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RECORDING engineer/producer

relating recording science • to recording art • to recording equipment

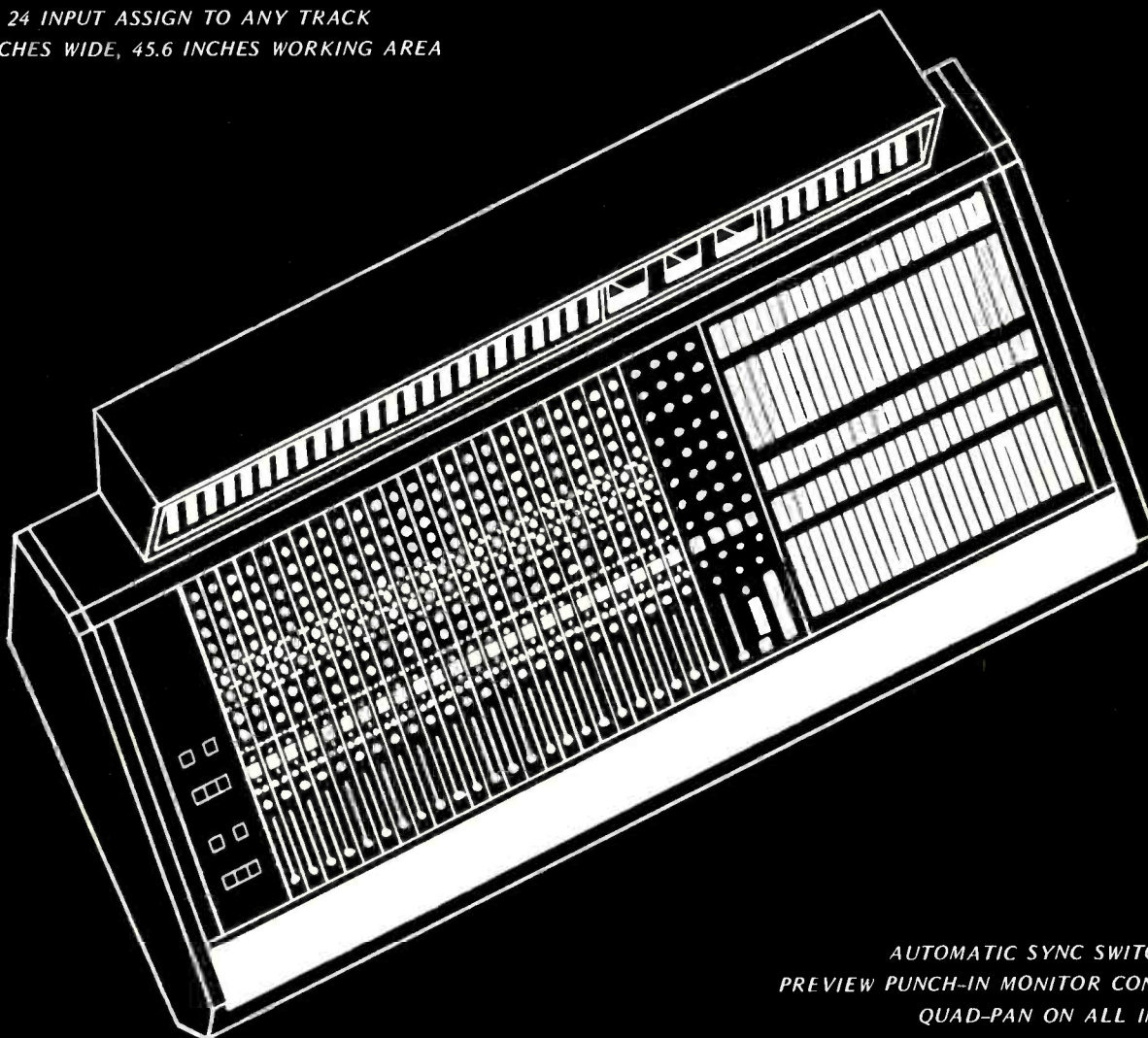
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an R-e/p report:
REMOTE RECORDING

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RECORDING
engineer/producer

—the magazine to exclusively serve the recording studio market... all those whose work involves the recording of commercially marketable sound.

—the magazine produced to relate... RECORDING ART to RECORDING SCIENCE... to RECORDING EQUIPMENT.

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credits — cover: TRICI VENOLA
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Allison Research

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When you're laying down the master, you'd better be sure your piano is air quality. That's what the Yamaha C7 Grand is all about. It's a 7'4" concert instrument that ranks among the world's great pianos. Just ask the talent at your next session.

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way through month after month of masters, rehearsals and spilled drinks, too.

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E-3. It's a symphony orchestra in a box. With fewer controls, the E-3 gives you more sounds, more music. What's more, it's a regular sound effects machine. Think about *that* the next time you have to synthesize some sounds.

Letters

From Martin Gallay
RECORDING engineer/producer

With the many forums for recourse available, both legal and scientific, we wonder at the recent involvement of the press in a, now very, public controversy which must ultimately be resolved only by the actual adversaries.

Recently, several of the magazines serving the audio business were asked unilaterally by GOTHAM AUDIO CORPORATION to delete certain advertising placed in those magazines by their competitor, SONY/SUPERSCOPE.

R-e/p, and we assume the other publications as well, was shown 'private' proof asserting that the Sony/Superscope presentation did not agree with the Neumann/Gotham findings. **R-e/p** never doubted the earnestness of this exhibit.

But, other than on the basis of the Gotham complaint **R-e/p** has no reason to question the earnestness of the published Sony/Superscope presentation . . . especially after Sony specifically confirmed that the contents of their ads was true.

Thus, **R-e/p** resisted the Gotham ultimatum . . . incurring, thereby, the threatened cancellation of Gotham's advertising in **R-e/p**.

Fair enough!

But, we do wish to clarify one additional point made necessary by the since published inference that the other publications which did, indeed, accede to the Gotham demand for the deletion of the Sony ads, did so on the grounds that they agreed, as alleged by Gotham, that the Sony ads were untrue.

The fact is that these other publications did exclude the Sony/Superscope ads . . . but, according to the correspondence of both of these publications, they acceded to the Gotham demand for other reasons than the engineering refutation initiated by Gotham.

To say it plainly once again: WE DO NOT KNOW WHO IS RIGHT . . . and we are not apt to know who is



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right until a proper jury, legal and/or technical, (but not the press) is constituted to render a proper judgement.

Obviously, such a substantiated decree will be of enormous commercial value to the triumphant . . .

We wonder, once more, why the press was involved?

From Stephen F. Temmer
Gotham Audio Corp.

Bill Cara's article in your May/June issue has certainly reached a new low in technical writing, but more specifically a new low in press discernment.

The reader is led down the garden path of engineering with well worn facts and figures, not all of them accurate (p. 15 left column center should be "0.0002 dynes/cm²), and is baited to an unbelievable extent with the promise of some revolutionary development of some totally unknown California manufacturer. It is inferred that this company has some secret patentable process which will, for the first time, introduce digital technology to the professional audio field.

It might be well to indicate that NHK, the Japanese Broadcasting System, has for years now been engaged in digital 4-track recording and there are numerous records on the market by Nippon Columbia which were recorded from digital tape! It may be safely stated that everyone who is the least involved in digital processing knows the potential and the difficulties for realizing a marketable product. It would have been far more helpful to outline the problems than to rehash 30 year old data on the parameters of music.

It never ceases to amaze this writer how simple it is to place free advertising in U.S. trade magazines in the form of articles, and how much paying advertisers can get away with when they place ads such as SONY/SUPERSCOPE which are totally untrue and misleading. It shows a clear chain: people who pay for space can lie, and people who get paid for writing articles can do all the advertising they can dream up under the guise of "expert opinion".

You are to be congratulated again for your lack of taste. The same goes for Bill Cara.

From Bill Cara
Samuels Engineering Co.

The two letters critical of my article on digital sound recording which appeared in your May/June issue hardly deserve a serious response. Both have missed the purpose of the article.

While the two critics may know everything there is to know about sound and recording, they fail to recognize that many mixers and engineers, and more particularly, our young creative musicians and producers are less technically oriented.

It is our opinion that everyone whose livelihood depends upon the recording arts should, at least, be cognizant of the technical parameters, and why and how they might be improved.

Whether or not Samuels Engineering is the first to introduce a practical digital sound recorder is not important. The fact remains that digitized audio will be widely used in this decade, and it may even invade the home. It is only a matter of time and effort to bring the costs of digital systems into line. Samuels is one of several companies laboring toward these goals.

P.S.: For your information, our pilot run of ADAmag kits is scheduled to begin in October 1971, and first shipments are planned for December.

From Paul C. Buff
President, Allison Research Inc.

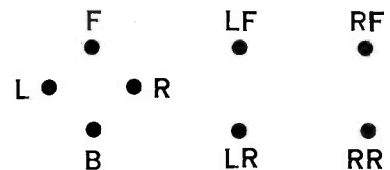
An open letter to R-e/p magazine, the recording industry and William Cara.

First, my applause to R-e/p for publishing an article as commercial as Mr. Cara's Digital Recording article. The reason for my applause is that, while the article is quite commercial, it had something very important to say to the recording industry. I think that the industry gained some rather important knowledge, which, after all, is the reason for R-e/p's existence. Our industry, to my thinking, is on the verge of massive changes in technology and thinking. Digital methods will play a big part in the future, and this fact, to me, is justification for Mr. Cara's words.

RIGHT-ON!

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Circle No. 103

Re/p 7

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Circle No. 104

I am curious as to what sort of distortion Mr. Cara expects from his system at low signal levels. It seems to me, that if a 10 bit system is used a resolution of 1 (one) part in 1024 will be realized at full scale. This represents an approximate distortion figure of .1% for a full scale signal. However, if a signal level of 40dB below full scale is processed, resolution will go down to around 1 (one) part in 10, yielding a distortion figure of about 10%.

My relatively uneducated calculations tell me that something like 18 to 20 bits would have to be used in order to achieve reasonable distortion figures throughout the range of signal levels involved.

I would be interested in hearing Mr. Cara's comments in regard to these parameters.

From Michael McLean
Motown Records

I was very disappointed in your editorial taste in selecting the article by William Cara in the May/June issue for publication.

Even if its were a legitimate paper on a new engineering break-through, the proper place for the public announcement of such a technical development would be the Audio Engineering Society. Your publication by its very nature is intended to help the somewhat less technically orientated music-making record producer type. You have no business concerning yourself with "State of the Technical Art", **pure engineering** subjects such as Digital Recording.

On top of that, the particular paper you chose was pure junk. After many pages of old hat, "This is why high fidelity is a good idea", technical justification Cara basically says nothing more than his company has a secret, Digital Recording Process, and hold on to your hats! Clearly, a cheap promotion line.

The net effect of your publishing this article will be that a number of trusting readers who would like to depend on your publication to help them sort out the nightmare of technical bunk thrown at them from many areas, are going to instead get a mouthful of Bill Cara's bunk.

In publishing this article, I feel that you have forsaken the very people you should be helping; your readers. The only person who benefits is Bill Cara, and his promoting scheme.

From the READERS

EDITORIAL MATERIAL RATING

May/June 1971 issue

MOST USEFUL FEATURE ARTICLE

DIGITAL TECHNOLOGY	33.1%
BAND PASS FILTER DESIGN	11.3%
MONITORING	34.6%
QUAD RECORDING	19.5%

From Horst Ankermann
SENNHEISER ELECTRONICS CORP.

We would like to comment on Mr. Bill Lobb's suggestion in his recent letter to you (see May/June 1971 issue).

The application of shotgun microphones in the recording of music offers indeed some astonishing results, as correctly described by Mr. Lobb. Actually, the idea is not new and everybody who would like to get a picture of how this arrangement sounds can listen to Enoch Light records which appeared under the "Command" label.

These recordings were made in the Bob Fine studios in New York, and Mr. Fine was probably the first to employ shotgun microphones (Sennheiser model MKH 805) for top quality recordings. Later on, several other reputable studios followed suit and applied the MKH 805 shotgun microphone under many different circumstances with outstanding success.

ELECTRO-VOICE AND SCHEIBER WILL COOPERATE IN 4-CHANNEL SOUND ACTIVITIES

It was jointly announced today by Lawrence LeKashman, president of Electro-Voice, Inc. and Peter Scheiber, president of Audiodata Company, that the two have reached an agreement in principle to cooperate in the area of four-channel matrixing systems for broadcasting, recording, and home

entertainment equipment. The companies have pooled their efforts in seeking encoding standards in the industry based on the E-V system. The agreement will also include co-patent protection and probably manufacture of equipment using developments from both firms.

Scheiber was one of the first to develop a matrix system with the goal of enabling standard stereo FM transmission techniques and regular two-channel records to carry a compatible four-channel signal. Additionally, he has developed a decoding technique using comparative amplifiers to increase separation of the system. The Electro-Voice Stereo-4 matrixing system, developed in conjunction with consulting engineer Leonard Feldman and Jon Fixler's Industrial Patent Development Corporation, is now in use by many FM stations, record companies, and recording studios. Decoder equipment has been sold in a wide area of the country and is being incorporated into home entertainment equipment by many high fidelity component and set manufacturers.

ROBINS INDUSTRIES ACQUIRES FAIRCHILD SOUND. In announcing the purchase of Fairchild, to be operated as a wholly owned subsidiary of Robins, Herman D. Post, president of Robins disclosed that operations of Fairchild will be headed by George Alexandrovich, vice president, and David Bain, sales manager.

Robins, located in College Point, New York, is a manufacturer of magnetic tape, cassettes and a variety of cassette, cartridge, tape recorder, hi-fi and data processing accessories.

3-M MINCOM DIV. PURCHASES RECORDER TEST EQUIPMENT LINE OF DATA MEASUREMENTS CORP. In announcing the acquisition, Paul Leeke of 3-M explains that the agreement includes inventory and the right to continue to use the trademarks 'DMC' and 'MICOM'.

The audio recorder test equipment line purchased from DMC, typified by the Model 8155 Flutter Meter (\$595), is used by recorder manufacturers, recording studios and service technicians.

Our "little dipper" cleans up SOUND pollution for less than \$500!

