer/ a.c. voltmeter/low-distortion oscillator Model 339A Distortion Measurement Set is capable of making harmonic distortion measurements as low as 0.0018 per cent from 10 Hz to 110 kHz, including harmonics to 330 kHz. The set measures thd from 0.01 per cent full scale to 100 per cent full scale (−80 dB to 0 dB) in nine ranges. Frequency resolution is two digits over the full range. Automatic set level and nulling is standard in the instrument. Accuracy claimed is ± 1 dB from 20 Hz to 20 kHz. As a low-distortion oscillator, the 339A provides a sine wave output from 10 Hz to 110 kHz. distortion claimed 0.0018 per cent.
Mfr: Hewlett Packard
Price: $1,900.00.
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POWER AMPS

• Basic amplifier Models CP120 and CP500 may be operated as two independent channels or as a single-channel unit in bridged configuration. Model CP120 is rated at 61 watts per channel, 122 bridged; Model CP500, rated at 255 watts per channel, is capable of 510 watts output bridged. Model CP500M, variation of CP500. also includes true peak-reading meters, blown fuse indicator, and a thermal production indicator. The amps are designed for 4-ohm operation. Unique to these amplifiers is the patented PowerLock™ feature, which senses any large input signals that could cause prolonged clipping, then controls the output level during the period of time that would be otherwise be perceived as clipping distortion. Normal music transients less than one msec. in duration are allowed to pass unaltered. Overload protection is provided by three threshold settings. Other features include peak-stretching l.e.d.s and l.e.d. drive circuitry, as well as relay load coupling.
Mfr: TAPCO
Price:$339.00 — $779.00.
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COLOR-CODED CABLE

• Easy circuit identification is possible for PVC Signal Tape Cable by referring to a choice of ten colors repeated from reference edges. The flat flexible cable comes in widths from 10 to 60 conductors. Composition consists of 28 (7/36) stranded tinned copper conductor, meeting UL requirements and VM-1 flammability standards. Insulation is 0.009 inch solid color self-extinguishing PVC. The cable is available in bulk cable in continuous lengths on reels, jumpers cut to length and/or stripped and tinned at both ends, and harnesses terminated to printed circuit boards. connectors, etc.
Mfr: Brand-Rex Co.
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WIDEBAND ELECTRET MICROPHONE

• A high gain, low noise amplifier powered by a single 1.5V size AA battery is contained in Model DX-30V electret condenser microphone. The cardioid mic presents either a 600 ohm or 50,000 ohm output impedance to its load as required. Frequency response is 20 to 18,000 Hz; high or low impedance sensitivities are −48 dB or −62 dB. The unit is supplied with a 20 foot cable, ¼-in. phone plug and on-off switch.
Mfr: Mura Corp.
Price: $69.95.
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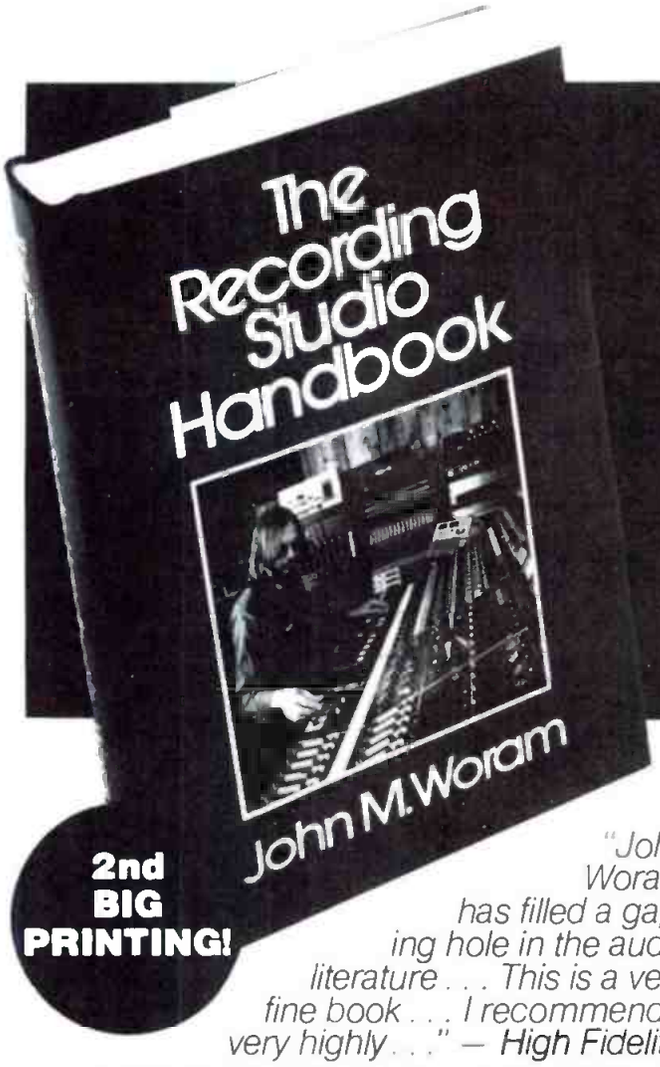

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• More than 50 aids for the engineer or draftsman are included in Kit JTK-81, housed in an attache case. Among the drawing accessories are a portable drawing board, templates, curves, triangles, ruler, knife, magnifier, pens, pencils, as well as a 13-piece precision drawing instrument set in a fitted velvet-lined case. There is a three-compartment file in the lid of the carrying case for drawings and two additional pockets on the front panel.
Mfr: Jensen Tools & Alloys
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TIME ANALYZER

• Completely self-contained a.c. battery operated one-third octave Model 500 Acoustic Analyzer displays wideband or weighted sound pressure levels in each one-third octave from 25 Hz to 20 kHz on a 13 by 31 l.e.d. matrix display with either peak or selectable averaging response. The reference level can be varied manually or automatically. The device displays reverberation time up to 10 seconds with 10 msec. resolution for either 15 or 30 dB decay, the decay plot graphed on the l.e.d. matrix and reverberation time shown on the digital display. The analyzer is equipped with a built-in pink noise generator that produces broadband noise for response measurement or octave-band noise for reverberation analysis. Also included are a keyboard control panel, two independent memories, data and oscilloscope outputs, and a choice of microphone or line input.
Mfr: Inovonics, Inc.
Price: $2,750.00.
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BASS DRIVERS

• Ruggedly designed Series PA 75 12-inch drivers encompasses four models, each tailored for a specific end use application—disco music, p.a., or studio monitoring. All of the drivers consist of a heavy cast six-spoke frame capable of supporting heavy weights, coupled to an unusually large magnetic structure. The gap length is large enough to accommodate large cone excursions. Heat dissipation is handled by materials similar to those used on automobile brakes; the precision edge-wound voice coil permits a narrow air-gap that improves heat transfer to the magnetic structure. Bass models use a special aluminum bobbin for maximum heat transfer. Fiber and resin content in the cones have been individually proportioned to provide optimum frequency response and minimum distortion for the specific application intended for that model of driver. A titanium alloy dust cap thermally bonded to the voice coil provides smoothly extended high end performance. All of the drivers are rated for power handling capacity of 150 watts continuous sine wave power, with voice coil impedances of 8 or 16 ohms.
Mfr: Forsythe Audio Systems
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MIXER/PREAMPLIFIER

● Offering three stereo turntable inputs, DMX-1 mixer/preamplifier also contains a stereo tape deck and microphone inputs, each with its own volume control. The mic input has its own equalizer. The portable compact unit also features complete program equalization in three bands, slide faders, a headphone jack with an adjustable volume control, program squelch for talkovers, and two sets of outputs with separate master controls. The back panel has an accessory jack for tape, reverb, or echo. A built-in preamplifier is capable of driving more than one high-powered amplifier. Panning control is included.
Mfr: Audio Speaker Techtronics, Inc.
Price: $575.00.
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CONTROL ROOM MONITOR

● A dome-shaped tweeter minimizes phase errors occurring in the Regency tapered acoustical line/semi-labyrinth loading stereo monitor loudspeaker. The unit is tri-amped for focus on power distribution. Additional fidelity is ensured through horn-loading and an aperiodic double chamber construction, unique voice-coil form, six-edged wire winding technique, hi-temp bonding material, and liquid-cooling system. The aperiodic double chamber construction, together with magnetic liquid in the air-gap removes basic resonances. Other features include a staggered driver arrangement to control diffraction effects, driver spacing, phase-corrected crossover design, and a telescopic dual tube for controlling resonance. Each speaker pair is audibly and symmetrically mirror imaged.
Mfr: Kustom Acoustics
Price: $389.00.
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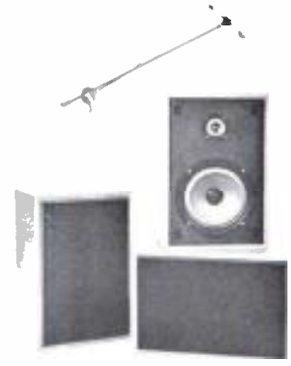
LITTLE RED MONITOR

● Compact Little Red Studio Monitors incorporate honeycomb wound air coils and mylar capacitors. Included are mid-frequency and high-frequency equalizers. The monitors are available not only in characteristic deep red, but in other colors, as well as wood finishes of epoxy Formica. Each unit weighs 45 pounds.
Mfr: Audiomarketing Ltd.
Price: $440 per pair.
Circle 60 on Reader Service Card



TWO-WAY SPEAKER

● Precise selection of construction materials add to the efficiency of Model SB-4500 linear phase two-way speaker system. The wide-range cone tweeter is made of a synthetic resin that prevents air-leakage around the tweeter and supports it with high compliance, also acoustically isolating it from the cabinet. The voice-coil is made of copper-clad aluminum wire to increase conductivity and heat dispersion. The crossover network is designed for precise waveform fidelity. The 10 in. woofer, 2⅜ in. tweeter and wide-range drivers are placed to create linear phase response with even sound distribution. A light strong woofer, made of corrugated pulp, permits a response from deep bass up to 4 kHz, utilizing the cone's linear-phase range while leaving the midrange free of partial vibration and undesirable peaks. The woofer has been placed away from floor level to reduce boom floor effects. A vented cabinet enhances bass reproduction. The system handles peak power up to 75 watts with 92.5 db/W/m efficiency.

Mfr: Technics by Panasonic
Price: $149.95.
Circle 64 on Reader Service Card

TRANSIENT NOISE ELIMINATOR

● Recordings that are not badly enough damaged to discard, but have developed medium and small ticks and pops because of scratches, dirt, and imperfections can be brought back to serene clarity by using the Model 7000 Transient Noise Eliminator. The device makes fine discrimination between transient noise and music, filtering out undesirables. An 80-600 millionths of a second off-time minimizes the disturbance to the signal. Switch spike cancellation cancels out any noise introduced by the filtering action. A time delay of 40 millionths of a second avoids psycho-acoustic side effects.

Mfr: Burwen Research
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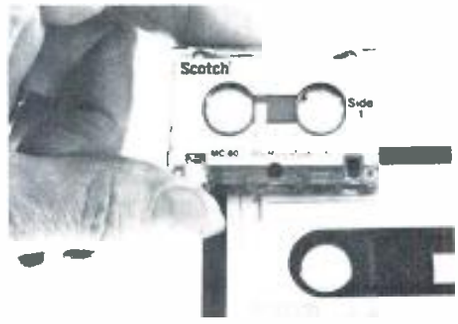
MICROCASSETTE

● Tiny 60-minute MC-60 microcassette, about one-sixth the size of a standard cassette, is compatible with Olympic, Panasonic, and Sony microcassette recorders, as well as with Lanier microcassette dictating equipment. Operating at 2.4 cm per second, the cassette delivers 30 minutes per side. It will be suitable for projected combination transistor radio/tape recorders now on manufacturers' drawing boards.



Mfr: 3M Company
Price: $7.99 for two.
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CLEANER/DEGREASER

● When used with an aerosol pulsating attachment, Electro-Wash gives electronic equipment a penetrating scrubbing that simulates a more expensive ultrasonic bath. The chemical, a concentrated blend of Freon solvents, penetrates, loosens, and washes away accumulated grease, dirt, and oxidation from even the most delicate parts. It is safe for plastics, evaporates quickly without leaving a residue, and is non-inflammable. The ingredients are designed to minimize pollution. An extension tube on the Vibra-Jet spray leads 12 inches into hidden crevices.
Mfr: Chemtronics, Inc.
Price: 24 oz. can: $3.80.
Circle 67 on Reader Service Card

AUDIOFILE TROLLEY

● Obediently rollaround, the Audiofile Trolley, made of brushed matte finished aluminum, will handle up to 400 pounds of stereo and hi-fi equipment with a rack mount capability. Amplifiers, tuners, etc. are mounted with a system of nuts from the front; individual units may be removed at will. The unit includes a shelf for holding a turntable.
Mfr: Hammond Industries
Price: $169.95.
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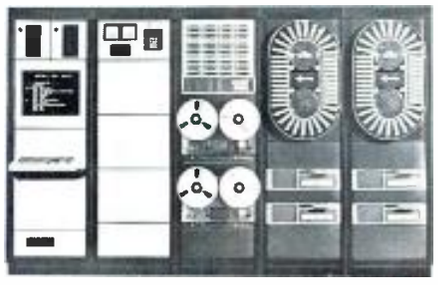
PHANTOM-POWERED CONDENSER

● Versatile 48V Phantom-Powered Condensor consists of one preamp/shaft and four interchangeable head capsules. The capsules include two omni-directional and two cardioid patterns, with one of each pattern incorporating a windscreen. Power source, as an alternative to a 48V line, is available externally for both balanced and unbalanced operation. Also available is a lapel clip-on condensor and its 18V power supply.
Mfr: Beyer Dynamic
Circle 50 on Reader Service Card

MODULAR PROGRAMMING

● Segments of a program can be given a label, stored and recalled in a bloc in the Basic A system, which uses modular storage. The system provides for 4,000 schedule entries, expandable in groups of 2,000. Features include real-time event control, conditional control, and programmable audio on and off fade control for each audio source. Combined with the 1K ITC playback unit, the system operates to furnish large capacity cartridge playback.
Mfr: IGM
Circle 51 on Reader Service Card



LIVE MUSIC MIXER

● Sound reinforcement mixing board Trouper I Stereo is a stereo version of this manufacturer's Trouper I. Features include low-Z balanced input: high-Z input and in/out jack on each channel; pan pot for shifting the acoustical image from left to right; echo send pan pot for switching the echo from side to side. Two built-in spring reverbs coincide and two sets of effects jacks furnish two more pannable outputs. Input characteristics include 20 dB of mic attenuation: monitor and echo sends; three-band graphic e.q.; solo switch; and input level control. Output features include House left and right level controls and outputs, monitor level control and output. In addition there are echo send/receive jacks, left and right; stereo headphone level controls and jack; two solid state l.e.d. vu meters providing average and peak reading information on individual inputs and outputs through the solo system.
Mfr: Uni-Sync, Inc.
Price: Control module: $898;
Expander: $838.
Circle 52 on Reader Service Card

DISTORTION ANALYZER

● Multi-purpose Model 3000C distortion analyzer features auto-nulling distortion measurement with thd residuals of typically 0.002 per cent, isolated internal oscillator, true output power and line power consumption measurements, built-in 8 ohm loads and 4-channel capability. It has a square wave generator, RIAA attenuator, a.c. voltmeter, and digital readout of all measurement results. Optionally available is an intermodulation distortion analyzer.
Mfr: BPI Audio Test Instruments
Price: $1,795.00.
Circle 53 on Reader Service Card

db New Literature

REP DIRECTORY

The 1978 directory, listing over 140 local representatives and 1400 manufacturers, available free from the Southern California Chapter, Electronic Representatives Assoc., 2387 Craftsman Rd., Calabasas, Ca. 91302.

LOW DISTORTION OSCILLATOR

Brochure on the Fleximix System and the Trident low distortion oscillator with digital frequency counter. Mfr: Sound 80, Inc., 2709 E. 25th St., Minneapolis, Minn. 55406.

MICROCOMPUTERS

A 52-page mail order catalog covering microcomputers, accessories, software, parts, and literature: kits or assembled units. Mfr: Tandy Computers, Dept. R7, P.O. Box 2932, Fort Worth, Texas 76101.

CONSUMER ELECTRONICS

Economic report on t.v., video systems & games, radios, audio compacts, tape equipment, home computers, calculators, CB equipment. Graphs and tables showing dollar and quantity fluctuations. Good for school math use. Publisher: Electronic Industries Association, 2001 Eye St., N.W., Washington, D.C. 20006.

MICROPHONES/HEADSETS

Catalog describing a variety of microphones, headsets, and accessories. Mfr: Mura Corp., 177 Cantiague Rock Rd., Westbury, N.Y. 11590.

ELECTRONIC COMPONENTS

Extensive, 104 page, catalog details about 10,000 items in electronic components or hardware. Mfr: Herman H. Smith, Inc., 812 Snediker Ave., Brooklyn, N.Y. 11207.

ELECTRONIC COUNTERS

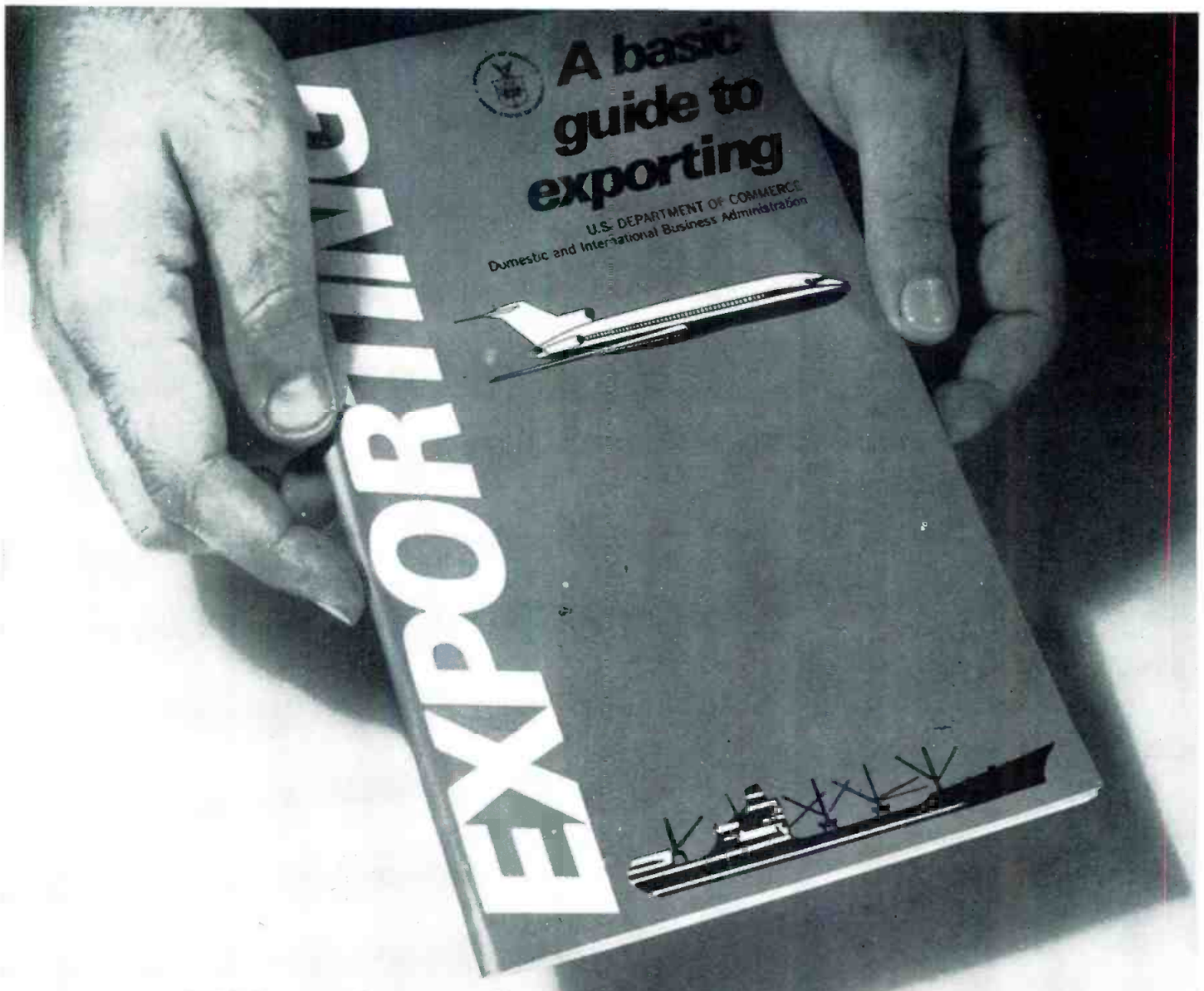
Specifications for counters ranging from "frequency-only" to high-speed universal and microwave counters are covered in a 6-page brochure. Mfr: Hewlett-Packard Co., 1507 Page Mill Rd., Palo Alto, Ca. 94304.