The Universal Audio Model 565 "Little Dipper" Filter Set cleans up problem tracks made under adverse conditions such as remote pickup or location filming. Whistles, heterodynes, hum, and other coherent sound can be filtered out, with no audible effect on the quality of the music or voice. Semi-coherent noise—motion picture camera noise, fluorescent fixture buzz, can be greatly reduced, as can the incoherent noise of jet aircraft, noisy amplifiers, and general background noise. Also, the versatile 565 can be used for many other tasks and effects:

- "Phasing" and other unique effects
- Sharp enhancement of any audio frequency
- Simultaneous elimination of any two audio frequencies
- Harmonic distortion filtering
- Wave analysis

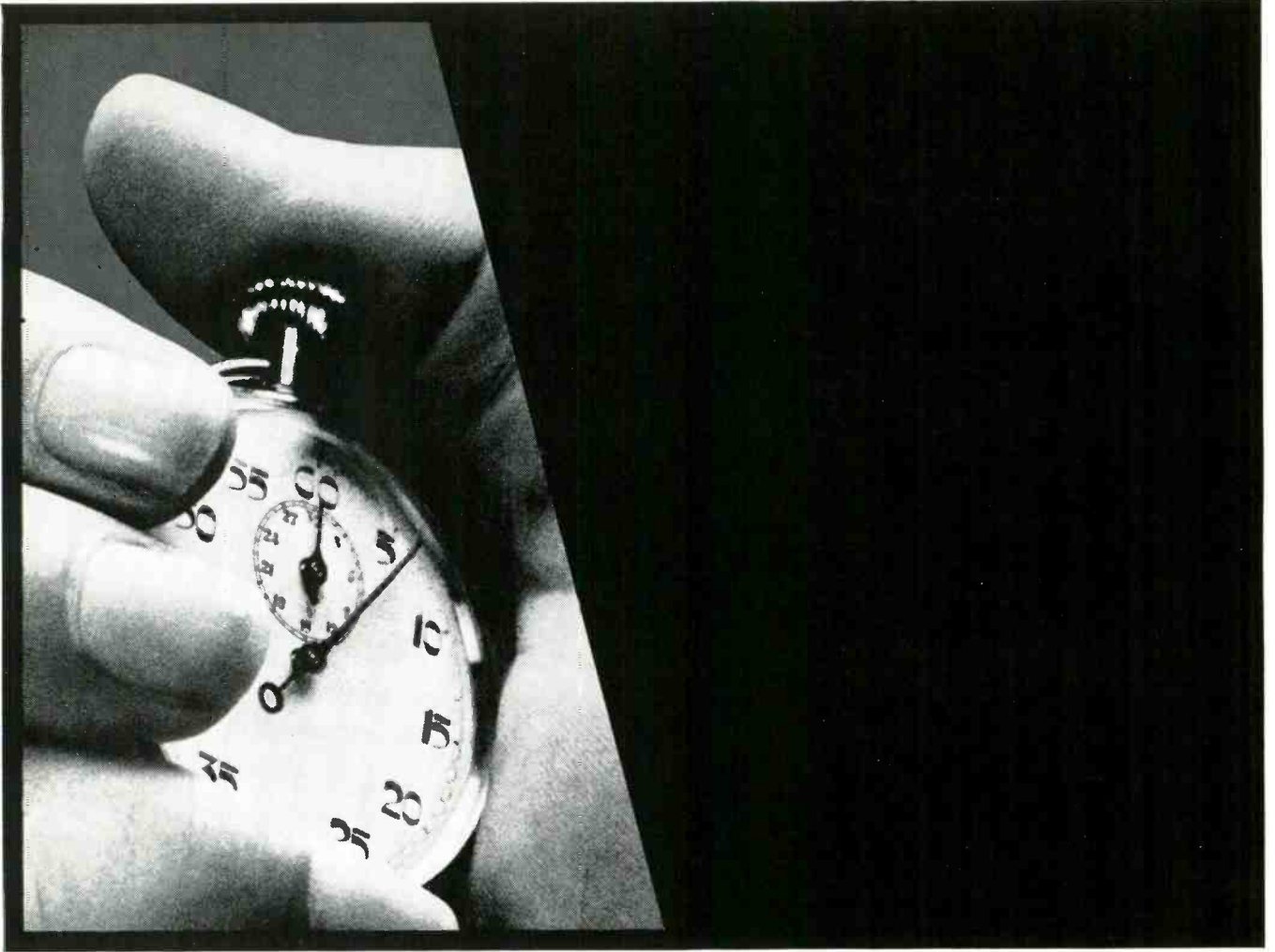
FEATURES

- Two variable width notch/pass filters, lo-pass filter, hi-pass filter, all continuously tunable
- Zero insertion loss or 20 dB gain
- Extremely low noise and distortion

See your dealer or write for complete specifications.



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Shure Brothers Inc.,
222 Hartrey Ave., Evanston, Ill. 60204.



Circle No. 106

Bring 'Em Back Alive . . .

A little trite, a little corny, antiquated perhaps as this old Frank Buck . . . ism is, it is undeniably the battle cry of the Remote Recorder.

. . . and with concert and festival fever also very much a factor, the Remote Recorder is often not that far from an animal stampede . . . in the human jungle.

. . . and talk about a man who has only one bullet . . . one shot to deliver with.

Miss that one shot, at the once, and once only, greatest, livest, in-person, all-star, end-of-it-all concert, and the Remote Operator faces a wounded charge of his client . . . a charge the ferocity of which couldn't possibly have been known by the most fearless lion hunter.

So the admonition is that if you want to be in the Remote business, you damned well better be fast on your feet . . . a minute-detail-loving-kind-of-a-guy, or at least . . . someone who heals quickly.



an Re/p report

Remote Recording, (more accurately for the purposes of this report, contemporary-music-live-performance-recording) is calculated to become an increasingly large part of the total recording business. During a recent week the record trade press identified more than 10 of the top 50 albums that week as being non-studio recorded. The increased popularity of live-performance recording is said to reflect the current "truth syndrome," the whole "tell it like it is" thing seems to be involved. There are, apparently, significant segments of the record-buying public who want to be reassured that "this is the way it really happened . . .", that this is not one of those sterile manufactured recordings.

It is generally agreed that although the Remote recorded release is often not as technically perfect as a studio-produced date the technical imperfections are mainly overlooked in favor of the excitement of the performance . . . spurred by the interrelationship of the artists and a live enthusiastic audience. This is certainly what is hoped for in arranging to have the talent recorded live.

In all of our discussions with remote vehicle operators, the only motivation reported for doing any of a number of things, or not doing any of a number of things during any session, was simply a reflection of this total search for an honest audio representation and reproduction of what happened.

In the main, this means cutting the tracks as flat as possible . . . with as much level as possible.

The idea of producing a relatively flat set of tracks is modified only slightly by the fact that several of the Remote Operators make their facilities available to "mixers" engaged by the client. Generally, guest mixers have worked with client producer and the performers often enough previously to know the kind of flavor, if any, they want to blend into the tracks at the point of the performance. However, even when the remote console is manned by a guest mixer, the philosophy of a flat multi-track tape is, more or less, the inevitable order of the session. This does not mean that there is an absence of processing of the recorded live sound, but it is cer-

The Dolby 360 Series



Each Series 360 unit is only $1\frac{3}{4}$ inches (44 mm) high. 16 channels therefore require only 28 inches of rack space.

Full compatibility with the A301

Models 360 and 361 are single-channel A-type (professional) noise reduction units which process signals identically to the two-channel A301. The new units are small in size and are designed for simplified installation and use of the Dolby System with 16-track recorders. The cost of the 360 series is somewhat less than that of the A301 for an equivalent number of channels.

Automatic record/play changeover in the 361

The Model 360 is a single-channel noise reduction processor unit. The Model 361 is identical to the 360 in size and appearance, but contains facilities for automatic record/play changeover controlled from the recorder. In the new series, the operating mode is set and clearly displayed by illuminated push-button switches.

Internal oscillator

An internal "Dolby Tone" oscillator is provided for establishing correct operating levels. The characteristic modulation of the tone also identifies Dolby-processed tapes. All oscillators in a multi-track installation can be controlled by a single switch.

High stability

The circuit is highly stable and does not require routine adjustment. A removable front panel allows input and output levels to be adjusted from the front of each unit. The panel also provides access to relays and the noise reduction module.

Single-module design

The noise reduction circuitry is contained in a single module which can be purchased separately. Should failure ever occur, plug-in substitution will restore operation of the system in seconds with no adjustments necessary.

Prices, delivery information and complete specifications are available from



DOLBY LABORATORIES INC

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(212) 243-2525 cables: Dolbylabs New York

UK and International
346 Clapham Road London SW9
(01) 720-1111 telex: 919109 cables: Dolbylabs London

tainly held to a minimum prior to mix-down back in a studio.

There is, however, some feeling that the experience of the Remote Mixer is not that critical where a master tape mix-down is not going to be the prime purpose of the session . . . and conversely where an uncolored set of tracks is the goal. The feeling is that audio engineering capability is, perhaps, more crucial than mixing talent.

In contrast to the unlimited options for change and adjustment to the recording set-up, concurrent with any number of "takes" available to the fixed studio mixer and producer, the remote crew finds their options for change much more drastically confined once the live performance begins. Without meaning to minimize the preliminary efforts of the fixed studio session, the preparations for the Remote session must be much more absolute. Every one of the mobile operators interviewed credited a large part of their success to meticulous preparation of the equipment and complete rehearsal of their crews.

For example, assuming an evening concert to be recorded: It is not unusual after a lengthy, less-than-smooth trip to the location, to spend all day completely checking out every system (things do loosen up in transit). The set-up which follows always includes complete calibration of the tape machines. As often as possible the set-up, based on the best information concerning the performance, is followed by as complete a stage sound check as possible.

So, when the microphone umbilical has been run out to the stage, with the possibilities of as much as 400 to 500 feet of it having to be hauled, all microphone pairs in the mike umbilical (FEDCO 33, BUTTERFLY 38, LOCATION 36, FAR-OUT 32, HEIDER 27, HAMEL 38) are run down to check that all are working and secure.

Interestingly, LOCATION RECORDERS terminates both ends of their microphone umbilical cables (2 sections of 300 feet each) with female connectors. (This suggests that at some time in the past 300 feet of heavy cable was hauled out, perhaps by some unknowledgeable minion of, maybe, a plumbers' union, only to find the wrong end up). So, as Larry Dahlstrom says, "It's just as easy to terminate both ends with female and carry male/male adapters."

It is at this point that the Remote Operator will probably begin to anticipate his interface problems with the other audio and electrical environments with which he may be involved. As Tom Scott, HEIDER's chief engineer reports, "As recording equipment gets more and more sophisticated, larger, and more power-consuming, a good clean power source that isn't going to involve ground loops with the house system is harder and harder to find. . . . yes, we use isolation transformers, but this sometimes will give you a potential between the two grounding systems . . . like plugging in a direct box only to discover you have giant sparks between your grounding system and theirs. There don't seem to be any hard and fast answers . . . we have a lot of success in taking power from the same source as the public address, so that we are both within the same grounding frame of reference . . . then we don't have to worry about ground loop."

"If your personnel is well rehearsed," says Scott, "and know their options, trying the isolation transformer, try changing the power source, try adjusting the grounds, try running ground straps to the plumbing . . . in an organized way, you can take care of the problem."

While on this subject of grounding and the problems of set-up and check-out, FEDCO's Fred Ehrhart describes their mike-bridging systems as having switches between the two outlets: "One outlet goes straight through and the other is directed through a bridging transformer. When you have set up your bridging, you then arrange these grounding switches so that you minimize or eliminate hum in each of the lines. To eliminate hum completely you must establish a proper relation between the PA ground and the truck ground. A heavy set of cables, battery cables like the ones we carry, are very handy to have for re-establishing a club's ground . . . most often at their power entrance. Then both club and truck are in a common ground relationship."

Among those vehicles with generators there seems to be the feeling that they would prefer to work off of supplied line power as their first preference.

The FAR-OUT PRODUCTIONS vehicle uses supplied line power and also is provided with a huge storage battery reserve.

REICE HAMEL operates exclusively from batteries, on which basis he says that he does not encounter grounding problems.

As with the comments on grounding, RF interference is also very much of a problem. Tom Scott tells of a remote where they were miles away from everything, in the hills above San Jose, on their own power, where there was very little they could do to get rid of RF sizzle from a radar sweep, from some distant station, as it went by every minute.

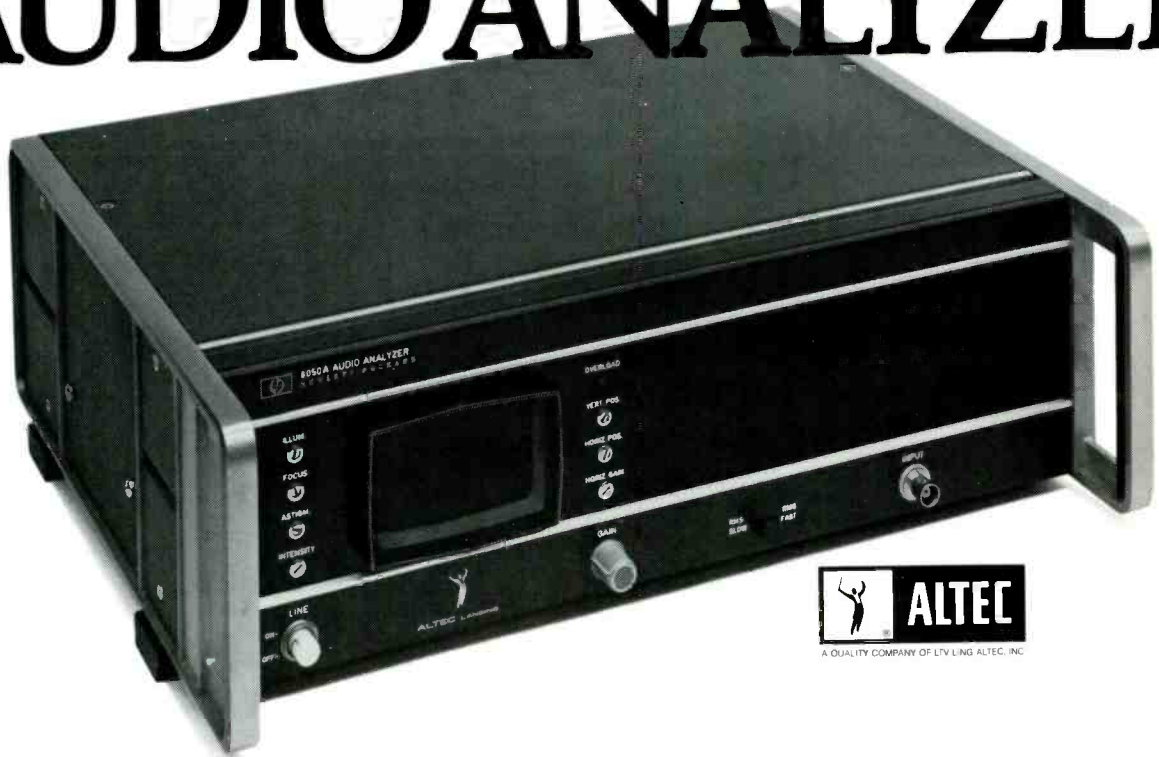
It seems to be the general advice that there isn't very much to be done except to try find out where the field is, what its shape is, and work around it by moving mikes and cables around and away from the field. If there is one strong recommendation, it is to stay as far from lighting controls and dimmer panels as possible. Again, mikes and cables can be adjusted to a different orientation to avoid an RF field. Again, according to Scott, "Sometimes you don't have to do any more than change the direction, or change the angle in which the cable is laid."

In cases of extreme interference traced directly to SCR dimmer controls, it may be that the Remote Recorder will have to run down the lighting cues, suggesting to the lighting crew that the dimmers might be used when the interference they cause would not affect the recording.

From all sources, it can be concluded that RF reduction in remote recording is far more a practical art of trial and error than it is a measurable science.