SEMICONDUCTOR ACCESSORIES

Handsome 67-page catalog with ring-binder holes gives very detailed, including diagrams, descriptions of heat sinks, coolers, insulators, and accessories. Mfr: Thermaloy, Inc. P.O. Box 34829, Dallas, Texas 75234.

PACKAGED SOUND SYSTEMS

A four-page leaflet describes speakers and sound columns, including photos of suggested applications. Mfr: Argos Sound, 600 S. Sycamore St., Genoa, Ill. 60135.



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Editorial

In March of this year, we attended the Audio Engineering Society's 59th convention in Hamburg, Germany. As John Woram's **Report From Hamburg** reminds us. ". . . we are well on our way into a new era of audio technology. and there's no turning back."

So, when we returned from Germany, we thought it would be a good idea to ask Ronald Ajemian to come back and tell us a little something more about the building blocks of digital audio. He obliged with the **Anatomy of Digital Logic—Part II,** and now we know a little more about digital logic.

Will the recording session of the future be run by a computer programmer? Hopefully not. if we don't lose sight of **The Lost Art of Recording.** Author Arlen H. Smith looks back at a simpler era, when there was no such thing as "We'll fix it in the mix." He reminds us that. in many cases, simpler is better—despite the marvels of multi-track. So, before you're upstaged by a microprocessor. try some good old fashioned two-track stereo. You may be pleased with the results.

We conclude with **An Educational Postscript,** in an effort to keep up to date with what's happening in school.

J.M.W.

"FOR THE FIRST TIME RECORD PEOPLE AND MOVIE PEOPLE HAVE REALLY PULLED IT TOGETHER."

Quincy Jones

It's not surprising that Quincy Jones sometimes feels like he was born in a studio. He's performed on, composed for, or produced over a thousand albums. Right now he's finishing his first musical, Sidney Lumet's version of The Wizard of Oz, The Wiz, starring Diana Ross.

While Quincy is one Jones that's impossible to keep up with, we were able to catch him briefly to find out his views on the current recording scene, his latest work, and "Scotch" 250 Mastering Tape.

The only thing Dizzy Gillespie, Andy Williams, Peggy Lee, and Ringo Starr have in common is that they've all worked with you. How can you work in so many musical styles?

"I don't get hung up in any bags. When I was studying in Paris, a teacher told me once, there were only twelve notes, so you should find out what everybody's done with them, because they're the same twelve notes that Palestrina was scuffling with. So I can live with the best of all different areas. I like that, you know. The menu is broad, man—eat everything."

There are a lot of movie scores that have turned into some pretty hot albums lately, Saturday Night Fever, for example...

"You know why I think it's happening? It's just a guess... for the first time record people and film people are basically the same people and they've really pulled it together.

"Of all the films I did, the thing that bugged me the most was that we'd be in the studio and the music would boom down at you, and when you got to the theatre it was almost like a rumor, all the bottom end and the top end falls off. Then Dolby came along and they got *A Star is Born, Star Wars, Close Encounters,* and *Saturday Night Fever.*

"Those are successful record-wise because for the first time people actually hear the music in the track, really hear it. We've got a new kind of sound system now with Dolby. Emotionally it hits you from a place you're not even aware of."

Is it technically harder to achieve what you want in a musical as opposed to doing a score for a dramatic film?

"Oh yeah, in *The Wiz* we've got choral things that go up to 80 and 120 voices, so to get a good lip sync we decided to use just two voices for guide tracks, almost like a Polaroid. After their mouths are moving in the right way, then we sit down and put the sweetening on the dance and singing numbers."

So the music is composed simultaneously with the filming?

"They've been sending me out dailies on videotape from New York because the color really turns me on. You get it at 2 o'clock in the morning and look at the reel about ten times. You have to eat it. That's the best homework you can do for a film."

You're a big user of "Scotch" 250. Do you find that it has a clean sound? That's one of the things we've been selling the tape on.

"That's right.

"It's like with film stock, you know. When you've got 800 people out there on a set, I don't care what happens on that performance, if it isn't recorded on camera, it's all over. And it's the same in the recording studio; everything else is superfluous.

"No matter how great a song we get, or performance or balance or anything else, if that same thing isn't reproduced and captured on that tape, nothing we do means a thing.

"That's why we stay with 'Scotch.'"

RONALD AJEMIAN

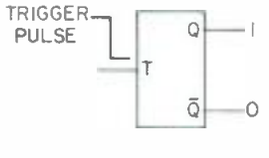
Anatomy of Digital Logic Part II

Continuing the flip-flop story, with the added dimension of Boolean algebra.

IN THE APRIL issue, we saw how logic gates work, and explained the operation of a simple flip-flop. Now, let's take a look at the operation of some other flip-flops.

THE T FLIP-FLOP

The T (toggle) flip-flop is one of the simplest types. It has one input and two output lines which change state with each trigger applied to the input (FIGURE 1). Either or both of the complementary outputs may be used. The T flip-flop has one drawback: the output state after a trigger pulse has been applied cannot be predicted unless the present state is known.



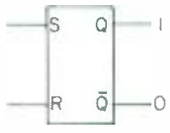
INPUT		OUTPUT	
CONDITION BEFORE TRIGGER		CONDITION AFTER TRIGGER	
Q	Q̄	Q	Q̄
0	1	1	0
1	0	0	1

Figure 1. T flip-flop with truth table. Note that $Q + \overline{Q}$ are the output symbols, and 1 + 0 are the (temporary) output levels.

The first part of Ronald Ajemian's discussion of digital logic appeared in our April, 1978 issue.

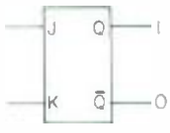
THE RS FLIP-FLOP

The RS (Reset-Set, but usually referred to as Set-Reset) flip-flop is another bistable device, with two input lines and two output lines (FIGURE 2). The outputs are complementary (that is, opposite in state), and change state in response to the states at the input. Two statements define the operation of the RS flip-flop: "Set to 1," and "Reset to 0." Set to 1 means that an input signal (1) applied to the *set* terminal (S) switches the circuit's Q output to HI (1) (and the $\overline{Q}$ output to LO). Reset to 0 means that an input signal (1, applied to the *reset* input (R) switches the flip-flop to the opposite condition (Q = LO (0), $\overline{Q}$ = HI (1)). Simultaneous inputs at both the R and S terminals are forbidden, since the flip-flop can never be in both states simultaneously. Therefore, the RS flip-flop is only used in situations which don't include simultaneous set and reset inputs.



INPUT		OUTPUT	
R	S	Q	$\overline{Q}$
0	0	NO CHANGE	
0	1	0	1
1	0	1	0
1	1	UNDEFINED	

Figure 2. RS flip-flop with truth table.



INPUT		OUTPUT	
J	K	Q	$\overline{Q}$
0	0	NO CHANGE	
0	1	0	1
1	0	1	0
1	1	COMPLEMENT	

Figure 3. JK flip-flop with truth table.

A	B	AB
0	0	0
0	1	0
1	0	0
1	1	1

Figure 4. Boolean expression for AND gate.

THE J-K FLIP-FLOP

The commonly-used J-K flip-flop has two inputs and two outputs and no ambiguous states (FIGURE 3). When a HI is applied to the J input, the flip-flop is switched to a HI state. (Note that when we say that a flip-flop is in a HI (or LO) state, we are referring to the state of the Q output. Therefore, the $\overline{Q}$ output is in the opposite state.)

Now, if we apply a HI to the K input, the flip-flop is switched to a LO state. If we apply HI's at both the J and K inputs, the flip-flop switches to its complement (opposite) state. Most J-K flip-flops have two or more J and K inputs, and we will often see one J and one K tied together, to form a "clock" input. From my explanation so far, it should be clear that a series of pulses applied to the clock input will toggle the J-K flip-flop back and forth between its HI and LO states. Presumably, the clock input is independent of the individual J and K inputs, which of course continue to influence the flip-flop's output state.

BOOLEAN ALGEBRA

In Part I, we looked at the various logic gates and their respective truth tables. With these same logic gates, we can apply the laws of Boolean algebra. Boolean algebra comes from George Boole, an English university professor. In 1847, Boole prepared several papers describing his system of mathematical logic. Recognition came some ninety years later, when a Bell Telephone engineer developed Boole's ideas into — as we now call it — *switching algebra*.

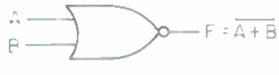
Boole says that a statement may be considered to be true or false. A value of 1 designates the true statement; a 0 indicates a false statement. We can represent either statement by any letter of the alphabet, in the following manner: A = 1 = true, $\bar{A}$ (read, "not A") = 0 = false. Going one step further, we can discard the "true/false" connotations, and simply say that A and $\bar{A}$ are opposites. Therefore if either of them is 1, the other is 0, and vice-versa. And now, we can apply a little Boolean algebra to the five basic logic gates described in Part I. These are the AND, OR, NAND, NOR and exclusive-OR gates.