Fortunate is the remote crew who can set-up before a complete rehearsal so that a really thorough sound check can be done. But even this doesn't guarantee a thing once the live session begins. The electrical and the acoustical environment of the afternoon often bears little resemblance to the same area a few hours later when loaded with humanity, lighting, air-conditioning or heating, and an actuated PA system. A great deal of what

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was done during set-up may need redoing very quickly as the live performance begins.

The set-up time is characterized by LOCATION RECORDERS' Aaron Baron as, "A time to discover any surprises. We don't want any surprises once the date starts." Or, as echoed by Fred Ehrhart of FEDCO, "You have to be crisis oriented . . . the name of the game is to always be prepared for something to go wrong. The point is that very often you can't fix the situation in the middle of the performance. Say, a mike is breaking up, you must be able to go around it. There is no such thing as calling for another take."

The first few minutes through each set of the actual performance, then, are normally the times of greatest crisis. These are the times, especially in the context of rock concerts, when a lot of the guesses about who is going to be where on stage, and into what mike, and into which amp, can be almost completely refuted. So assuming a dutiful equipment check-out prior to the performance, this pretty well establishes that the most likely place for problems to develop will be between the performers and the truck. The on-stage conditions become the great variables and break down into two essential categories: 1—performance variation or on-stage movement; 2—equipment failures.

FEDCO . . . Providence



Stage movement is a very severe challenge to the microphone channel assignments provided for in the set-up. The problem is not at all restricted to the opening bars of a new set, or when the group returns or another group goes on stage, as we may have inferred. Actually, the movement of the performers on the stage becomes more accelerated in the heat of the performance, especially if the audience reacts with great enthusiasm. Of course, this audience reaction is exactly what the producers are hoping for . . . the excitement and the spontaneity is what live performance recording is all about.

Just the movement of one or two players on the stage, and the track assignments set-up to provide clean track separation will suddenly have changed drastically. Of necessity, any remedy must be applied quickly. Instant rapport and positive communications between truck and stage must be available to effect the changes required.

Equipment failure, we are told, is more a question of breakage than electrical failure. Most stage failures involve mikes being knocked over, being hit by drum sticks, cables being tripped over and separated, boxes being kicked, and the like. However, for whatever reason, failures do occur. When they do, instant communications between the truck and the stage are essential to take remedial action.

Common to all of the facilities viewed is a combination communications system which relies on closed circuit TV and two-way voice communications. Additionally FEDCO uses a light-signaling system to, as Lyle Fain explains, "call for immediate voice communications, either way, during periods of extra loud sound passages when an audio call might be overshadowed, or somebody might be off the earphones."

So important to LOCATION RECORDERS is their closed circuit TV system that in answer to the question, "Assuming no financial restrictions, what additional equipment would you install?" Larry Dahlstrom responded, "Probably only a second TV monitor system."

Using these means of communication, the information flow can go both ways and proper adjustments can be made. From where the TV camera is located it can show the crew in the truck things that would be difficult to see from the stage level in the wings: something like a keyboard man switching from organ to piano, or piano to electric piano; or a guitar or bass player going from an electric instrument to an acoustic. The importance of pulling one mike down or opening another in each of these situations is self-evident. There are things, too, that the stage crew will see that elude the TV cameras.

With this kind of need for flexibility of assignment in mind, it is not unusual to see very highly developed patching systems in each of the trucks. Something like 300 jacks in the FEDCO truck, the same in the LOCATION vehicle and about the same in each of the others. Or as AARON BARON says, "The only jacks you are ever sorry about are the ones you left out."

And, as BOB FRIESE of BUTTERFLY reports, "At the truck end all of the input lines terminate at the patch bay, where most of them are normalled into various microphone inputs. This permits the recording engineer to group the mikes across his board the way he wants them, no matter how many times instrumentation may change."

Every live performance recorder will tell you that he must begin his work with the understanding that above all else his task is only secondary to the performance itself. The understanding is that the recording is made only as a by-product of a successful live performance. In whatever action he takes the remote recorder must, of necessity, assume a very low profile. He must operate as anonymously as possible, contributing not one bit of inhibiting influence to the performance.

Most of the remote operators seem to steer away from wanting control of the PA system, although each has means for feeding a PA mix to the audience. The feeling is that a proper PA mix cannot be made from any point other than in the audience, in front of the stage.

The PA job does, however, have a decided effect on the recording. The audience mikes hung by the recorder

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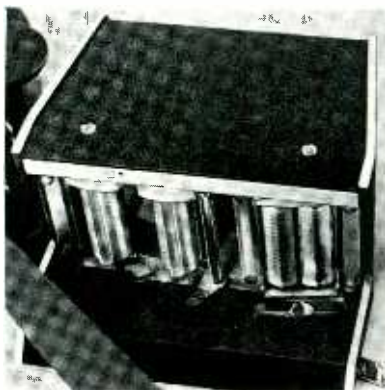
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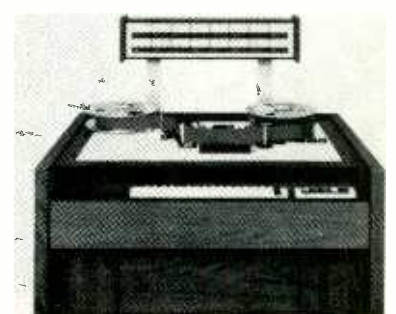
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pick-up the hall, both the audience reaction and the public address broadcast of the performance. This ambient is a very essential part of the recording, adding natural depth to the tracks and contributing audience excitement.

Where the PA job is something less than good, as where speaker placement or sound levels generate feedback, there is little the recorder can do to keep from documenting poor PA on the recording.

As Fred Ehrhart reports in commenting on their co-existence with PA: "Our interface with the PA doesn't create any additional problems with him . . . the PA never hears anything we are doing . . . but we sure do hear what he is doing!"

On most dates the sharing of as many microphones as possible with the public address system reduces wiring confusion as well as visual clutter on the stage. The use of transformer bridged microphone systems, as reported by all, minimizes the possibility of grounding problems.

Milking the live performance session presents some interesting challenges in that means for track separation found in the studio . . . the architectural design of the studio itself, placement of the individual instruments, baffles, overdubbing . . . all of these which give the recorder acoustical control are not available to the remote operator. On the live stage with very little possibility of control, the selection of microphones is much more critical. Close-miking techniques, *ultra close-miking*, along with the highest possible record levels are about the only alternatives that the remote operator has for insuring cleanly separated tracks.

The choice of microphones for remote sessions is as variable as each individual taste, just as it is in the studio. However, there is the general feeling that, because of their rugged characteristics and their greater resistance to overloading in close-miking situations, dynamic microphones are more generally used than condensers.

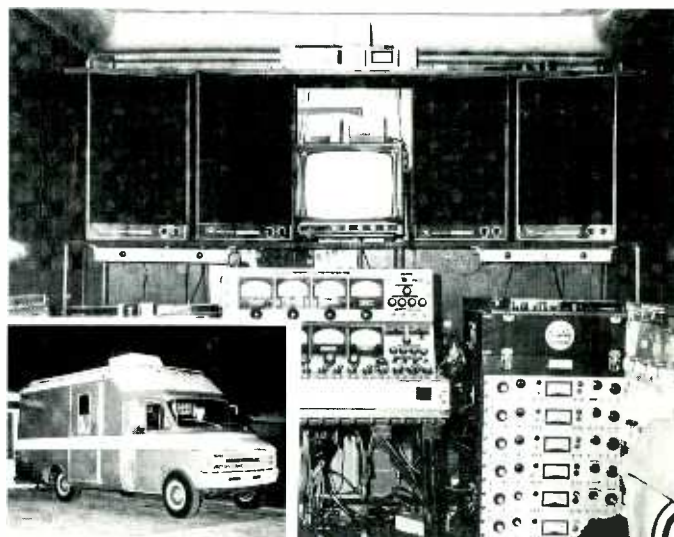
A deviation from this thinking comes from REICE HAMEL who uses all condenser or ribbon mikes for his sessions. In his words, Reice says, "I like the sound of condensers and I find that I can use the FET condensers, putting out even +15dB, even inside a bass drum by using a 30dB pad along with as much additional attenuation as I need from the continuously variable 200Ω bridge T circuits I built into my console in front of each input transformer. This enables me to pad even during recording without changing levels by working the pad against the fader simultaneously. This arrangement allows me easily 60dB of attenuation. On this console you are looking at +40 before clipping."

Hamel's universal method of phantom powering his mikes deserves mention. In his words again, "*Neumann uses a 50-volt supply using two 6.8K resistors and this makes their mikes compatible to give a draw of about .4 mils, AKG uses a zener diode to control their voltage right down to 9 volts. You can use a variety of voltages on the AKGs providing you use the proper value resistance. The AKGs have a capability of from 2½ to 10 mils. It's a different system from the Neumann. You can't plug an AKG into a Neumann power supply because it will be drawing about 12*

mils and you will blow the zener. I have simply inserted in series with the two 6.8K resistors another resistor . . . say a 12K resistor if you want the AKG to run at 2½ mils, in series. What happens is that when you plug in the Neumann with the larger value series resistor of 12K, the Neumann is now drawing only .4 mils which hardly sees the larger resistor so it pulls down your 48-or 50-volt supply to 45 volts . . . which is fine because the Neumanns will work within specs at any voltage between 42 and 50 volts. So you are still within the specs.

"Now with the AKG plugged in you have a much larger load of 2½ or 3 mils so now it will pull that 50 volts down to exactly 9 volts, at the output of the microphone head. It will work the Sonys, too.

"This is fail safe in that if you have a direct short at the end of the mike line right to ground you would only draw 2 mils . . . which will burn out nothing. A warning: one of the few mikes which will not work in this circuit is the Sennheiser 9-volt MK 405 system because it's modulation lead powered."



REICE HAMEL . . . Las Vegas

The rapidity with which the live performance recorder must react to changes in signal dynamic range and maximum peak levels, without being able to get on to the stage to rearrange the miking, leads inevitably to these problems of pre-amplifier (front end) overload and the attendant difficulties of distortion on the tracks, to which Hamel refers.

LOCATION RECORDERS tackles the problem with pre-amp feedback loop gain controls on their console. FEDCO is prepared for the problem with a 30-60 dB feedback gain control on their board, but feeling, as Lyle Fain expresses it, "that sometimes 30dB of gain is too much for the pre-amp, and the output will overload, then we are prepared to insert a balanced line 20dB pad . . . either patch it in here in the patch field or with XL's into the line before the pre-amp stage. Either way we will only lose the mike for a few seconds. It may be a little more attenuation than you like in some situations but you always have reserve in the pre-amp to make up the gain."

Pre-amplifier sensitivity is thus another reason for the preference for the use of dynamic mikes in critical high

peak level positions. It was additionally mentioned that dynamic microphones are less prone to RF pick-up.

With all the talk about live performance recording being, as Chris Huston (FAR-OUT) says, "the difference between documenting and producing" the appearance of so much equalizing capability in each vehicle is mildly surprising.

Most of the operators report that guest mixers are a great deal more prone to use production EQ than are the house mixers.

We make a distinction here between *production* EQ as basically affecting the flavor of an instrumental or vocal sound as opposed to EQ which is quite ordinarily used by everybody to clean up an environmental acoustic condition. Like, perhaps, rolling off a low frequency room rumble, or something of that sort. As Wally Heider reports, "If you hear something on the monitors that you know shouldn't be there . . . and you can get at it with EQ . . . you must."

Leakage can often be controlled with EQ as well. For example, taking cymbal leakage out of a bass track by rolling-off all but the bass frequencies.

There is the point that the live performance mixer must establish relative EQ during the performance if, for example, he has several microphones going onto one track. This is most often the case with drums. If one or two tracks are being used for a six-microphone drum set-up, the relationship of the snare to the cymbals to the bass, etc., must be established before the track is down.

As George Koch of FAR OUT relates, "EQ is a handy safety device occasionally. For example, we found out that we had lost a bass mike when we punched up the bass track on the solo monitor. It turned out that there was another mike on the stage, not too far away, that wasn't being used during that set. We patched that mike in, changed the equalization on that mike channel to roll off all but the bass response and we had a phantom bass guitar with pretty effective separation . . . and we saved the tracks."

The same general philosophy seems to apply to other signal processing devices, limiters, compressors, noise

reduction devices, etc. To some degree each of the facilities has some amount of processing gear in their racks. There is, however, a reluctance to use anything which tends to color the performance. The most general exception is limiting on the vocal channels, and this is almost exclusively for peak content limiting.



FAR OUT . . . Hollywood

The basic philosophy encountered in discussing the construction of the interiors of the various mobil recording vehicles . . . the monitoring equipment . . . involves the attempt to develop a flat and isolated audio environment.

The relatively small areas inside the vehicle apparently present some problem in that they yield an ultra damped sound somewhat devoid of dimension or depth. While these areas wouldn't be described as "good listening rooms" in the sense that a control room used for remixing would be so described, their goal seems to be an environment where the most minute details of the sound can be identified for whatever action might have to be taken.

In discussing the difference between fixed studio and mobil monitoring requirements, Aaron Baron emphasizes the point that the mobil facility is in no way a remix room. As Baron puts it, "Sure we have Acousti-Voicing and we do carry some nice little KLH speakers, which we use for some quick remixes, but they flatten things out and we feel that you lose a lot of what is really happening.

"With the Acousti-Voicing out and using the 604E's, we get a screaming mid-range, a screaming top, which is really annoying to listen to in here. But one thing we can be sure of, there is not a damned thing that happens that we don't know about . . . If anything happens, the least static, the least crackle, it really hits you. With these speakers in here you can really pick the sound apart. These are real analytical recording speakers. They are the kind of speakers we need for this kind of recording . . . our business is live recording . . . we have to find out what we have damned quickly . . . sure, we know we have a hump in this room at 3 to 5000 Hz . . . which is really nice for us because it's really the presence range . . . when the groups and producer come back to hear the stereo mix we do switch to the KLH's with the tuned system switched in."



BUTTERFLY . . . Cincinnati

In discussing their choice of monitoring equipment, BUTTERFLY chief engineer Nelson Weber puts it this way, "Small (speaker) systems created no size problems but were lacking in several sonic respects. Large systems could do the audio job better but we didn't want to make the truck into a gigantic speaker enclosure . . . we decided the best system for the size consisted of a pair of ADVENT systems and a pair of ALTEC 9844 s. With the Advents stacked on the Altecs, bass response was now adequate to 30 Hz and the total sound was now good enough to satisfy the ears of the musicians of the staff.

Hamel has had his best experience monitoring on JBL LE 8 full range speakers, mounted two to an enclosure with a 3" port cut into the center of each enclosure.

Not surprisingly, every facility represented in this presentation was well equipped with totally flexible monitoring systems. The need to instantly switch from the normal monitoring of the rough stereo mix to periodic monitoring off of the tape machines, to solo track or solo channel monitoring is very consistent with the whole idea that nothing can be taken for granted when doing a live-performance recording.

As Fred Ehrhart puts it, "Our main purpose is to make the track acoustically extremely dead. Any truck to do the best possible job you have got to have an accurate representation of what is going on in the hall. The truck shouldn't lend any flavor at all."

The FEDCO facility is lined top, bottom and sides with thick long pile carpeting to effect the kind of environment they require. Ehrhart further explains, ". . . from measure-

ments with an H.P. spectrum analyzer with the mike at the engineer's (mixer's) position we start rolling-off at low bass, at below 100 Hz. From 100 to 8000 Hz response varies ± 4 dB. At about 8000 we have some absorption effects from the carpeting which attenuates the high end. The attenuation is smooth to about 15,000 and it rolls off to, say, -10 at 15K."

LOCATION is constructed using fiberglass and lead sandwich, RF and sound attenuated, with 4" of urethane foam in the ceiling and floor, as well as a double sandwich layer of lead and fiberglass on the front wall to cut down on airborne noise of the generator.

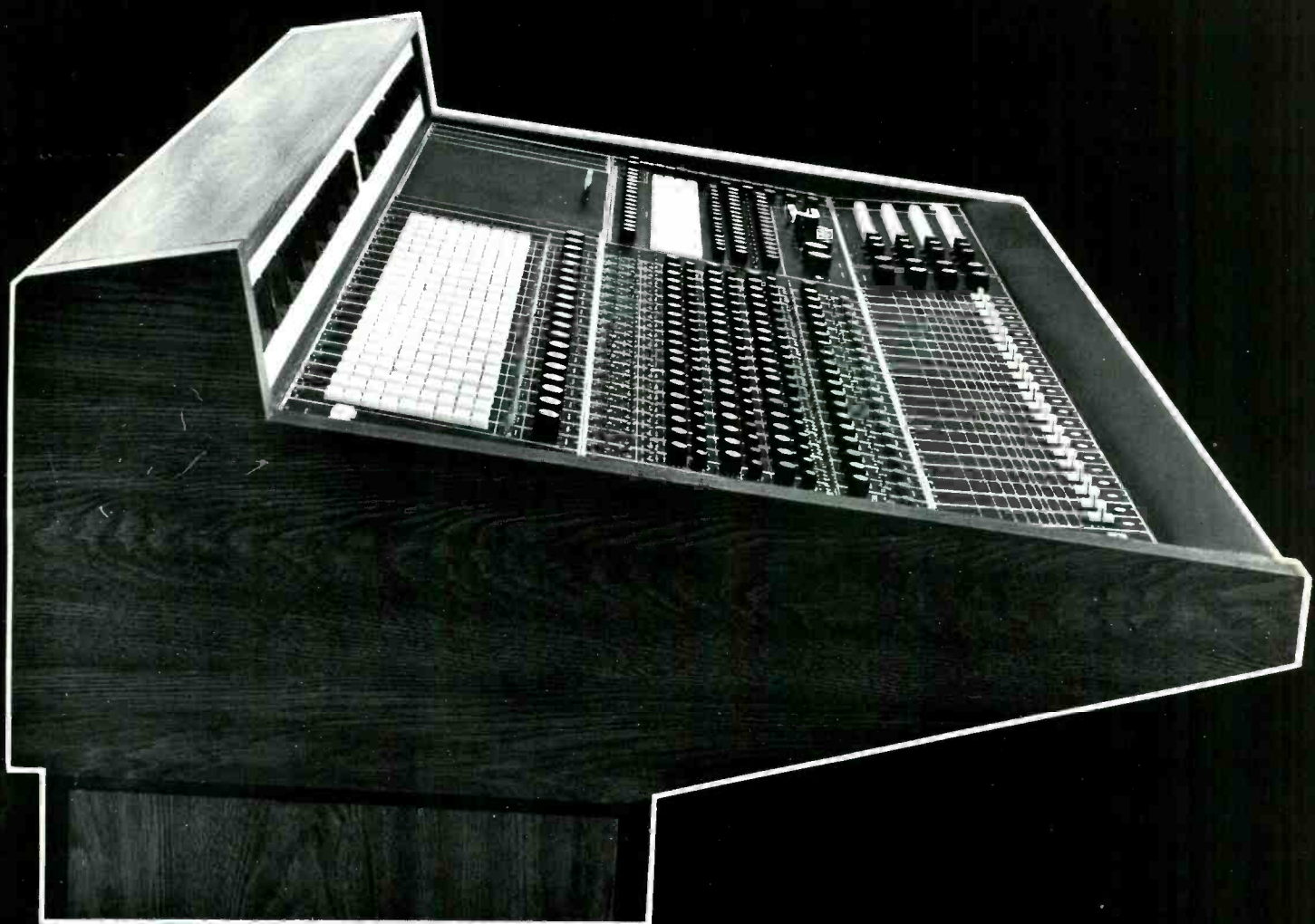
A basic difference in construction is represented by the FAR-OUT truck which is assigned a bit of a different task, which appears to account for the rougher finish of the rear of their vehicle. According to Gerry Goldstein, "Our truck is designed to go out on the concert tour with the groups we produce. The whole back of the truck, behind the 'studio' is meant to carry the groups' gear as we go from concert to concert . . . still the sound back there is really good."

So, in these preceding paragraphs, as many readers have requested, we have some insight into the remote recording business, at least as it appears to be conducted by several of the most prominent of the remote operators. There is no question, both in terms of the state of their equipment, as well as the appreciation of the finished products, "that they have succeeded in their efforts to duplicate the finest fixed studio control rooms . . . on wheels.

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monitoring . . .

you can't hardly believe what you hear . . .

A PRACTICAL FREQUENCY RESPONSE MEASUREMENT METHOD

by RON MALO

In this article a method of measuring a monitor system without the use of special equipment will be described, along with ways to correct some of the problems which are encountered in the monitor system. In this article a monitoring system is defined as all of the components following the console program output, i.e., the monitor level control, power amplifiers, the speakers, the room, and the listening position.

No matter how flat a speaker system was when it was measured at the factory under ideal acoustic conditions, when it is installed in a room the speaker system's response, chances are, will be a long way from being flat. Standing waves, the acoustic treatment of the room, the position of the speaker in the room will greatly affect how the speaker sounds. Since the monitor system is the most important and critical quality control point in the recording process, it must be right.

No matter how expensive a monitor system is, how well it performs will depend on the room in which it is used. Even where and how the system is placed in the room can change its characteristics.

But even though most modern recording studios attempt to build control rooms that possess ideal acoustic conditions to produce flat absorption characteristics, practical considerations often force them to place the speakers in less than the best positions.

So, up on the ceiling they go, over the control room window, or just suspended in mid-air, with no floor and/or wall loading to couple the speaker system to the room for low frequency efficiency.

The method described here is not proposed as a replacement for laboratory calibrated equipment. But the

method can give a realistic picture of what is happening to the frequency response under actual operating conditions.

MEASURING THE FREQUENCY RESPONSE OF A MONITORING SYSTEM

In starting the procedure, a check of the frequency response of the output of the monitor power amplifier should be made. The frequency response should be nominally flat from 40 to 15 KHz at all settings of the monitor level control. If the measurements are flat, "pass go." (Nobody is apt to give you \$200, unfortunately). At this point we leave the usefulness of sine waves. If the monitor speaker were operated in an anechoic environment without reflections, reverberation or standing waves, pure sine waves could be used.

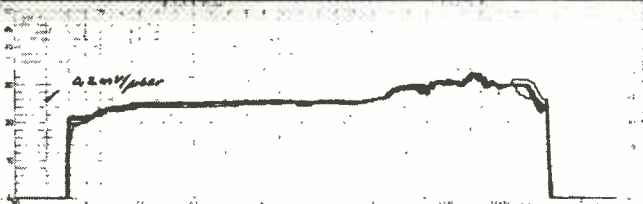
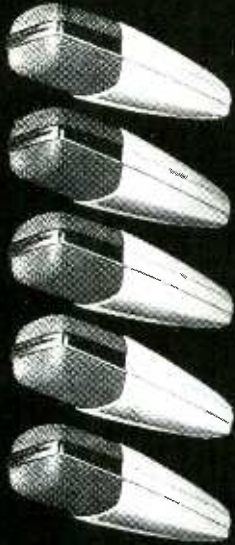
However, in a real room acoustic problems will cause sine waves to double or cancel, and obtaining a realistic response curve would be impossible. The use of "pink noise" will give the measurable results that are needed.

Pink noise produces a uniform output of a random nature across the audio spectrum. Thus, the standing wave problems which pure sine waves would produce are not present when using pink noise. The random nature of the pink noise means that it can be used for speaker measurement as well as more closely resembling the characteristics of music.

By using $\frac{1}{3}$ octave bands of pink noise from approximately 40 — 15KHz, a measurable sound source is obtained.

There are several sources for calibrated pink noise. If you are lucky enough to have a $\frac{1}{3}$ octave filter set and a noise generator, or if you can borrow one, you are all set. Otherwise there is a disc with pink noise bands and

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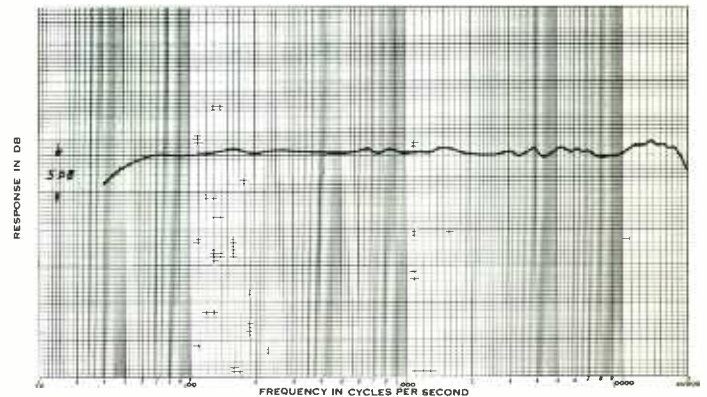
Circle No. 112

sweeps available from CBS Labs or, as was used for the measurements described here, a pink noise tape is available from STUDIO ENGINEERING CONSULTANTS, 19123 Castlebay Lane, Northridge, CA 91324. Either the tape or the record will yield equally good results.

THE MICROPHONE

A high quality professional microphone of known response is needed as part of the test set-up. The manufacturer's published response for a new microphone of the type will be close enough for the tests. The ideal would be to have a curve of the actual microphone to be used.

The microphone used in our tests was an omni-directional dynamic. The calibrated response curve for this microphone appears in Fig. 1.



The omni-directional microphone was chosen so that the random reflections of the sound in the room could be picked up equally whereas a cardioid would favor only the front response and would reject any problems from the sides and rear.

THE TEST SET-UP

Any two of your VU meters can be used to indicate the speaker response. However, it is important that the input levels to the monitor system, and the output of the microphone be read on the **same** type of meter.

When playing the 1KHz, $\frac{1}{3}$ octave level set band on the tape, set the VU you will use to read the output of the console to 0VU. Then adjust the monitor level control to reproduce an acoustic level of about 80dB. This should be just loud enough to be able to talk over.

Connect the microphone to be used to one of the microphone inputs on the console, adjusting the mike level to read 0 on the VU meter which will be used to read out the output of the mike. The microphone should be placed at the position the mixer's head would occupy at the console. (The person making the measurement should stay as far from the microphone during the test as possible.

In setting the levels, a little practice will be required to read the average VU readings because of the fluctuations of the random noise, particularly at the lower frequencies. The objective is an average VU reading.

The test itself involves playing all 27, $\frac{1}{3}$ octave bands of pink noise, noting the difference in VU dB for each band on a chart. If off-scale readings become a problem,

the 0 level may have to be reduced.

It will be best to make several runs on each speaker, using an average in the final calculations of the speaker curve.

After each speaker in the system has been checked individually, the same method should be used to measure the combined system in the same fashion. In a 4-speaker system, the pair used for stereo playback are fed a common signal. This would represent the response of any center channel information in a stereo mix or the response of a mono playback using both speakers. If all speakers are used for mono, then the response should be checked for that configuration also.



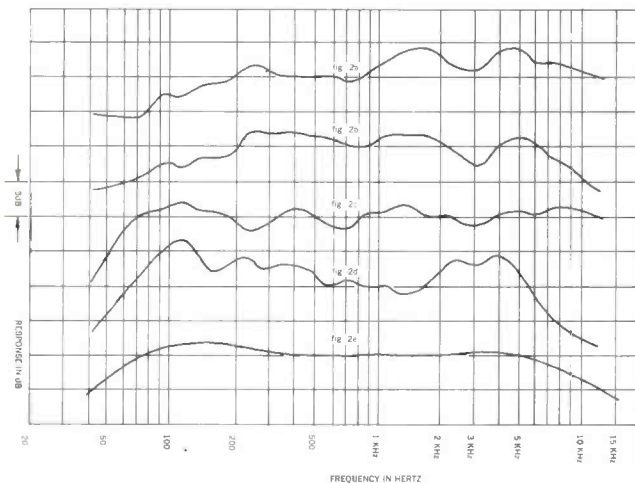
Later on you might change the position of the microphone in the room to observe the changes that occur at different listening positions.

If a response graph is available for the microphone that is used, find the center frequency of each $\frac{1}{3}$ octave band on the graph. This will give the $+$ or $-$ correction needed to add or subtract from the figures obtained in the monitor system response runs. After the corrected figures are obtained, plot the frequency response using the center frequency of each of the 27, $\frac{1}{3}$ octave bands on standard semi-logarithmic graph paper.

Now that you can see the response of your monitor system, the decision is up to you. Is it flat enough to satisfy your needs? How much correction is required to make the response flat? Can the acoustic treatment of the room be changed to make the correction, or will electrical equalization be needed?

Figure 2 shows the response of several monitor systems measured using this method. All of the studios were using good quality monitor systems. The operating personnel were satisfied with the sound of each of the systems and considered their system as a standard for flatness. Curves 2A & B were made in the same control room, but the speaker system was changed to one of a different manufacturer. The effect of the room on both speakers can be seen.

During the tests made using this method, the response shown in Figure 2E seemed to sound best to the ear for systems operating at nominal monitor levels, 80 to 90 dB. If higher levels are used, the high frequency roll-off would be greater.



Simple RC equalizers can be used to make minor corrections. To correct sharp peaks or dips in response, a filter similar to the ones described in the May-June issue of R-e/p, "Active Filter Design" can be used.

An important point to remember is that if equalization is required to bring up the response at the extremely low frequencies, for every 3 dB-increase the amplifier's power will have to be doubled.