A	B	A+B
0	0	0
0	1	1
1	0	1
1	1	1

Figure 5. Boolean expression for OR gate.

A	B	$\overline{AB}$
0	0	1
0	1	1
1	0	1
1	1	0

Figure 6. Boolean expression for NAND gate.

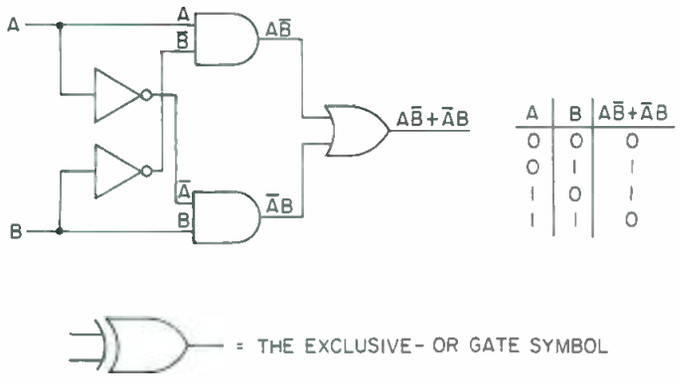


A	B	$\overline{A+B}$
0	0	1
0	1	0
1	0	0
1	1	0

Figure 7. Boolean expression for NOR gate.

Figure 8. Boolean expression for Inverter Amplifier.

A	$\bar{A}$
0	1
1	0



A	B	AB̄+ĀB
0	0	0
0	1	1
1	0	1
1	1	0

Figure 9. Combinational logic circuit for the Exclusive-OR gate. The Exclusive-OR gate is constructed from a collection of inverters, AND gates, and an OR gate. From the truth table, note that 1•1=0.

The Boolean expression for the AND gate, with two inputs, A and B, and one output, F, is, AB. This is done by multiplying A and B, giving us $F = A \cdot B$, or simply, AB. (FIGURE 4) (The output of a three-input AND gate would be ABC, and so on.) Note that the resultant value of AB is equal to 1 *only* when A =1 *and* B = 1, simultaneously.

The OR gate is represented by the addition sign (+). Therefore, the expression "A or B" may be written as A + B (FIGURE 5). Note that the right hand column of the truth table gives the logical value of A +B, and that this value is 1, whenever one or more inputs equal 1.

Figure 10. Boolean Algebra Theorems chart.

$A + A = A$
$A \cdot A = A$
$A + 1 = 1$
$A \cdot 1 = A$
$A + 0 = A$
$A \cdot 0 = 0$
$A + \bar{A} = 1$
$A \cdot \bar{A} = 0$
$\bar{\bar{A}} = A$
$A + AB = A$
$A(A+B) = A$
$\overline{A+B} = \bar{A}\bar{B}$
$\overline{AB} = \bar{A}+\bar{B}$
$A(\bar{A}+B) = AB$
$A + \bar{A}B = A + B$
$\bar{A} + AB = \bar{A} + B$
$\bar{A} + A\bar{B} = \bar{A} + \bar{B}$

Summarizing, a 1 output from an AND gate requires that inputs A *and* B are both 1; the same output from an OR gate requires that A *or* B (or both) is 1.

The NOT function is represented by either a line above the letter ($\bar{A}$), or by a prime mark $(A)'$. The inverter indicator (a small circle at the output of the gate) indicates that a NOT function is to be performed.

The NAND gate employs the NOT function, and can be represented by the expression AB or $(AB)'$. (FIGURE 6).

The NOR gate also employs the NOT function, and can be represented by the expression (A +B) or $(A + B)'$. (FIGURE 7).

Since the NAND and NOR gates employ the NOT function, sometimes they are referred to as AND-NOT and OR-NOT gates.

The inverter amplifier inverts the input signal at its output. Therefore, if the input is A, the output expression is $\bar{A}$ (FIGURE 8).

A combinational logic circuit consists of logic gates whose present outputs depend solely on the values of their present inputs; it does not remember previous input signals or how they were applied. The exclusive-OR gate is an example of a combinational logic circuit (FIGURE 9).

FIGURE 10 provides a chart of some useful Boolean algebra theorems for those who want to go further. Good luck! ■

ARLEN H. SMITH

The Lost Art of Recording

The two basic methods of two-track recording provide a foundation for all recording.

"WE'LL FIX IT IN THE MIX!" The engineer of today is surrounded with enough buttons and knobs to create a musical masterpiece or to destroy one. He can cut out one note with a parabolic filter or computerize his mixing board so that it mixes itself. Boards with cigarette lighters are old hat.

The fact that recording technology has made such tremendous advances is a definite asset. But the dependence upon technology to the point of forgetting basic skills is a detriment which is slowly creeping into the industry.

It is through learning the basic skills of two-track recording that the engineer will gain a good foundation of the true science of recording. If he cannot proficiently operate on two tracks, how can he handle eight or sixteen tracks?

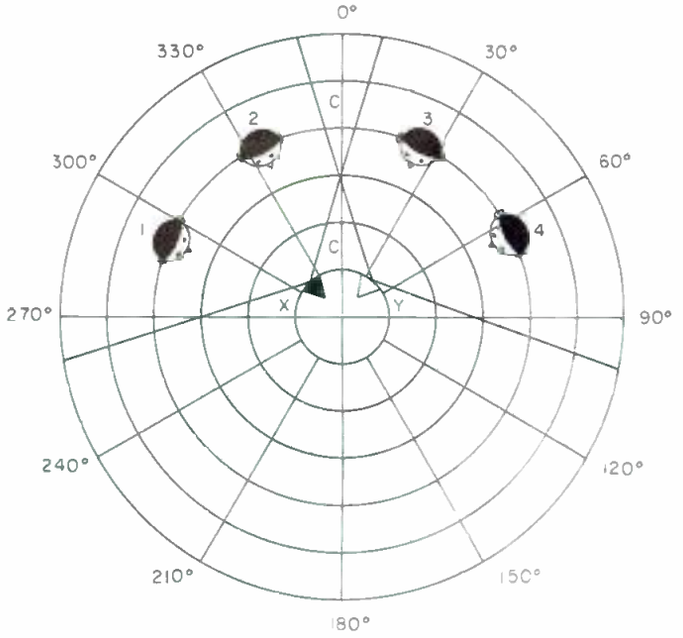
Let's examine some of the two-track methods and then compare them to multitrack recording.

THE SPLITTING OF STEREO

Now that we have so many tracks with which to work there are unlimited possibilities. But indiscriminate use of track separation can adversely affect the quality of stereo recording. Consider two methods of recording vocals on two tracks. FIGURE 1 illustrates what we shall call *phase-related stereo.* FIGURE 2 shows *phase-separated stereo.*

In FIGURE 1, microphones X and Y are routed to two tracks — microphone X at full left and microphone Y, full right. Note the interaction between the two micro-

Figure 1. Phase-related stereo. Note how pickup patterns overlap. The area between intersections would be center (C).



Arlen H. Smith is the president of A.S P. Recording Co., and installs recording systems for Audio Distributors in Grand Rapids, Michigan.

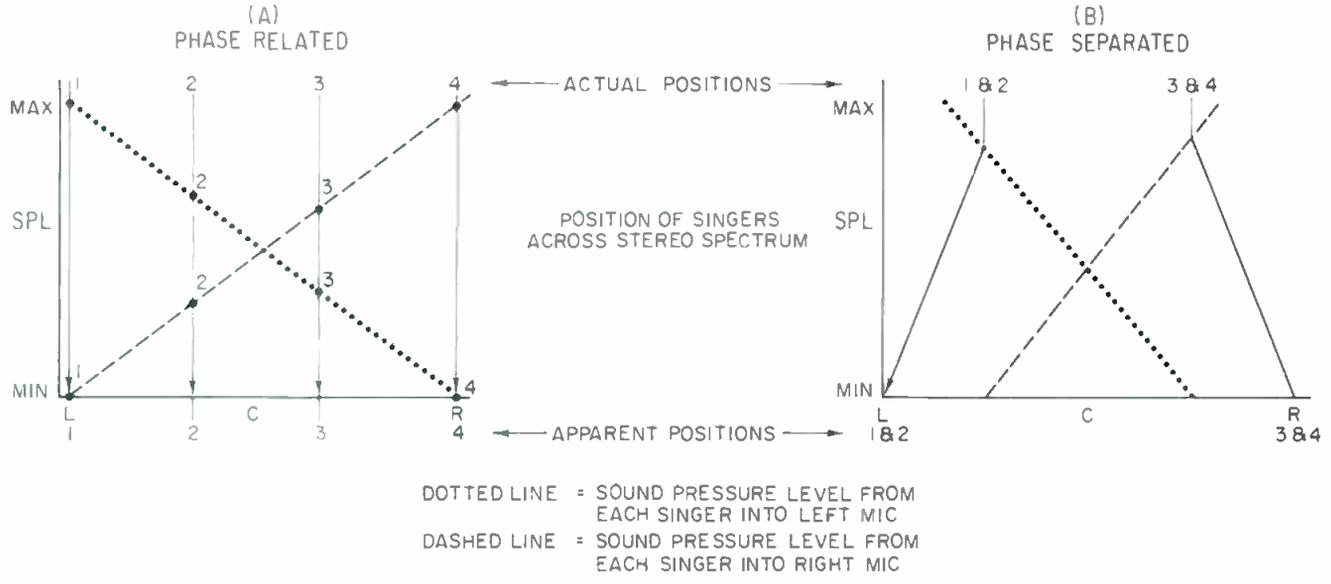


Figure 3. (A) A graph showing the S.P.L. of each singer across the stereo spectrum. Addition of decibel levels for each singer equals the total S.P.L. for that voice. This example gives equal S.P.L. for each singer across the spectrum. (B) This graph shows the S.P.L. of each singer, recorded bimonaurally. Note that the total S.P.L. is not a combination of two tracks.

phones. Movement bringing any voice within the microphone pickup field will affect the balance of both tracks. Therefore, when using this method the position of each singer is critical. Once the proper balance has been achieved, the interaction of phase relationships between the two microphones creates self-variable positioning. That is, the singer's relative position in the pickup field determines his position across the stereo spectrum. Each singer's position within the group will be reflected by his position on tape, as if he were being heard live. The only other method used to position the singers across the two-track spectrum is the employment of individual microphones with stereo panning on each one.

The microphone placement illustrated in FIGURE 2 will give better isolation between microphones X and Y. For example, the left channel can be turned up or down without affecting the right channel. In addition, the relative position between the singers on microphone X to those on microphone Y is not critical. It would seem that this method would be the more desirable of the two, simply because of the increase in control. However, this method cannot reproduce the true-to-life phase relationships of phase-related stereo. The method used is a matter of individual preference; a good engineer should be able to handle either mixing situation with equal efficiency.

The effect of these two methods on stereo balance is shown in FIGURE 3. The phase-related method puts signal across the entire left-to-right spectrum. Components of each singer's voice are contained on both tracks, with varying intensity and time delay depending on the singer's position, relative to the microphones. Every point within the stereo spectrum is affected by both microphones.

The phase-separated method does not share its signals — each signal is concentrated at one point of the stereo spectrum. Although using a pan pot will place this point at a different location on the spectrum, it will still be *one point* and not a combination of two pickup fields. In this situation, every point on the stereo spectrum is *not* affected by both microphones. In fact, there is *no* stereo spectrum — just two points.

ACOUSTIC MIXING

Drum sounds have always been a problem in the studio: it is very difficult to get a natural drum sound with close miking methods. But achieving the desired separation without putting the drums in an isolation booth is also difficult. Putting microphones all around a set will give you plenty of separation but the end result may be a wall of drums.

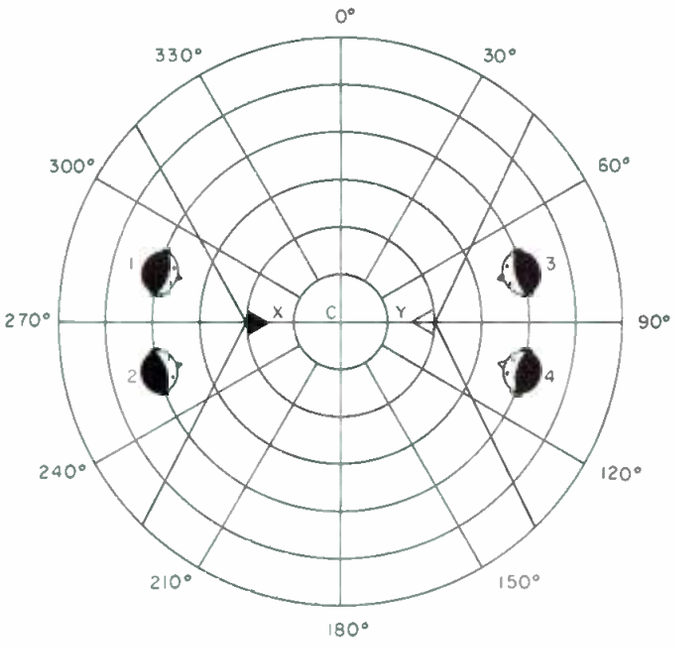


Figure 2. Phase-separated stereo (two-track mono). Pickup patterns do not overlap, thus eliminating the center area.

This sound is acceptable in a situation where you want a heavy mix. Drum mixing with five or six microphones can give some very interesting results.

But what about a natural sound? FIGURE 4 shows a method which gives excellent results. The theory behind this method is to consider the drum kit as one acoustic instrument rather than a group of individual drums. By using the phase-related method of mixing, a true-to-life reproduction of the drum kit is achieved. Microphones 2 and 3 are set full left and right, respectively, and the bass is set center.

This method only uses two tracks to record the set. If track availability is limited, this is a good method to employ to get a full stereo without eating a lot of tracks. Also, separation between left and right is very good, as well as the separation between the drums and the other instruments in the studio.

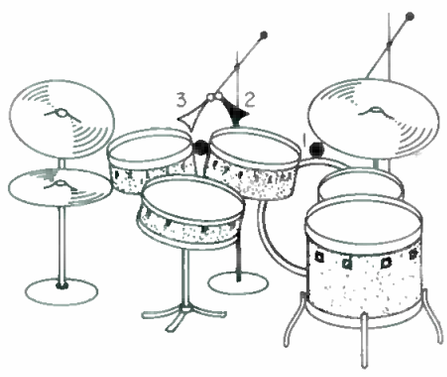
ACOUSTIC AND REVERBERATION

No studio would be complete without a good reverberation chamber. There are many very good electronic chambers on the market, but the best chamber I have ever heard is an acoustic chamber of Artie Fields Productions in Detroit. The chamber consists of a 1,200 seat theatre from which all the seats have been removed. The reverb send consists of two Altec A-7 cabinets. The return consists of four E-V 635-A microphones strategically placed.

By mixing the microphones into the desired combination, a natural reverberation with variable decay times is achieved. Once again, natural acoustics are used as an integral part of the system.

Naturally, every studio cannot have a theater next door with which to experiment. What we are concerned with is the basic principal of natural acoustics, as opposed to electronic synthesization. Perhaps there are other applications in which you could use this concept to create an exciting effect.

Figure 4. Representation of a drum set with phase-related microphone techniques. Bass drum (1) is hidden from view.



IN SUMMARY

What I have tried to bring to point here is the loss that takes place when engineers remove themselves from two-track recording methods. It is important to be aware of the methods of using two-track recording, but this is not enough. Without direct *experience*, the methods are not at your command.

Someone who was raised on 16-track may never have been forced to squeeze all of his material onto two tracks. Therefore, he has never mastered certain techniques. The whole recording industry suffers from these gaps in training. 16-track engineers should go through a training period during which they record primarily in a two-track format. This way a firm foundation is achieved and the engineer can move ahead with complete versatility. ■

JOHN WORAM

Report from Hamburg

The 59th Audio Engineering Society Convention

Views around the exhibition hall.

IF ANY OF US had lingering doubts about the long-term significance of digital technology to the audio industry, surely the 59th convention of the Audio Engineering Society has at last laid those doubts to rest.

Automated consoles are nothing new—even digital tape recorders have been seen before. But at the recent Hamburg exhibit, computer terminals, microprocessors and such seemed to be lurking behind almost everything new. Clearly, we are well on our way into a new era of audio technology, and there's no turning back.

THE ULTIMATE AUTO-LOCATOR

It's getting to the point where you can't even rewind a tape without the use of a microprocessor. From England, Audio Kinetics introduced the XT-24 Intelocator, which may be the ultimate auto-locator (this month, anyway). The XT-24 interfaces with the following tape recorders: Ampex MM 1200, Studer A 80, 3M M79.

On the typical multi-track session, a lot of time can be spent searching for the proper punch-in point. And Murphy's Law clearly states that when the engineer gets the punch-in right, the artist won't, and naturally, vice-versa. So, a lot of time is spent going back to "go" and doing it over again. The XT-24 handles this sort of assignment with ease. During the first return to point 1, the system analyzes its own behavior. Next time you ask it to return to the same point, it will get there a lot faster, for now it "knows the way." Four such locations may be stored in memory, so if you get sick of listening to one section of the tape, you can move on to another, and come back later.

The Intelocator will also "commute" between any two memory locations for as long as you can stand it, or if you wish—just once. When ready to record, the XT can be programmed to go into—and then out of—record at the appropriate moments, rewind, playback, rewind again, and stop. Next move is up to you. You can repeat the entire sequence again (and again, and again) or move on to something else and come back later.

Chances are, the Intelocator can do just about anything else that may occur to you, but on the off-chance that you should ask it to do the impossible, it discreetly displays the legend HUH? on its read-out. Which shows that sometimes even computers can be human.

Computers are people too. Audio Kinetics' Interlocator responds to an impossible command.

AUTOMATING THE GRAPHIC EQUALIZER

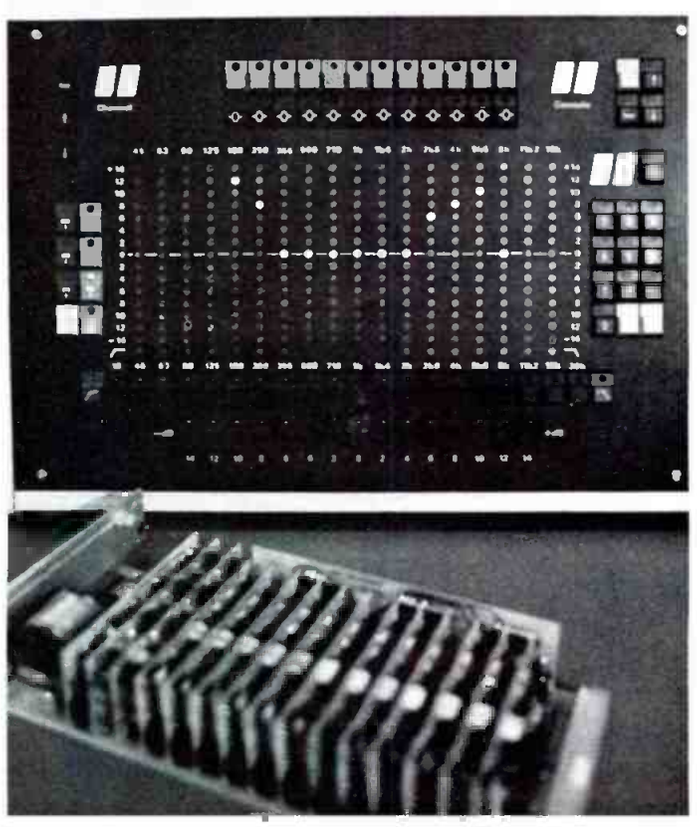
Do we really need automated equalizers? Of course not. That is, until we discover what can be done with them. Then, it's a wonder we've been able to live this long without such wondrous machines..