This same method can be used to plot the frequency response of echo chamber, P.A. systems, etc. Remember, it isn't intended to replace calibrated laboratory-type equipment. But it will let you see on paper that you "CAN'T HARDLY BELIEVE WHAT YOU HEAR." END

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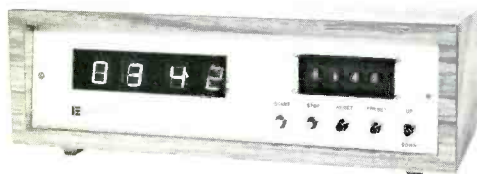
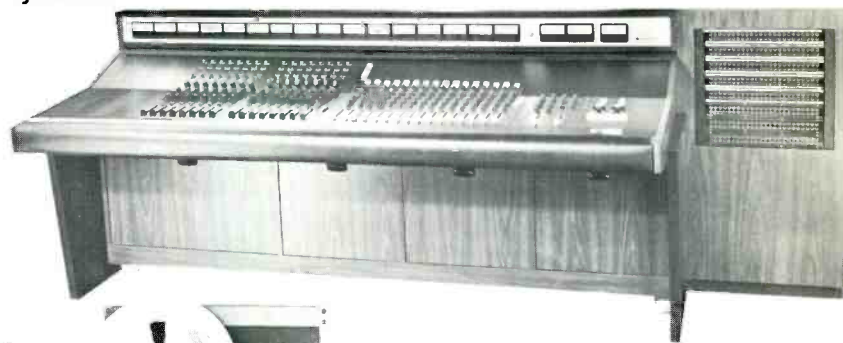
mca tech

the versatile group

Well-known performers — each a technical and creative specialist in electronics. Result — the range and quality that makes for success. We can help you get it all together, from the smallest switch or component to complete custom recording studio systems.

AUDIO CONSOLES — Electrodyne is expertly staffed to design, engineer and fabricate broadcast and production systems to meet your exact requirements — with the finest quality and highest reliability available anywhere built into every product.

Circle No. 113



ELECTRODYNE'S DIGITAL STOPWATCH DC1000 —

Here in one package are all the features wanted for precision timing of minutes and seconds at a moderate cost. It will count forward or backward and stop at 00:00. Can be preset to a selected number and count up or down from there. All integrated circuit logic; no moving parts. Remote control and dress cabinet are optional features. Engineered and tested to guarantee unflinching reliability.

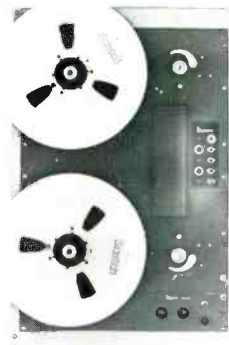
Circle No. 116

GRAPHIC EQUALIZER INPUT MODULE by ELECTRODYNE — This most recent addition to the product group is an input module with control of **9 frequencies simultaneously** — with microphone preamplifier, isolated echo send and ultra low noise straightline attenuator. The 712L provides you with the most sophisticated audio channel ever attained in one plug-in unit.

Circle No. 117

LANGEVIN'S BC-8A BROADCASTER CONSOLE features 24 inputs (8 Full Stereo and 8 NEMO), stepless faders, separate program and audition outputs, solid-state modular plug-ins, 2 power supplies with switching for fail-safe operation, stereo/mono input selector keys, separate cue amplifier and lobby feed amplifiers, 5-position monitor select switch and amplifiers, equalizers for Program, Audition and Monaural outputs. There is a choice of microphone input preamplifiers and separate monaural outputs switchable between Simulcast and Independent inputs.

Circle No. 118



THE LANGEVIN TR-100 SERIES TAPE TRANSPORT is designed and built to provide the professional broadcaster with a highly reliable, long play, bi-directional, tape playback unit. The transport uses a dual-speed, hysteresis-synchronous capstan motor, resulting in low wow and flutter characteristics. Automatic reversing is accomplished through foil contacts on either end of the tape. Cut-off arms are provided adjacent to both tape reels, and a connector on the rear panel is also provided for remote control of the unit.

Circle No. 114



THE LIMITER/COMPRESSOR AM-7A by LANGEVIN is a high quality gain reduction and peak limiting device for use with speech or music inputs. It may limit only, or limit in combination with compression. It features fast attack time and release time with low distortion. It has a three-position de-essing circuit. A stereo system may be provided by connecting 2 units in parallel using the stereo sync terminals provided. It is designed to accept low level inputs and is self-powered.

Circle No. 115



mca tech
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Corporate Offices:
Langevin, Electrodyne, Gauss
13035 Saticoy Street, No. Hollywood, Calif. 91605 U.S.A.
Telephone (213) 875-1900

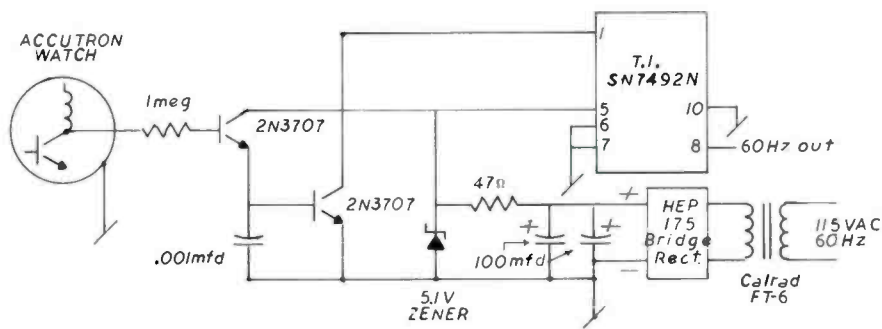
AN ACCUTRON WATCH ... A 60 Hz STANDARD

by George Koch

PROBLEM: You're going to Europe where line frequencies tend to be about as stable as most engineers, and you've got two 16 track tape machines that perform admirably at 60 Hertz, but get strange with any deviation. Further, not only is it 60 Hz that strays, but in many places it's 50. What to do?

SOLUTION: John Stevens, of Stevens Electronics, with a remarkably smooth sleight-of-hands (raising some question about his previous incarnation), slipped an Accutron watch from the wrist of a nearby Chris Huston, put it under a microscope, drilled a small hole in its back plate, and tacked a wire unto the collector of its output transistor. Then, stage by stage, he conceived and constructed this rather unique circuit:

An Accutron watch utilizes a 360 Hz oscillator as its time base. By



bridging its output through a one megohm resistor into a divide-by-six network, an exceptionally stable 60 Hz standard may be constructed.

The divide-by-six network consists of an emitter-follower, a grounded-emitter (both 2N3707's), and a Texas Instruments SN7492N Divide-By-Twelve I.C., tapped at its divide-by-six output. This then feeds the power amplifier which drives the tape machines.

The unit traveled all through Europe and functioned happily in temperatures from -15 to 100 degrees Fahrenheit, although some attention was given to its comfort at the two extremes.

The watch has since returned to Chris Huston's arm, and is now attached to a small plastic explosive, lest anyone again attempt to be off with it.

A LAMP CIRCUIT AUDIO OVERLOAD INDICATOR

by Charles Davis

This device is in answer to the need, often voiced, for an inexpensive audio overload indicator which will accurately respond to the severe attack transients so prevalent in dynamic music.

The audio overload indicator described in this article is designed to operate at speeds of up to 1 μ second which is in the order of 3000 times as fast as the dynamic characteristic standards called for in the design of the standard VU meter.

The design can use either a neon or the considerably slower incandescent lamp. Either way the light indications will be much more rapid than the needle travel in the VU meter.

As an outrigger device, the overload indicator can be placed anywhere from the microphone input into the console, to the recorder line outputs. The device can be used selectively on just certain of those inputs where peak content problems are expected to occur, and then, obviously, not be used on channels where overload problems are not expected. What is suggested is that in limiting the number of these light signals in front of an already busy engineer's eyes, as

opposed to the monotony of the eight or sixteen lined-up VU meters, the few of these that are being used become definite focus points.

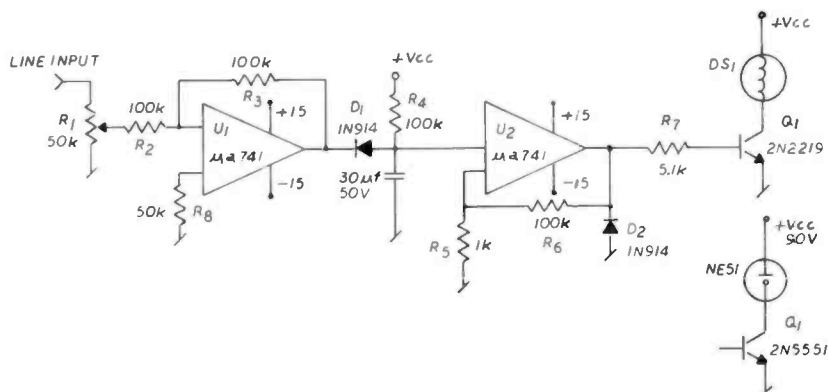
The indicator uses two inexpensive op-amps, a couple of diodes, a capacitor and a few resistors. None of the components is of critical value, by any means.

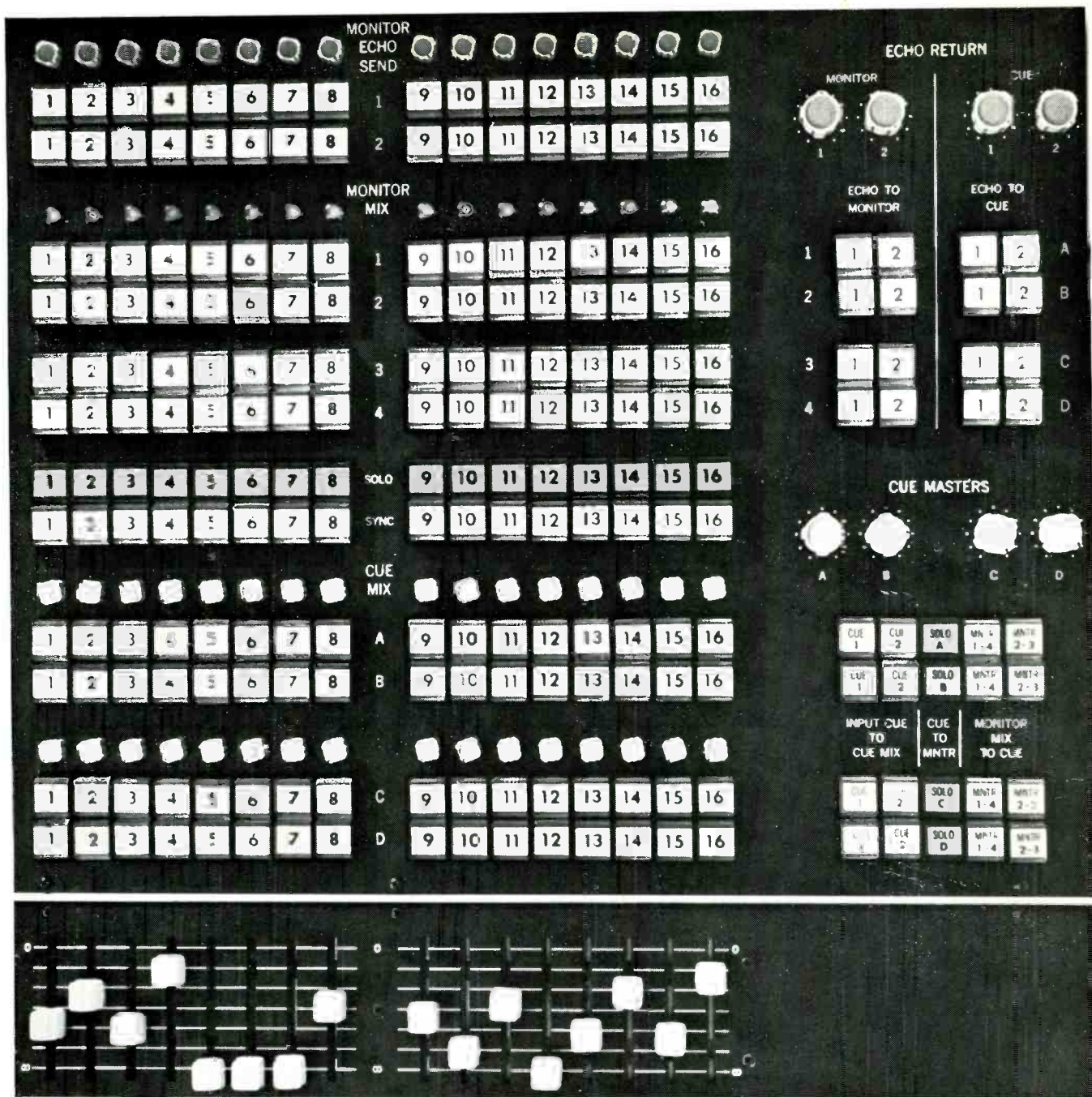
As shown the input level gain control is connected to one op-amp then to a peak detector diode which drives a level storage capacitor. The second op-amp is wired as a Schmitt Trigger.

In this section the feedback is shown wired back to the positive side of the differential input. In this configuration the op-amp is in a "controlled unstable condition." Positive feedback, with the proper phase angle, is an oscillatory condition. However, in this configuration the op-amp functions as a fast bi-stable switch.

Q-2 also operates as a switch: As its base-emitter junction is driven positive the collector goes to ground. The lamp DS 1 lights, indicating overload.

END



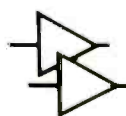


Ever stop to think that to be fully flexible, a monitoring matrix must be a virtual console in itself? This is the monitor section of Automated Processes' Model 2061 Console—with full provision for Quadrasonics—Truly a "Console within a Console"!

The Model 2061 provides up to 20 inputs, each with full equalization; 8/16 outputs; complete patch bay; simo-stereo; limiters. What most others offer as options is included in the 2061 as standard equipment, yet at a competitive price.

For a look at the rest of this console and a complete description of its features, contact us today.

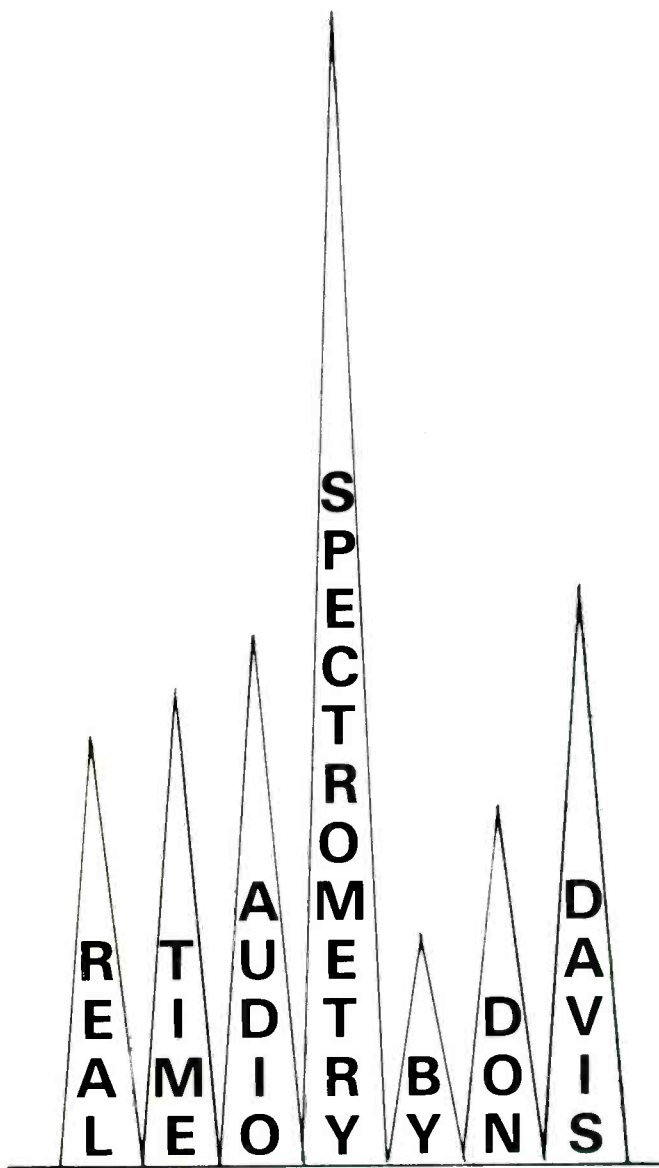
A CONSOLE WITHIN A CONSOLE



AUTOMATED PROCESSES, INC.