Consider the graphic equalizer for instance. The conventional one is often a rack-mount job. It's versatile, though bulky, and it's not really designed for quick changes. Now, along comes automation, and all that changes..

The Danish firm, NTP Elektronik A/S, introduced its new 582-100 programmable, centrally-controlled graphic equalizer. Although the system may be added to any sort of conventional console, NTP envisions the 582-100 as a sub-unit of a totally new console, designed to meet the requirements of the broadcaster.

In an application note, NTP asks, "How much help can a broadcast sound engineer get from computer-controlled VCAs or automatically moving faders, when the program is . . . going to be performed, mixed and transmitted *simultaneously?*" (Our italics—and yours too, if you're a broadcaster.)

The NTP Elektronik 582-100 programmable graphic equalizer. Our photo shows the central control system with the rack mounted electronic in the foreground.



(continued)

For such applications, the engineer will want to do the gain-riding as he goes along, but could certainly use lots of extra hands for instant eq. changes between songs. And here's where the automated system comes in handy. Prior to going "on-the-air," each song—or program segment—could have its equalization settings stored on cassette, which is then loaded into the console. At the appropriate moment, a single instruction to the computer will change the settings in one input module, or across the entire board.

This sort of facility has obvious application for the travelling road show as well. Basic equalization settings could be stored in memory, taken to the next city, and fed into the sound reinforcement console during set-up. Minor (or major) changes could then be made without losing the basic reference set-up.

The AD 070 proGraphic Equalizer from Audio Developments will store as many as sixteen pre-programmed response curves, any of which may be recalled and compared within milliseconds. This allows the luxury of making instant A/B comparisons between several totally different response curves—something obviously not possible with conventional graphics. The proGraphic covers the audio bandwidth in half-octave steps, each of which is adjustable over a ±14 dB range.

Audio Developments' proGraphic Equalizer. You can also see the AD 055 Compressor/Limiter just below it.

The Telefunken sixteen-track machine shown here is distributed in the U.S. by Gotham Audio.

MICROPHONES

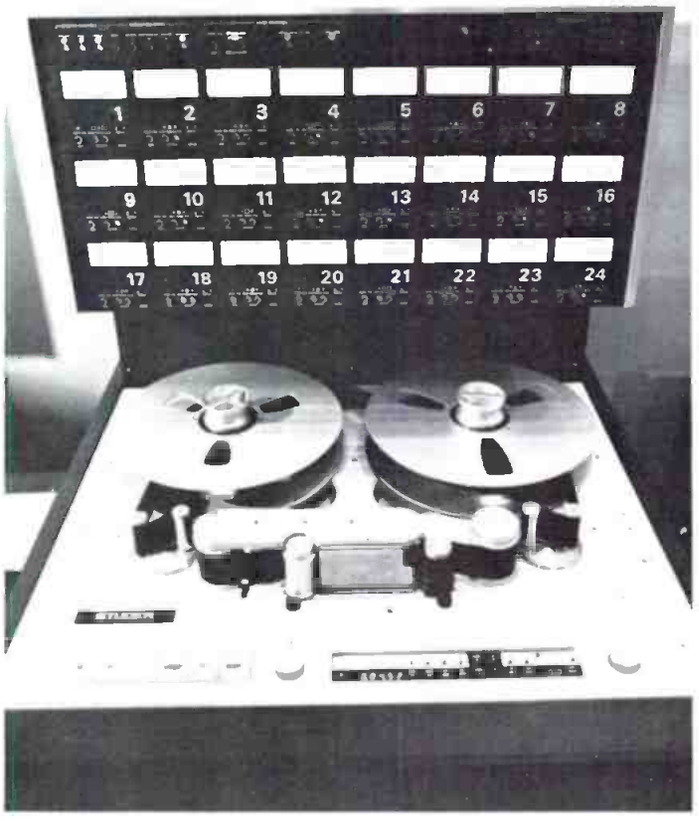
Of course, all is not automated yet, especially at the microphone end of the signal path. Shure Brothers, well known for their dynamic moving coil and ribbon microphones, introduced the SM 81, a unidirectional electret cardioid microphone. The SM 81 will operate with any well-filtered voltage from 12 to 48V dc. Thus, it may be operated from an 18 volt battery power supply, the Shure PS1 accessory power supply, or a phantom power supply built into the console. Concerning the latter, Shure prefers the term "simplex-powered," which follows the original use of the term by the telephone industry, where "phantom" described a method of transmitting three communication channels over two balanced lines.

A three-position switch on the microphone casing selects flat frequency response, a 6 dB/octave roll-off below 100 Hz, or an 18 dB/octave cutoff below 80 Hz for high SPL applications, a built-in 10 dB attenuator may be switched in. The output level of the SM 81, like that of many other

Calrec's intriguing new Sound Field Microphone System.

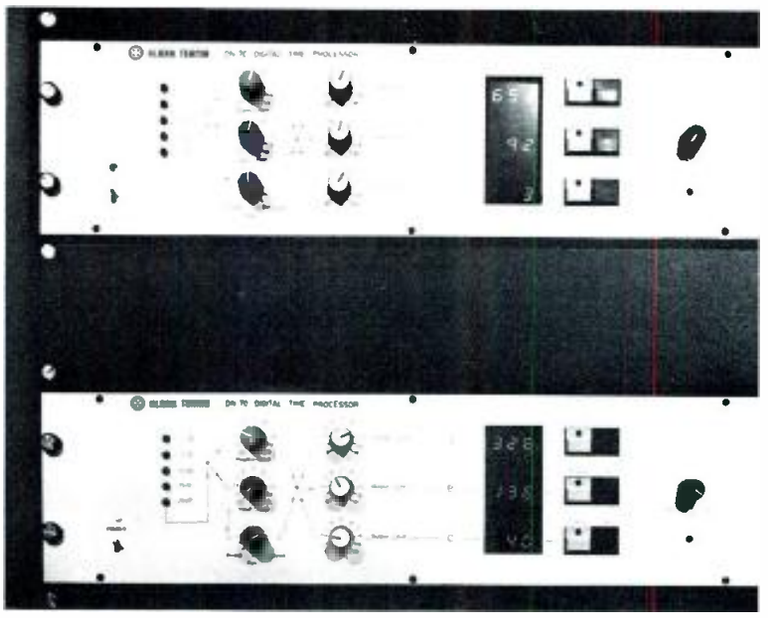
The Itam 806 eight-channel tape recorder.

The recording studio with a budget will want to consider the Brenell Mini 8 recorder.



The Studer A800 multichannel tape recorder.

Larry J. Scully is making this advanced disc recording lathe and selling it in the U.S. in conjunction with Ortofon heads and electronics.



Klark-Teknik has this digital time processor with one input and three main outputs. An additional output provides a mix of the three delayed outputs plus input signal.

condenser microphones, is some 15 dB higher than in most dynamic microphones. If, despite the built-in attenuator, the console input is still overloaded, a resistive network may be required if this facility is not already available within the console's input circuit. Shure cautions that commercially available mic line attenuators are not recommended, due to loading. The spec sheet for the SM 81 lists preferred attenuator resistor values that may be used without interfering with the microphone's powering system.

By the way, a Shure paper describing the design of the SM 81 also notes that "The status of the use of 48 volts is expected to come under close scrutiny in the United States and Canada due in part to the UL (Underwriters Laboratory) and CSA (Canadian Standards Association) restriction against voltages greater than 42.4 volts peak or dc appearing at the terminals of connectors such as those used with professional microphones."

Perhaps the most intriguing new microphone at the show was the Calrec Sound Field System, which consists of the CM 4050 Sound Field Microphone, and the CS 5014 Sound Field Signal Control Unit.

Once the microphone has been set up, an incredibly vast amount of control is available from a remote location, presumably near the console. The system has four outputs, and in the quad mode these may be varied between cardioid and hyper-cardiod polar patterns.

In the stereo mode (i.e., two-channel) the apparent angle between the outputs may be varied between zero degrees and 180 degrees. Other controls allow the microphone to be rotated or tilted. Actually, the microphone itself doesn't budge; its outputs are manipulated to produce the effect. Polar patterns are variable between figure-8 and omni-directional. There's also a mono mode, but who would want to use that?

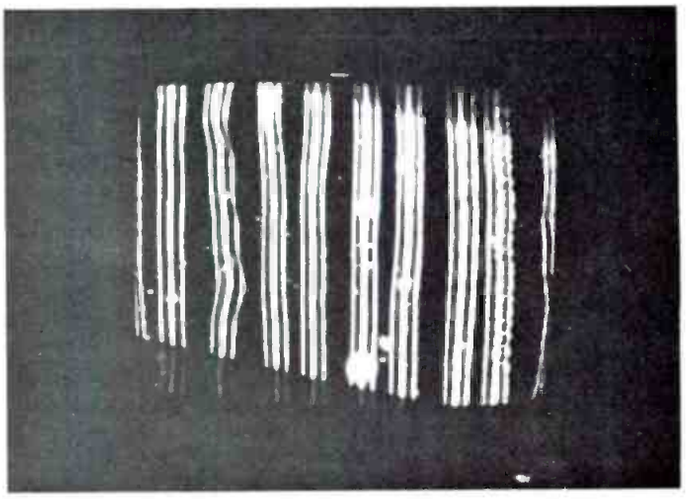
For "We'll fix it in the mix" applications, the microphone's outputs may be recorded directly on four separate tracks, and all the variations just described can be tried later on. And if that's not enough, Calrec expects to have additional control modules available in the future. This includes a joystick, ". . . so that microphones may be panned, with full 'interior' effect, into the sound field with or without height information and adjustment." This would allow the engineer to adjust the apparent height of the microphone without actually moving it at all.

Calrec also has a rather complete line of more conventional condenser (oops, capacitor) microphones that just lie still and behave themselves. Hopefully, these will eventually see wider popularization here in the colonies.