35 CENTRAL DRIVE, FARMINGDALE, NEW YORK 11735 · 516-694-9212

In Canada: PERCEPTION INDUSTRIES, INC.



The Altec-Hewlett Packard 8050 audio analyzer

The real time audio frequency spectrum analyzer is unique among precision test instruments. These instruments allow continuous viewing of the entire audio spectrum in real time. Heretofore, price has been the principal reason that these instruments have not been used extensively in recording studios across the country for fast, accurate visual reference to provide spectrum, loudness, and balance information of the acoustic system as it is heard. Anyone involved in the reproduction of sound is working in the blind without the aid of real time analysis.

Since 1968 when the HEWLETT PACKARD COMPANY introduced a real time audio frequency spectrum analyzer priced at approximately \$10,000, and ALTEC-LANSING was investigating new ways to improve the accuracy and speed of the ACOUSTA-VOICING method of tuning sound systems, the engineers of both companies have collaborated in the development of a series of increasingly economical real time audio frequency spectrum analyzers. This collaboration through several previous product releases led to the ultimate introduction of the Model HP HO1-8056A Real Time Analyzer.

The HP HO 1-8056A has become the essential tool used by the increasing number of professional sound contractors to calculate for, and install, Acousta-Voicing.


THE REAL TIME ANALYZER AS AN END PRODUCT MONITOR

Until this time the real time analyzer was thought of as a test instrument only. After observing what artists and recording engineers did with the units, work was started at once to develop a low cost, fully equipped real time analyzer for monitoring use. The Altec 8050A audio analyzer was the result. On its own built-in screen, it displays in real time twenty-seven $\frac{1}{3}$ octave bands starting at 40 Hz and ending at 16,000 Hz. The window is 20 dB and provides both RMS "slow" (for tuning) and RMS "fast" (for monitoring). The price has been reduced to \$2,933 without microphone and \$3,348 with a precision $\frac{1}{2}$ " condenser measuring microphone.

TYPICAL USES FOR REAL TIME ANALYZERS

When a mixer sits at a remix console to perform a mix-down from 16 to 2 tracks, as is often done in commercial recording work, the mixer must make accurate, artistic aural judgments with only his trained hearing and an occasional glance at the venerable VU meters on the console. While the VU meter is useful for gauging the **total** energy being put on a track, it tells the mixer absolutely nothing about the spectrum of the signal, the loudness of the signal, or the balance of the signal. Further, it only reads the total energy electrically available.

The mixer is working in an acoustic environment. More often than not he is in a relatively poor acoustical environment and perhaps, to him, an unknown one. (Mixers



**The best
microphone money
can buy.**

The Sony C-500 Studio-Standard Condenser Microphone is the only studio microphone able to surpass the technical capabilities of all other equipment in today's advanced recording studios. Its dynamic range—in excess of 130 dB—permits distortion-free recording of extremely dynamic works of music. No other microphone even approaches its distortion-free performance—less than 0.1% (I.M. or T.H.D.) at or below 134 dB SPL, and its maximum sound pressure level is a devastating 154 dB, without significant increase in distortion. All other performance characteristics are equally impressive, thus justifying the C-500's title: STUDIO-STANDARD. \$395.00.

**The best
microphone buy
for the money.**

Now Sony enhances studio capability with the new incredibly low-priced ECM-377 cardioid condenser microphone—the outstanding successor to the popular Sony C-37A. The ECM-377 surpassed the performance of all existing condenser microphones except Sony's new C-500. It is compatible with all "phantom power" systems or may be powered by an internal battery. You can use it anywhere. Outstanding performance at a remarkably low price—\$195.00—The Sony ECM-377.

The Sony ECM-377 and the Sony C-500 are available at select Sony/Superscope dealers. For their names, as well as complete details and specifications, please write Special Application Products Division, Sony/Superscope, 8132 Vineland Ave., Sun Valley, Calif. 91352.

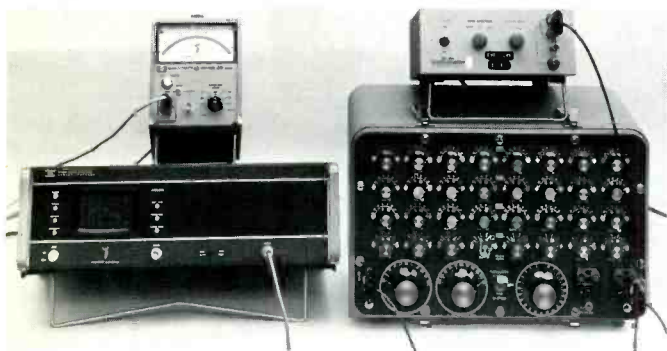
SONY SUPERSCOPE

have been known to judge mixing rooms in terms of which ones are "least bad.")

Now imagine the introduction into this situation of a fast accurate visual reference that provides spectrum, loudness and balance information of the acoustic signal as he actually hears it. Watching the screen of the real time monitor he introduces the track containing the bass part and sees the frequency response of the instrument and its level. He now introduces some drums and is able to judge the balance between them and the basses, both aurally and visually, and even sees the "beats" between them on sustained tones. As each subsequent track is woven into the aural tapestry, more and more of the spectrum is being filled on the screen of the real time analyzer.

The mixer discovers that he can mark balance points on the screen with a crayon for future reference and that he is gaining visual insights into relative balance between instruments and their relative loudnesses that he has always suspected but unable to confirm by listening alone. When he has a portion of the spectrum to fill, a quick check of all tracks reveal instantly in a visual manner if any of the tracks contain that kind of information. Better yet, he can listen to today's hot sellers and note the balance and spectrum being used by other mixers.

The mixer can now make an entire checkout of his system each day from the pink noise tape on his recorder to the pick-up microphone at his head to insure that the entire signal path to his ears has remained as he left it the day before. He can use the real time analyzer to examine the real acoustic response of the microphones he uses by placing them in front of an Acousta-Voiced monitor loudspeaker and connecting the microphone's output through a calibrated preamp to the analyzer's input.



Shown here are the typical accompanying components used during actual adjustment of the Acousta-Voicing filters after the entire system has passed design and installation tests. On the left the Altec 8050A audio analyzer with the special Altec-HP 1-8058A sound level meter on top.

Auditorium managers can evaluate different system set-ups in their spaces and instantly detect changes in the acoustical performance of their permanent systems. The auditorium sound engineer can monitor every live performance from a series of strategically placed monitoring microphones.

Hi Fi dealers can use such a tool to quickly survey the potential of a new loudspeaker system, the various demonstration positions in his show room, and, of course, make home room equalization a matter of 10 to 15 minutes per channel. He can show his client where the best

location is for his stereo speaker system in his own living room and the best listening area by simply walking about the room with the real time analyzer microphone. The very sophisticated home high fidelity system will include the real time analyzer as a fixed component of the system.

The broadcaster can instantaneously view the ambient noise level and spectrum that comes in over a remote pickup. He can, by using Acousta-Voicing filters, equalize a totally strange phone line in about 5 minutes by putting a pink noise generator at one end and himself with a real time analyzer and Acousta-Voicing filters at the other end.

The ability to see transient diaphragmatic absorptions come and go as corrections physically applied to the resonant surface in a studio reveal the value of continuous viewing versus a one-time look at the situation. (One studio being equalized had a sharp dip at 80 Hz. As the house curve was flattened the dip at 80 Hz continued to appear, indicating it was a diaphragmatic absorption. Someone entered the studio and leaned against the door while I was monitoring the real time analyzer. I saw the 80 Hz dip disappear. It was a simple matter to have the door properly braced, thereby correcting the problem.)

The effect of having studios, laboratories, schools, auditoriums, road shows, arenas, etc., able to watch acoustically what happens as they employ typical program equalization will be a liberal education in itself and will certainly curtail the use of such equalizers unless the system has been acoustically tuned as they will find that then, and only then, is it acoustically valid to use the program equalizer.

As more and more end users of electro-acoustic systems have the opportunity to gain "hands on" experience with these modern measuring and monitoring devices the final result will be a noticeable improvement in audio quality. END

**New Entertainment Industry Series book:
THE MANAGERS', ENTERTAINERS', and AGENTS' BOOK,**
by Johnny Minus and William Storm Hale.

This is the sixth in the series of entertainment industry books published by Seven Arts Press and it continues the format of bluntness in advising ways to plan, plot, scheme, learn, perform, protect and enjoy a career in the entertainment business.

The volume has a strong introduction by James W. Alexander, who has been instrumental in creating and guiding many stars in the musical fields.

Minus and Hale, the authors, are both pseudonyms for prominent entertainment business figures. Their anonymity enables them to write as bluntly as they do, calling a spade-a-spade (and a crook-a-crook).

The book exposes the "sharks" that feed off the industry and tells how to spot them. It delves into public relations and its importance. It makes a strong case for the agent and the manager. It goes into contracts and how to tell a good one from a bad one.

480 pp, \$37.00.

Prepaid orders only, should be directed to Dept. SA, R-e/p, Box 2287, Hollywood, CA 90028.

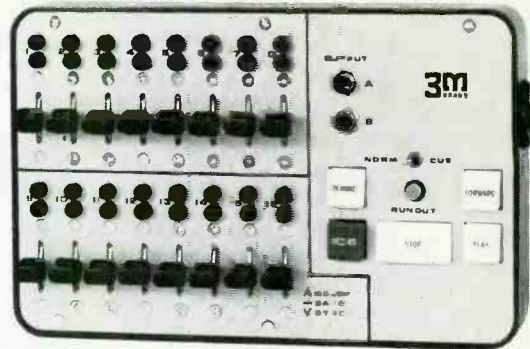
Listen: we're handing you a line.

The most complete and advanced line of professional audio recorders made.

16-, 8-, 4-, 2- and full-track units to cover just about any audio recording requirements that you'll ever have. All with the same consistent quality and convenience because they're all built with the same transport and electronics.

And the transport is our own unique Isoloop[®], with performance like nothing you've ever seen before: Just 3½" of unsupported tape length. Automatic tape tension control. And the lowest flutter spec in the industry.

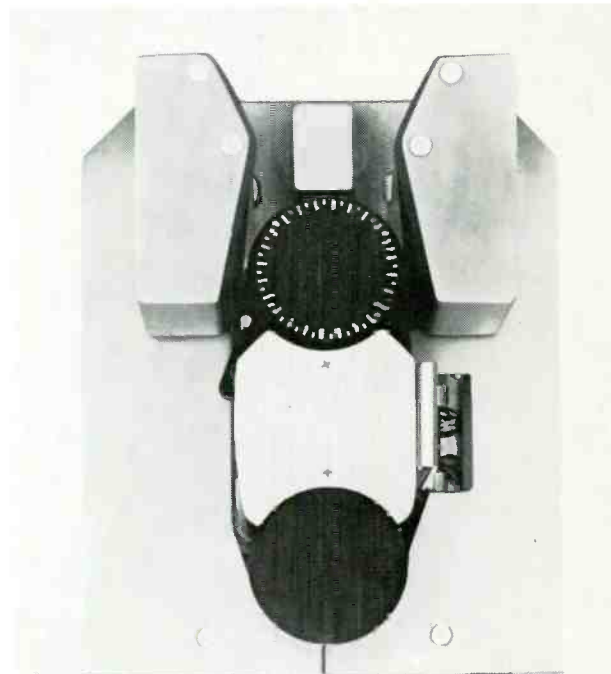
The major recording studios agree that it's the finest equipment made, but check it out for yourself. Listen.



Remote overdub unit for full remote console operation.



Pre-selectable counter for rapid relocation of material.



Our unique Isoloop[®] differential capstan tape drive for convenient tape threading and editing and uniform tape speed no matter where you are on the tape. (Isoloop photo)



Our 2-track and 16-track units: they look and sound the same because they're built the same.



This is what the major studios are choosing.

NEW PRODUCT

NEWS

THE SPECTRA SONICS MODEL 1020-8/16 PROFESSIONAL AUDIO CONTROL CONSOLE is based on a modular console design utilizing plug-in modules of outstanding performance and quality. This modular approach allows maximum versatility, flexibility, and future expansion of design.

The Model 1020-8/16 Professional Audio Control Console is composed of the following interconnected modules: 20 Microphone/Line Position Input Modules; 20 Switching Modules; 1 Program Master and Echo Control Expanded Module; 1 Sixteen Track Matrix and Monitor System; 1 Control Room Monitor; 1 Studio Monitor System; 2 Cue Buss System; 1 Talkback System; 2 Operational Control Modules. The master patch system assures free grouping of the various module switching functions allowing an es-



entially unlimited number of mixing permutations and integration of related equipment.

Console Frequency Response - ± 0.5 dB, 20 Hz to 40 kHz.

Console Signal-To-Noise Ratio - Not less than 80 dB below +4dBm output, with -50 dBm input, normal attenuator setting, 20 Hz to 20 kHz, unweighted.

Console Harmonic Distortion - Unmeasurable — less than 1/100th of

1% (measurement residual) 30 Hz to 20 kHz at +16 dBm.

The performance and reliability of all Model 101 Audio Amplifiers — the basis of this console design — are **Unconditionally Guaranteed** for a minimum period of two full years. If an amplifier should become damaged, it will be repaired at no cost to the user, the same day received.

SPECTRA SONICS, 770 WALL AVE., OGDEN, UTAH 84404.

Circle No. 122

QUAD EIGHT MODEL MQ 184 device to add full QUADRAFONIC MIXDOWN CAPABILITY to any well designed 16 Track Console.

The 16 inputs are positioned in 4 quadrants by Concentric Pan Pots. These new Concentric Quad Pan Pots are exclusive with Quad-Eight and they are also part of the Quad features and options in our new consoles.

These new pots are identical circuits to the Joystick variety. However, they offer the added features of compactness, low cost and the Concentric Knobs can be calibrated to allow easy return to logged positions. The two Joystick Pan Pots increase the input capability to 18. This provides for final mixdown additions of tape echo or special solo tracks.

Four echo return pots are provided, plus four balance pots and master gain control.

The basic design allows conventional stereo mixdowns to be accomplished without modifying the Quad Panner connections to your present console.

The **MQ 184** Mini Quad Panner Sys-



tem is a unity gain device intended to operate at a nominal +4 dbm in and out. The signal-to-noise ratio is 70 db.

All input impedances are 600 ohms unbalanced, including the 4 echo returns. The four outputs are 600 ohms, transformer isolated.