TAPE RECORDERS

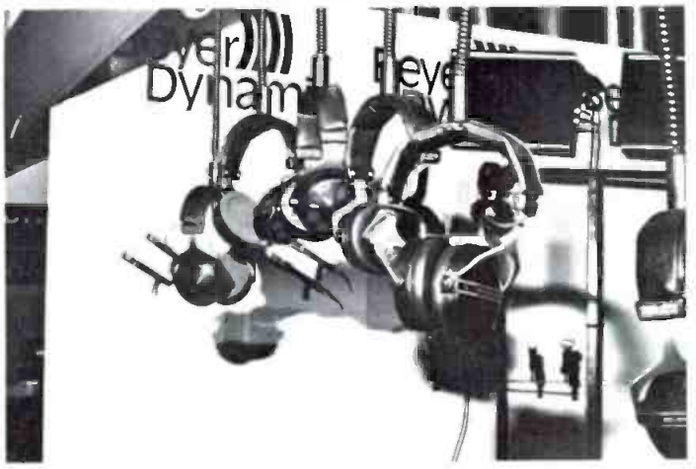
Studer introduced the A 800, its new multi-channel tape recorder with microprocessor (well, what else?) control. The microprocessor controls all transport and electronic functions, via a series of bus systems. For example, tape motion may be regulated by the machine's local or remote controls, or by other peripheral equipment. In fact, the microprocessor control system ". . . has been designed to provide optional access to all functional controls of transport and audio electronics, resulting in a flexibility never achieved before."

The Neumann VMS 80 disc mastering system. Note the video camera on it, and also note the adjoining crt display.



It's a lot easier than staring into a microscope all day.

A collection of headphone models were on demonstration in the Beyer booth.



Woelke Magnetbandtecknik manufactures distortion and wow/flutter measurement equipment.

Consoles, or as they are known in Great Britain, mixing desks, were shown by these British companies:

Helios.

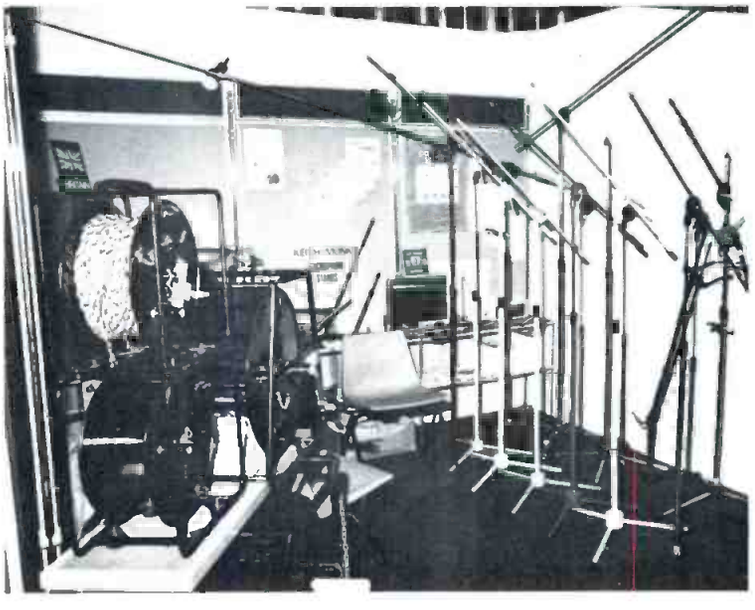
Soundcraft.

Neve.

Tweed.

One of the busiest stands was MCI's. They had consoles, tape recorders, automation systems, and in the foreground, their tape locator, on display.

Keith Monks showed this assortment of mic stands, cable drums, and other important studio accessories.



Another interesting feature is the "rehearsal" function. One of the problems with tight punch-ins (*and* -outs) is making sure that desired information does not get erased. No problem here—just depress the "rehears" (sic) button and make a few practice runs. Now, when the record button is depressed, the playback electronics are muted (but the track is not erased). You hear the effect of an erasure, without actually making one. Once your rehearsal is perfected, you're ready for the real thing. Just release the "rehears" button and repeat the punch-in, this time for keeps.

THE A.E.S. STANDARDS COMMITTEE

Before moving on, this seems like a good place to salute the Audio Engineering Society, in recognition of its efforts to establish some sort of digital audio standards.

With every new digital device, the need for such standards becomes more apparent. For instance, the new Studer A 800 has been designed to interface with a variety of digital-based systems, at least some of which have not yet been designed. When they do come along, it would be a great pity if still more gadgetry was required, merely to connect system A with system B. Clearly, some standardization is needed, and needed fast. Obviously, standards must not impede the flow of anyone's creative juices, but wouldn't it be nice if we could all agree on tape speed, sampling rates and such? And so, good luck to the A.E.S. Digital Audio Standards Committee—they'll need it!—and so will we.

FOR THE SEMI-PRO

Is there anyone in the USA who has not heard of Tascam, TEAC and Otari? Perhaps not, but what about Brenell and Itam? These British companies manufacture tape recorders that may interest the studio on a budget. The Brenell Mini 8 and the Itam 806 are both eight-track tape recorders. The Mini 8's one-inch tape format makes it compatible with standard pro machines, while the Itam uses half-inch tape. The Brenell should sell here for about $8,500, and the Itam for about half that amount.

The Itam literature agrees that eight tracks on half-inch tape does have its theoretical disadvantages, but that these may be more than offset by the price differential. So, just for the fun of it, a quick comparison of specs was made—or rather, was attempted.

Forget it! Here's an excellent case for standardization of spec sheets. About the only thing both companies agree on is the method of specifying tape speed. As for everything else: The Brenell has a Fast Wind Time of 100 seconds; the Itam has a Rewind Time of 1 min, 40 secs. (That one's easy enough.) For signal-to-noise, one is "ref 900 nWb/m 65 db (sic) weighted," the other "-60 unweighted reference 0VU." One machine quotes crosstalk at "60 dB at 1 kHz." On the other, adjacent channel crosstalk is "better than 44 dB at 400 Hz." Inputs are "100 mVolts up to 20 volts" for one and "adjustable from —10 dBm to +20 dBm for the other. And so it goes.

And so does this convention report, with the hope that sooner or later there will be some sort of standardization, if only of spec sheets. That way, we shall be able to tell one standard machine, or whatever, from another. ■

An Educational Postscript

NEEDLESS TO SAY, our February issue was not the last word on the subject of education. At the upcoming 60th convention of the Audio Engineering Society there will be a symposium on *Trends in Audio Education*, under the chairmanship of Geoffrey Wilson, of Pennsylvania State University. Following is a list of topics and guest lecturers.

Introduction: The AES Education Survey—Geoffrey Wilson, Pennsylvania State University. State College, Pennsylvania.

Physics of High Fidelity for Non-Scientists and Audio Marketing—K. W. Johnson, Southern Illinois University, Carbondale, Illinois.

A Curriculum in Music Industry Arts—Tom Lodge, Fanshawe College, London, Ontario, Canada.

An Audio Technology Option Within the ECPD Accredited Electrical Engineering Technology Program—Thomas M. Yackish, Purdue University, Calumet Campus, Hammond, Indiana.

Curriculum in Recording Engineering—Raghu Gadhoke, University of Sound Arts, Hollywood, California.

An Audio Design Engineering Certificate Program for BS Students in Electrical Engineering—C. Dale Manqueen, California State University, Northridge, California.

Balancing Theory and Practice in Audio Education: Experience of a Recent Graduate—Mark R. Gander, James B. Lansing Sound, Inc., Northridge, California.

Hiring in the Audio Industry: You May Be an Engineer, But Can You Drive a Train?—Brad Plunkett and Dennis G. Fink, United Recording Electronic Industries (UREI), Sun Valley, California.

The Educated Ear in Professional Recording—Guy A. Costa, Consultant (former vice-president of Motown Records), Westlake Village, California.

And here are the who, what, when and where of a few more seminars, sponsored by various schools, which may be of interest to the reader in search of more education. For further information, contact the participating schools directly.

Who?
Stephen F. Temmer, president, Gotham Audio Corp.

What?
A Seminar on
FUNDAMENTALS OF RECORDING

A one-week seminar, with six hours daily of scheduled class and hands-on recording work. In addition, there will be optional discussion sessions in the evening, which will probe the philosophy of recording and exchange views on future technology.

The course will look at all technical aspects of recording, from the viewpoint of the end product—music in the home. Musicians will lend a hand as "guinea pigs" for experimentation in microphone and musician placement. Special emphasis will be placed on the fundamentals of microphone design and technique.

Where?
The Banff Centre
School of Fine Arts
Box 1020
Banff, Alberta TOL 0C0
Canada
403 762-3391

When?
29 May—2 June, 1978

Who?
M. William Krasilosky, LL.B. co-author of
THIS BUSINESS OF MUSIC
MORE ABOUT THIS BUSINESS OF MUSIC

What?
A Seminar on
THIS BUSINESS OF MUSIC

A general introduction to the business of music, business affairs, problems of recording studios, record companies and artists' relations, copyright concepts in sound recordings and compositions, songwriter contracts and publisher's rights, operations of ASCAP, BMI, and SESAC, international aspects of publishing and recording, demonstration records, the role of the record producer, agents and managers, special situations for show music and film music, general review plus Q. and A.

Where?
Institute of Audio Research
64 University Place
New York, N.Y. 10003
212 677-7580

When?
19 June—7 August, 1978 (7 Monday evenings, 6:30-9:30 pm)

Who?
Bill Porter, director of Recording Services, University of Miami
William F. Lee, Dean of the School of Music, University of Miami.

What?
A University of Miami special program MONTREUX MUSIC ENCOUNTER. This month-long program is designed specifically for those who want to improve their skills in jazz, audio engineering, and the music business. Class sessions will be held during the entire four weeks of the Encounter. Students may select up to three courses, such as: Evolution of Jazz and Pop-Rock, Arranging, Audio Recording Techniques, The Recording and Entertainment Industry, Film, Television and Radio Commercial Scoring, Audio Engineering—Microphone and Mixing Techniques.