Power requirements are 115 or 230 VAC, 50 or 60 Hz.

QUAD-EIGHT ELECTRONICS, 11810 VOSE STREET, NORTH HOLLYWOOD, CALIFORNIA 91605.

Circle No. 123

EXTENDED RANGE DBM METER FROM DBX INC. Designed as a portable, battery operated test instrument to measure audio system noise and dynamic range, or an application where noise measurement is needed without elaborate laboratory instruments. In addition a percentage scale facilitates distortion analysis.

Accuracy is ± 1 db @ 0 dBm (600 ohm ref.), ± 1.5 db from -60 to +10 dBm, ± 2.5 db @ -70 dBm.

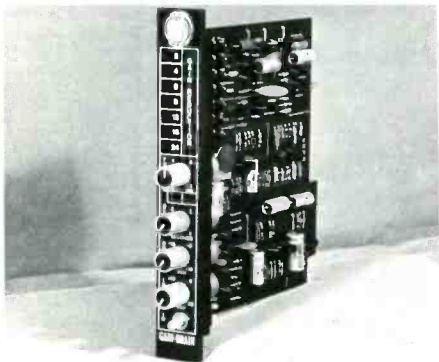
Response is 20 HZ to 20 KHZ from -40 to +10 dBm, 15 KHZ @ -60 dBm and, 7.5 KHZ @ -70 dBm.



Unit price \$189.
Available from stock.
DBX INC., HARVARD, MASS. 01451.

Circle No. 124

THE ALLISON RESEARCH GAIN BRAIN DUAL THRESHOLD LIMITER. This new limiter named the "GAIN BRAIN," is actually two limiters in one; a high ratio peak limiter and an RMS limiter with the attack and release times coordinated.



The threshold of the RMS limiter may be moved as much as 12 dB below the peak limiter threshold. It features a sequential light gain-reduction indicator, and peak and RMS indicators. All lights are solid state and will never have to be replaced. The GAIN BRAIN is the same physical configuration as the KEPEX and will fit into all of the same hardware. A detailed bulletin is available.

Price: \$283.00, PC module only.

ALLISON RESEARCH, INC., 7120 SUNSET BOULEVARD, HOLLYWOOD, CALIFORNIA 90046.

Circle No. 125

GATELY ELECTRONICS is proud to announce that arrangements have been completed with Schalltechnik to be exclusive North American import agents for Schoeps Condenser Microphones. These microphones feature, in addition to their extremely flat frequency response, small size, selectable patterns, standard XLR connectors, and 48 volt phantom powering, and standard American 150 ohm impedance.



These microphones are available from stock. Further information including frequency and polar response information may be obtained from GATELY ELECTRONICS, 57 WEST HILLCREST AVENUE, HAVERTOWN, PA. 19083.

Circle No. 126

LANGVIN, A DIVISION OF MCA TECHNOLOGY, has introduced a stereo audio control console



The BC-8A Broadcaster console was primarily developed for use by the emerging radio station featuring FM stereo broadcasting, with or without AM transmitters.

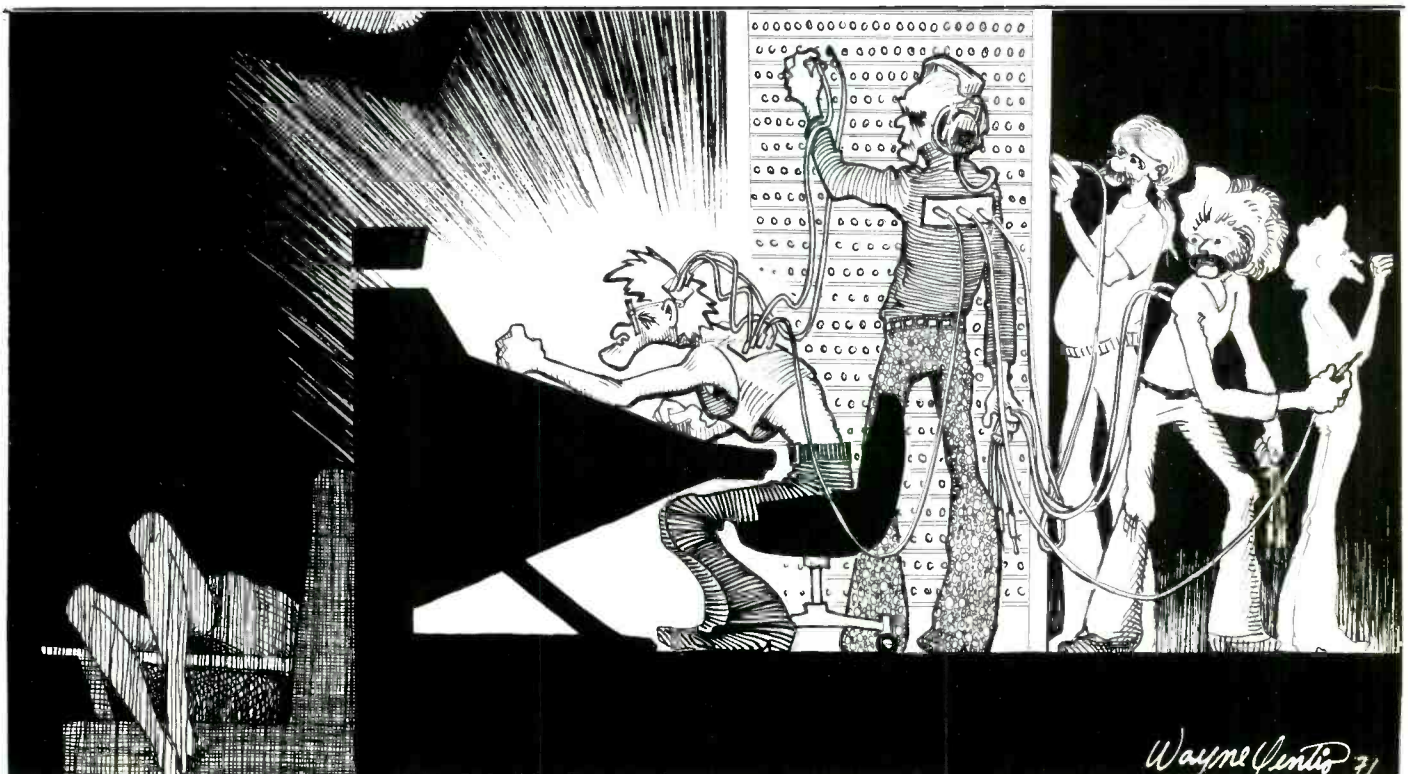
The moderately sized console has 8 full-stereo input mixing channels; left and right stereo output channels; an optional separate monaural output channel; a stereo audition output; two stereo monitor outputs with muting and on-the-air lamp relays.

It also features a cueing amplifier; a talkback switch; stereo headphones, and two power supplies, either of which is capable of handling the power requirements of the console.

It has a suggested list price of \$3,550 without options and \$3,975 with options.

MCA TECHNOLOGY, 13035 SATICOY STREET, NORTH HOLLYWOOD, CALIFORNIA 91605.

Circle No. 127



Wayne Ventio 71

LANG ANNOUNCES MODEL PEQ-4. The new Lang PEQ-4 is a new generation Program Equalizer utilizing computer design technology, silicon circuitry and precision networks. The Lang Model PEQ-4 is an unusually versatile control system used in the recording or reproduction of sound which requires the correction or enhancement of deficient program material.



Model PEQ-4 Specifications:

Equalization:

Low Frequency Peak Boost: 0 to plus 10 db at 200, 300, 400, 600, 800 or 1000 HZ.

Low Frequency Dip Notch: 0 to minus 10 db at 200, 300, 400, 600, 800 or 1000 HZ.

Mid Frequency Peak Boost: 0 to plus 10 db at 1250, 1875, 2500, 3750, 5000, 6250 or 7500 HZ.

Mid Frequency Dip Notch: 0 to minus 10 db at 1250, 1875, 2500, 3750, 5000, 6250 or 7500 HZ.

Low Frequency Shelf Droop: 3 db points at 200, 300, 400, 600, 800 or 1000 HZ.

Mid Frequency Shelf Droop: 3 db points at 1250, 1875, 2500, 3750, 5000, 6250 or 7500 HZ.

Input Impedance:

600 ohms, Terminating, Transformer Input. BALANCED OR UNBALANCED.

Output Load Impedance:

600 ohms, Transformer Output, BALANCED OR UNBALANCED.

Frequency Response (In flat position):

Plus or minus 1 db 20 to 20,000 HZ.

Operating Level:

Minus 25 dbm to plus 14 dbm.

Maximum Output Level:

Plus 28 dbm into 600 ohms.

Distortion:

Less than .15% THD from 20 to 20,000 HZ at plus 24 dbm.

Negative Feedback:

40 db.

LANG ELECTRONICS, INC., 14 EAST 39th STREET, NEW YORK, N.Y. 10016.

Circle No. 128

NEW STEREO MICROPHONE MIXER. Users will find the M688 perfect for stereo recording of musical or dramatic events, while simultaneously providing a left plus right (monaural) microphone level output for use in the sound reinforcement system for the presentation. Amateur and professional users will find it ideal for mixing sound-on-sound tape recordings.

The M688 accepts four high or low impedance microphones through four inputs, plus a stereo auxiliary high level input, each with its own volume control. Three microphone inputs have front panel switches for left or right channel output. The fourth microphone input has a pan control which allows this input to be directed to the left channel, the right channel, or anywhere in between. A stereo master



volume control simultaneously adjusts the level of all inputs. If further inputs are needed, the unit can be paralleled with a Shure M67 Mixer or another M688 via mix bus jacks.

The M688 has a stereo high level high impedance output plus a left plus right (mono) microphone level output (Hi or Lo Z).

User net price for the M688 is \$114.

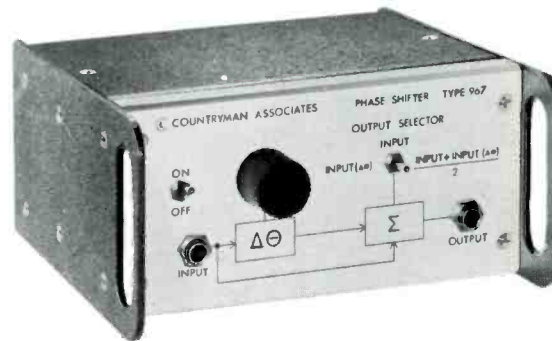
SHURE BROTHERS INCORPORATED, 222 HARTREY AVENUE, EVANSTON, ILLINOIS 60204.

Circle No. 129

PLAN NOW . . .

**ATTEND NEW YORK 'AES' CONVENTION
OCTOBER 5-8
HOTEL NEW YORKER**

THE PHASER



Would you use phasing and flanging effects more often if they were less difficult to obtain? Now you can produce these effects without tape machines, reproducibly and with complete control.

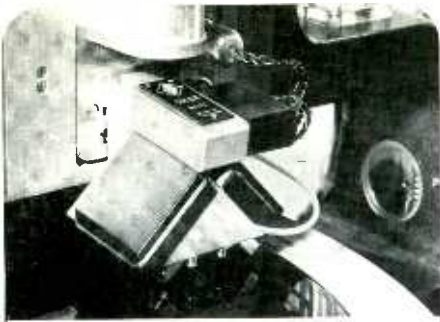
The Type 967 Phase Shifter electronically delays an input signal and then mixes the delayed and undelayed versions together. It allows you to add the striking "turning inside out" effect of Phase cancellation to any audio signal live or recorded, in the studio or in performance, in minutes instead of hours.



**COUNTRYMAN
ASSOCIATES**

424 University Avenue
Palo Alto, Calif. 94302
Phone 415-326-6980

Circle No. 130



Cut it in half

Half the cost, time, and worry, at Dick McGrew Recording Service in Dallas.

Dick beats the competition with record master costs like \$30 per side for stereo 12 inch 33 $\frac{1}{3}$ rpm, and \$10 per side for 45's. The day he receives your tape, he'll groove your master with the Neumann SX 68 cutter, the ultimate in cutting machines. Dick'll give it the individual and expert attention of a man who does a lot of producing himself.

For no extra charge, Dick will provide equalization, reverberation, or other special services at your request. And he's used to giving attention to problem tapes.

Interested in album pressing or singles? Dick's got a competitive price list for these services, too. Let us hear you!

Dick McGrew
recording service

7027 TWIN HILLS AVE • DALLAS 75231 • 214 691-5107

Circle No. 131

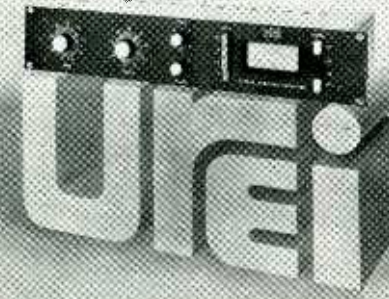
for that heavy studio sound!

1176 LX limiting amplifier

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Circle No. 132

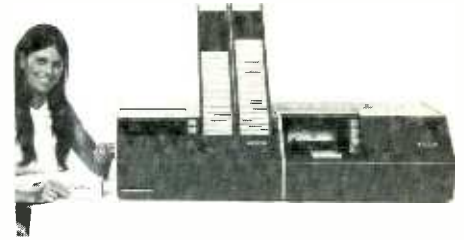
NEW AMPEX CD-200 HIGH SPEED CASSETTE-TO-CASSETTE DUPLICATION SYSTEM, which is said to be five times faster than previous cassette duplicators, was demonstrated to distributors for the first time in July.

The system is designed for use by medium size contract duplication companies and by schools, libraries and businesses which require cassette copies of educational, entertainment or instructional material, and can duplicate up to 45-hour-long cassette programs in one hour using a single slave duplicator. The reproducer can drive up to five slave units for a total of 225 hour-long copies per hour.

Operating at a duplication speed of 75 inches per second (ips), the CD-200 system makes copies 40 times faster than a cassette can be duplicated in simple real-time duplication.

The higher speed is made possible in the Ampex system by the use of vacuum servo columns in both the master reproducer and the slave units. The tape is pulled out of the cassette into the vacuum chambers where the duplication process occurs. This results in close tape-to-head contact and assures gentle, precise tape handling despite the high tape speed.

In addition, solid state broadband electronics are used in the system to



achieve the necessary bandwidth of 320KHz for high speed recording.

As both sides of the cassette are duplicated in a single pass, a 60-minute recording is duplicated in 45 seconds at a tape speed of 75 ips. Rewinding the master cassette and the duplicate is done at 150 ips, which takes an additional 17 seconds. It takes another five seconds to eject the duplicated cassette and reload the slave unit with a blank cassette, for a total time of 67 seconds to duplicate an hour-long program and ready the equipment for the next duplication cycle. The system continues to cycle automatically as long as a blank cassette is in the loader.

Cost of a two-track monaural reproducer, a single slave unit and automatic loader is \$9,400. A 4-track stereo reproducer with slave unit and automatic loader costs \$10,500. First units will be available in August 1971.

AMPEX CORPORATION, 401 BROADWAY, REDWOOD CITY, CA 94063.