Where?
Mountain Recording Studios
Montreux, Switzerland

When?
2—30 July, 1978
For further information:
Montreux Music Encounter
University of Miami
School of Music
P.O. Box 248165
Coral Gables, Florida 33124

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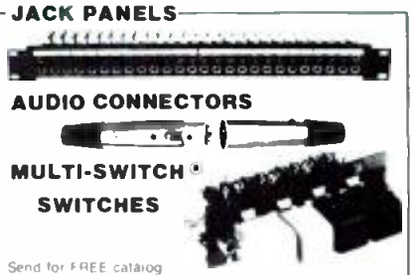

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STUDIO SOUND—back issues available in U.S. $1 each postpaid, January '74 to June '75 available. **3P Recording, P.O. Box 99569, San Francisco, Ca. 94109.**

USED EQUIPMENT. 8-tracks from $3,500; 2-tracks from $1,100; duplicators; TEAC #10 from $1,000; Audio Designs, Aengus, custom boards from $2,500. **Soundesigns, 313 W. 57th St., NYC. (212) 765-7790.**

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Subject to our terms, financing is available on the above used consoles. $20,000 cash, balance over 24 months. Sales taxes not included. Please call. **Bethel, Conn. (203) 744-6230. Malton, Ontario. (416) 677-6611.**

Neve

USED 12- and 24-track tape recorders: Ampex, Scully, MCI, 3M. **Soundesigns, 313 W. 57th St., NYC (212) 765-7790.**

SONY C-77, superdirectional, tele-microphones, @ $200. **Larry Godby, 9724 Columbus, Sepulveda, Ca. 91343. (213) 847-3059.**

AMPEX TAPE. ¼ in. and wide widths in stock. **Techniarts, 8555 Fenton St., Silver Spring, Md. 20910. (301) 585-1118.**

SCULLY 8-track w/Sync Master—mint condition, $6,800. 4-track, 12-track, 2-track available. **Soundesigns, 313 W. 57th St., NYC. (212) 765-7790.**

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NEW PROFESSIONAL LINE of pre-assembled mic and patch cables in seven colors, two thicknesses; not a me-too copy of existing cables. Further info, **Sound Applications, 342 Lexington Ave., Mt. Kisco, N.Y. 10549. (914) 241-0034.**

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BUSINESS OPPORTUNITIES

INDEPENDENT ENGINEER desires to establish a production and mixing association with an independent producer in the Los Angeles area. Engineer has 8 years of experience in multi-track, video production, and post production on both East and West coasts. Currently involved with multi-track mixing in L.A., and custom digital design for audio applications. Resume and references available upon request. All inquiries will be held in strict confidence. **Engineer, 20211 Sherman Way #215, Canoga Park, Ca. 91306. (213) 998-7541.**

EMPLOYMENT

CHIEF ENGINEER, established motion picture/t.v. sound recording studio has opening for E.E. with heavy experience in audio equipment maintenance, modification, design, and fabrication. Confidential interview; send resume and salary history. **Photo Magnetic Sound Studios, Inc., 222 E. 44th St., New York, N.Y. 10017.**

MUSICIAN-ENGINEER seeks position involving work in both fields. B.S.E., M. Mus. degrees. Music, teaching, location recording experience. **P.O. Box 220, St. Clair, Mich. 48079.**

DANBURY, CONNECTICUT area tape duplicator has opening for hourly or per diem wiring, installation, and maintenance engineer; commercial experience necessary. **Radio Yesteryear, Box C, Sandy Hook, Ct. 06482.**

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INTENSIVE SUMMER WORKSHOPS in recording techniques, electronics, electronic music, jazz improvisation, instrumental master classes. Write **Frank Stachow, Lebanon Valley College, Annville, Pa. 17003.**

db People/Places/Happenings

• Changes at **CCA Electronics** of Cherry Hill, N.J. include the appointment of **Joseph T. Consalvi** as vice president, finance/treasurer and the promotion of **James J. Ehrmann** to the position of controller. Assistant treasurer **Anthony F. Tierno** has expanded his responsibilities to include the areas of systems, controls, and procedures.

• **Preston R. Weaver,** chief engineer of the Broadcast Products Division of **UMC Electronics Co.** has been appointed chairman of the **National Association of Broadcasters'** Tape Machine Standards Committee. Mr. Weaver will oversee the work of several sub-committees whose job it will be to update and maintain the technical level of cart machines produced in the U.S. and to act as a liaison with non-domestic machine producers.

• Geophysicist and nuclear engineer **Dr. John J. Wooldridge** has been named senior director of engineering for the Satellite Communications product activity of **California Microwave, Inc.** of Sunnyvale, Ca. Dr. Woolridge had been with **Hughes Aircraft Corporation,** where he designed ranging systems and small satellite terminals, as well as sensors for measuring satellite parameters. The company has also announced the appointment of **H. Edward Shulman** as director of programs and systems for the satellite communications product area.

• Reorganization of the marketing group at **Telex,** of Minneapolis, renamed Audio Visual Products, has altered its concentration to market research and new product development, under the direction of **Morton Stone,** assisted by **Joe Hollenkamp. Tom Johnson** was named to the new post of director of sales for a/v products.

• Announcement has been made of the appointment of **Dale R. Brown** as administrator of entertainment and industrial services for the **RCA Service Company,** Cherry Hill, N.J. Mr. Brown's responsibilities include technical support services, departmental liaison, customer service, and financial and operational analysis.

• **Ray Kimber,** formerly of **Spectra Sonics,** has joined the sales staff of **Audio Concepts, Inc./Dave Kelsey Sound,** of Hollywood, Ca. The company has instituted a phone service, managed by **Gil Reyes,** for professional accounts. The telephone number is (213) 851-7172, including Saturdays.

• A report of a study made by the **Electronic Industries Association** in collaboration with the **NAB** on a.m. stereophonic broadcast systems is available. The report provides the **FCC** with the technical information to evaluate competing systems. Priced, prepaid, at $20, the study is available from the Electronic Industries Association, 2001 Eye St. NW, Washington, D.C. 20006. Checks should be payable to "EIA."

• As part of an expansion program, **TMC Sales Corporation** of Ft. Lee, N.J. has appointed **Walter R. Traucenick** and **Michael R. Berish** to vice presidential positions. The company represents manufacturers of electronics components and audio equipment.

• After four years with the **Ampex Corporation, J. D. Strand** has returned to the **Nortronics Company** of Minneapolis as sales manager of the recorder care division. Mr. Strand's background includes extensive selling experience.

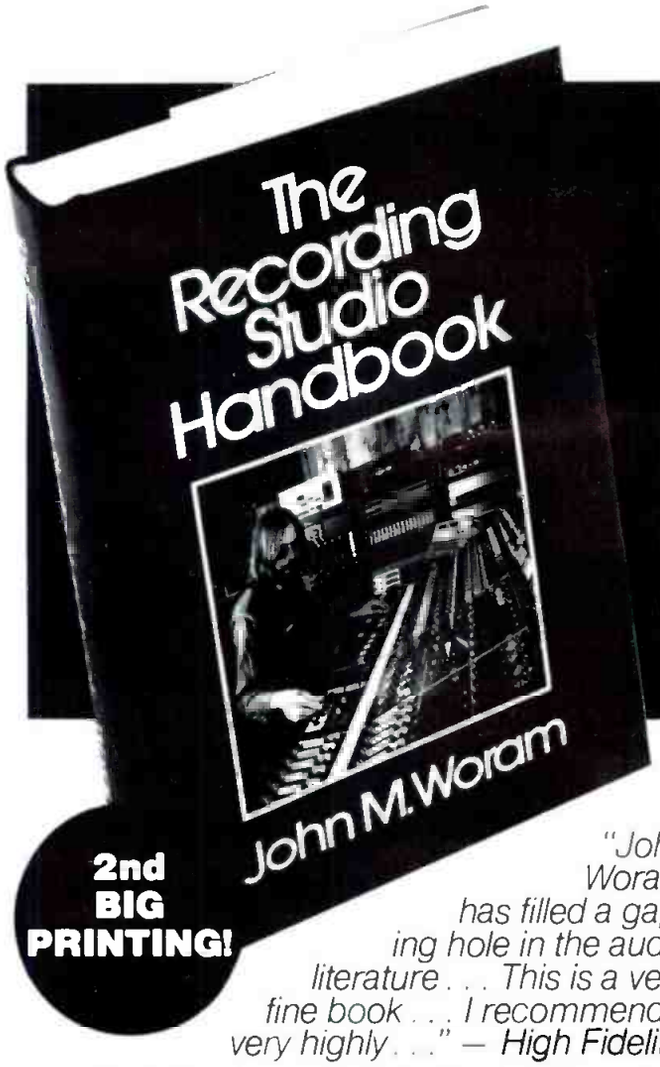
• Personnel changes at **Bressler & Baum Associates,** New York City manufacturers' reps, have added **Fred J. Cahn** as key accounts manager and promoted **Charles R. Siebel** to the post of general sales manager. Mr. Cahn had been with **Carduner Sales.**

• A series of workshops on the design and installation of sound reinforcement systems is being held in various cities by **James B. Lansing Sound's** Professional Division. Scheduled are June: Chicago; July: Montreal; August: Kansas City; September: Vancouver. For information, contact **Ewald Consen, at (213) 893-8411.**

• **William A. Raventos** has been appointed product director at **Ivie Electronics** in Orem, Utah, coming from **Electro-Voice.** Mr. Raventos will serve as liaison between the end users of Ivie's equipment and the company's marketing and engineering departments.

• The promotion of **Stephen D. Spence** as vice president, Hybrid Microelectronics at **Rockwell International's** Electronic Devices Division of Dallas, Texas has been announced. Mr. Spence has been with the firm since 1961. The company's Electronics International Operations has opened a new marketing branch office in Brussels, Belgium. **W. J. Richards** is the manager of the new facility located at No. 4 Rue de Geneve, Evere, Brussels.

Long-time employee of **Rockwell International G. R. (Dick) Johnson** has been appointed director of personnel for the Commercial Telecommunications Group. Mr. Johnson's association with the firm stemmed from his affiliation with **Collins Radio Company** which later merged with Rockwell.



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