Circle No. 133

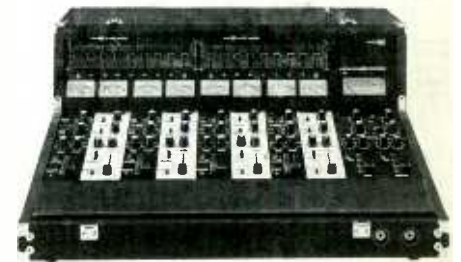
THE SUNN COLISEUM AUDIO CONTROLLER utilizes modular design, combines portability and Sunn reliability to provide musicians the capability of studio quality during live performances. By simply adding modules the total sound coverage of the Coliseum Audio Controller can be increased. The modular system also facilitates easy repair or replacement of parts at minimal cost to the user.

Major features of the Coliseum Audio Controller are:

Ten channels: eight mic channels each with tone and volume controls, effects and reverb controls, lighted vu meter and monitor level control. Two line channels each with volume control.

Main and monitor level controls, each with electronic cross-over featuring high, low, and full range outputs.

Two 120 watts RMS power amplifiers (280 watts peak each).



Two nine-band graphic equalizers. Rugged modular construction designed so that each section can be removed, replaced, repaired, or added, simply by plugging it in.

Suggested retail prices; from \$1995 to \$3445.

SUNN MUSICAL EQUIPMENT COMPANY, AMBURN INDUSTRIAL PARK, TUALATIN, OREGON 97062.

Circle No. 134

THE NEW AMPEX BROAD FLEXIBILITY MODEL AD-15 TAPE DUPLICATOR permits duplication and on-line tailoring of audio programs in any 150-mil or 1/4-inch tape format and is modularly expandable, allowing use of from one to three slave units.

A change of plug-in heads, guides and tailoring assemblies allows reproduction directly onto monaural, stereo and quarter-track open reels, two- and four-track cassettes and four- and eight-track cartridges. Proper settings for maximum performance are locked into each head stack so there is no need to make head adjustments when changing formats.

The AD-15 master and slaves employ the widely used Ampex ABR-15 professional audio transport which accepts 150-mil and 1/4-inch tape on pancakes and reels ranging from 5-inches to 15-inches in diameter.

The AD-15 provides important economies for businesses and institutions with requirements for copying and distributing informational, religious and educational audio programs on all formats.

The AD-15 slaves may be tempor-



arily converted for use as master production recorders when required.

The system, capable of producing up to 168 1,200-foot copies in one 8-hour shift, is available with from one to three slaves and with any configuration of heads and tailoring devices.

Price of the AD-15 ranges from \$5,000 to \$16,000. Deliveries will begin in November.

AMPEX CORP., 401 BROADWAY, REDWOOD CITY, CA 94063.

Circle No. 135

GATELY ELECTRONICS ANNOUNCES THE INTRODUCTION OF ITS QE-1 QUADRAPHONIC ENCODER.

This QE-1 Encoder is intended for use by radio stations and recording studios for encoding 4 channel Quadrasonic information into 2 channel information. This encoder is unique in that a front panel switch is incorporated permitting encoding in either the Dynaquad or Stereo-4 format. The unit is intended for standard 19" wide rack mounting and utilizes 1 3/4" of rack height. Provision is incorporated for plugging in optional input transformers where balanced input lines must be accommodated. Output capability is in excess of 20 dbm into 600 ohm lines. The A model is intended for driving unbalanced output lines.



The B model incorporates an output transformer for driving balanced lines. For monitoring input line levels, the accessory MP-4 four VU meter panel is available. For monitoring the output lines the accessory MP-2 two VU meter panel is available. Either meter panel requires 3 1/2" of rack space. The QE-1 and accessories are available from factory stock or authorized Gately dealers.

Prices are as follows: QE-1A — \$249, QE-1B — \$299, MP-2 — \$125, MP-4 — \$250.00.

GATELY ELECTRONICS, 57 WEST HILLCREST AVENUE, FAVERTOWN, PA. 19083.

Circle No. 136

Please include a Recording engineer/producer address label whenever you write to us about your subscription. The numbers on your address label are essential to insure prompt and accurate service.

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Box 2287 hollywood, cal f. 90028

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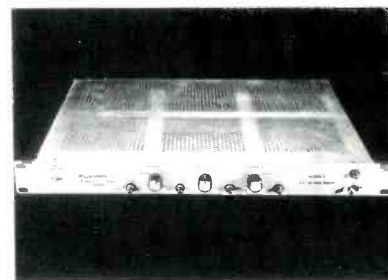
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EMPLOYMENT OPPORTUNITIES

The United States Marine Band is anticipating an opening in its Recording Laboratory staff for an operations/recording engineer.

The position requires familiarity with recording studio equipment and techniques. Backgrounds in studio engineering, production, and music are advantageous but not required. Either a degree or equivalent experience in the field is required.

Selection will be made through a personal interview with the Chief Engineer and one or more of the Directors. Interviews are by appointment, Monday through Friday, from 9:00 a.m. to 3:00 p.m. at the Marine Band Recording Laboratory. Any expenses incurred, transportation, lodging, etc., will be the responsibility of the interviewee.

When interviews for the vacancy have been completed, the applicant selected will be enlisted and promoted to the rank of Staff Sergeant (E6) and transferred to Wash., D.C. at government expense.

Resumes and inquiries may be addressed to:

Geoffrey M. Langdon
Chief Engineer, Recording Laboratory
U.S. Marine Band
8th & Eye Streets, S.E.
Washington, D.C. 20390
(202) 693-4398

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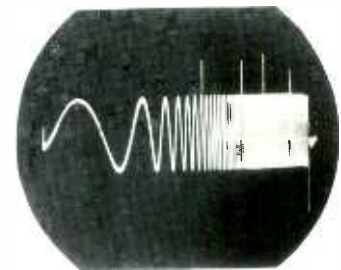
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A NEW SWEEP FREQUENCY TEST TAPE FOR STEREOPHONIC SYSTEMS. The new No. 113T 8 Track Cartridge test tape offers an instantaneous method of checking frequency response on all types of stereophonic equipment. This tape is designed with all necessary correction factors included in it, therefore, no charts or graphs are needed for instant response measurement.

Before the development of the Sweep Frequency Tape, the tone tape was used for frequency response measurements on playback systems. This method was both time consuming and laborious. If adjustments were required, a new frequency run was required after each adjustment. Now all that is needed is a cathode ray oscilloscope and a Sweep Frequency Tape for instantaneous response measurements. Only a few quick adjustments on the equalizer circuits and the job is done.

The audio range of the No. 113T 8 track cartridge is from 60 Hz to 15 KHz with marker pulses at 1, 3, 5, 10 and 15 KHz.



Price less than \$7.00.

PACIFIC TRANSDUCER CORPORATION,
2301 FEDERAL AVENUE, LOS ANGELES, CALIFORNIA 90064.

Circle No. 139

NOTICE

INDIVIDUALS seeking employment in the recording industry may submit their qualifications for FREE publication in *RECORDING engineer/producer*.

Listings will be limited to 30 words, and will be limited by available space. Listings will be selected for publication on the basis of earliest postmark. Listings will not be automatically repeated or carried over to the succeeding issue.

Circle No. 138

1968

1969

1970

1971

DC 300
POWER AMPLIFIER

THE STANDARD STANDS

In 1968, Crown introduced a laboratory power amplifier that set new standards for the audio equipment industry. It was so unique it was put in a class by itself. It became the "yardstick" against which many other types of equipment were measured, thus earning the title LAE STANDARD.

That was over three years ago. Today the DC300 amplifier is still acknowledged as The Standard. This is due to the unique combination of features made possible by its highly advanced patented circuitry. This circuitry provides for the exclusive combination of high power with complete protection and low distortion at low power levels.

So today, where does Crown's DC300 stand, when compared side-by-side with all major commercially available amplifiers? Here's the record:

(1) The DC300 delivers the **most continuous power** of any commercially available power amplifier -- guaranteed at 150 watts per channel rms with 8 Ω loads; typically 300 watts per channel rms with 4 Ω loads. In actual laboratory testing, it has produced over 900 watts rms continuously for four hours, with only a single whisper fan for cooling.

(2) The DC300 has the **lowest distortion level** of any commercially available power amplifier -- guaranteed at 0.1% IM distortion across the entire power spectrum; typically under 0.01%.

(3) The DC300 has the **most complete protection** of all commercially available power amplifiers. It is fully protected against shorts, mismatching, open circuits, RF overload and overheating.

(4) The DC300 has the **lowest noise level** of any commercially available power amplifier -- guaranteed

at 100db S/N below 150 watts output; typically better than 115db.

(5) The DC300 is backed by a **complete three-year warranty** covering all expenses -- parts, labor and round-trip shipping. This warranty covers every unit ever made and has been in effect from the initial unit, providing ample record of DC300 reliability.

That's the record, and what it all means is purer, more reliable sound for your system. Audio professionals have proved the DC300 in hundreds of applications, from recording studios to stadiums. Ask the men who use them.

We'll also be happy to send you detailed specifications, performance graphs and independent laboratory test reports. For an explanation of the DC300 design, send 25¢ for "Functional Protection of High-Power Amplifiers," a technical paper presented at the Audio Engineering Society 39th Convention.

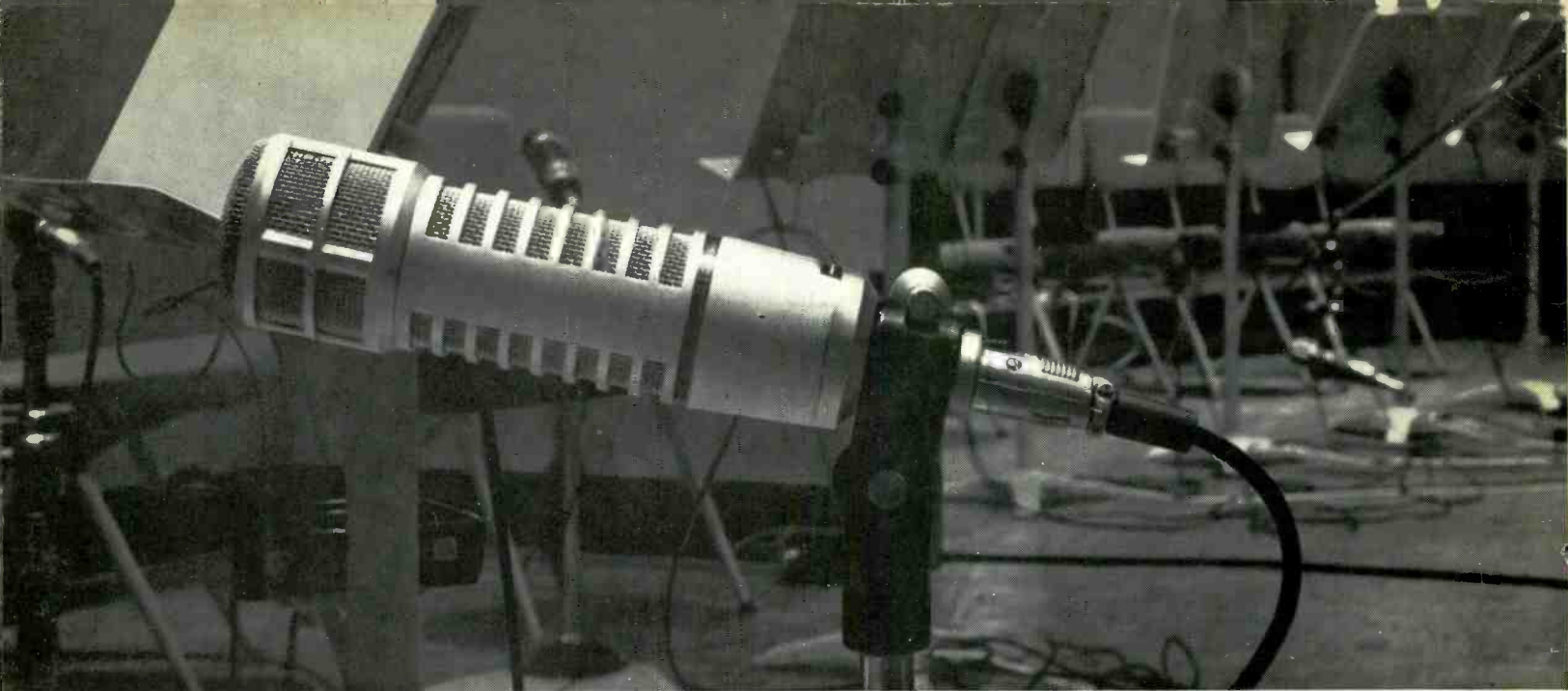


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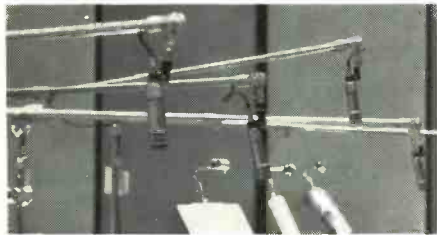


How good is the new Electro-Voice RE20 studio dynamic microphone?

Here's proof from the new scoring stage at Glen Glenn.

Ey The fine reputation of Glen Glenn Sound Company rests on their knowledge of sound... their ability to turn a full symphony orchestra into a perfect sound track for TV, the movies, or a new album. And their desire to be first with the finest.

So for their new scoring Studio M, Glen Glenn engineers asked to see the latest products in every category... tape, film, electronics, and — of course — microphones. Especially a new E-V dynamic cardioid microphone which they had seen in prototype form earlier.



Glen Glenn put the RE20 to the test. Including days of studio experiments and actual sessions that pitted the RE20 against every type of musical instrument. Plus a searching critique by the musicians themselves. The RE20 passed every test with flying colors.

As a result, when Studio M was completed, RE20's were on the booms... almost four dozen of them from our first production run.



Since then, Glen Glenn has scheduled a number of major recordings with RE20's. And the RE20 has often been used where previously an expensive condenser was the automatic choice. Why? Because the RE20 has proved itself a significant advance in microphone design. With wide-range, peak-free response on axis (even the off-axis response is better than many other studio microphones on axis). Transient response rivals any other studio microphone, regardless of design. Directional control is uniform and predictable from every angle. Yet proximity effect is virtually eliminated (a problem that plagues almost every cardioid — except E-V Continuously Variable-D[®] microphones).



MODEL RE20 dynamic cardioid studio microphone \$425.00 list, less normal trade discounts.

In short, the RE20 does everything a good condenser does, and some things better. Without the complication of power supplies. Or special cables. Or shock mounts or windscreens (they're both built in). Or the need for equalization just to overcome design faults.



It's simple. It's flat. It's rugged. It's clean. With a 2-year performance warranty unmatched in the industry (it's spelled out completely on the spec sheet). The RE20. For the studio looking for better sound. Your E-V microphone specialist will gladly loan your studio an RE20 to make any tests you like. Call him today.

P. S. For full technical data on the RE20, write us today. To find out more about Studio M, write Joe Kelly, VP, Engineering, Glen Glenn Sound Company, 6624 Romaine St., Hollywood, Calif. 90038

ELECTRO-VOICE, INC., Dept. 601AE
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Electro-Voice[®]

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